

UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

FACTORS INFLUENCING VACCINE-HESITANCY IN FIRST-TIME EXPECTANT
MOTHERS: A QUALITATIVE STUDY

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

In partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By

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Norman, Oklahoma

2022

FACTORS INFLUENCING VACCINE-HESITANCY IN FIRST-TIME EXPECTANT
MOTHERS: A QUALITATIVE STUDY

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF HEALTH AND EXERCISE SCIENCE

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Abstract

Objective. To identify and better understand factors of vaccine-hesitancy in first-time expectant mothers, pertaining to childhood vaccines and compliance with the Advisory Committee of Immunization Practices (ACIP) schedule. **Methods.** Semi-structured interviews were conducted in the fall of 2018 and spring of 2019 with fifty vaccine-hesitant first-time expectant mothers living in the United States. The Parents Attitude About Childhood Vaccines-modified (PACV-m) survey identified vaccine-hesitancy. The interview question path was developed using the Theory of Planned Behavior and select constructs from the Health Belief Model, feedback from pilot study, and related literature. Interviews were transcribed and analyzed for themes.

Conclusion. Most factors of vaccine-hesitancy are driven by a fear of injury to their child. Feeling informed was a factor that built confidence, but there were obstacles to getting reliable and comprehensive vaccine-information. Healthcare providers have an important role by providing vaccine-information during pregnancy, listening without judgment, and engaging in vaccine-related conversations. Most intended to use an alternative or delayed schedule but did not have a definite plan yet. There is parallel between reasons to not accept COVID-19 vaccine and childhood vaccine refusal. Recommendations are made to provide education and training to prenatal healthcare providers and to understand the social norms around the mothers' decision to vaccinate.

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Chapter I: Introduction

Introduction to the Problem

Since becoming available in the mid-20th century, childhood vaccines have played a substantial role in the decline of early mortality rates [1]. During the Reagan administration in the 1980s, authorization of the National Childhood Vaccine Injury Act led to the formation of the National Vaccine Advisory Committee (NVAC). This committee's purpose was to improve availability, accessibility, safety, and efficacy of childhood vaccines [2]. To help accomplish these goals, a group of experts across several public health domains (e.g. epidemiologists, biostatisticians, clinical medical providers, and researchers) were selected to create an official guideline for childhood immunizations [3]. The committee, known as the Advisory Committee on Immunization Practices (ACIP), was tasked with creating a childhood immunization schedule that, when followed correctly, would provide ultimate protection against common infectious diseases [2, 3]. Each year the committee investigates the spread of diseases and uses the information to modify or maintain recommendations on the schedule [2].

These actions have had a tremendous impact on mortality demographics in the United States (US). As of 2020 the leading causes of mortality in the US are due to chronic diseases rather than infectious diseases [4]. Vaccines are also attributed with reducing years of potential life lost (YPLL) [5]. According to Guyer et al. [6] a comparison of US vital statistics between pre and post vaccine eras of the 20th century shows an increase in average life expectancy of 60% post vaccines.

As generations age, time creates a greater distance between the modern age and the pre-vaccine era; however, attitudes towards vaccines are trending to greater skepticism and less

acceptance [7, 8]. Once widely feared, infectious diseases have become less of a perceived threat by many [8, 9]. Over the past two decades, fewer parents are following the recommended ACIP schedule as it is written [10]. Some attribute the resurgence in vaccine-preventable diseases (VPD) to the growing number of parents choosing to not follow the ACIP schedule [11-14]. Some of these diseases, such as measles and pertussis “whooping-cough,” have serious health consequences and have even been known to cause early mortality [15].

Many times, those infected are under-vaccinated children whose parents have chosen to refuse or delay for non-medical reasons [16, 17]. Studies show that children who miss some of the scheduled vaccines, and/or receive them at wrong times, have up to a 35% greater risk for contracting measles compared to children who were up to date with the measles, mumps, rubella (MMR) series [18-20]. According to a predictive model created as part of a study in Texas, a decrease of 5% of vaccinated children could predict a 40% to 4000% increased size of a measles outbreak relative to the population in that area [21]. Because children are still in the process of developing their immune system, they are more vulnerable to developing an infection and spreading it to others. Unfortunately, children younger than 12 months are not recommended to receive the MMR. A way to protect those not able to be vaccinated is to ensure that enough people in their community have immunity to the diseases, thus preventing diseases from entering the community and spreading [12, 22]. The public health terminology for this sort of community protection is *herd immunity* [23].

Although rare, there are uncontrollable circumstances where children cannot be vaccinated due to health issues or for other reasons (e.g. insurance coverage, accessibility to vaccines, financial deficiencies, lack of transportation, etc.) [24]. According to Bednarczyk et al. [25] the prevalence of children with medical exemptions is low. According to a review of the

National Immunization Survey from 2017 to 2018, only 2% of all kindergarteners in the US have medical exemptions [25]. Additionally, because many county health departments have received federal funding through programs such as Vaccines for Children, financial affordability is seldom an obstacle [26, 27]. Predominately, under vaccinated children are the result of parents who have chosen to opt out of some or all vaccines [13, 24, 28, 29].

Historically, there was a time when most parents belonged to one of two types of vaccinators, pro- or anti-vaccinations [11]. A third type of vaccinator, the vaccine-hesitant, has emerged over the years and has become increasingly popular [30-32]. Vaccine-hesitant parents differ from pro- and anti-vaccinators as they are unsure about making a vaccination decision in either direction [32-34]. The World Health Organization, Strategic Advisory Group of Experts on Immunizations (WHO SAGE) defines vaccine-hesitancy as “interwoven complexities of multiple socioemotional factors, causing parents to refuse or delay vaccines despite their availability” [35, 36].

Studies have found that vaccine-hesitant parents are less stable in their position and even after deciding, may change their mind at any given time [37]. They are characteristically somewhere on a continuum between believing that vaccines are necessary or are unnecessary; range from accepting all vaccines to accepting none; or accepting some vaccines on time while delaying others [38, 39]. Hesitancy is rooted in emotional, psychological, and perceptual beliefs about vaccine injuries and threats of disease [39, 40]. In the past decade, researchers have created vaccine-hesitancy screening tools to identify parents with hesitancy [41, 42]. These tools have just recently begun to be used in research studies aimed at improving vaccine uptake [43].

Vaccine-hesitancy is also affected by current events, background experiences, personal stories, and social factors [35, 44, 45]. For example, in 2008 Jenny McCarthy, an actress and

autism activist, appeared on the Oprah Winfrey show stating that the MMR had caused her son to develop autism, now known as autism spectrum disorder [45]. A significant number of US parents who were teetering on the edge of vaccine hesitancy were swayed to refuse the MMR [45]. Conversely, in January 2014, an outbreak of the measles originating from a popular theme park in California gained national attention causing some hesitant parents to be swayed towards accepting the MMR [14, 46].

Studies have found evidence of vaccine-hesitant parents' fluctuation between accepting and refusing vaccines [47-49]. Salmon et al. [47] describes vaccine-hesitant parents as a group of people that relate to both sides of the vaccine debate, constantly in a sort of “tug-of-war” with feelings of guilt, worry, and fear for consequences of their making a vaccine decision in either way. Vaccine-hesitant parents differ from parents who are confident in their vaccine stance, but also differ in opinions about timing, necessity, and safety within the vaccine-hesitancy group [31, 49, 50].

Several commonly shared reasons to delay or refuse vaccines have been identified. These reasons include: feeling uncertain about their safety [51, 52]; feeling that they are unnecessary in this day and age [33, 53]; believing that VPDs have been eradicated and are no longer a threat [54, 55]; concern with how many vaccines are given at one time [56, 57]; lack of confidence in their efficacy [32, 44]; and a mistrust for the government and medical field [58, 59].

Vaccine-hesitant parents' indecision makes them a better target for vaccine-uptake interventions compared to anti-vaccinators [30, 50, 56, 60, 61]. Multiple strategies have been used to improve parents' intentions to comply with the ACIP schedule [62]. These efforts have included: giving parent-centered vaccine information[19]; financial incentives [63, 64]; debunking that vaccines cause ASD [16, 65, 66]; providing at home vaccinations [67]; and

sending postal/telephone reminders [68]. A systematic review conducted by Sadaf et al. [19] found that many of the interventions attempting to improve the vaccine-hesitant parent's confidence in vaccines have had little success. For example, people are generally receptive to public health messages raising awareness or giving information about health issues. Yet this is not true for vaccine-hesitant parents [69, 70]. Studies have documented an increase in hesitancy after vaccine-hesitant parents had viewed public health messages [71, 72]. It is not exactly known what provokes vaccine-hesitant parents to adversely react to positive public health messages about vaccines, but researchers have uncovered some contributing factors that are worthy of consideration [45, 69, 71].

