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Communicating About Routine Childhood Vaccines: Meta-Analysis of Parental Attitudes, Behaviors, & Vaccine Hesitancy

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COMMUNICATING ABOUT ROUTINE CHILDHOOD VACCINES: META-ANALYSIS OF PARENTAL ATTITUDES, BEHAVIORS, & VACCINE HESITANCY

by

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ABSTRACT

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As scientific and medical communities research the next generation of vaccines, medical providers and parents observe the current routine vaccination schedules published for children today. And despite the fact protection is available from a number of preventable diseases through the use of safe, reliable, and accessible vaccines, Vaccine Hesitancy VH (delaying or refusing vaccination for reasons other than accessibility) is a growing issue. Using meta-analysis to examine existing research on communication about routine childhood vaccines, the study explores parental attitudes, behaviors, and demographics using the Protection Motivation Theory PMT. The study explores categories influencing VH such as: alternative medicine, safety, side effects, religion, and governmental/pharmaceutical conspiracies. Findings confirm parental attitudes, behaviors, and demographics influence VH and offer effect size information by study category. Implications of understanding effect size by category may include support for provider selection and prioritization of effective communication strategies for reducing VH.

Dedicated to

Peter,

Judah,

Eli,

& Stella

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Communicating About Routine Childhood Vaccines: Meta-Analysis of Parental Attitudes, Behaviors, and Vaccine Hesitancy

Parental attitudes about routine childhood vaccinations represents a relevant and timely focus area for communication studies (Bianco et al., 2019). Current events reflect concern related to vaccination coverage and vaccine preventable diseases (VPDs) including, for example, pertussis and measles outbreaks in the Unites States (US) (Winter, et al., 2012; Zipprich et al., 2015). In 2000, the US achieved extremely high vaccination coverage rates and declared measles eliminated (World Health Organization [WHO], 2013); however, trends over the past two decades indicate parents increasingly choosing not to vaccinate children (Larson et al., 2014). Geographical clusters of vaccine refusal are often associated with outbreaks of disease (Omer et al, 2008). In states permitting nonmedical exemptions to school immunization requirements vaccine refusal rates increased (Omer et al., 2006). Reports of pertussis and measles cases continue (Gilbert et. al. 2016). In fact, national coverage rates for all but two vaccines [Tetanus, Diphtheria, Pertussis (Tdap) and Meningococcal Vaccination (MCV)] now fall below the 80% goal for adolescents in the US despite wide vaccine availability (Walker et al., 2017). In summary, concerned parents display attitudes and behaviors reflecting greater hesitancy toward routine childhood vaccinations.

Literature Review

Successes in routine childhood vaccination

Vaccination provides a public health success story (Centers for Disease Control and Prevention [CDC], 1999) as well as a story of a "victim of their own success" (Ołpinski, 2012, 382). Every year vaccines save millions of lives and billions of dollars (CDC, 1999). Based on information from the National Immunization Survey (NIS), the CDC estimates vaccination

prevents approximately 732,000 deaths among children born in the US between 1994– 2013 (Whitney et al., 2014). Parents operate as the decision makers for patients (children) in the context of healthcare decisions about vaccination.

Parents and patients

The Advisory Committee on Immunization Practices (ACIP, 2019) currently recommends vaccination against 16 diseases under the Schedule of Vaccinations for Children Ages 0-18 in the US. The WHO (2015) defines any refusal or delay in accepting vaccination services according to the recommended schedule as vaccine hesitancy (VH). VH remains prevalent among parents (Dube, 2015). The concept of VH describes parent decision-making behaviors related to intentional under-vaccination despite access to vaccination services (Dube, 2015). Under vaccination due to access barriers exist for racial-ethnic minority and lower socioeconomic status (SES) families; whereas, VH appears with most prevalence among white, higher SES parents, (Carpiano & Fitz, 2017; Gowda & Dempsey, 2013; Smith et al., 2004; Smith et al., 2010). Parents identified factors with frequent impact on VH including: fear vaccines would not protect community, children receive too many vaccines, vaccines weaken the immune system, fear of adverse side effects, perceived vulnerability of the child as low, perceived severity of the VPD as low, lack of trust in the (doctors, government, pharmaceutical companies providing) information about vaccination, and/or not believing vaccines prevent diseases; parents use the factors to make decisions about vaccinating (Brown et al., 2010; Dube et al., 2016; Falagas & Zarkadoulia, 2008; Kennedy et al., 2011; Mills et al., 2005; Quadri-Sheriff et al., 2012; Sturm et al., 2005; Tickner et al., 2006).

Communication in the vaccine life cycle

As visibility of the effects of VPDs dissipate, public interest tends to fade and attention to maintaining high vaccination coverage rates declines (Kennedy, 2011). The pattern of declining vaccination in the US reflects an increasing rate of parents choose to delay or refuse recommended vaccines for children (Williams, 2014). The increasing rate of parents choose to delay or refuse recommended vaccines for children largely involves fears of the consequences of vaccination (Kennedy, 2011; Olpinski, 2012; Williams, 2014). On one hand, the pattern of increase in vaccine delay or refusal correlate to the decline in parental fear of the threat of VPDs. In part, the pattern of parents choosing vaccine delay and refusal in the period immediately following when vaccines cause massive decreases in VPDs and deaths in a population occurs as individuals begin to lose memory of the threats associated with VPDs (Olpinski, 2012). Individuals may no longer associate as much vulnerability to the threat of VPDs, seeming more distant, or perhaps individuals assess the threat of VPDs as less severe due to the decreased visibility. On the other hand, the pattern of increase in vaccine delay or refusal partly involves the elevated fear of the perceived side effects associated with the vaccine. Focus often shifts to the perception of vaccination side effects, due to events occurring around the time of administering the vaccines like seizures, diabetes mellitus, SIDS, ADHD, autism, MS and many other diseases (Campion, 2002; Olpinski, 2012). In some cases where individuals fear the threat of vaccine side effects, they might know someone impacted by a perceived vaccine side effect versus a VPD (Olpinski, 2012). Resulting impacts include reduced or delayed vaccination coverage for VPDs and resurgence in VPDs like the measles (Williams, 2014). The anti-vaccination movement and vaccine conspiracy theories influence parents to delay or refuse recommended vaccines for children.

Communication in the anti-vaccination movement

The anti-vaccine movement is not new. Organized activity dates back to the 1800's; (e.g., 19th Century Documents, Swales 1992; Wolfe & Sharp, 2002), and the Anti-Vaccination Society of America was founded in 1879 with similar organizations emerging in the following years (Kaufman, 1967). Current events highlight how public health communication challenges persist concerning vaccinations (Sugerman et al., 2010). Health communication efforts become challenged currently by online anti-vaccine information that confuses some parents (Cohen et al., 2018). According to Downs et al. (2008), parents deciding whether to vaccinate children, in particular, may be more likely to seek vaccine information online than via healthcare providers, and parents searching terms related to vaccines online find links to anti-vaccine conspiracy theory content (Kata, 2012; Offit, 2010). The promulgation of vaccine conspiracy theories increases the confusion (Intlekofer & Cunningham, 2012). The anti-vaccine conspiracy movement online revolves around a central cover up theory involving bribing researchers to fake data, inflate statistics on vaccine efficacy, and hide evidence of harmful vaccine side effects to maximize profits (Jolley et al., 2014; Kata, 2012; Offit, 2010). As an example of the persisting confusion related to vaccine conspiracy theories, more than 20% of respondents in polls endorsed a link between childhood vaccines and autism (Public Policy Polling, 2013) even though the 1998 article in *The Lancet* concerning a possible link between the MMR vaccination and autism was retracted, the author discredited and no longer permitted to practice medicine (Burgess et al., 2006; Jolley et al., 2014; Opel, et al., 2011). Current research also considers vaccine conspiracy theories.

Vaccine conspiracy theory

Current research advises future interventions attempting to increase vaccination intentions should consider the role of conspiracy theorizing (Jolley & Douglas, 2014). Vaccine conspiracy theories, false claims about vaccine risks, fuel anti-vaccination movements and decrease parental trust in vaccinations (Deer, 2006; Dobson, 2003; Intlekofer & Cunningham, 2012). Beliefs in conspiracy theories build on a foundation of mistrust of scientific claims (Lewandowsky et al., 2013). Anti-vaccine conspiracy theories distrust overwhelming scientific evidence of vaccination effectiveness, safety, and necessity (Kata, 2010). One example of a vaccine conspiracy theory involves distrust of government and pharmaceutical company economic ties to infant vaccines (Kata, 2012). Conspiracy theories operate as significant drivers of distrust inducing vaccine refusal (Kata, 2012). Many strategies to counter vaccine-hesitant beliefs currently prove ineffective in convincing parents to vaccinate children and may boomerang to decrease vaccination intentions (Nyhan et al., 2014). Evidence indicates that some educational interventions increase anti-vaccination attitudes (Giambi et al., 2014). Specifically, interventions failing to associate vaccines with appropriate risk may lead individuals to inaccurately form perceptions of vaccines as riskier than in reality forming barriers to vaccination (Betsch & Sachse, 2013; Giambi et al., 2014).

One successful method for countering anti-vaccination attitudes included highlighting factual information about dangers of communicable diseases (Horne et al., 2015). A successful strategy focusing on risk ignores counter anti-vaccine conspiracy claims trying to explain away or discounting scientific evidence, the successful messages simply stated factual information about a disease. Successful interventions that help dispel vaccine conspiracy theories reduce

vaccine hesitancy. Therefore, understanding how conspiracy theories impact vaccine hesitancy provides a basis for creating messages to reduce the anxiety.

Communication and vaccine hesitancy

Health communication research identifies vaccine hesitancy (VH) as a central concept in the anti-vaccination movement (e.g., Bianco et al., 2019; Henrikson et al., 2017; Napolitano et al., 2018; Repalust et al., 2017; Shapiro et al., 2018). VH encompasses all forms of intentional under-vaccination and excludes situations where lack of awareness or access serve as barriers to vaccination (Dube, 2015). Factors such as complacency, convenience and confidence influence VH; VH is complex, context specific, and varies according to the particular time, place, and vaccine (Meeting of the Strategic Advisory Group of Experts on Immunization, 2014). Although VH is rarely population-wide and is more often specific to sub-groups within populations, the VH concept is used widely as a measure in various research contexts (Gallagher et al., 2016).VH involves complexity beyond cognitive factors and includes emotional, cultural, political, social, and spiritual elements (Dubé et al., 2013; Dubé et al., 2015; Hobson-West, 2003; Streefland et al., 1999). Worldwide new vaccines have been licensed in increasing numbers, like the HPV vaccine (Ackerman, 2008; Beharry, 2011). One example of vaccination completion rates that varied by place and type of vaccine appears in Canada with the HPV vaccine where in-school-delivery were 75% compared to 36% for girls via a community-delivery model (Musto, et al. (2013). As the vaccine type was HPV and the recommendation at the time focused on girls, the sub-group of the study focused only on girls for VH versus on the entire population including boys in the measures for VH. In addition to place and type, the context was different because in school would be more of a required environment than in the community as all of the students would be grouped together in a single setting as long as they were in attendance. In school would

also have been a greater convenience than in the community which may influence the greater coverage rate for the vaccine. School would not have been an additional destination; whereas, going to a vaccination site would be an additional destination.

Communication about vaccines in preventive healthcare

A better understanding and more precise measurement of influence on vaccine hesitancy remains desirable. The Strategic Advisory Group of Experts (SAGE) on Immunization Working Group on Vaccine Hesitancy recommended using validated and standardized assessment tools to measure vaccine hesitancy rates including underlying determinants (Eskola, et al. 2015). Assessment tools could measure in various settings and between populations and be applied for monitoring trends (Larson et al. 2015). Further, discrepancies between attitudes and behavior long interested researchers, and the Parent Attitudes about Childhood Vaccines (PACV) survey screens for Vaccine Hesitancy (VH), a measure of the attitudes towards vaccines (Bianco et al., 2019). Measuring the influence of communication about vaccines on vaccine hesitancy permits monitoring change in the environment and the potential effectiveness of interventions.