Two main theories to explain this phenomenon have been proposed, the “backfire effect” [73], and the “big pharma conspiracy” theory [74]. The “backfire effect” occurs when the intended target of a message reacts adversely to the message’s intent. Pro-vaccine messages, but not anti-vaccine messages, have been known to have a “backfire effect” in vaccine-hesitant parents [73-75]. A reason is the use of absolute and affirmative messaging that does not include potential vaccine risks [76, 77]. Studies have found that vaccine-hesitant parents believe that all medicine has risks and should come with proper warnings, therefore, for vaccines not to have warnings is suspect [73, 78]. One study found that not only did participants have increased skepticism for vaccines after seeing pro-vaccination messages, they also had a significant increase in threat appraisal of the vaccines [55]. Some researchers have proposed modifications to pro-vaccine messages so that messages included potential risks in similar fashion to other prescription drug advertisements [45, 77, 79]. Although not typically needed in messaging for other matters of public health (e.g., heart disease, diabetes, mammograms, lead-poisoning),

vaccine-hesitant parents seek full disclosure of all potential risks, no matter how unlikely, presented to them before making a confident decision [31, 45, 79].

The “big pharma conspiracy” is a belief that pharmaceutical companies have purchased the advertisements and control the content of the pro-vaccine messages targeting the public [58, 70, 71]. According to Kata [70] this conspiracy theory is frequently shared on social media sites and in online anti-vaccination forums. Many vaccine-hesitant parents believe that powerful companies, such as those in the pharmaceutical industry, control the narratives on the mainstream news outlets and are therefore untrustworthy [59].

Both theories are grounded in a broader scope of mistrust, making public health campaigns less effective in their efforts to educate the public about the importance of vaccines. These beliefs are driven by people who believe pro-vaccine messages use false information to entice them to vaccinate their children for others’ financial gain [62, 80]. Lee et al. [62] conducted a study that discovered that parents who mistrust the government are twice as likely to be non-compliant with the ACIP schedule as those who trust the health officials and agencies. Conversely, researchers hold the position that for some, their mistrust in government is rooted in other difficult-to-change factors such as personality type [81, 82]. From the literature, however, it is not clear if the underlying issues of personality types and mistrust in the government are related to vaccine-hesitant parents or only anti-vaccinators. Therefore, a need exists to explore the intricate and complex concepts as they relate to the vaccine-hesitant parent.

Although vaccine-hesitant parents are not always receptive to public health pro-vaccine messages, existing literature shows that they physicians are often a trusted source [59, 83, 84]. Some studies have found that vaccine-hesitant parents are more likely to be receptive to pro-vaccine information if it is coming directly from a trusted physician [84-86]. Glanz et al. [87]

conducted a study between 2008 and 2011 with mothers of children younger than four years. Over half of the participants reportedly stated that they would trust their doctor's advice on vaccines [87, 88]. Benin et al. [83] interviewed mothers of infants to explore factors related to their vaccine-decision making. A thematic analysis found that trust in their pediatricians was a central theme that connected all other themes in the study [83].

Although physicians are perceived as giving trustworthy advice, obstetricians have not always been the focus for the type of provider who should give vaccine information [89, 90]. For example, many reported first receiving childhood vaccine information after they had already had their children [34, 91]. However, studies have found that over 75% of vaccine-hesitant mothers reported making the vaccine decision during pregnancy [34, 87, 92]. Therefore, giving this information after the child is born is too late. Thus, it is important to find ways to improve the timing of childhood vaccine information delivery.

One way to improve vaccine compliance is to establish trust between the prenatal direct care providers during pregnancy, so that vaccine information is better received. In relation to optimal timing of vaccine information delivery, the mother's previous birth history also plays a part. For example, compared to mothers who have already had children, first-time expectant mothers are more likely to be vaccine-hesitant and have a greater fear of the unknown due to lack of previous experience making a vaccine decision [88, 91, 93].

Grant et al. [88] urges researchers to focus efforts on first-time expectant mothers, because they appear to receive, process, and make the vaccine decision differently than experienced parents who have practice at making the decision. Additionally, because first-time expectant mothers become saturated with childcare advice after a child is born, knowing how they feel *before* they are influenced by outside pressures would provide great insight into which

factors are influencing their current vaccine hesitancy [93, 94]. Should healthcare providers (e.g., obstetricians, gynecologists, etc.) have this knowledge, they could better tailor their interactions with soon-to-be mothers.

There is a crucial need to address vaccine concerns so that vaccine-hesitant parents feel comfortable and confident when making a vaccine decision. Controlling and reducing vaccine-preventable diseases (VPD) are dependent on it [95, 96]. Thus, this study's purpose is to qualitatively explore reasons contributing to first-time expectant mothers' hesitancy towards following the ACIP schedule. Because there is little research investigating this group of mothers, an exploration using qualitative methodology will provide an opportunity to gain rich descriptive information from the participant's lived experiences and provide clarity to an otherwise under-studied group.

Purpose of the Study

The purpose of this study was to qualitatively explore factors influencing vaccine-hesitancy in first-time expectant mothers who were in their second or third trimester of pregnancy. Through semi-structured interviews this study aimed to gain valuable insight into the factors driving their hesitancy.

Theoretical Foundation

According to Gesser-Edelsburg et al. [97] vaccine-hesitant parents are highly complex, and their decision-making process is different from other vaccine behavioral groups. Therefore, it was decided to use a health behavior theory to provide a framework to understand this behavior [67, 97]. Health behavior theory can make the process of identifying interrelated variables more efficient by structuring the qualitative narrative in such a way as to facilitate the identification of perceived barriers and facilitators within the constructs of well-proven theories

[98]. The Theory of Planned Behavior (TPB) has been used in that to examine mothers' intentions to vaccinate their daughters against human papilloma virus (HPV) [99, 100]; college aged men and their intentions to get the human papilloma virus (HPV) vaccine [101]; adults' intentions to receive a seasonal influenza vaccine [102]; and several other various health-related behaviors [66, 101, 103]. The TPB has three primary constructs that directly influence behavioral intention. These constructs include attitude towards a behavior, peer influence, and perceived behavior control [38, 101]. The TPB also includes background factors that indirectly impact the three primary constructs [104, 105]. However, the TPB lacks the ability to assess how threat perceptions influence behavioral intentions. Several studies have found perceived threat to be an influential factor contributing to vaccine decisions [67, 106-108].

Vaccine-hesitant parents who are “fence-sitters” can go either way at any given time. Therefore, being able to explore how they perceived severity and susceptibility of risk factors was viewed as important information to better understanding them [30, 37, 109]. Consequently, both constructs were taken from the Health Belief Model (HBM) and used in conjunction with the TPB. Vaccine-hesitancy is recognized as an attitude, or an emotional evaluation of feelings brought about by the fear of deciding in either direction [50]. At the time of this study, constructs of the TPB had not been applied to a qualitative study exploring vaccine-hesitancy in first-time expectant mothers.

Research Questions

Research Question 1: What are the perceived barriers and facilitators for intentions to *fully comply* with the ACIP schedule for second or third trimester first-time expectant participants who are vaccine-hesitant?

Research Question 2: What are the factors influencing second or third trimester first-time expectant vaccine-hesitant participant's intentions to not comply with the ACIP schedule?

Research Question 3: Are there differences in how first-time expectant participants perceive measles, mumps, and rubella (MMR) vaccine compared with the other mandated childhood vaccines?

Research Question 4: What, if any, are the similarities and differences between vaccine-hesitant first-time expectant participants and what is known about vaccine-hesitant mothers who already have children?

Significance of Research

In 2005, a Kaiser Family Foundation Study found that over 80% of females report being the primary decision maker for their children's vaccine uptake [110]. The Kaiser Study results are like several other subsequent studies that have documented mothers' roles as the primary health decision maker in their family [111, 112]. Given that mothers are the primary decision maker regarding children's vaccines [47], this study aimed to hear from them directly about the reasons for their hesitancy.

At the time of this study, first-time expectant mothers were largely understudied in spite of evidence showing that vaccine decisions begin during pregnancy [91]. Studies comparing them to other pregnant women have found them to be seven times more likely to be unsure about how they will vaccinate [113]; and to have stronger aversion towards childhood vaccines [91]. To best understand the complex reasons for their hesitancy, it was decided to conduct one-to-one interviews with first-time expectant mothers. Using qualitative methodology allowed them a

space to give an in-depth explanation using their own words and from the perspective of their own reality [114].

Most miscarriages occur during the first trimester, or week one through 12 of gestation [115]. Only about 2 to 3% of miscarriages occur beyond the first trimester [115, 116]. To help reduce the chance of a participant unexpectedly miscarrying, this study chose to focus on first-time expectant mothers who were at least 13 weeks pregnant. It was anticipated that the information gained would greatly enhance and advance what is known about vaccine-hesitancy. Additionally, it was projected to give insight about how to promote physicians and mothers in their dialogue about childhood vaccines.

Delimitations

Delimitations of this study included:

1. The research participants included females who were expecting their first child and were in their second or third trimester.
2. Participants would be the primary custodian and care giver of the child after birth.
3. Online interviews through Google Hangouts, Skype, or FaceTime included participants who lived anywhere in the United States.
4. All participants were US citizens and were currently living in the United States.
5. All participants were fluent in English.
6. All participants were at least 18 years of age.

Limitations

Limitations of this study included:

1. The study design used cross-sectional methodology and cannot therefore, be used to identify causal factors of intention to vaccinate.

2. The data was collected using self-report methods that increases the risk for statistical error.
3. To ensure that the Health Insurance Portability and Accountability Act (HIPAA) was not violated, participants were not required to provide documentation confirming their pregnancy. Therefore, there was no attempt to medically confirm their pregnancy.

Assumptions

The assumptions of this study included:

1. Participants were pregnant with their first child and were at least 13 weeks pregnant.
2. It was assumed that the Parental Attitudes about Childhood Vaccines, modified version (PACV-m) correctly identified vaccine-hesitant participants.
3. Each demographic survey and PACV-m were completed independently only once.
4. Participants were able to read and understand all instructions related to the demographic survey, the PACV-m, and interview questions.
5. Participants answered the demographic survey, the PACV-m, and interview questions truthfully and to the best of their ability.
6. Participants had basic knowledge of vaccines.
7. Participants anticipated having full and complete accessibility to vaccinate their child and would not have this decision impeded by uncontrollable circumstances.

Operational Definitions

Operational definitions used in this study included:

1. **Vaccination**- the action of receiving an injection of a modified infectious pathogen that causes an immune reaction that protects the one inoculated against futuristic exposures to a specific pathogen [117].
2. **Vaccine**- the physical object that houses a chemical and pathogenic formula used to inoculate people so that an immune response will elicit immunity [23, 117].
3. **Vaccine hesitancy**- the current state or condition of hesitancy towards making any vaccine decision [118].
4. **Vaccine compliance**- parents who intend or are actively vaccinating their children according to the recommendations of the Advisory Committee on Immunization Practices (ACIP) [10].
5. **Intention (construct of TPB)** - the direct preceding factor for impending vaccination behaviors after the child is born [103, 111].
6. **Perceived behavioral control (construct of TPB)** - a direct influence of how the first-time expectant participants view their capability to be compliant with vaccinations-based on perceived barriers or facilitators [103, 111].
7. **Subjective norm (construct TPB)** - first-time expectant participants' beliefs about whether people within their environment would agree or disagree with how they intend to vaccinate their child [99, 103].
8. **Attitude (construct TPB)**- first-time expectant participants' feelings about vaccines and factors associated with vaccines (e.g., following the ACIP schedule in its entirety, feelings of fear related to the outcome of their impending vaccination decisions, mistrust, vaccine efficacy) [103, 111].

9. **Background factors (moderators for TPB constructs)** - pre-existing characteristics that strengthen and drive beliefs, attitudes, and feelings towards impending vaccines [53, 103].
10. **Perceived severity (sub-construct of perceived threat in HBM)**- how first-time expectant participants perceive the seriousness of specific diseases and/or adverse effects from vaccinating their children [119].
11. **Perceived susceptibility (sub-construct of perceived threat in the HBM)**- first-time expectant mothers' perceptions of the likelihood that theirs, or another person's, under-vaccinated child will be exposed and/or infected with a vaccine preventable disease (VPD) [119].

Inclusion Criteria

1. First-time expectant females who were at least 13 weeks' gestation and ≥ 18 years old were included in the study.
2. Online interviews were with participants who lived locally or nationally.
3. Participants that were interviewed online were required to have access to high-speed internet capable of video chat and to a quiet secured space for the interview.
4. Participants must have either self-identified as *vaccine-hesitant* on the Parent Attitudes and Childhood Vaccines, modified version (PACV-m) or had a score of ≥ 42 [43, 120, 121].
5. All participants intended to keep their child and be their primary health care decision maker.
6. All participants were fluent in English and did not have an auditory disability that prevented them from hearing and/or responding verbally to the interview questions.

Exclusion Criteria

1. Participants who were younger than 18 years of age did not qualify to participate in the study.
2. Participants who had known hereditary medical conditions that would prevent their child from safely receiving vaccinations were not included in the study.
3. Participants who did not show mental capacity to understand the questions were not included.
4. Participants who had other children that they had not birthed, yet did make vaccine decisions for, were excluded from the study.
5. Participants that scored ≤ 42 on the PACV-m and did not self-identify as vaccine-hesitant were not qualified to participate in the study.

Chapter II: Literature Review

Introduction to the Literature

Chapter two reviews literature on the background and history of vaccines, vaccine-preventable diseases, vaccine trends, vaccine behaviors, and gaps in the literature. Two health theories streamlined the study's focus. The entire Theory of Planned Behavior (TPB), and two constructs, perceived severity, and susceptibility, from the Health Belief Model (HBM). The term "parent" describes people who have children; however, because the studies in this literature review often exclude fathers inadvertently or coincidentally, parents often mean mothers only.

The Issue

There are three general types of vaccine behaviors, pro-, anti-, and hesitant vaccinators [8, 30]. Pro-vaccinators characteristically accept all mandatory vaccines on the ACIP at the right time [122]. Studies show that pro-vaccinators have trust in the medical field [123]; believe that vaccines are safe and that VPD are dangerous [122]; and have an overall positive view of vaccines [124]. Anti-vaccinators have a negative view of vaccines expressing opposition to vaccines and the vaccine schedule [125]. Studies show anti-vaccinators mistrust the medical community [126]; have preference for natural immunity [127] and alternative medicine [74]; believe that the MMR causes autism spectrum disorder (ASD) [13, 128]; and believe vaccines are ineffective and unnecessary [129]. Pro- and anti-vaccinators maintain a more permanent stance and are less likely to change their minds [130]. Vaccine-hesitancy may share some of the beliefs of the pro- and anti-vaccinator, but do not fully agree with either side [131, 132]. Studies show that vaccine-hesitant parents fluctuate more in their beliefs and are not permanently committed to a vaccine stance [50, 52].

The growing number of vaccine-hesitant parents is a concern for public health [5, 39, 44, 89]. Compared to pro-vaccinators, they are also more likely to have their children on an alternative vaccination schedule, thus under-vaccinated and more susceptible to vaccine-preventable disease [46, 48, 133]. Unfortunately, not only are under-vaccinated children more likely to become infected with a VPD [40], their pervasiveness is reducing the number of people with immunity to diseases in communities across the US [12, 15, 134]. First-time expectant mothers have greater vaccine-hesitancy than parents who have already experienced making vaccine decisions for their children [87, 91]. Their elevated hesitancy makes them more likely to opt-out of some or all the vaccines after their child is born [90]. Although an ideal population for interventions, it is unclear what is driving their hesitancy. In order to develop effective interventions, there needs to be a better understanding of their vaccine decision-making process.

History of Vaccines and Diseases in the United States

In 1964, the United States assembled a group of health experts to form the Advisory Committee on Immunization Practices (ACIP). The purpose of this committee was to establish a branch of government that would monitor vaccination compliance to reduce early mortality caused by infectious diseases [135]. Collaborating with the Food and Drug Administration (FDA), the ACIP committee advocated vaccines safety for human use and their necessity to disease prevention. Immediately after their release, an overwhelming majority of people gratefully accepted vaccines [6, 136]. Historians believe that this resulted from personal experience from witnessing infections that maimed and killed many of the youth from that era [6, 137]. The government's distributions of vaccines, along with the "Clean Act Bill," and the public's willingness to accept vaccines contributed to an immediate decline in early mortality

from infectious diseases [138-140]. Within a short time, the number of immunized people drove cases of vaccine-preventable diseases to low numbers in the United States (US) [6, 11, 141].

Elimination versus Eradication

Incidence rates of common infections, such as measles and “whooping cough,” became so low in the years following vaccine releases that they were declared eliminated by the US Surgeon General in 2000 [142, 143]. However, eliminating infectious diseases, such as measles, has confused many who mistakenly believe elimination is synonymous with eradication. According to the World Health Organization (WHO), the definition of elimination is when rates of infections remain at a certain low threshold for at least twelve months [144-146]. Smallpox has been eradicated, and polio is near eradication [142, 147]. Although some nations have eliminated measles, it has not been eliminated globally. Therefore, the number of measles cases worldwide have prevented the disease from being eradicated [148, 149]. Unfortunately, this confusion has caused some US parents to have a false sense of security, believing that measles and other diseases are no longer a threat [1, 142].

Surveillance reports of VPD show that many diseases still exist in our environment and can spread rapidly among people without immunity [26, 150]. Frequently, infections are traced back to international travelers who enter the US while unknowingly sick [151, 152].

Table 1 shows the results of epidemiology reports of measles cases reported to the CDC in the US between 2010 and 2020 [153, 154].