Hussain et al. (2018) identify stakeholders in the medical world including physicians, researchers, educators, and governments as influencers in the anti-vaccination movement target parents. Current vaccination rates remain less than optimal for all scheduled vaccines (Gilbert et al. 2016). Some communication strategies demonstrate general improvement in vaccination intentions including, for example, expert advising toward vaccination (Hopfer, 2012) and emphasizing the normative aspects of vaccination (Conroy, 2009). Anti-vaccine conspiracy theories, however, represent one obstacle to communication interventions (Jolley & Douglas, 2014). Providers experience other obstacles supporting vaccine hesitant parents.

Providers

Providers play an important role supporting vaccine hesitant parents in the vaccination decision-making process (Williams, 2014). For healthcare providers, vaccine hesitancy may become a frequent component of provider to parent interactions. Parents may ask questions and share concerns with providers researched on the internet.

Providers in the US have the published schedule of the 2019 vaccination recommendations: Recommended Child and Adolescent Immunization Schedule for ages 18 years or younger. In most cases, providers are not familiar with the details of all existing vaccine conspiracy theories and in a position to argue the merits of said theory in the context of an office visit. Generally, credibility as a knowledgeable resource on the benefits and harms of vaccination reduces the fear associated with the unknown (Glick, 2015). Providers must possess updated vaccination knowledge including selected content proposed by anti-vaccine movements (Tafuri et al., 2014). One strategy research found to counter anti-vaccination attitudes successfully highlights factual information about communicable disease dangers (Horne et al., 2015).

Although vaccine hesitancy presents challenges for providers, research reports almost 75% of parents trust vaccine safety information from children's pediatricians (Glick, 2015). Direct communication from physicians to parents/patients remains highly influential and maximally effective for providing accurate information about vaccines, (Dempsey et al. 2009; Fredrickson et al. 2004; Gellin et al., 2000; Intlekofer et al., 2012). However, individuals receive and seek information from more than a single source. Whereas parents in previous generations may rely on a physician as the primary source of medical advice or relied on family, friends, or research at a library to obtain information about vaccines, excessive information of all types exists online literally at the fingertips. Access to learn about children's health information online

provides a positive benefit for parents seeking information about vaccines. Unfortunately, online access to information is not automatically accompanied by health information literacy, an individual capacity and confidence to locate, understand, and use health information (Batterham et al., 2017). The potential disconnects between access to information and skills to apply the information may lead parents to confusion or to trust information about vaccinations from unreliable sources. As a result, parents seeking information about vaccines consume large amounts of anti-vaccination information, a pattern enhanced as socioeconomic status increases because the higher SES parents gain more access to contradictory information (Tafuri, et al., 2014). Anti-vaccine communities flourish on social media sites (Benecke & DeYoung, 2019). For example, one study reports up to 50% of vaccination related tweets contain anti-vaccine content (Tiedje et al., 2013). Anti-vaccination content parents consume via the internet and other media fuels fear of vaccines and causes parents to refuse to immunize children. (Olpinski, 2012). Research into strategies for deflecting anti-vaccine information are not promising (Tafuri et al., 2014). Conspiracy theory research identifies a self-insulating element strengthening anti-conspiracy theories when deployed strategies to counteract the anti-conspiracy message (Sunstein & Vermeule, 2009). That is, when parents question providers not equipped to appropriately respond or dispute a given claim about a vaccine, providers trying to dispute the concern or debunk the myth, may be, in fact, enhancing the anti-vaccine messaging (Tafuri, et al., 2014). Therefore, providers need current knowledge of anti-vaccine movement contents. (Tafuri et al., 2014).

Providers continually encounter parents with experience searching for information about vaccinations online (Tafuri et al., 2014). As parents share health information online, the current emphasis is on user-generated content (International Communication Union, 2012) via video-

uploading, blogging, photo-sharing (e.g. YouTube, Blogger, Facebook, Twitter) (Kata, 2012). The environment prohibits the possibility for providers to retain exclusive message control as individuals generate content, ideas, and questions. That is where medical knowledge was previously limited to professional access through textbooks and journals, information now empowers parents to actively engage in care (Ratzan, 2002). The increasing level of health communication, user engagement, and education (O'Reilly, 2005) in the online environment facilitates a transition from a traditional medical decision-making model to a shared model between parents and medical professionals (Sarasohn-Kahn, 2008). Vitally, providers must engage in the conversation with focus on listening, building, and sustaining trusting relationships (Seeman et al, 2010) as parents will make decisions based on trust, relationships, and exchange of information and not based on providers simply telling parents what they need to know (Tafuri et al., 2014).

In one study, Olpinski (2012) noted over 30% of pediatrician respondents to a Connecticut survey reported dismissing patients from care because parents chose not to vaccinate children. The American Academy of Pediatrics (AAP) recommends against dismissing patients due to refusal to vaccinate and offers specific strategies for providers to pursue with patients (Diekema, 2005). For example, some research suggests reminders and presumptive recommendations operate as effective communication strategies (Kempe et al., 2015). In any case, vaccination coverage rates indicate room for improvement. Primary-care providers are frustrated according to one Connecticut survey and perceive current efforts as not very effective (Kempe et al., 2015). Research identifies need for effective communication strategies for providers to connect with vaccine hesitant parents (Williams et al., 2016).

Research outcomes report recommendations for additional provider education or training in vaccination as patients report some providers fail to provide strong recommendations; recent studies do call for further research into why some trained medical professionals retain doubts with respect to the safety and effectiveness of vaccines (Kumar et al., 2016). For example, 11.8% of parents in one study reported pediatricians discouraged vaccination for the child (Bianco, et al., 2019). According to Brewer et al., (2017) providers need more practical evidence-based interventions given time and resource constraints in primary care.

This meta-analysis combines results of existing studies to determine what the body of literature reveals regarding vaccine hesitance and parental attitudes to help providers communicate in a clinical situation to increase vaccination coverage levels. According to Brewer et al. (2017) a multi-strategy implementation becomes most likely to produce the best effect (increase in vaccination coverage). MacDonald & Butler (2018) suggest the multi-strategies include reminders, requirements, and standing orders, for example. Another successful framework for predicting behavior in diverse health contexts is the Protection Motivation Theory (Milne et al., 2000).

Protection Motivation Theory (PMT)

PMT predicts behavioral intentions in diverse health contexts (Milne et al., 2000). Specifically, PMT constructs predict behavioral intentions increase as an individual experiences greater vulnerability to a threat with severe negative consequences and if the individual perceives benefits of performing behavior outweigh costs. In the literature, researchers have applied PMT framework to health-related behavior, specifically including vaccination (Floyd et al., 2000; Milne et al., 2000).Therefore, PMT provides an appropriate theoretical model for exploring the concept of how parental attitudes relate to routine childhood vaccination behaviors. The

constructs of PMT align precisely with the constructs when considering how parental attitudes relate to routine childhood vaccination behavior. As a model for comparison, PMT describes behavioral intention as a function of two cognitive processes, threat appraisal and coping appraisal. When considering routine childhood vaccinations, parents might theoretically apply the PMT framework in the context of making a decision about choosing whether to vaccinate a child, for example. Parents might use the PMT framework by measuring the threat (threat appraisal) by learning about the vaccination and the disease or diseases vaccinated against. Then, parents might make a choice about whether to perform the preventive behavior or whether to vaccinate based on the assessment (coping appraisal). First, according to the PMT framework example, parents might assess the threat.

Threat appraisal

Threat appraisal includes assessing two component, vulnerability and severity. In the context of parents making decisions about vaccinations for their children, within the PMT framework vulnerability means the parent's assessment of the child's susceptibility to specific disease(s). That is, how likely is the child to become exposed to or to contract the vaccine preventable disease. Severity means the parent's assessment of the severity of the consequences to the child of contracting the disease. That is, how severe might the consequences be if the child were to contract the disease, for example: Is there a possibility of death? Threat appraisal is the parent's combined measure of vulnerability and severity of threat. An example to illustrate the combined elements of threat appraisal involves parents assessing the vulnerability of their children to Human papillomavirus (HPV) and the severity of HPV when considering whether to choose HPV vaccination for their child. Specifically, vulnerability is one measure.

Vulnerability.

HPV is a common sexually transmitted infection with the highest rates of HPV infection occurring among individuals aged 15 to 24 years (Bruni et al., 2010). HPV impacts the population broadly; about 75% of all sexually active women will experience at least one HPV infection during their lifetime (Syrjanen et al., 1990). Facts reflect the adolescent population is highly vulnerable to HPV. In other examples, intentional under-vaccination can be a major threat to public health, medical systems, and families. Even with overall high rates of vaccination coverage for diseases like the measles, clusters of unvaccinated children can increase the risk of the disease to others in the community (Diekema, 2013). Measles is very contagious making anyone at-risk in the community vulnerable. The virus spreads through breaths, coughs, or sneezes. There is possibility to catch measles by being in a room where a person with measles has been, up to 2 hours after that person is gone (CDC, AAFP, AAP, 2017). A person can catch measles from an infected person even before they have symptoms like a measles rash. Almost everyone without the MMR vaccination will contract measles if exposed to the virus. Approximately 20 million people contract measles each year; measles remains common in other parts of the world (CDC, AAFP, AAP, 2017). When people with measles travel to the U.S. from abroad, the disease can spread to people who are unvaccinated including children too young to be vaccinated. Intentional under-vaccination increases the disease risk to others in the community.

Severity.

Childhood VPDs offer a serious potentially dangerous condition. Measles may be deadly, for example, especially for babies, leading to pneumonia, brain damage, deafness, and death. Statistics from 2001-2013 show 28% of children younger than 5 years contracting measles were

hospitalized (CDC, AAFP, AAP, 2017). Consequences of VPDs are serious. Just as the public must understand the level of vulnerability associated with the threat of VPDs, the public must understand the severity of the threat associated with VPDs. In the US, individuals may not have firsthand knowledge of the severity of the effects of a VPD as they may never have been exposed to a person who suffered from the effects of the VPD. Therefore, access to sufficient health communication messages regarding severity of VPDs is critical in order for parents to complete an accurate threat appraisal in assessing whether to vaccinate a child. Examining severity of the threat is important and is also a part of the threat appraisal according to PMT. HPV types 16 and 18 cause 70% of cervical cancer cases globally (Munoz et al, 2004; Smith et al., 2007). The highest HPV infection rates occur in the 15-24 years old age group (Bruni et al., 2010). Together, these facts might indicate HPV is associated with a high level of severity. Parents completing a threat appraisal investigating whether to choose an HPV vaccine for a child based on the information presented in this section might consider the threat sufficiently severe and the child sufficiently vulnerable to support choosing an HPV vaccine for the child. The next section describes the coping appraisal according to PMT.

Coping appraisal

Parents consider three specific components related to vaccination behavior as part of coping appraisal according to the PMT framework: response efficacy, response cost, and self-efficacy (Rogers, 1975). The response efficacy component involves parents assessing the effectiveness of the preventive behavior in mitigating the threat. That is, if the vaccine will effectively protect the child against or help the child avoid the disease.

The response cost component involves the parent assessing whether the parent has the resources to cover the cost associated with performing the preventive behavior. That is does the

parent have the time and money resources, for example, to transport the child to an appointment to receive a vaccination and to pay for those services.

Finally, self-efficacy involves a parent assessing whether they are able to follow through with completing the vaccination requirements for the child as well any follow-up commitments that may be required of them after the vaccination, for example, caring for a child with mild side effects as a result of the vaccine. The following section outlines the coping appraisal process in the context of parents making decisions for routine childhood vaccines according to the PMT. The framework is also relevant for modeling the decision a parent might consider regarding choosing an HPV vaccine for their child.

Response efficacy.

The recommended schedule of routine childhood vaccines in the US protects children from sixteen vaccine preventable diseases (Chickenpox, Diptheria, Hepatitis A, Hepatitis B, Flu, Hib, HPV, Measles, Meningococcal, Mumps, Polio, Pneumococcal, Rotavirus, Rubella, Tetanus, and Whooping Cough). The vaccines protect children so well against these diseases, the general public does not have daily reminders of what the diseases look like. Currently, on the CDC (2019) website, there exists a link to a page explaining *Diseases You Almost Forgot About (thanks to vaccines)* https://www.cdc.gov/vaccines/parents/diseases/forgot-14-diseases.html. The PMT framework specifies parents are more likely to vaccinate a child (perform a protective behavior) if they assess the vaccine (response behavior) as effective in protecting the child against the disease (mitigating the risk). According to a systematic review by Cobos Munoz et al. (2015), mistrust of vaccination program effectiveness appeared as the most common variable influencing vaccination behavior. In the case of the HPV vaccine, a study by Remes et al. (2014), reported refusal highest among girls when parents previously refused another vaccine (e.g.,

MMR, DTP, hepatitis B, and meningococcal conjugate vaccines). Coping appraisal also includes the element of response cost.

Response cost.

The Cobos Munoz et al. (2015) systematic review, concerns about the harmful effects of vaccinations followed mistrust of vaccination programs as the most common variable influencing vaccination behavior. The Cobos Munoz (2015) research further reported cultural, religious, and social beliefs strongly influenced beliefs about harmful effects of vaccines. Vaccination safety and side-effects are likely the most prevalent parent concerns in terms of response cost when considering vaccines. For example, parents perceiving vaccines as safe, effective, and important for health, report lower odds of HPV vaccine refusal (Gilbert, 2016). However, when parents have concern about vaccine side-effects and believe alternative practices can replace vaccines, there exist higher odds the vaccine will be refused (Gilbert, 2016). For example, less than half of all eligible girls received free HPV vaccinations as part of a program in Ontario between the 2007 and 2011 school years (Remes et al., 2014). The last component assessed in the coping appraisal process involves self-efficacy.

Self-efficacy.

One example of an intervention providers have undertaken to help address potential parent self-efficacy issues with completing multi-dose vaccinations for adolescents is to capitalize on other care contacts with the patient not specified for vaccination to follow-up on vaccinations due. This could be addressing self-efficacy issues as a busy parent may be challenged to return the child to the office at the recommended scheduled time(s) in order to complete the remaining dose(s) of vaccination(s) or may be challenged to remember how many doses are remaining and when they are due. Provider initiated follow-up at a convenient time to

conserve resources and ensure quality of care may be appreciated. Efforts need to continue past the first dose to reduce inequality in completion. Adolescents captured for the first dose remain only partially protected from vaccine related disease until receipt of the final dose of the schedule. Opportunistic vaccination at the delivery point of other services should be utilized as a strategy to increase vaccine completion. There is no evidence that concomitant service delivery is associated with lower completion. Using office visits not originally scheduled for preventative care services to provide vaccine follow-up as needed could make a significant impact on vaccine completion rates (Gallagher, et al., 2016; Lee, et al., 2016; & Wong, et al., 2013). As another example of parent self-efficacy in PMT, consider the strong bias for people to overestimate the likelihood they will engage in socially desirable behavior like vaccination and inconsistencies between intentions and actions the bias may produce (Ajzen et al., 2004). Given strong positive attitudes towards vaccination reported in a study by Bianco et al. (2019) there could be an argument a sizeable proportion of parents might forget about vaccination. Researchers reported results of a North Carolina statewide survey indicated parents refusing or delaying vaccines most often appear to be the same parents best equipped with resources for obtaining preventive care for children (Ajzen et al., 2004; Bianco et al., 2019). Remes et al. (2014) reported similar findings related specifically to determinants of HPV vaccine refusal as the highest (and lowest) income quintiles reported the highest levels of refusal. Research indicates wealthier and more educated individuals are more likely to choose VH in developed countries to reject or delay vaccination (Dempsey et al., 2011; Luthy, 2009).

Summary of review – rationale for meta-analysis

This study informs the work of healthcare providers and to contribute knowledge to the body of health communication literature as it relates to communicating about routine childhood vaccinations. Evidence-based interventions are needed to increase timely immunization and better guide primary care and public health practice. (Kempe, 2015). Providers need updated knowledge about vaccinations including awareness of content promoted by anti-vaccination sources as a preparation to communicate with parents and patients who have access to content via the internet (Tafuri et al., 2014). This meta-analysis examines how parental attitudes regarding routine vaccines impact vaccination status in children to support providers in understanding vaccine hesitancy and selecting the most appropriate communication strategies to affect the intended outcome during patient interactions as providers negotiate with parents in various care contexts.

By examining the data via meta-analysis, there is opportunity for scholars to combine studies into a larger body of research to examine for change in effect direction or confirmation in effect direction of specific outcome variables. Common variables that influence VH are found among different theoretical models in the health communication field. There is also the opportunity to compare outcomes between groups.

This premise suggests new research on how to integrate approaches and whether particular combinations are more effective under specific conditions. This analysis will compare research conclusions to conclusions predicted by the PMT framework seeking new insights. And while systematic reviews have assessed parental knowledge, attitudes, and beliefs regarding vaccine hesitancy and routine vaccination (e.g. Allen et al., 2010; Kessels et al., 2012; Mills, et al., 2005; Trim et al., 2012), this meta-analysis contributes updated knowledge to the field by

focusing on studies published 2014 and subsequently. Updated knowledge is an important health communication research focus as it relates to vaccinations because developments in communication technology, medical research, and the vaccination landscape all impact health communication variables and vaccination outcomes. Addressing VH is an important issue as the risk of decreasing vaccination coverage presents significant consequences in the area of controlling preventable diseases (Biasio et al., 2016).

Meta-analysis

Glass (1976) defined meta-analysis as integrating findings from a large collection of results from individual studies in social science literature into a statistical analysis. Meta-analysis estimates the average effect across results from a combination of research studies on the same topic for the purpose of drawing general conclusions (Nakagawa & Cuthill, 2007). Borenstein et al. (2009) explained meta-analysis as combining outcomes from quantitative studies focused on a broad research question into a single review. This meta-analysis combines studies addressing parental knowledge, attitudes, and behaviors as related to VH for examination and analysis. Benefits of meta-analysis are sometimes evident when a larger, complex, and apparently conflicting body of literature exists with apparently inconsistent statistical outcomes (Hadish, 2010). Meta-analysis constitutes an appropriate choice for analyzing the selected study outcomes because it may produce more precise estimates of variable effect sizes than any of its representative studies may contribute. Further, an important component of concerns considering sources of variability in study outcome to ensure all of the included studies address the similar concepts, and a critical component of meta-analysis is considering heterogeneity among study outcomes (Haidich, 2010). According to Allen (2009), the following are common steps for conducting a meta-analysis: (a) literature search, (b) conversion of statistical information, (c) estimation of average effect size, and (d) consideration of sources of variability.

Literature search procedure

The first step of conducting a meta-analysis requires researchers to conduct a "thorough and disciplined" literature search (Haidich, 2010). A literature search to identify routine childhood vaccination materials used online databases including: *MEDLINE (ProQuest*), *MEDLINE/PubMed* (NLM), *PsychNet (PsycINFO, PsycArticles*), *Science Citation Index*

Expanded (Web of Science), and *ProQuest Central*. Preferred disciplines listed in account settings of the search tool included Social Sciences (Journalism and Communication), Nursing, and Public Health. Search complete with primary search terms listed in the subject fields with descriptors contains the word, "communication" and "vaccine". Then, active filters applied to search results including: Material Type "All Items", Language "English", and Publication Date 2009-2019. After applying active filters, and excluding Topics including "Adult," "Influenza," and "Veterinary" as well as all Languages other than "English," the search yielded 405 results.

Data Screening

Via individual review of 405 results, with 99 studies deemed relevant for further consideration based on content aligning with purpose of the study and exported for further review. Focused on studies examining the relationships between parental attitudes and behaviors and vaccine hesitancy (intentional refusal or delay of vaccination services). Upon further and more detailed review of the 99 selected resources, removed 24 qualitative, 3 duplicate, and 3 non-English source results.

In total, identified 70 quantitative results for inclusion in the next step of the study. Added reference lists for all 70 quantitative sources to create a resource list totaling 2,950 lines of total sources for review.

Data Excluded. First, removed 441 duplicates leaving 2,509 sources remaining. Then, 190 qualitative sources (as determinable by study title) removed leaving 2,319 remaining sources. Then, reviewed and considered each of the remaining 2,319 studies again individually first by title, next by reviewing the abstract as needed, and finally by reviewing the full-text study itself as needed, to determine whether the study met the exclusion or inclusion criteria for the present study. The author identified many qualitative studies during this process which were

removed from consideration. In terms of content, studies which focused on populations other than routine childhood vaccinations like vaccinations for travelers or flu vaccinations for pregnant women were removed from consideration from this study.

Data Included. Selected studies examining parental attitudes and behaviors in relationship to vaccine hesitancy for analysis. Finally, limited selection to focus on studies published 2015 and after for the analysis.

The final criteria for inclusion for studies published after 2015 provide the basis for analysis of more recently published outcomes. Most importantly for this analysis, this inclusion criteria will separate the boundaries of this study from any identified existing published study based specifically on data from studies post 2015 on the subject with data post 2015. From this perspective the research may offer updated and current perspective on how parental attitudes impact VH. A total of 42 studies met the inclusion criteria at the completion of the review.

Coding procedure

Variables defined under the headings below make up the coding structure for this study. Two researchers reviewed each study individually and coded variables according to the definitions provided. Any variable coding differences were resolved via researcher discussion.

Demographics

Studies reported a range of demographic variables potentially related to VH. The current analysis summarized demographic variables by categories for parent, socioeconomic status, and child via binary categories created to closely reflect patterns the researcher observed among study data.

Parent. Under the parent category, data is further specified by age, gender, and SES (including household income and educational level) as listed. Parent is the name of the category

for identifying the individual responsible for decision-making regarding vaccines for the child which may be a guardian other than a parent. This category is almost exclusively referred to as the parent category in other studies reviewed in preparation of this analysis.

Parent age. The age variable is divided into two categories represented by less than 35 years of age and 35 years of age and greater. Parental age categories were not reported via a standard age range or distribution among the studies represented in the meta-analysis. Categories representing age groups both younger and older than 35 were observed reported among various study outcomes. Less than 35 years of age or 35 years of age and greater represents an estimated median age for parental reporting categories. The selected point of demarcation is also significant in terms of parenting from a medical perspective in that women being pregnant after the age of 35 are at greater risk for some pregnancy complications (March of Dimes website, updated April 2016).

Parent gender. Most studies represented in this meta-analysis were coded for gender using a binary structure indicated by female or male. The gender data for this category are also represented via a binary structure in this analysis. Female represents the reference variable for this category.

SES. *Household income.* Numerous studies have reported important relationships between household income and vaccine hesitancy. For example, higher socioeconomic status is associated with nonmedical vaccination exemptions (Brennan, 2017). The studies represented in this meta-analysis reported household income using a variety of ranges. For purposes of this meta-analysis, a binary category was created to reflect an estimated median point for identifying low- and high-income households with low income (under $75K) and high income ($75K+) per *four-person household.*

Education level. Reporting on the education level variable was common among most studies represented in the meta-analysis. Generally, three or more categories reported some differentiation among schooling from some high school through multiple or advanced degrees. For purposes of this analysis, the binary category was constructed as some high school/high school graduate/equivalent or some college/undergraduate/graduate degree which differentiated among individuals with a high school level education and individuals with an opportunity for higher education. Dempsey et. al, 2011, Salmon et. al, 2005, and Wei et. al, 2009 as presented in Nadeau et. al, 2015, report parents intentionally deviating from the routine vaccination schedule, similar to parents refusing vaccines as disproportionately college educated with high socioeconomic status.