Table 1 Measles Cases in the United States

Year	Number of Measles Cases
2010	63
2011	220
2012	55
2013	187
2014	667
2015	188
2016	86
2017	120
2018	375
2019	1282
2020	13
2021	49
<i>Note: Data from Table 1 was accessed online from the Centers for Disease Control and Prevention on 04.15.2022</i>	
<i>Source: https://www.cdc.gov/measles/cases-outbreaks.html</i>	

Although the US has eliminated some vaccine-preventable diseases, such as measles, mumps, and pertussis “whooping cough,” this is not the case globally [155]. As long as these diseases are still prevalent in other parts of the world, international travel will continue to spread infectious diseases, increasing risks for exposure and outbreaks [26, 148].

Recent Outbreaks of Vaccine-Preventable Disease

The burden of finances to treat a person infected with a preventable disease is usually assumed by the person’s private health insurance or if they do not have individual insurance, federally funded insurance (e.g., Medicare, Medicaid, and SoonerCare). These costs come from the medical treatments to recover the infected person [156]. According to Moser et al. [156] the cost to treat a pertussis case in 2014 ranged from \$278 to \$4,331. These costs are estimated to have nearly doubled in the past couple of years. The level of involvement from health agencies

trying to control an outbreak, the number of cases burdening the local medical system, the virulence of the diseases, and the rising costs of medical care have produced an overwhelming burden on the public health system that affects the entire population [156-158].

Measles

Measles is a particularly virulent disease and is, therefore, associated with some of the highest accrument of medical costs on individuals, the healthcare system, and federally funded insurance programs [156, 159]. According to Bloom et al. [39] each measles infection financially burdens the health system by costing tens of thousands of dollars to prevent further spreading. The number of annually reported measles cases had been consistently below 200 cases from 1997 until 2007 [39, 160]. Beginning in 2008, new cases of measles began to spike. San Diego experienced a measles outbreak in 2008 that triggered a resurgence of measles outbreaks that lasted months [11, 161].

Shortly following the 2008 measles outbreak in San Diego, Amish communities across Ohio also started experiencing similar types of outbreaks [162]. Again, most of the infections were in under-vaccinated children, most of whom lived near one another [163, 164]. In 2011, sixteen outbreaks resulted in 220 confirmed cases, of which 62% of the infected were unvaccinated [140]. In 2014, the US experienced another surge of 644 cases after an infected traveler unknowingly exposed many people to measles at California's highly populated theme park, Disneyland [46, 160]. The number of infections from this outbreak was one of the largest that the US had seen in a long time [165]. The immediate 125 confirmed cases were the result of other patrons at the park that day [14, 20]. Most of the cases occurred in those who were unvaccinated (45%), under-vaccinated (11%), or their vaccination history was unknown (43%) [11]. As a result of this outbreak, California passed the bill SB277 to end all non-medical

vaccine exemptions [166]. The outbreaks in 2014 were pivotal to vaccine exemption policies and the public's perceived threat [167]. Because most of the infections happened on the west coast in non-medically exempt unvaccinated children, California changed the laws regarding the allowance of non-medical exemptions [167].

Later that year, between March 2014 and July 2014 there was a measles outbreak across nine counties of Amish communities in Ohio. The cases were more numerous than the Disneyland outbreak [162]. Ninety-nine percent of the 383 cases were in people of the Amish faith, who were unvaccinated due to religious objections [162, 168]. The 2014 Ohio outbreak is an example of how disease spreads rapidly in tight-knit communities, where the percentage of immunized people is too low for herd immunity to occur [24, 150].

From September 2018 to September 2019, there were 649 cases of measles recorded in New York City traced to an unvaccinated child who had traveled internationally [151]. An investigation into the vaccine history for people infected showed that 85% were unvaccinated. In addition, the median age of infections was just three years old. As a result, the New York Department of Health and Human Hygiene initiated mandatory exclusions of unvaccinated children from schools and daycares in the communities affected [151]. The 2018-2019 measles outbreak in New York City boroughs has been the largest and most financially burdensome outbreak since 1992. Since 2008, outbreaks had continued steadily each year until 2020 when COVID-19 restrictions reduced measles transmission [11, 154, 169, 170].

As is often the case with viruses, different strains have varying levels of virulence [11]. Virulence is defined as the degree to which a pathogenic disease causes severity of symptoms, the ease of which is transmissible, and the long term health outcomes associated with an infection [171]. Strains of a pathogen have different biomarkers and mutations that affect its

virulence. According to Gastañaduy et al. [162] the measles of 2014 seemed abnormally virulent as over 100 people died in the Philippines that year alone [16]. This is alarming, as people continue to be globally mobile, international travel will remain a vehicle for serious infectious diseases [11, 152]. According to the World Health Organization (WHO), measles is a leading cause of infant death in other parts of the world [172]. Particularly in areas with low accessibility to preventative medicine such as the MMR vaccine [172].

Mumps

Between 2013 and 2014, the number of mumps infections doubled in the United States [173, 174]. Frequently, measles and mumps are discussed together. Likely, this is due to the MMR vaccine that combines attenuated viruses from these two and rubella into one injection [172, 175]. However, the two viruses are quite different, and the infections target different physiological functions of the body. For example, although both viruses cause fever, measles can cause the internal body temperature to reach dangerously high temperatures, increasing the risk for permanent epithelial scarring [11, 176]. Mumps primarily targets the salivary glands causing them to painfully swell much greater than their usual size [171]. Fever is common, but not usually fatal. Compared to mumps, measles has more significant potential for causing severe health outcomes [177, 178]. Although rarely fatal, mumps infections are more common than measles [152, 179]. However, there is a positive correlation between measles and mumps outbreaks because of the combination vaccine, MMR [148].

Although there are many etiological differences between mumps and measles, there are some similarities. For example, both diseases spread quickly in under-vaccinated people living near one another [179, 180]. Because of mumps' high rates of transmission, places where people congregate, such as schools, college campuses, and military locations, are common sites of

outbreaks [174, 181]. In the US, most mumps cases occur in either those too young to get the vaccine or older vaccinated people whose immunity has weakened [177].

Arkansas recorded the second greatest outbreak of mumps in thirty years of US history, between 2016 and 2017 [158]. The outbreak affected 3,000 people and was traced back to an unvaccinated Marshallese older adult. In the US, Marshallese community members often live near one another, allowing disease to spread quickly from person to person [158, 182]. Mumps is also unique in that the immunity from a vaccination appears to weaken over time naturally. Around six years of age, the last of the MMR series is given. As people age, their protective antibodies in blood serum wane [143, 183]. At the time of this study, there had been ongoing discussions about the necessity and benefit of a third mumps dose to booster immunity [179, 180]. Many who opposed the number of vaccines on the ACIP schedule were expected to object to a third dose added [57, 106, 166]. However, that did not stop a recent modification to the ACIP schedule. In 2017 at a committee meeting, the ACIP Mumps Work Group presented data from their surveillance of outbreaks [184]. As a result, a unanimous decision by ACIP members was passed to approve a third dose of the MMR vaccine for people with an increased risk of infection [184].

Rubella

The virus that causes rubella was first identified and isolated in 1962 [185]. Before 1965, rubella infections occurred in endemic proportions, infecting over twelve million people each year [186]. However, in 2004 the US declared it eliminated. Since its elimination, the US averages about ten cases per year [13, 186]. Like measles, most of these cases originated from an unimmunized international traveler. Except for immune compromised people and pregnant women, the health outcomes have not been severe [186]. The symptoms of rubella include a

low-grade fever, red eyes, body aches, and lethargy that typically resolves within ten days [175]. Pregnant women, however, who do not have immunity have a greater risk for health complications related to an infection [185]. In addition, pregnant women infected with rubella can pass the virus to the fetus in utero. Congenital rubella syndrome (CRS) is life-threatening for the baby as it attacks each developing organ [185]. Prior to the vaccine, congenital rubella was responsible for 11,000 pregnancy losses, over 2,000 newborn deaths, and over 20,000 cases of CRS [186]. The rubella vaccine is included in the same vaccine as the measles and mumps and is about 80% effective [187]. Some studies anticipate a resurgence in rubella outbreaks because it is part of the frequently rejected MMR [13].

Bordetella Pertussis "Whooping Cough"

Infections of this bacteria compromise the respiratory system. The bacteria attach to cilia in the lining of the respiratory passageway, resulting in the infected person having a severe cough that makes a particular "whooping" sound [155, 188]. As a result, the lungs are susceptible to secretions pooling and causing bacterial pneumonia, the cause of mortalities [189]. The disease is transmitted easily through nasal secretions but can also be airborne, increasing its contagiousness [190]. Before the diphtheria, tetanus, and pertussis (DTaP) vaccine, there were on average 200,000 cases annually [155]. After the vaccine was made available to the public in the 1960s, there was an 80% decline in incidence [160]. Like the measles vaccine, despite the initial acceptance and success, perspectives on its necessity, safety, and efficacy are being questioned [191, 192].

Regrettably, since the start of the 21st century, the number of pertussis cases are higher than they have been in the past 50 years [190]. In 2012, there were 48,277 cases in the US which was the largest outbreak since 1955 [193]. The Provisional 2017 Reports of Notifiable Diseases

show there were 17,972 cases reported in 2016 and 18,975 cases in 2017 [153]. The 2019 Final Pertussis Surveillance Report shared by the CDC found reports 15,609 cases in 2018, and 18,617 in 2019 [153].