Child. In the child category, the child is the individual to be vaccinated in each of the studies according to the routine vaccination schedule. The coding structure identifies the child by age range as listed below and by gender.

Child age. The age variable for children was reported using many different age ranges and categories among the studies examined; most often the age range reported was associated with the study of a particular vaccination type. Vaccination type refers to the type of vaccine that the child is given. HPV and MMR are examples. This study examines parental attitudes, behaviors, and concerns toward all types of childhood vaccines associated with the Routine Childhood Vaccination Schedule. This meta-analysis reports child age in relationship to vaccine hesitancy using a binary category of 0 to 5 years of age or 5 to 18 years of age. The selection of age ranges for the binary categories for the age structure is significant as the 0 to 5 years of age category will largely capture children required to receive vaccines prior to school admission, and the 5 to 18 years of age category will create a grouping a school age children.

Child gender. Most studies represented in this meta-analysis were coded for gender using a binary structure indicated by female or male. Data for the gender category are also represented via a binary structure in this analysis. Female represents the reference variable for this category. In addition to demographic categories, the study was coded using further analytic categories.

Analytic categories

First, the researcher reviewed all included studies to create a list of possible data categories appropriate to each study. Then, the researcher compared the lists of categories by study to identify common categories among studies. Where there were three or more studies represented in a category, the category was confirmed as a final category for data coding purposes. Where there were less than three studies per categories, similar categories may have been combined. For example, initially "government conspiracies" and "pharmaceutical conspiracies" were separate categories. Both categories of content were represented among the studies, but not each category of content was represented among the studies in at least three separates cases. So, the two categories were combined into a single category "government/pharmaceutical conspiracies" and confirmed as a final category for data coding purposes. In other cases, single categories with less than three studies represented without similar categories were eliminated from the final coding structure. The categories coded for this study include: (a) alternative medicine, (b) information, (c) threat, (d) delay, (e) religious, (f) vaccine efficacy, (g) safety, (h) side effects, (i) government/pharmaceutical conspiracies, and (j) pain/distress. Further description follows explaining each category.

Alternative medicine. Alternative medicine is a category for vaccine hesitancy related to or the result of any alternative medicine practice or belief. Generally, parents who prefer alternative medicine practices are more likely to believe misconceptions about vaccination and

less likely to view vaccinations as beneficial for children (Gellin et. al, 2000; Salmon et. al, 2005). According to one study by Chow et. al (2017), obtaining vaccination information from an alternative health practitioner was one of the factors found to be associated with VH as it relates to the routine vaccination schedule.

Information. Individuals obtain health information from various sources and are not limited to obtaining information from a single source. Information about vaccines can come from providers, family, friends, or online research, for example. According to a WHO report (2014), vaccine information on the internet may not be as accurate when compared with vaccine information provided by health professionals. Studies by Jones et. al (2012) and Salmon et. al (2005) report parents who obtain information about vaccines online are more likely to hold anti-vaccination beliefs and to delay vaccinations (Moran et. al., 2016; Smith et. al, 2010). And one study by Azizi et. al (2017), reported VH parents were more likely to have researched vaccination information on the internet; whereas, parents who received vaccination information from healthcare providers were less likely VH.

Threat. Threat refers to any vaccination hesitancy due to a belief that a vaccine preventable disease is not a threat, a severe enough threat, or not an urgent enough priority to follow the routine vaccination schedule. Threat appraisal is one component of Protection Motivation Theory (PMT) and includes assessing vulnerability to and severity of a threat (Rogers, 1975). These assessments are relevant to how individuals assess the threat of a disease when deciding whether or not to vaccinate a child against the disease. VH leaves children vulnerable to infection from vaccine preventable diseases (VPDs) and increases potential for VPD outbreaks (Nadeau et al, 2015). In fact, the growing antivaccination movement over recent decades coincides with increased incidences of some communicable diseases (Hornsey et. al,

2018). VPDs can be severe and dangerous for children; in fact, the CDC estimates vaccines prevent billions of dollars in direct and indirect costs related to VPDs as well as thousands of deaths related to VPDs over a lifetime in the US (CDC, 1999).

Delay. Vaccination status refers to whether a child is currently up to date with routine vaccinations according to the recommended routine vaccination schedule or not. Delay refers to any departure from the recommended routine vaccination schedule except for where there is medical contraindication. Delay associated with vaccination results is VH. One example of delay is the situation where a parent requests to "spread out" vaccines to multiple visits so that a child does not receive as many vaccines per visit.

Religious. Religious refers to any vaccine delay related primarily to a religious belief or practice. Even in the face of school requirements, parents and other decision-makers often pursue exemptions when it comes to vaccinations due to personal, religious, and medical beliefs. According to Streefland's (2001) study, vaccines refusal could be connected with strong religious convictions. Religion was reported as a significant risk factor for vaccine hesitancy in a study by Kalok et. al (2020).

Coping Appraisal. is another component of PMT and includes assessing response efficacy, response cost, and self-efficacy. Assessing these elements are relevant to how individuals assess coping with the threat of a disease when they are deciding whether or not to vaccinate their child against the disease (Rogers, 1975).

Vaccine Efficacy. Vaccine efficacy refers to the perception of confidence individuals have that vaccinations are effective in preventing vaccine preventable diseases. In the context of assessing whether to have a child vaccinated or not, response efficacy refers to understanding the vaccine effectiveness, that is does the vaccine protect a child against the disease?

Response Cost. In the context of assessing whether to have a child vaccinated or not, response cost refers to understanding if the benefits of the vaccine outweigh the costs of the vaccine for the child. This is not limited to monetary costs; parents consider costs in several categories when considering this decision. For example, parents might consider if children get too many vaccines during the first two years of life, side effects (short term), are vaccinations safe for children, or conspiracy theories like vaccinations are primarily to economically benefit pharmaceutical companies.

Safety (long-term)**.** Safety refers to any long-term impacts a vaccine might have on a child. The risks for such occurrences are very low and part of the parent education literature provided with each vaccination. In one study, parental beliefs supporting vaccination safety and effectiveness were associated with lower odds of vaccine refusal (Gilbert, 2016). In contrast, parents who refused flu vaccinations for their children in a study by Stelitz et. al (2015) cited safety as the primary reason for declining the vaccination.

Side effects (short-term). Side effects are more short-term occurrences and are much more common for individuals to experience as a result of vaccinations. Information about possible side-effects is also distributed as part of the parent education literature provided with each vaccination. In a study by Gilbert (2016), concerns about vaccine side-effects were associated with higher odds of vaccine refusal. In a study by Kalok et. al (2020), adverse vaccine side effects were the main concern of all participants.

Government /Pharmaceutical Conspiracies. This category refers to any vaccine delays that might be primarily the result of a concern or belief in a government or pharmaceutical conspiracy theory related to vaccines. Lee et. al (2016) found distrust of government was a significant factor related to vaccine beliefs; further, parents who distrusted government had

increased odds of thinking government-based vaccine information was unreliable specifically identifying the CDC, the Food and Drug Administration (FDA), and state health departments, for example, as poor sources of vaccine information. Hornsey et. al (2018) reported measuring anti-vaccination attitudes highest among individuals also measuring high in conspiratorial thinking.

Pain/Distress. Pain and distress refer to the short-term pain and distress that the child might experience as a result of the vaccination process. It does not refer to side effects or long-term safety concerns. Pain might result from the actual needle or injection itself. Babies might cry; parents may become distressed. For older children, distress might be the result of anticipating receiving an injection. A 2020 study by Kalok et. al, reported fear of pain due to vaccination as the most significant reason cited by the vaccine hesitant group versus the non-vaccine hesitant group. A pain and distress category might most appropriately fall under the self-efficacy for parents in the context of vaccinating children.

Self-efficacy. Self-efficacy refers to understanding the ability of self to successfully complete the response (Rogers, 1975). In the context of assessing whether to vaccinate a child or not, there are several elements that decision-makers consider. With respect to the PMT model, the vulnerability and severity in the threat appraisal is addressed in the threat category of this analysis. In terms of the coping appraisal, vaccine efficacy is a separate category in this analysis, as well, inclusive of response cost. Pain/distress are part of the self-efficacy category because the parent is ultimately the individual who decides whether a vaccination will be completed for an otherwise eligible child. A parent may experience pain/distress related to deciding whether to vaccinate a child. For example, a parent may become informed about the benefits and risks of vaccines and understand that the risks of a poor outcome are low. Yet, this may not eliminate a parent's worry that a poor outcome could happen as a result of the vaccine. The poor outcome

would technically be a safety issue if it had long-term impact on a child or a side-effect if it had a short-term impact, but the worry about the poor outcome occurring is distress. Distress causing vaccine hesitancy is a self-efficacy issue because the ability of the self is preventing successful completion of the response. The pain/distress a child experiences related to a vaccination may also cause a parent to experience pain and distress related to a vaccination which may lead to vaccine hesitancy. For example, consider a new parent with a two-month old child who begins crying upon experiencing pain after receiving four vaccinations at the end of their office visit, two injections in each leg given simultaneously by two nurses and cries much more than normally over the next two days. Despite the information a parent might understand intellectually about vaccines, it might be very distressing to watch someone inject a tiny, innocent, healthy human with multiple needles. If the parent were to delay future vaccinations due to the distress of witnessing the child in pain or to request that the physician only give the child some of the vaccines during the next visit and delay some vaccines for future visits, this would also be a self-efficacy issue as an issue of the self would be interfering with the intended response, vaccination.

Data extraction

Data was extracted from each of the included studies for all categories represented in this study present in the individual study. The data extraction process for each of the selected studies was based on the data available in the study and how it was presented. Where data was presented in a correlation table, it was possible to transfer data directly from selected studies to the current meta-analysis. In other cases, studies presented data using a variety of figures including Odds Ratios, means, standard deviations, and confidence intervals. In these cases, a data conversion step was required prior to adding the data to the summary for meta-analysis.

Study Data Revision and Update

At this point, researcher removed twelve studies from the list of 42 studies originally selected for inclusion in the meta-analysis. Studies removed from inclusion as upon closer examination at the point of data extraction, the researcher determined study subjects were indirectly versus directly aligned with the study criteria, or studies did not supply sufficient data required for inclusion in the meta-analysis. A total of 30 studies remained in the meta-analysis; two of the published papers actually included two studies bringing the grand total to 32 studies in the meta-analysis. Subsequently, a supplemental search was performed via Google scholar using the term PACV Parent Attitudes About Child Vaccines, a measure of vaccine hesitancy. Based on first ten pages of search results for the PACV term, selected five studies published 2015 and later that aligned with study criteria and contained sufficient data to add to this meta-analysis after data extraction bringing the total number of studies included in the meta-analysis to 37.

Data conversion. Various metrics were used to express effect size among the studies collected for analysis. With researcher review and decision, combined effect sizes from each study to include for analysis as studies are comparable related to the research question concerning VH and parental knowledge, attitudes, and behaviors. Borenstein et al. (2009) indicate formulas may be applied to convert variables among studies using different measures in order to compare average effect size for each variable using a common measure.

Statistical analysis

This meta-analysis considers 37 studies and examines the effect size of parental attitudes and demographics and how they relate to routine vaccination hesitancy for children 0-18-years-old. Meta-analysis was completed using a random effects model on cross-sectional studies reporting parental attitude and demographic correlates of routine vaccine hesitancy. Studies

included correlation matrices or odds ratio data converted to effect sizes. Then mean effect sizes were calculated for each parental attitude or demographic category variable (weighted by the sample size across applicable studies). Finally, to verify significance, the standard deviation of each effect size was calculated and compared to the mean effect size. All study parental attitude and demographic category effects were significant. Results are summarized in Table 2.

Results

Overall Effects

This section reports the distribution of main effects calculated by parental belief and demographic categories on vaccine hesitancy. Each parental belief and demographic category examined produces a significant main effect on vaccine hesitancy. Specifically, Table 2 at the end of the chapter summarizes the range of main effect sizes. The following sections review the details for average effect sizes calculated for each variable by category examined in this study and include interpretation statements.

Parental Beliefs

Perceived Threat of the Disease. In the context of study results, the correlation indicates as parents perceive concerns regarding the threat of disease increasing VH increases. That is, if there is uncertainty in the parent's mind about the threat of disease like is the vaccine more of a danger to the child' health than the threat of contracting the vaccine preventable disease then VH is more likely an effect. The first average effect size calculated involved perceived threat of the disease (r = .705, k = 17, N = 42,053) based on a heterogeneous data set χ^2 (16, N = 42,053) = 1,981, p < .05. In the case of perceived threat and in keeping children healthy, parents want to protect them from threats. Parents desire to not endanger children by giving "extra" vaccinations, introducing risk if no threat exists to the child. Other variables effect vaccine hesitancy according to study outcomes, as well.

Belief in Alternative Medicine. The correlation indicates parents believing in alternative medicine practices or obtain vaccination information from alternative health practitioners report more VH (r = .351, k = 14, N = 21,720) based on a sample of heterogeneous correlations χ^2 (13, N = 21,720) = 1,576, p < .05. The correlation establishes alternative medicine parental belief

generates a pronounced effect on VH. Belief in alternative medicine is sometimes associated with practices that discourage vaccination. Alternative medicine was observed to be connected with VH in several studies (Bryden, Browne, Rockloff, & Unsworth, 2018; Jones, Omer, Bednarczyk, Halsey, Moulton, & Salmon, 2012).

Behavioral Delay in Vaccination. Behavioral delay occurs when parents choose to delay some or all scheduled vaccines for a variety of reasons. The correlation indicates as delay increases, VH also increases. The average effect size for delay in this study was calculated, r = .612, k = 4, N = 2,908, based on a heterogeneous data set χ^2 (3, N = 2,908) = 288, $p < .05$. Delay has a moderate impact on VH on average and compared to other study variables. The operational definition of VH mostly necessitates that any requested parental delay in the vaccination schedule be considered VH unless parents plan ahead to request spacing vaccinations ahead of the defined vaccination schedule.

Perceived Safety of the Vaccination. As there are increasing concerns about safety of a vaccine, including increasing concerns for long-term impacts, VH increases as parents take more time and care to consider decisions about the safety of the vaccination for their child. Using a heterogeneous data set, χ^2 (18, N = 43,186) = 3,671, $p < .05$, average effect size for safety was, r = .679, k = 19, N = 43,186. The average effect means as parental concerns about the safety of vaccines increase, the average effect size on VH increases. The impact of safety concerns includes such behavior as collecting information or conferring with a provider. Despite hesitancy due to safety concerns (or any other concerns) parents may ultimately decide to proceed with vaccinating their child. Other variable average effects influence VH.

Belief in Vaccination Side Effects. Another example is side effects. As parental concerns regarding side effects increase, according to study outcomes, we can expect VH to

increase. Average effect size was calculated with a heterogeneous data set, χ^2 (11, N = 12,969) = 309, $p < .05$, for the impact of belief in vaccination side effects (r = .211, k = 12, N = 12,969). In terms of this study, side effects are defined as having a shorter-term impact upon a child versus safety concerns which have a longer-term impact upon a child.

Perception of a Lack of Vaccine Efficacy. According to study outcomes, as concerns about vaccine efficacy increase, VH increases. For vaccine efficacy, the average effect size was positive, r = .796, k = 16, N = 33,663, based on a heterogeneous sample χ^2 (15, N = 33,663) = 2,134, $p < .05$. Vaccine efficacy, the effectiveness of the treatment would correspondingly increase vaccine adoption.

Religious. A positive average effect for this category means that as religious concerns regarding vaccines increase, VH increases. The average effect size for the religious category was calculated next, r = .245, k = 5, N = 5,048. Effect size calculations for the religious category were based on a heterogeneous comparison set χ^2 (4, N = 5,048) = 312, $p < .05$. Religious belief may not impact all study participants but remains an important consideration for parents. Some religious beliefs can deter individuals from pursuing vaccination for children.

Belief in a Government/Pharmaceutical Conspiracy. For government/pharmaceutical conspiracy category, the average effect calculation was based on a heterogeneous set of correlations χ^2 (9, N = 14,415) = 1,921, $p < .05$. The average effect was calculated as (r = .524, k = 10, N = 14,415). As parental concerns regarding governmental/pharmaceutical conspiracies increase, VH increases. Government/pharmaceutical conspiracies have been connected with vaccine VH in other studies (Jolley & Douglas, 2014; Sunstein & Vermeule, 2009). Conspiracy theories becomes influential for parents especially in absence of other information about vaccination from reputable sources. The conspiracy belief becomes particularly pernicious since

all information provided by the medical profession becomes suspect and the practitioner simply a dupe or an active participant in the conspiracy.

Information. As parental concerns regarding information sources about vaccinations increase, VH increases. The average effect size calculated for information was, $r = .530$, $k = 18$, $N = 45{,}526$, from a heterogeneous comparison set χ^2 $(17, N = 45{,}526) = 3{,}785$, $p < .05$. Sources of information about vaccines are very important, and parents need to have trust in the sources of information in order to have trust in decisions about vaccinations. In absence of trust in source of information about vaccination, VH will be more likely.

Demographics

Parental gender. The outcome shows an effect size with the female gender measuring as more VH for this study. For example, an average effect size was calculated for parent- female, $r = .855$, $k = 12$, $N = 10{,}277$, according to a heterogeneous data set χ^2 $(11, N = 10{,}277) = 810$, $p < .05$. This may be partly due to females overrepresenting parents in medical appointments where vaccines are given. Subsequent vaccination studies might then reflect outcomes providing more information about VH for parents who are female. There are additional variables to consider in reference to demographics.

Parental age. For example, the parental age average effect size was calculated as, $r = .322$, $k = 15$, $N = 20{,}416$, based on a heterogeneous data set χ^2 $(14, N = 20{,}416) = 1291$, $p < .05$). This means as the parent – age increases, VH increases. In some instances, older parents might have more education because it takes more years to gain more education. However, parent – education is the demographic in this study with the largest average effect.

Parental education. This means as the level of parent – education increases, VH increases dramatically. As parent education increases, VH might occur as parents take more time

to ask questions or research a specific situation before making a decision about a course of action. Parents may attempt to reference other resources to supplement their knowledge sometimes resulting in VH. Effect size for parent – education was calculated as, r = -.902, k = 20, N = 166,762 as determined according to a heterogeneous set of correlations χ^2 (19, N = 166,762) = 7,949, p < .05.

Household Income. The average effect size for household income demonstrates a positive association. As household income increases, an increase can be expected in terms of VH. Average effect size calculated for household income was (r = .218, k = 13, N = 18,494) based on heterogenous data point sets χ^2 (12, N = 18,494) = 772, p < .05. This might be the case due to global efforts to make vaccinations available to populations despite obstacles including household income as one example. Vaccinations are sometimes available at free clinics or in schools. Some people have access to universal healthcare options including access to vaccinations. Finally, average effects for child – gender and age were reviewed.

Child gender. Parents would be more hesitant to vaccinate female children versus male children according to the study outcomes. The average effect size for child - gender was calculated as, r = .649, k = 6, N = 13,366, based on a heterogeneous set of correlations χ^2 (5, N = 13,366) = 797, p < .05. Likely, this measurement is due to differences in parental choices associated with HPV vaccinations. The vaccination is newer on the schedule as compared to some of the longer standing recommended vaccines, and the recommendations regarding who should be vaccinated and when have been developing over the last several years.

Child age. Average effect size was calculated for child – age as, r = .721, k = 7, N = 11,929, based on a heterogeneous data set χ^2 (6, N = 11,929) = 715, p < .05. That is, as the child's age increases, average effects indicate increasing VH. As children get older they have

greater chances of becoming behind schedule on vaccinations because there are more opportunities to miss or become late with scheduled doctor appointments, for example. Also, the requirements for vaccinations begin to accumulate, and if a child becomes behind on the vaccination schedule, it might be more difficult to catch up. As a child ages, parents might perceive a child as less vulnerable to vaccine preventable diseases, assume a child is protected against vaccine preventable diseases given the vaccinations they have already received, or change perceptions about accepting vaccination for children if they had agreed previously due to information they have viewed in the media, for example.

Table 1 *Studies Included in Meta-Analysis of Effects of Parental Beliefs on Routine Vaccine Hesitancy*

Study #	First Author Last Name	Year Study Published	Number of Participants
1	Azizi	2017	545
2	Bianco	2019	575
3	Brennan	2017	3,225
4	Browne	2015	1,256
5	Bryden	2018	2,697
6	Buttenheim	2015	1,107
7	Chow	2017	452
8	Clay	2017	375
9	Dubé	2016	218
10	Firenze	2015	350
11	Giambi	2014	1,738
12	Gilbert	2016	5,720
13	Gilbert	2017	125
14	Gilkey	2017	550
15	Gilkey McRee	2016	9,354
16	Gilkey	2016	9,018
17	Henrikson	2017	237
18	Hornsey	2018	692
19	Jolley - study 1	2014	89
20	Jolley - study 2	2014	188
21	Kalok	2019	1,081
22	Kornides	2018	494
23	Krishna	2016	1015
24	Lee	2016	2,445
25	MacDonald	2014	444
26	Martin - study 1	2017	409
27	Martin - study 2	2017	92
28	Moran	2016	761
29	Motta	2018	1,310
30	Napolitano	2018	437
31	Oladejo	2016	1,200
32	Remes	2014	144,047
33	Repalust	2017	1,000
34	Riaz	2018	8,400
35	Shapiro	2018	1,892
36	Strelitz	2014	1,015
37	Williams	2016	158
Total Number of Participants			**204,711**

Table 2 Summary of Main Effects of Parental Beliefs on Routine Vaccine Hesitancy

	Parental Beliefs									***Demographics***					
Category	***Threat***	***Alt.***	***Delay***	***Safety***	***Side Effects***	***Efficacy***	***Relig.***	***Gov't./ Pharm.***	***Info***	***Parent - gender***	***Parent - age***	***Parent - education***	***Income***	***Child - gender***	***Child – age***
K	*17*	*13*	*4*	*19*	*12*	*16*	*5*	*10*	*18*	*12*	*15*	*20*	*13*	*6*	*7*
N	*42,053*	*21,720*	*2,908*	*43,186*	*12,969*	*33,663*	*5,048*	*14,415*	*45,526*	*10,277*	*20,146*	*166,762*	*18,494*	*13,366*	*11,929*
r (effect size)	*.705*	*.351*	*.612*	*.679*	*.211*	*.796*	*.245*	*.524*	*.530*	*.855*	*.322*	*.902*	*.218*	*.649*	*.721*
χ^2	*1,981*	*1,576*	*288*	*3,671*	*309*	*2,134*	*312*	*393*	*3,785*	*810*	*1,291*	*7,949*	*772*	*797*	*715*
critical value	*26.296*	*22.362*	*7.815*	*28.869*	*19.675*	*24.996*	*9.488*	*16.919*	*28.869*	*19.675*	*23.685*	*30.144*	*21.026*	*11.070*	*12.592*

NOTE: k=number of studies, N=number of research participants, r=correlation coefficient, χ^2=chi square value, $p < .05$.