Like measles cases, the most vulnerable to these infections are under-vaccinated young children [190]. Between 2016 and 2017, 44% of those hospitalized from the infection were children younger than 6 months [153]. Additionally, children younger than a year accounted for four of the 13 deaths from pertussis in 2017 [194]. A team of researchers reviewed cases of pertussis reported through seven US Emerging Infections Program Network states from January 2011 through December 2015 [193]. Out of the nearly 16,000 cases that were reported, almost 30% of hospitalizations were in infants younger than two months old. Second in hospitalizations were infants younger than 11 months old and older adults [193].

Glanz et al. conducted a case-control study comparing under-vaccinated children aged 2 to 18 months to matched controls of children up to date on their vaccines. The targeted participants were members of a health plan between 1996 and 2007 and had confirmed pertussis infections [189]. The results found under-vaccinated children to be 23 times more likely to get "whooping cough" than the fully vaccinated control group [189]. The DTaP vaccine is a threat to many who are opposed or fearful of combination vaccines [107, 194]. Those concerned about the number of vaccines given to young children are likely to deny or delay this vaccine [56, 107, 195]. In a longitudinal study of pertussis cases over six years, more than half of the children infected were on a modified or delayed immunization schedule [10]. Other studies have found similar correlations [155, 190].

Diphtheria

Before the 1920s, *Corynebacterium diphtheria*, the bacteria responsible for diphtheria, was highly dangerous in the US [196]. It is transmitted from person to person through infectious nasal secretions and accounted for over fifteen thousand deaths in one year [197]. Mainly this bacteria affects the respiratory system causing inflammation of the lungs, swollen lymph nodes, fever, and lethargy [197]. Since the 1920s cases of diphtheria have decreased so significantly that any case in the US is an extraordinary occurrence. After the recommended vaccination series given in childhood, boosters every ten years are recommended to maintain immunity [117].

Tetanus

Many relate the need for a tetanus shot as the result of being pierced by a rusty piece of metal. Tetanus occurs when the bacteria *Clostridium tetani* enters the body. It attacks the neuromuscular system, which is why one of the most notorious symptoms of tetanus infection is “lock-jaw” [198]. According to the CDC fatalities caused by tetanus have decreased by 99% in the US since a vaccine was made available in the 1940s [199]. A reduction in fatalities is directly the result of mandatory childhood vaccines and recommended boosters that create antibodies to fight infections [198]. Tetanus is part of the DTaP vaccine, but immunization can wane over time. Mostly the booster is recommended either on an as-needed basis (e.g., stepped on a rusty nail, a cut from an old knife) or routinely every ten years [160, 199]. However, because there have been reports of people becoming infected with tetanus following an acupuncture session, ear piercings, and intravenous drug use, the best way to prevent tetanus from occurring is to receive all vaccines as a child and to continue to get a booster every ten years after the age of seven [198]. In 2019, the ACIP committee voted to approve a single dose

Td for people who had received the DTaP at 11 or 12 years of age [200]. The singular antigen vaccine is available per request at the time that a booster is needed.

Hepatitis A and B

In general, hepatitis is a virus that attacks the liver. It has multiple strands categorized as A through E, each pathologically different from the other [201, 202]. The US mostly sees hepatitis A, B, and C [203]. Hepatitis C cases are usually associated with blood exchange through sex or intravenous drug use. There is no vaccine for hepatitis C, but there is promising medication to keep viral loads low [203].

Hepatitis A and B are different from C in that there are vaccines available to prevent them. It is recommended that children receive a total of three doses of the hepatitis B vaccine given at 2, 4, and 6 months of age [200]. Two doses of the hepatitis A vaccine are recommended between 12 and 15 months. For the most part, vaccines have had a high rate of effectiveness, evident by the 95% decrease in hepatitis A since the vaccine was made available in 1995 [140] and an 89% decline of hepatitis B infections from 1990 to 2002 in people aged birth to 18 years [142].

The hepatitis A vaccine was licensed in the US in 1995 [204]. Hepatitis A is spread from person to person through fecal-oral transmission [201, 204]. There was an increase in infections between 2012 and 2016 originating from imported pomegranates [201]. For this particular outbreak, the age group with the lowest infection rates were those younger than 18 years of age [202]. A second outbreak occurred from July 2016 to June 2019 in Kentucky, Michigan, and West Virginia. Hofmeister et al. [204] randomly selected and analyzed 817 cases of infection that occurred during this time in these states. They found that 812/817 were adults who self-

reported or documented having received one dose of the hepatitis vaccine, however, none could provide evidence of receiving a second dose as is recommended by the ACIP [204].

Polio

Polio has had a significant impact on people's health throughout history [149]. The poliovirus (PV) dates back to ancient times, even having records found in Egyptian tombs [205]. The virus is easily spread from person to person through respiratory secretions and fecal matter [147]. Once infected, the virus can move to the central nervous system (CNS), causing permanent motor neuron damage that can result in paralysis [205]. After the vaccine was deemed safe and thus distributed across the US in 1954, polio cases decreased significantly [206]. In the late 1970s to the mid-1990s, the vaccine had also successfully reduced polio infections globally [205]. Baicus [205] states that between 1970 and 1990, children who received all three doses of the series before they were three years of age increased their chance for survival from 5% to 80%.

The high compliance rate (>80%) of children vaccinated globally significantly reduced the spread of this disease, and thus the WHO declared polio eradicated in the late 1980s [149]. According to the CDC [147] Afghanistan, Nigeria, and Pakistan are currently the only countries still experiencing high rates of polio infections. International travel to and from these three countries increases the probability of importing the virus into the US [142]. For children to gain immunity against polio, they must receive all three doses of the series at age two months, four months, between six and 18 months, and then a booster before they are six [3, 147].

The ACIP Schedule and Under-Vaccination Status

Not following the Advisory Committee on Immunization Practice (ACIP) vaccine schedule causes under-vaccination and leads to a resurgence of vaccine-preventable diseases

such as measles, mumps, and pertussis “whooping-cough” [20, 136]. As a result, under-vaccinated children are the most vulnerable. In addition, the steadily increasing number of exemption requests filed annually indicates an upward trend towards under-vaccination [24, 166].

For children to be fully vaccinated, they must be up to date with the vaccines recommended for their age [10]. According to Kurosky et al. [207] the ACIP allows a four-day grace period before a child is non-compliant. The timeliness of children receiving vaccines is vital to preventing outbreaks. At the time of this study, the ACIP immunization schedule for children up to 36 months of age included four doses of diphtheria, tetanus, and pertussis (DtaP) vaccine, a two-dose series of the hepatitis A (HepA) vaccine, a three-dose series to protect against polio, at least one dose of measles, mumps, and rubella (MMR), the complete series of Haemophilus influenza type B (HiB), at least one dose of the varicella vaccine, and four or more doses of pneumococcal conjugate (PCV) [110]. After this study, the ACIP schedule was modified in 2019 to reflect the following changes: a three-dose primary series of DTaP at 2, 4, and 6 months and boosters at 15 to 18 months and 4 to 6 years, and approval for hepatitis A vaccine during pregnancy [200].

There is significant variability in the contagious properties of each pathogenic disease [208]. Some of these diseases are more virulent than others, causing a greater level of concern [209]. For example, according to Hviid et al. [210] even though mumps is much more common than measles and “whooping cough,” their more significant risk for adverse health outcomes causes more public alarm [210].

Some additional vaccines are recommended but not mandated by many states (e.g., seasonal influenza, COVID-19, rotavirus) [211]. In addition, the child and adolescent ACIP

schedules are birth to 18 years, yet the majority of vaccines occur in the first three years. See Appendix A for the current ACIP Schedule.

Alternative Schedules

Saada et al. [118] conducted a study that identified four types of modified or alternative vaccine behaviors. According to Saada et al. [118] these were (1) parents that relied on alternative schedules, (2) parents who omitted vaccines, (3) parents who waited until their child was older, and (4) parents who were unsure about what to do and therefore made spontaneous decisions [118]. Although the ACIP schedule is created to meet the current needs, many vaccine-hesitant parents do not approve changes that add doses or boosters to the schedule [81].

Combination Vaccines

TDaP or DTaP. The age given determines whether it is the TDaP or the DTaP. Children younger than seven years receive the DTaP, and the TDaP is for people older than seven years [191]. The vaccine protects against tetanus, diphtheria, and pertussis “whooping cough” [3]. The vaccine is a combination vaccine as it includes antigenic properties of three diseases. In 2013, a modification to the ACIP schedule recommended giving pregnant females the TDaP [188]. The rationale for making such a change was scientific evidence showing that babies will acquire passive immunity to pertussis from their mother in utero [188, 212]. Receiving antibodies from their mother in utero protects infants until they are old enough to start receiving the DTaP [91, 139]. Currently, the recommendation is for children to receive their three-dose series at 2, 4, and 6 months of age. Boosters are recommended at 15 to 16 months and 4 to 6 years [91, 213].