Table 1 summarizes the studies included in the meta-analysis; studies are listed by last name of the first author and labeled by the year of publication. This meta-analysis includes thirty-seven studies with a total number of 204,711 research participants. All thirty-seven studies were published between the years 2014 and 2019. *All studies included in the meta-analysis are also marked with an asterisk in the reference list at the end of this paper.

Table 2 summarizes the main effects of the parental belief and demographic categories in relationship to vaccine hesitancy as examined in this study and specifies the number of studies in the meta-analysis included per category as well as the total number of study participants included in the examination. Table 2 includes categories for threat, alternative medicine, delay, safety, side effects, vaccine efficacy, religious, government/pharmaceutical conspiracy, and information. The table also includes demographic categories for parental gender, age, and education, household income, and child gender and age.

Discussion

Addressing VH remains an important global health issue as the risk of decreasing vaccination coverage presents significant consequences in the area of controlling preventable diseases (Biasio et al., 2016). Research in the form of systematic reviews assesses parental knowledge, attitudes, and beliefs regarding VH and routine vaccination (e.g. Allen et al., 2010; Kessels et al., 2012; Mills, et al., 2005; Trim et al., 2012). Results inform healthcare providers negotiation with parents in various care contexts about routine vaccination and increases providers understanding of VH permitting strategic selection of the most appropriate communication strategies during patient interactions. Specifically, providers need updated knowledge about vaccinations including awareness of content promoted by anti-vaccination sources as preparation to communicate with parents and patients who access to online content (Tafuri et al., 2014). Primary care and public health practice find useful information involving evidence-based interventions to better guide and increase timely immunization (Kempe, 2015). This meta-analysis examines impact of parental characteristics on routine vaccination status in children.

Summary of results

The following section presents a summary of meta-analysis results in the form of explanations of Binomial Effect Size Displays (BESD)s. (The BESD are presented by category in Tables 3.1 through 3.15 at the end of the chapter.) Rosenthal & Rubin introduced BESDs in 1982. BESDs answer the question, "What is the effect on the success rate of the implementation of a certain procedure?" (Rosenthal et al., 2000, p.17). Essentially, the BESD takes the average effect and translates that information into a more understandable and usable metric to permit assessment of the impact of any observed association. Below, responses to this question are

explained for each BESD by category along with additional information about how to interpret the tables.

Threat

The BESD shows meta-analysis outcomes for threat (r = .705) indicate 85% of individuals who perceived a concern regarding a significant threat of vulnerability to a severe, vaccine preventable disease were likely to vaccinate; whereas 15% who did not assess a concern related to the severity of the threat of vaccine preventable disease were likely to vaccinate. In other words, the BESD indicates the effect size for threat (r = .705) by displaying the rate of people who are likely to be concerned about threat and therefore vaccinating increasing from 15% to 85% given the perceived presence of a child's vulnerability to a severe threat due to a vaccine preventable disease, that is a 70% difference in effect depending on perceived presence of a severe threat of a vaccine preventable disease. This result is not surprising given the basic premise of PMT predicts an individual takes a protective action such as vaccination if there exists a perception of vulnerability to a severe threat like a vaccine preventable disease. In the case of threat, the meta-analysis outcomes seem to confirm PMT predictions.

Alternative Medicine

The BESD shows meta-analysis outcomes for the alternative medicine category (r = .351) indicate 68% of individuals consulting or visiting alternative medicine providers, for example, increases VH; whereas 33% of individuals subscribing to alternative medicine expressed more likelihood to vaccinate children. In this case, the BESD shows the effect size for alternative medicine (r = .351) by displaying the rate of people expressing VH increases from 33% to 68% given the individual subscribes to alternative medicine in some manner, a 35% difference rate in VH given different consult or visit history for alternative medicine provider.

The result aligns with the basic premise of PMT predictions considering alternative medicine beliefs in relationship to response efficacy issues. That is, as individuals adopting alternative medicine practices, become more hesitant to adopt traditional practices in response to traditional threats. Individuals adopting alternative medicine practices increase in VH.

Delay

The BESD shows meta-analysis outcomes for the delay category (r = .612) indicate 81% of individuals seeking delays in applying the routine vaccination schedule increase in VH compared to the 19% of individuals not seeking delays and with childhood vaccination. Another way of saying this is, the BESD shows the effect size for delay (r = .612) specifies the rate of people who are likely to be VH will increase from 19% to 81% given the individual seeks to delay vaccinations according to the routine vaccination schedule, a 61% difference.

Safety

The BESD shows meta-analysis outcomes for the safety category (r = .679) indicate 84% of individuals who perceived vaccines may present long-term safety issues for children were more likely to be VH as compared to 16% of individuals who perceived safety issues with vaccines were VH. In this case, the meta-analysis outcomes for safety (r = .679) display the rate of people who are likely to be VH will increase from 16% to 84% given the individual perceives vaccines may present long-term safety issues for children. Safety issues would fall into the response efficacy category in terms of the PMT model when considering any predictions. Known changes in perceptions of safety (r = .679) would impact the rate of VH as parents would pause to weigh the costs versus benefits of specific treatments available to children given the context of risk.

Side effects

The BESD shows meta-analysis outcomes for the side effects category (r = .211) indicate 61% of individuals who perceived vaccines may present short-term side-effects for children were more likely to be VH. The meta-analysis outcomes for side effects (r = .211) indicate the rate of VH response increases from 39% to 61% given the individual perception that vaccines generate short-term side-effects in children. It makes sense that the observed effect size for side effects (r = .211) is less than the observed effect size for the observed effect size for the safety category (r = .679) because side effects are by definition of shorter duration and less serious than potential safety issues. The difference in observed effect size between the safety and the side effect categories also serves to confirm the research was able to discern between the two distinct categories for purposes of discussion and future research.

Efficacy

The BESD shows meta-analysis outcomes for the efficacy category (r = .796) indicate 90% of individuals who perceived vaccines have efficacy issues were more likely to be VH. Another way of saying this is, the meta-analysis outcomes for efficacy (r = .796) specify the rate of people who are likely to be VH increases from 10% to 90% given the individuals perceive issues with vaccine efficacy. Vaccine efficacy also aligns with the response efficacy category in the PMT model. The result of (r = .796) is not surprising and makes sense given parents' responsibilities for caring and decision making for children's health.

Religious

The BESD shows meta-analysis outcomes for the religious category (r = .245) indicate 62% of religious individuals were more likely to be VH. In this case, the meta-analysis outcomes for religious (r = .245) display the rate of people likely to display VH increases from 38% to

62%. As all categories examined, the religious category contributed significant results for consideration. In general, the research expectation initially involved great emphasis on parental attitudes and behaviors versus parental demographics, so it was surprising that the religious category effect size was observed as given (r = .245).

Government and pharmaceutical conspiracy/threat

The BESD shows meta-analysis outcomes for the government and pharmaceutical conspiracy/threat category (r = .524) indicate 76% of individuals who consulted or believed in or subscribed to government and/or pharmaceutical conspiracies/threats, for example, were more likely to be VH; whereas 24% of individuals who did not believe in related conspiracies were more likely to vaccinate their children. In other words, the meta-analysis outcomes for the government and pharmaceutical conspiracy/threat category (r = .524) indicate the rate of people who are likely to be VH will increase from 24% to 76% given individuals perceive the presence of a government and pharmaceutical conspiracy/threat. Most surprising from a research perspective was the availability of data in order to be able to analyze this perspective. Governmental and pharmaceutical conspiracy theories are not uncommon in the vaccination literature and are certainly relevant to any study of this nature.

Information

The BESD shows meta-analysis outcomes for the information category (r = .530) indicate 77% of individuals seeking information from various sources other than healthcare providers about vaccines are more likely to be VH. Another way of saying this is, the meta-analysis outcomes for information (r = .530) specify the rate of people likely to express VH increases from 23% to 77% given the individual seeks information from various sources other than healthcare providers about vaccines. Information was framed as a broad category with much

opportunity for future investigation in terms of investigating more specific alternate sources of vaccination information.

Parent gender

The BESD shows meta-analysis outcomes for the parent gender category (r = .855) indicate 93% of individuals who were VH were female; whereas 7% of those who were VH were male. In this case, the meta-analysis outcomes for parent gender (r = .855) display the rate of VH males will increase from 7%. Overall, parent demographics factored into this study beyond expectations in terms of impact. Effect sizes for parent gender and parent education, specifically were the two highest reported effect sizes in the study. The result means parent demographics are helping predict outcomes even more than the attitudes and beliefs initially the focus of this study.

Parent age

The BESD shows meta-analysis outcomes for the parent - age category (r = .322) indicate 66% of individuals who were VH were older parents; whereas 34% of the VH parents were younger. In this case, the meta-analysis outcomes for parent age (r = .322) display the rate of people who are likely to be VH will increase from 34% given parents who are younger to 66% given parents who are older.

Parent education

The BESD shows meta-analysis outcomes for the parent - education category (r = .902) indicate 95% of individuals who were VH were parents with increased higher education; whereas 5% of the VH parents were parents with lesser higher education. In other words, the meta-analysis outcomes for parent education (r = .902) indicate the rate of parents who are likely to be VH will increase from 5% to 95% given parents levels of higher education increases.

Household income

The BESD shows meta-analysis outcomes for the household income category (r = .218) indicates 61% of households with VH parents were households with more income; whereas 39% of households with VH parents were households with less income. In other words, the meta-analysis outcomes for household income (r = .218) indicate the rate of parents who are likely to be VH will increase from 39% to 61% given the level of household income increases.

Child gender

The BESD shows meta-analysis outcomes for the child - gender category (r = .649) indicate 82% of individuals who were VH were parents with female children; whereas 18% of those who were VH were parents with male children. In this case, the meta-analysis outcomes for child gender (r = .649) display the rate of parents who are likely to be VH will increase from 18% given children who are male to 82% given children who are female.

Child age

The BESD shows meta-analysis outcomes for the child age category (r = .721) indicates 86% of individuals who were VH were parents with older children; whereas 14% of the VH parents had younger children. In this case, the meta-analysis outcomes for child age (r = .721) display the rate of parents who are likely to be VH will increase from 14% given children who are younger to 86% given children who are older.

Implication of results

Theoretical implications

Overall, past research on VH demonstrates parental beliefs and demographics have significant effects on parental decisions about routine vaccinations in children. Generally, all categories examined in this analysis influence VH. Specifically, demographic categories seem especially strong predictors of VH according to past research. In the case of parent education (r = .902), for example, indicates the rate of VH parents increases from 5% to 95% given parents levels of higher education increase. Similarly, according to past research changes in VH rates are also related to parental gender and children's age. The reasons for the relationships with VH may be disparate.

Parent education.

On its face, an apparently surprising result, that as parents are more educated the level of VH increases. PMT predicts if a parent perceived a child at greater risk to a threat then the threat can be combatted with the vaccine and an educated parent should understand. Some potential issues that may interfere with this model of interpretation of events include that the educated parents are probably more likely to search for information sources and actively ask questions about vaccination to gather information. Incorrect information sources far outnumber accurate information about vaccination available to the public. The information becomes compelling about vaccination fails to represent fact-based information. Fact based information may be viewed as dry and unconvincing compared to emotional story-based or anecdotal information and images conveyed on the internet. Also, level of education does not necessarily equate to information literacy or certainly medical literacy. So, if individuals take action or more accurately do not take action based on information they do not obtain from direct sources then

they are at-risk of VH which probably places parents with education at the highest level of risk because they may be more proactive in seeking information and in making decisions (perhaps prematurely delaying vaccinations) until they meet with a provider for follow-up resulting in VH and resulting in greater risk to children.

Theoretically this might mean in terms of the PMT, we need to look into the process earlier and getting parents information earlier so they can have time to process information to be proactive versus just-in-time which does not allow for time to process information for individuals who want to be involved in decision-making about their care as part of a co-operative care model versus a more paternalistic care model. From a practical perspective, it might be more effective to provide parents information to review about vaccinations that are due for the next visit versus solely providing information sheets about the injections due at the day of the visit along with the side effects model.

Delay.

Refusal or delay of vaccination not related to ability to access vaccinations are both forms of vaccine hesitancy. That means any form of delay not related to access is considered vaccine hesitancy as operationalized in this study. Therefore, any parent requests to "spread out" vaccinations will generally result in vaccine hesitancy. The delay category in the context of this study primarily refers to such parent requests to "spread out" vaccinations.

Requests to "spread out" vaccinations may be so that a child does not receive as many vaccinations on a single visit or so a child receives vaccinations over a longer period of time. In either case, the delay is defined as vaccine hesitancy which places the child behind on the Routine Vaccination Schedule and places the child and community at greater risk for vaccine preventable disease. In some cases, the delay might be related to parents attempting to gain more

time to review and consider vaccination information as in the category above; however, primarily this category includes parents interested in the "spreading out" strategy. There are many reasons that parents seek the "spreading out" strategy for vaccinations whether they think a child is simply receiving too many vaccinations in one visit, perhaps a parent believes the body's immune system will be overwhelmed by too many vaccines, or sometimes, new parents just think a baby is too small for all of the vaccines. Many providers refuse to accommodate such requests to "spread out" vaccines. Other providers will work with parents on this type of request. When examined according to the PMT model, the delay issue might fall under different areas of the model. For example, perhaps parents do not view the threat of vaccine preventable disease as urgent or severe enough that they feel they have the flexibility to act in such a manner. On the other hand, perhaps parents question the response efficacy or cost of vaccine and attempt to compensate for perceived dangers through executing the "spreading out" strategy for vaccines to protect their child. Parents aim to protect their children from all types of harm known and unknown.

Government and pharmaceutical conspiracy and threat.

The effect size near the middle of the categorical results is of note as conspiracy theories might generally be thought of as occurring on the fringes of society. The combined category relates to broader conspiracy theories about vaccination. Conspiracy theories arise when there is a lack of information or explanation of facts. In the context of vaccines and the PMT model, it seems this might arise as the threat assessment becomes more difficult for individuals to perform as vaccine preventable disease becomes less visible through the success of vaccines in fighting disease. The success of vaccines remains necessary to prevent disease; however, the threat seems less certain. A significant effect, .524, remains related to vaccine hesitance for government and

pharmaceutical conspiracy according to the PMT model likely due to the decreased visibility of the threat. Public health and health communication strategies could assist in decreasing this effect by helping make the effects of vaccine preventable disease more visible though updated messaging and campaigns regarding threats.

Practical implications

Meta-analysis contributes updated knowledge to the health communication field by focusing on studies published in the topic area from the year 2014 through 2019. Pursuing this strategy as a basis for meta-analysis, the results provide information on recent trends under research in the area of vaccine hesitancy reflecting the current state of the science. Whereas some of the vaccinations in the schedule have longer term histories to examine, vaccines like HPV are newer and have recommendations that have developed and changed over recent years. Therefore, focus on recent years in the meta-analysis will help reflect current issues in research.

Household income and parent education.

Of significant note, socio-economic status SES in the study is comprised of the parent education and the household income categories. The household income category was effect size, .218, reported in the study. In any case, clearly as SES increases, vaccine hesitancy increases. From one perspective, the outcome seems counterintuitive. For example, considering the PMT model, as SES increases parents would have more information and education about a child's vulnerability to the threat of vaccine preventable diseases in the threat assessment portion of the model than parents with less SES opportunities. From a response perspective, higher SES might help better inform and educate parents about response efficacy and provide easier access to vaccinations from the perspective of response costs. According to the PMT model, self-efficacy remains as a possible differentiator.

Considering self-efficacy as a primary differentiator for parent education according to the PMT model when making decisions about vaccines might require adjustments of public health messages and messages strategies from providers. For example, in the current model of health communication, the parent is expected to trust the provider, listen to the provider, and do what the provider says regarding completing vaccinations during a same day appointment. The series of events requires a parent trusts a provider's medical advice and is willing to act upon the advice without reading any of the supplemental materials provided to the parent by the provider informing the parent about potential risk to the child and in many cases without asking any questions. Otherwise, the parent is defined as vaccine hesitant (even if a parent later decides to vaccinate a child), has already placed the child at greater risk for vaccine preventable disease, and has exposed other members of the community to greater risk for vaccine preventable disease. As a parent becomes more educated, it might be likely that they become more confident in engaging in a relationship with a provider and perhaps want to read the material they are provided and ask questions about the vaccination before providing consent for the child to receive a given vaccination. Whereas trust remains important; blind trust may be irresponsible. Whereas being part of a community is important, caring for your own child over the value of the community may be the job of the parent according to the parent's value system. Whereas listening to the doctor is important, reviewing the information the doctor provided to you and asking question when you do not understand and expressing concerns about side effects would be a normal, rational expectation and might make sense to educated parents.

The PMT model points to the effect size of parent education upon vaccine hesitancy indicating self-efficacy concerns need to be re-examined more closely. From a public health perspective, potential accommodations or revisions to the Routine Vaccination Schedule to

account for appropriate time for parents to review materials, ask questions, and make an informed decision about vaccinations could be meaningful. From a health communication perspective, reconsidering, for example, the timing of communication regarding vaccines might be meaningful. Instead of talking only about the vaccines needed today and plopping a pile of papers with all the warnings about injections due now, one strategy more educated parents might appreciate in order to be able to review materials and inform themselves about vaccines is to receive the material at the appointment prior to when the vaccination is due allowing time for processing information and asking appropriate questions on a provider's schedule and timeline mutually benefitting all parties.

Side effects.

Initially, the result for side effects seems surprising when considering the PMT model as if a threat is assessed as vulnerable and severe, safety and side effects might be commonly associated with response efficacy and response cost when thinking about vaccines. Health communication messages may already successfully communicate accurate messaging about the safety and side effects associated with routine vaccination.

Child age and gender.

Child age and gender effect sizes were influenced by the HPV vaccination impacting the overall Routine Childhood Vaccination Schedule picture. As the HPV vaccine is newer in its life cycle than some of the other more established vaccinations in the schedule and the HPV vaccination is given later in childhood, these factors likely impact size of effect. Further, the HPV vaccine was initially recommended first for females before recommendations were extended to include females and males. Recommendations for HPV aim to vaccinate children

before they become sexually active. Parental influences on the timing of the HPV vaccination may extend delays and contribute to VH.

Limitations

The current analysis is not a comprehensive meta-analytic review of all previous studies completed in the area of research to date. The date range of the studies has been specifically limited by publication date for purposes of limiting the meta-analysis. Therefore, larger patterns may exist through the entire time period to present may have been overlooked or not observed in the study, and study conclusions might neglect larger patterns. Summary categories in the analysis represent parental beliefs and demographics that do not cover the full range of extant research topics or demographics details available by each individual study. Additional studies exist on topics regarding parental beliefs and covering demographics on VH outside the purview of the current analysis. Further, ranges of data have been grouped to represent summary categories and do not necessarily reflect the detail available by individual study.

Future research

Future research might consider employing various theoretical lenses to explore patterns and conclusions in the data gathered for this investigation to determine further insights it might be possible to gain through further examination. Specifically, theoretical models focusing on earlier in the communication process may be beneficial. Another possibility to extend the reach of this research might be to expand the project to a broader and comprehensive meta-analysis in terms of dates by including relevant studies that were excluded from this analysis pre-2014. One future meta-analysis idea might consider potential “interventions” by creating a communication piece to distribute to parents with providers at an appointment about upcoming vaccines and exploring potential impacts on VH.

Conclusion

Meta-analysis results demonstrate parental attitudes, beliefs, and demographics have a range of effects on VH. This study does not bring to conclusion the complex conversations surrounding VH nor does it offer a singular solution to the multi-layered challenges involving VH. Rather, this meta-analysis lends a current perspective to VH concerns by summarizing a number of more recent study outcomes regarding VH. In turn, this study confirms some previous study outcomes to forward and strengthen conclusions for selected effects and provides possible insights for consideration of future health communication strategies.

In conclusion, this meta-analysis examined parental attitudes and beliefs regarding routine vaccination in recently published studies in order to observe the impact on VH. After a thorough and careful search of the available data, the 37 selected studies generated information the researcher divided into 15 categories for further review and analysis. After reviewing studies and converting the data to a common metric, the researcher was able to examine the effect size of the categories in each study. The outcomes for each category were observed as significant. Attitudes and beliefs examined are significant factors impacting VH; however, parent and child demographics were observed to be as influential in terms of effect size. In terms of health communication strategy implications, this information is meaningful for providers because it confirms information already known about communicating with parents given specific demographics of parents and children with respect to VH. Further, the outcomes provide new information about the effect sizes of beliefs and attitudes in categories across studies and how they might impact communication with parents with respect to VH.

Table 3.1: Binomial Effect Size Display for **Threat** (r = .705)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Threat	85	15	100
No threat	15	85	100
Total	100	100	200

Table 3.2: Binomial Effect Size Display for **Alternative Medicine** (r = .351)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Alt. med	68	33	100
No alt. med.	33	68	100
Total	100	100	200

Table 3.3: Binomial Effect Size Display for **Delay** (r = .612)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Delay	81	19	100
No delay	19	81	100
Total	100	100	200

Table 3.4: Binomial Effect Size Display for **Safety** (r = .679)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Safety	84	16	100
No safety	16	84	100
Total	100	100	200

Table 3.5: Binomial Effect Size Display for **Side Effects** (r = .211)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Side effects	61	39	100
No side effects	39	61	100
Total	100	100	200

Table 3.6: Binomial Effect Size Display for **Efficacy** (r = .796)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Efficacy	90	10	100
No efficacy	10	90	100
Total	100	100	200

Table 3.7: Binomial Effect Size Display for **Religious** (r = .245)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Religious	62	38	100
No religious	38	62	100
Total	100	100	200

Table 3.8: Binomial Effect Size Display for **Gov't/Pharm. Conspiracy** (r = .524)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Gov't/pharm.	76	24	100
No gov't/pharm.	24	76	100
Total	100	100	200

Table 3.9: Binomial Effect Size Display for **Information** (r = .530)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Information	77	23	100
No information	23	77	100
Total	100	100	200

Table 3.10: Binomial Effect Size Display for **Parent - gender** (r = .855)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Female	93	7	100
Male	7	93	100
Total	100	100	200

Table 3.11: Binomial Effect Size Display for **Parent - age** (r = .322)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Age - greater	66	34	100
Age - less	34	66	100
Total	100	100	200

Table 3.12: Binomial Effect Size Display for **Parent - education** (r = .902)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Ed – more	95	5	100
Ed - less	5	95	100
Total	100	100	200

Table 3.13: Binomial Effect Size Display for **Income** (r = .218)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Income, more	61	39	100
Income, less	39	61	100
Total	100	100	200

Table 3.14: Binomial Effect Size Display for **Child - gender** (r = .649)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Female	82	18	100
Male	18	82	100
Total	100	100	200

Table 3.15: Binomial Effect Size Display for **Child - age** (r = .721)

Measure	**Variable**		**Total**
	Vaccinated	*Unvaccinated*	
Age - greater	86	14	100
Age - less	14	86	100
Total	100	100	200

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Zhou, X., McClish, Donna K, Obuchowski, Nancy A, & Wiley InterScience. (2002). *Statistical methods in diagnostic medicine*. New York: Wiley-Interscience.