MMR. The measles, mumps, and rubella (MMR) vaccine is a combination vaccine that has drawn considerable skepticism over the past few decades [129]. Gilkey et al. [44] examined

data from the 2011 National Immunization Survey (NIS) regarding vaccine preferences and particular behaviors. They analyzed vaccine preferences from 9,354 participants and found that the MMR, varicella, and influenza vaccines were most frequently refused by parents [44, 214].

The MMR vaccine is between 95-99% effective at preventing measles, mumps, and rubella infections [140, 152, 169]. Despite the MMR effectively preventing measles, mumps, and rubella, studies show it is often the most feared and mistrusted [7, 215-217]. The following are known reasons that people would skip or delay the MMR: fear that it causes autism spectrum disorder (ASD), concern that the combination of multiple vaccines in one injection will overwhelm young immune systems [107], a belief that for unknown reasons it can cause seizures, and fear that it will cause the development of allergies [61, 218-220]. Studies have indicated that one of the most common reasons parents skip or delay the MMR is the fear that it causes ASD [45, 173, 219]. In a systematic review conducted by Brown et al. [107] parental anti-vaccination attitudes were most frequently related to (1) concerns of vaccine safety (seven of the 11 articles), and (2) fear of vaccines causing autism (four of the four articles).

People who express opposition to vaccines are not always equally opposed to all childhood vaccines. Numerous studies have demonstrated greater mistrust, primarily for the MMR and DTaP [107, 215]. It is not uncommon for vaccine-hesitant parents to modify the recommended vaccination schedule by either omitting, delaying, or modifying the dosage of one of these two vaccines in particular [56]. Because children on a modified immunization schedule have similar risks as unvaccinated children, it is essential to find effective interventions to improve compliance [136]. In addition, science-based evidence has debunked a link between vaccines and autism, yet it remains an obstacle to vaccine compliance [16, 219]. A study in 2010 found that as many as one in four parents still believe that MMR causes autism [221]. A study in

2015 of 1,000 participants found that 28% had concerns that the MMR caused autism [222]. Fombonne et al. [223] looked at a cohort study of over 16,000 participants who had a child with ASD. According to a retroactive look of the SPARK cohort from 2016, one in six participants believed that vaccines could have caused their child's autism [223]. Despite efforts to find a definitive link between MMR and ASD it continues to remain a reason to not accept the MMR [128, 129, 175, 224].

Herd Immunity

Immunity is often used interchangeably with vaccinated; however, they are not necessarily synonymous. Immunity is a person's state or condition of having biological protection against a specific pathogen [209]. Immunity can be gained through vaccines but can also be acquired naturally from active infection and passively as a child acquires from their mother's immune system while in utero. When exposed to certain diseases, people's immune systems respond by creating biological cells designed to attack that particular pathogen should it invade the body again [208].

Fine et al. [181] describes herd immunity as the necessary ratio of immunized people to unimmunized people within a community, which prevents the spread of disease to the unprotected. When herd immunity is functioning correctly, the number of people with immunity in a community will be proportionately more significant than those without immunity [13, 62, 134]. Depending on the kind of disease, about 83% to 94% of the population must have immunity for herd immunity to be effective [12, 225]. The majority of situations where a child is under-vaccinated in the US is due to parents choosing to omit or delay a vaccine [226]. Rarely, uncontrollable reasons, such as lack of access to health facilities or finances to pay for the vaccines, are reasons for under-vaccination [206].

National Immunization Coverage

When studying herd immunity and national immunization rates, the data can be sometimes misleading and seemingly contradictory. Studies show that the nation as a whole is maintaining immunization rates necessary to facilitate herd immunity [10]. The 2012 National Immunization Survey (NIS) found that 90% of the nation's population has received all vaccines mandatory for school enrollment [10]. However, the NIS data does not consider the number of under-immunized youth who are either not enrolled in public schools or are not old enough to start school [227]. Freeman et al. [29] reviewed data from the 2017 National Immunization Child-Survey data and found out of 15,000 children, only 41% had received vaccines on time at 19 months of age.

Getting an accurate measurement of how many parents are following the recommended ACIP schedule has been particularly challenging. One study estimates that around 15% of parents could be using alternative vaccination schedules [228]. Other studies show that this number could much higher [118, 229]. Nadeau et al. [229] examined the state of New York's immunization coverage. Records for over 200,000 children, mostly birth to nine months, showed that only 25% of them were up to date on their vaccinations [229]. Other studies show even greater percentages of under-immunized children [10, 230]. For example, one recent study found that only half of the kindergartners have received all of the recommended doses in the MMR and DTaP series [214].

From 2019 to 2020, national coverage for DTaP was 94.9% and 95.2% for at least two doses of the MMR [27]. Therefore, the number of people with immunity to the diseases protected by the MMR and DTaP would indicate an excellent percentage to sustain herd immunity. At a glance, it could seem like the coverage rates would prevent measles, mumps,

and pertussis outbreaks. However, that has not been the case, mainly due to two reasons. First, communities share common beliefs and perceptions. When these communities are based on geographical location, a clustering effect of vaccine-hesitant parents living in close proximity can have too few people with immunity to keep disease out [12]. Second, failure to consider the over-representation of under-vaccinated young children in the national data [10]. It is essential to consider immunization coverage between different age groups. For example, the number of under-vaccinated children aged birth to two years is proportionately larger than older children [10, 231].

Changing Social Norms Regarding Under-Immunization

Over the past two decades, social norms around vaccine refusal and delay have changed, becoming more accepting and mainstream [232]. More parents are finding it socially acceptable to not comply with the ACIP schedule [105, 233]. Bandura [234] stated that "the social structure of a person's environment will determine their health behaviors" [45, 234]. The truth of Bandura's statement is evidence of growing popularity in parents reporting their hesitance towards childhood vaccination [54, 87]. The change in attitudes contributes to the declining percent of compliant vaccinators and diminishes herd-provided protection [12, 13, 150]. Therefore, improving people's confidence in vaccines is essential in disease prevention [108].

Exemptions

Mandatory vaccination requirements have ensured that a large portion of school-age children have received their immunizations prior to school [235, 236]. According to the most recent report from *State School Immunization Requirements and Vaccine Exemption Laws*, currently 50 states require complete vaccination coverage as deemed necessary by the ACIP as a pre-requisite for attendance in public school, and 47 also require it for private schools [27, 211,

237]. Although a mandatory requirement, some cannot safely get a vaccine due to health reasons. There are methods that their parents can take to appeal the requirements [236]. Although laws constantly change in each state, the most recent report shows that all states currently allow for medical exemptions [211]. Forty-four states allow for religious exemptions, and 14 allow for philosophical exemptions [211]. According to the CDC's School Year Vaccination Exemption Reports, the national rate of kindergartners with medical exemptions for the 2016-2017 school year was .2% [238], and .3% for the 2018-2019 school year [27]. The low number of actual medical exemptions are not contributing to outbreaks [166, 239], but non-medical exemptions are [239].

Some states with high non-medical exemptions (e.g., Oregon, California, Washington) have responded by making efforts to make non-medical exemptions more difficult [121, 157, 167, 239]. Exemptions to vaccines for religious or personal reasons are non-medical exemptions. There has been an upsurge in the number of non-medical exemptions filed across the nation in the states that allow them [25, 224]. For example, since the year 2000, the state of Arizona has witnessed a 129% increase in personal exemptions filed between 2010 and 2011 [224]. The enormous spike in Arizona occurred within the short span of a decade.

In Oklahoma, the 2017-2018 Kindergarten Immunization Survey showed the rate of kindergartners with non-medical exemptions was 2.1% in public school [240]. For the 2018-2019 school year, the same survey showed an increase to 2.56% in public school non-medical exemptions of kindergartners [240]. Like Arizona and Oklahoma, other states are also witnessing similar increases in actuality and theoretically [21, 63]. For example, Whittington et al. [157] used modeling to project the risk for a measles outbreak in a state with lax exemption

laws. They estimated that a state with lax laws would have a 140% greater risk than a state with moderate laws and a 190% greater likelihood than a state with strict laws [157].

The extensive use of non-medical exemptions reduces the minimum proportion of immunized people needed to protect unimmunized people through herd immunity [23, 62, 241]. A strong correlation between non-medical exemptions and vaccine-preventable disease outbreaks has been documented [23, 224]. Yet, non-medical exemptions continue to account for the majority of exemptions in the US.

Types of Vaccination Behaviors

Parents broadly fit into one of three vaccination behavior groups. First, those that accept and completely follow the ACIP recommendations, *pro-vaccinators* [78]. Second, those that openly oppose and refuse vaccines and vaccine mandates, *anti-vaccinators* [17, 58]. Third, those who are unsure about accepting all vaccines at the recommended time according to the ACIP schedule, *vaccine-hesitators* [37, 97, 108, 128]. Those in the first and second group are on opposite sides of the vaccine debate. However, they share commonalities in their stability and inflexibility with their stance [86]. The third group is a unique group that agrees partially with some of the attitudes and beliefs characteristically found in the other two groups. Additionally, their flexibility has made them an ideal target for interventions aimed at increasing ACIP vaccine compliance [30, 78].

Pro-Vaccinators

Compliant vaccinators are people who accept the ACIP schedule as it is [10, 78]. These parents have historically and continually accounted for the majority of all parents in the US [10]. Studies have shown that they have trust in physicians, belief in vaccine safety and efficacy, and generally do not question medical experts' recommendations [83].

Anti-Vaccinators

It is not easy to accurately know how many people are anti-vaccination in the US because they are less likely to seek medical attention than the other two groups [62, 242]. One study found that anti-vaccinators account for approximately 14% of the population [10]. They are mostly white, affluent, and well-educated. Parents who refuse vaccines have been somewhat ostracized in the health research literature often called derogatory names such as “a crazy anti-vaxxer,” “societal plagues,” “typhoid mommies,” and “irresponsible parents” [124, 243]. They are perceived as having a propensity to elevate celebrity opinions above trained professionals [244]. Additionally, they largely distrust government and pharmaceutical companies [58, 80]. Many have been known to prefer alternative medicines and naturally acquired immunity [45, 232, 245]. Although it is difficult to know how many anti-vaccination parents there are in the US, some believe that it is a growing group [128].

Hesitant-Vaccinators

Presently, when examining national data for vaccination compliance rates of the entire US population without separating by age, it would appear that 90% of the population is compliant [10]. However, this data indicates that only 75% of children between birth and two years have received all of their vaccines on time [10, 130]. It is alarming because under-vaccinated children are more likely to become infected with vaccine-preventable diseases and are also more likely to experience severe health consequences [11].

Some believe that the growing rate of vaccine-hesitant parents is evidenced by the increasing number of parents asking physicians for an alternative vaccine schedule [228, 229]. To accommodate the growing number of parents seeking alternative schedules, the Center for

Disease Control and Prevention (CDC) has included an alternative, catch-up immunization schedule on their website [28, 118].

According to Kumar et al. [130] there has been an upward trend in the number of parents delaying some of the vaccines, modifying the age they are received, or choosing some to refuse. Studies suggest that these parent choices are threatening communities' ability to have herd immunity [23, 62, 134]. Additionally, studies have found that vaccine-hesitant parents fear vaccine injuries and diseases [39, 118], social consequences like not being allowed to enroll in school [50], being shunned from friends and family [122], and having to live with the guilt if something goes wrong [246].

Hesitant parents are more flexible than pro and anti-vaccinators, recognizing valuable points on both sides of the debate [247, 248]. Mainly due to their malleability and their growing number, they have become a favored target population for interventions in the past five years [5, 19, 44]. There has been discussion about how to define vaccine-hesitancy. The World Health Organization, Strategic Advisory Group of Experts (WHO SAGE) on Immunizations describes vaccine-hesitancy as *“a delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place, and vaccines. It is influenced by factors such as complacency, convenience, and confidence”* [35, 249]. Salmon et al. [250] suggests that any parent who is hesitant towards vaccines for any reason, even those in a current state of compliance, are unstable in their position, susceptible to change, and should be considered vaccine-hesitant. According to Jarrett et al. [36] this is also a largely acceptable definition by researchers. It is also the foundational premise of which recently developed and validated instruments to identify vaccine-hesitant parents have been created [251].

Unique problems in study results. It is difficult to precisely measure how many US parents are vaccine-hesitant. However, there are studies that show a trend towards this number steadily increasing [15, 34, 49, 130]. One of the difficulties in trying to get an accurate number of vaccine-hesitant parents is their constant fluctuation on the spectrum of accepting all to accepting none, and everything in between [252]. According to Enkel et al. [252] there are parents who accept vaccines according to the ACIP schedule that still fit the WHO Working SAGE Group's definition of vaccine-hesitant [111, 249].

Defining vaccine-hesitancy. Jacobson et al. [253] of Mayo Clinic suggests that most, but not all, hesitant parents will modify the recommended ACIP schedule to create a vaccine schedule that fits their needs. For this reason, some suggest that measuring parents' attitudes towards vaccines is a better strategy to assess current and prospective trends, rather than grouping parents by their compliance with the ACIP schedule [15, 44, 251, 254]. Enkel et al. [252] conducted interviews with mothers of young children who were currently accepting vaccines for their children. According to the study's findings, some mothers were accepting the schedule reluctantly. Researchers referred to these mothers "hesitant-compliers" pointing out that although they were currently accepting vaccines, they were amenable to refuse or omit them at any time [252].

Compared to quantitative methods, some suggest using qualitative research methods is a better way to fully understand the intricacies of vaccine-hesitancy [42, 83]. However, the literature shows a disproportionality fewer number of qualitative studies than quantitative studies in the field of vaccine-hesitancy [19, 36]. Despite tremendous variability between study designs, methods, and statistical results across numerous vaccine hesitancy and behavior studies, there has been an increasing prevalence of hesitancy or the use of alternative [107]. For example,

according to National Immunization Survey (NIS) data in 2003 and 2009, there was an increase in hesitant parents from 21.8% to 39.8% [47]. Another study using national survey data found vaccine hesitancy to occur at a rate up to 50% in 2009 [105]. A study conducted by Kennedy et al. [255] found that 77% of parents were hesitant towards vaccination. Therefore, a need exists to explore factors of vaccine hesitancy in order to implement tailored interventions aimed at improving vaccine uptake.

The Vaccine-Hesitant Parents' Characteristics

Studies have found that the vaccine-hesitant parent is demographically unique compared to anti-vaccinators. Vaccine-hesitant parents are primarily college-educated [17, 256]; affluent [257]; use the Internet as a primary medical resource [258]; and have a preference for alternative medicine [127, 229].

Health-Literacy and Affluence

Health-literacy is defined as the ability to comprehend health information as it relates to one's health [259]. Most frequently, health literate mothers are more likely to take on the role as the primary health expert for their child [260]. Faasse et al. [123] analyzed social media by comparing the language used in pro- and anti-vaccination messages. They found that anti-vaccination messages tend to use science-based terminology and analytical arguments that appeal to the intellect of mothers making their family's health decisions. However, pro-vaccination messages used simple language, straight-forward messaging and contextually were written to elicit emotional responses [123].

Furthermore, health-literate mothers are more likely to conduct their own research into vaccines, use non-scientific books, and believe science-based vaccine messages on the Internet [229, 259, 261]. Several publications have become quite popular among well-educated, such as

Dr. Sears's best-seller, 'The Vaccine Book: Making the Right Decision for Your Child' [257, 262]. In addition, many famous works encourage mothers to become their children's medical experts and rely on their intuition when making medical decisions [258, 263]. Essentially, mothers are encouraged to think and act according to their own beliefs, but to do so even when it contradicts a physician's advice [233, 263].

Lack of Confidence

Research shows that vaccine-hesitant parents often lack confidence in making a vaccine decision [44, 264]. Some define confidence as a faith or belief that an outcome will be guaranteed [44, 265]. As it relates to vaccine-hesitancy, lack of confidence can describe perceptions of low vaccine-efficacy, or uncertainty that a vaccine-related outcome will occur. For example, some question if the vaccine will stop the infection of a disease it is intended to prevent [266]. Others wonder if the physical, emotional, or neurological risk of harm from getting a vaccine is worth the potential benefits offered [82]. Others question the legitimacy of vaccine information shared by government health agencies [80]. Mistrust in health agencies and pharmaceutical companies are transparent and forthcoming with the risks of vaccines and the documented cases of vaccine injuries [80, 255, 265, 267].

Avoidance of Causing Child Physical Pain

Some parents report hesitating to have their child vaccinated because they are not comfortable causing physical pain from an injection [268]. Kennedy et al. [255] reviewed data from the 2009 HealthStyles Survey, finding a common reason for concern was due to parents' concern with the physical pain that vaccine inflicted. Conversely, the preference to risk harm to one's child from natural conditions (omission) rather than from an act or decision from the parent (commission) has been documented in other vaccine-refusal studies [67, 269].

Too Many Too Soon

The concerns for vaccine safety usually stem from a belief that the vaccines' antigens will cause an infection of the disease they are supposed to prevent or ingredients in the vaccines, such as preservatives, salts, or adjuvants, will cause an allergic reaction [83, 270], or that the onslaught of toxic ingredients will cause ASD [219]. Unfortunately, the Internet is a common source for these theories and beliefs [258].

Between the years of 2002 and 2003, one group of researchers conducted 18 focus groups with married couples with children, single parents, and expectant couples with the sole purpose of investigating how parents felt about the number of vaccinations that children receive at once, during the first few years of life [57]. They found the majority of participants expressed grave concern about overloading young immune systems with too many vaccines at one time. This appeared to be a common concern among all types of parents in the study, regardless of which type of parent they were [57]. The findings from this study have also been supported in other studies as well [56]. Hulsey et al. [56] reviewed 27 articles on how parents feel about vaccines overloading their children's immune system. The review was limited to articles published between 2000 and 2014. The results of the review indicate a need to further understand how this concern affects the vaccine decision, for certain types of parents such as first-time expectant mothers [56].