Curriculum Vitae

Angela K. Victor

EDUCATION

Doctor of Philosophy, Communication, anticipated August 2020

Focus: *Health Communication*

Dissertation: *Communicating about routine childhood vaccines: Meta-analysis of parental attitudes, behaviors, & vaccine hesitancy*

Chair: Dr. Mike Allen

University of Wisconsin-Milwaukee, Milwaukee, Wisconsin

Master of Arts, May 2008

Counseling**,** Emphasis: Higher Education

Lakeland College, Sheboygan, Wisconsin

Master of Business Administration, August 1999

University of Wisconsin Oshkosh, Oshkosh, Wisconsin

Bachelor of Arts, May 1996

Major: Communication Processes, Emphasis: Organizational Communication

Minor: Information & Computing Science

University of Wisconsin Green Bay, Green Bay, Wisconsin

PUBLICATIONS

Allen, M., Bourhis, J., Burrell, N., Cole, A.W., Cramer, E., Dilbeck, K., England, N., Hawkins, J.M., Maier, M., Mullane, R., Omachinski, K., Omori, K., DeCloedt-Pincon, D., **Victor, A.**, Willes, K. L., & Zmyslinski, A. N. (2013). Comparing communication doctoral

programs, alumni, and faculty: The use of Google Scholar. *Journal of the Association of Communication Administration, 32,* 55-68.

Song, H., Zmyslinski-Seelig, A., Kim, J., Drent, A. M., **Victor, A.**, Omori, K., & Allen, M. (2013, November). Does Facebook make you lonely?: A meta-analysis. *Computers in Human Behavior.*

Victor, A. (2011, January). Book review: *Developing dissertations in the sciences*: A graduate student's guide to achieving excellence. *National Academic Advisors Association (NAcAdA)*.

CONFERENCE PAPERS & PRESENTATIONS

Nicolini, K., **Victor, A.**, Willes, K. (2016, April). Sustaining HIV Activism: The Foundations of HIV Activism: Self Care and Solutions for Sustainability The Role of Self-Care in Igniting and Inspiring Innovative Solutions, Paper to be presented at the 2016 meeting of the Central States Communication Association, Communication Ethics and Freedom of Expression group for the, Grand Rapids, MI.

Willes, K., Hawkins, J., Manning, J., McBride, C., Nicolini, K., Turner, L., & **Victor, A.** (2015). The same sex marriage debate: how the Supreme Court ruling affects communication. Round table discussion Invited Participant at the Organization for the Study of Communication, Language & Gender Conference on October 1, 2015.

Nicolini, K., **Victor, A.**, Willes, K. (2015). Developing an HIV Activist Identity: A Narrative Analysis Paper presented at the Organization for the Study of Communication, Language & Gender Conference on October 1, 2015.

Victor, A. & Xiong, M. N. (2014, March) Expressing Sexual Orientation & Cultural Identities Through Professional Dress, Leadership & Diversity Conference

Kim, S. Allen, M., Cole, A., Cramer, E.C., Becker, K. A., Choi, C. S., Dilbeck, K. E., Gross, C. M., Hawkins, J. L. M., Jayroe, T.J., Kim, M., Mullane, R.R., Priddis, D.M., Smith, K., **Victor, A. K.**, Willes, K. L., & Zmyslinski-Seelig, A. N. (2013, November). Testing the evidence effect of Additive Cues Model (ACM). Presented at the 99th annual convention of the National Communication Association, Communication and Social Cognition Division, Washington, DC.

Song, H., Zmyslinski-Seelig, A., Kim, J., Drent, A. M., **Victor, A.**, Omori, K., & Allen, M. R. (2013, November). Does Facebook Make You Lonely?: A Meta-Analysis. Paper presented at the annual conference of the 99th annual convention of National Communication Association, Washington, D.C.

Victor, A. (2013, Summer). Importance of Professional Networking. Round table discussion host, IMComm, UW System Conference, University of Wisconsin Oshkosh, Oshkosh, WI.

Burrell, N., Maier, M., Priddis, D., **Victor, A.**, Jackl, J., Gross, C., & Allen, M. (2013, June). Emotional Intelligence: A framework for examining bullying in schools. Paper presented at the International Communication Association Convention, London, UK.

Victor, A., Priddis, D., Dilbeck, K., & Burrell, N. (2012, November). Examining Educators' Reflections on Bullying: A Shift in Ideology. Paper presented at the 98th annual convention of the National Communication Association Convention, Orlando, FL.

Victor, A. & Bain, B. (2009, October). Dangerous Liaisons: Initiating and Nurturing Critical Relationships with Faculty Advisors in Support of Student Success. Presented at the National Academic Advising Association Conference, San Antonio, TX, October 2009.

TEACHING EXPERIENCE - University of Wisconsin Oshkosh, Oshkosh, Wisconsin

Communication 111 Introduction to Public Speaking

Fall 2017, 2015, 2014, 2012

Human Services 204 Professional Career Skills in Human Services Leadership

Spring 2016, Fall 2015, 2014

Professional Counseling 202 Career Planning and Implementation

Fall 2010 - Fall 2013

Professional Counseling 201 Academic and Career Exploration

Spring 2010

Professional Counseling 101 Introduction to Higher Education: Great Expectations, First Year Experience Fall 2009, 2008

HIGHER EDUCATION EXPERIENCE - University of Wisconsin Oshkosh, Oshkosh, WI

Project Manager, *Admissions* February 2018 – present

- Communicated with contacts at access campuses during restructuring to maintain recruiting budget
- Research, document, and publish complex business processes involving interactions between the Student Information System (PeopleSoft) and the customer relationship management (CRM - Salesforce)
- Managed updates, collected feedback, and conducted detailed reviews prior to publication of marketing collateral

HIGHER EDUCATION EXPERIENCE (continued)

Assessment Coordinator, *Student Recreation and Wellness* September 2017 - February 2018

- Update assessment reporting/collaborate with UMC and Director to produce infographic
- Hire and manage social media student to maintain office accounts

Career Development Manager, *Career Services* July 2013 - September 2017

- Communicate effectively verbally and in writing - write formal reports & procedures, present information sessions, teach classes, facilitate meetings, conduct interviews, and interact 1:1 with students, faculty, staff, and employers
- Plan, develop, and organize professional development programs for all student employees, interns, and staff
- Manage comprehensive assessment plan for career events and services: collect, analyze, evaluate, and report learning outcomes and satisfaction data
- Administer Professional Skills curriculum, enrollment, instructors, and electronic text updates
- Recruit, hire, and supervise Career Resource Specialists to perform front desk customer services and operations

Marketing and Communications Manager, *Career Services* July 2010 – June 2013

- Advised Alumni, Education, Non-traditional, and Fine and Performing Arts students regarding career
- Supervised Graduate and Undergraduate Interns and Alumni Career Advisor
- Managed software and hardware office technology initiatives: research, quotations, inventory, and maintenance

- Promoted career events and services to all students via multiple marketing and social media strategies

Academic Advisor, *Undergraduate Advising Resource Center (UARC)* July 2009 - July 2010

Associate Academic Advisor, *UARC* July 2008 - July 2009

- Provided developmental advising, support, and career exploration resources to approximately 450 students
- Encouraged students to get involved on campus, interact with faculty, and practice independent decision-making
- Nurtured relationships with partner offices, faculty, and staff: advising liaison to seven Departments/Programs in the College of Letters & Science: Art, Communication, English, Journalism, Music, Radio-TV-Film, & Theatre

Career Advising Intern, *Career Services* January 2008 - June 2008

- Designed and built cumulative experiential learning game for Professional Skills in Business course
- Assisted students and employers in creating, updating, and using Titan Jobs accounts

CAMPUS INVOLVEMENT HIGHLIGHTS - *University of Wisconsin Oshkosh*, Oshkosh, WI

- **Search Chair,** Search and Screen Committee, Summer 2019
- **Search Assistant,** Search and Screen Committee, Spring 2019
- **Facilitator,** $tart$mart Salary Negotiation Seminar, Spring 2016, 2015
  American Association of University Women, The WAGE Project
- **Judge**, UW Oshkosh Speech Festival, December 2015, 2014, 2012
- **Member,** Inclusive Excellence Award Selection Committee May 2015, 2014

- **Co-facilitator,** Owning your skills: Gendered language in professional communication Women's Center/Career Services, Fall 2013 - Spring 2015
- **Mentor,** UW Oshkosh Titan Making Achievement Possible (MAP) September 2013 – May 2014
- **Member,** Division of Student Affairs Inclusive Excellence Committee September 2010 - May 2011
- **Writing Your Career Story**, Titan Advantage Program (TAP), Summer 2009

SELECTED CONFERENCES ATTENDED

- **Legal Issues for the University Community: Misconduct and Executive Order #54** March 2015 UW System Office of General Counsel, University of Wisconsin Oshkosh, Oshkosh, WI
- **Campus Labs Assessment Workshop**, University of Wisconsin – Madison, Madison, WI, July 2013
- **Wisconsin Women in Higher Education Leadership Workshop: "Can We Talk?"**, Appleton, WI, April 2012
- **OUT for Work: 2012 National LGBTQA College Student Career Conference** The University of Illinois Chicago Campus, Chicago, IL, September 2012

SELECTED PROFESSIONAL DEVELOPMENT, University of Wisconsin Oshkosh

- **Students, Staff, and Faculty for Equality (S.A.F.E.) Training,** Spring 2015
- **Teaching About Race: A Collaborative Lesson Study Project,** October 2014 Provost's Teaching and Learning Summit: Engaging 21st Century Learner
- **Provost's Summit for Teaching & Learning: Civic Engagement Connection Extravaganza**, October 2012

- **Social Media and Student Affairs: Communication, Connections & Community** July 2012
- **How to Help a Student in Distress Workshop,** January 2008

COMMUNITY & VOLUNTEER INVOLVEMENT

- **Classroom/Events Volunteer,** Read School, Oshkosh, WI, Fall 2011 – present
- **Judge**, Region VI Championship, Region VI Invitational, May 2019, 2013
  National Christian Forensics & Communications Assoc.**,** Oshkosh, WI
- **Judge**, UW-Milwaukee Public Speaking Extravaganza, Milwaukee, WI, December 2013
- **Non-traditional Student Representative**, Communication Graduate Student Council
  Sept. 2012 - May 2013
  Subcommittee for Department Climate Member, September 2011 - May 2013
  Communication Graduate Student Council, University of Wisconsin-Milwaukee
- **Volunteer**, Christine Ann Domestic Abuse Services, Oshkosh, WI, December 2012
- **Member**, Graduate School Scholastic Appeals Committee, September 2010 - May 2011
  University of Wisconsin - Milwaukee, Milwaukee, WI
- **Chair**, Volunteers Subcommittee, Conference Planning, Fall 2009
  Wisconsin Academic Advisor Association, Appleton, WI
- **Volunteer Recruiter & Coordinator**, Plexus Rocket Slide Build**,** Riverside Park, Neenah, WI, Spring 2007

PROFESSIONAL EXPERIENCE - *Plexus Corp.*, Neenah, WI

Marketing Communication Specialist September 2004 - January 2008

- Managed time-sensitive, professional marketing projects and interdepartmental teams of up to 30 contributors: trade shows, marketing event participation, and corporate sponsorships
- Provided critical support for corporate branding and Marketing Communication activities: Investor Day, Quarterly Business Reviews, and Press Releases
- Designed, published and maintained creative and effective corporate presentation program for $1 billion corporation
- Contributed article ideas, wrote, edited, and distributed quarterly business newsletter to customers, potential customers, and employees worldwide
- Consulted with all global sites and departments on corporate branding policies and initiatives: use of logo, available literature and resources, and website development

Project Manager August 2000 - September 2004

- Led global project teams, managed multifaceted timelines, and prepared complex customer quotations for business opportunities ranging from $5 to $150 million
- Collaborated with all levels of the organization: Executive Management, Sales, Finance, Manufacturing, Engineering, and Materials
- Interacted with all global Plexus Corp. facilities including: China, Malaysia, U.K., Mexico, & U.S.