Influences of Internet

Downs et al. [66] conducted a study to explore the decision-making process. The study included 27 parents of children between the ages of 18 to 23 months of age. The majority of participants (70%) reported having trust in vaccine information on the Internet. A small number of them (19%) cited using Internet sites that are loosely considered science based by the general

population, such as WebMD [74]. According to Downs et al. [66] the first ten sites that are generated following a Google search for general vaccine information are anti-vaccination. Additionally, lack of credible sources sharing misinformation has contributed to false ideas, ultimately leading to increases in vaccine refusals [65, 70]. Because the Internet is such a widely used source for vaccine information, researchers have tried to better understand the mechanisms for which it influences vaccine intentions [271, 272]. Some have suggested that confirmation bias is a key factor [273]. Meppelink et al. [273] studied 480 parents of young children who felt positively or negatively towards childhood vaccines before viewing a mix of pro and anti-vaccination online headlines. The participants were asked to pick their favorite messages after their predisposition was determined [273]. The results found that parent's attitudes toward childhood vaccines (e.g. positively, negatively) could significantly predict ($b = 0.32$, $t(476) = 9.60$, 95% CI [0.25;0.38], $p < .001$) whether they selected pro- or anti-vaccination headlines online as their favorite [273]. Meppelink et al. [273] suggests that parents are drawn towards websites that will confirm their beliefs and will even use search words/terms to generate desired results.

The Internet has propagated several fears by either creating false stories or mainstreaming 'exceptions to the rule' reports [243]. The Internet has allowed for like-minded people to form online groups where they can share their concerns and opinions about many health-related issues, including childhood vaccines [129]. For example, McKeever et al. [274] found that mothers who do not hold favorable attitudes towards vaccines are more likely to post online messages about their dangers, ultimately making them more outspoken than others who are in favor of vaccines [274]. Plantin et al. [275] conducted a review of the literature focusing on how parents seek health information and support on the web. Compared to other types of parents, they found

that first-time expectant mothers have a greater likelihood to seek health information and support from the Internet [275].

Although studies [74, 243, 273, 275] have helped explain how parents seek vaccine information on the Internet, they have not specifically focused on first-time expectant mothers. Because physicians are often a source of information for parents who have children, and because first-time expectant mothers have not yet begun well-child visits where vaccine information is most frequently given, it is possible that first-time expectant mothers rely on the Internet even more than other parents [112, 276]. However, to date there has not been research that has specifically focused on how first-time expectant mothers use the Internet for vaccine information is needed.

Popular sites and search engines such as YouTube, Google, and Pinterest predominately promote anti-vaccination propaganda [74, 266]. This is concerning as more people are using the Internet and social media as a primary source to get vaccine information [74, 271]. Implications are that many vaccine-hesitant parents are more likely to come across anti-vaccination propaganda that could influence them to refuse or delay vaccines [266, 271]. This finding contributes to a growing area of interest regarding the anti-vaccination movement through Internet channels [74, 266]. However, it is unknown how and/or if first-time parents use the Internet for vaccine information. More research is needed to explore this area with this particular population.

Downs et al. [66] conducted open-ended interviews with 30 parents (mothers n=26, 86%) of children between 18 and 23 months. The purpose of the study was to understand vaccination beliefs and behaviors. One part of the study was to explore which sources the parents used to become informed. Interestingly, 70% said the Internet was their preferred resource and 30% said

their physician. When all participants were directly asked if they would use the internet for information, 93% answered that they would use it as a source [66].

Relying on the internet for health information has contributed to widespread belief in myths surrounding childhood vaccines, and ultimately allowing for the expansion of the anti-vaccination movement [74, 271, 277]. Some studies have explored the ratio of anti-vaccination versus pro-vaccination messages on the Internet [74, 271]. The majority of vaccine related topics on the Internet support the anti-vaccination movement [243, 278, 279]. This means that when new mothers seek vaccine information from the Internet, they are likely to find material that could increase their apprehension towards vaccines and dissuade them from complying with the ACIP schedule. This has not been explored in the literature; therefore, further investigation is needed.

Fear of Autism Spectrum Disorder (ASD)

Many have found that fear of vaccine injury is a leading cause of vaccine-hesitancy [31, 280-282]. Several studies have documented vaccine-hesitant parents' concerns about their child having side effects from receiving childhood vaccines [33, 110]. Concerns are for acute injuries such as fever, rash, seizures, and discomfort [195, 270]; and chronic injuries such as ASD, cognitive regression, and personality change [52, 81].

The number of vaccine-hesitant parents did not happen overnight. Several cascading historical events have amplified fear and distrust in vaccines and the government health agencies that promote them [281, 283]. One of these events is the increase in children diagnosed with ASD over the past three decades [224]. In 2020, the CDC published prevalence data collected through The Autism and Developmental Disabilities Monitoring (ADDM) Network across

eleven of their sites in 2016 [284]. According to this data, 1 in 54 children aged 8 had received an ASD diagnosis, with male children four times more likely than females [284].

Historically, the Diagnostic and Statistical Manual of Mental Disorder, fifth edition (DSM-5) was completed and released to public in 2013 [284]. As anticipated, spectrum disorders were rearranged, combined, or eliminated from the manual [285]. The differences between the prior versions and the new DSM-5 include: (1) removing Rett Syndrome from spectrum disorders, (2) combining social and communication deficits, (3) increasing number of possible symptomatic criteria for social/communication and repetitive behaviors, (4) eliminating diagnostic titles for pervasive developmental disorders-not otherwise specified (PDD-NOS), Asperger's, and Childhood Disintegrative Disorder, (5) including abnormal sensory issues as criterion, and (6) adding severity levels [285].

Specifically, it is the fear that the MMR causes ASD most frequently identified in studies [219, 286]. Most researchers are of the consensus that the origin of the fear that MMR causes autism is due to an article published, and later retracted, in the Lancet medical journal written by Andrew Wakefield [281]. However, Wakefield's article had been primed for acceptance because of previous historical events, beginning with literature published by Leo Kanner [287]. Leo Kanner has been referred to as the "father of autism" and it was he who first coined the phrase "autism disorders" [287, 288]. A fundamentally important pillar of autism's history, Kanner significantly influenced how the world viewed this rarely seen disorder. Much of his research prospectively benefited the field of autism research, as he made important discoveries that are still relevant today [217]. However, his greatest failure was to blame mothers for causing children to have autism [288]. Kanner was so passionate about his belief that it was a mothers' coldness towards their child that caused autism, he referred to them as "refrigerator mothers" in

several publications [287]. Later a psychologist named Bernard Rimland disproved this theory after his own son was diagnosed [288]. Dr. Rimland was such an adamant advocate for his wife's nurturing of their son, that he gave rebuttal for Wakefield's claims. Thus, in 1964 he published the well-known book titled *Infantile Autism* disputing mothers' coldness as the cause for autism [288].

Although Rimland's book helped alleviate some of the blame placed on mothers from the medical community, he could not give an answer for the cause of the disorder. Nevertheless, mistrust between mothers and the medical field was fostered. Fearing that the MMR causes ASD has been one of the most common reasons to avoid the MMR [107, 219, 282]. Even though this is mainly due to the redacted Wakefield article in the Lancet, it has continued to influence people's perceptions about the MMR [17, 173, 250, 281].

Social Consequences of Vaccine Decision

Gesser-Edelsburg et al. [122] conducted an online survey with 437 parents to explore how family dynamics are impacting vaccine decisions. They were interested in how the primary decision maker navigated conflict with other family members who disagreed with their vaccine decisions [122]. According to Gesser-Edelsburg et al. [122], compared to pro-vaccinators and anti-vaccinators, vaccine-hesitant parents were up to four times more likely to report greater family discord, hostility, and conflict. The Gesser-Edelsburg et al. [122] study is a rarity in the study of vaccine-hesitancy, as few other studies have given insight into the family dynamics involving the vaccine decision. Although Gesser-Edelsburg et al. [122] has contributed uniquely to this field, it was conducted within the scope of quantitative methods and was therefore unable to explain *why* family discordance is so much higher. Therefore, there is a continued need to

better understand which factors are contributing to family conflict centering on disagreements about childhood vaccines, and which direction the vaccine-hesitant parents are pressured to go.

Vaccines Success has Lowered Perceived Threat

Vaccines appear to be a victim of their own success. It is speculated that they have worked so well at preventing infections that people no longer feel threatened by them [8, 38]. Studies show that this belief factors into many parents' decision to not fully vaccinate their children [140, 289, 290]. Experts in the health field believe that as generation's age and move further from the pre-vaccine era, the threat of fatalities from infectious diseases lessens [127, 215, 247]. As the US ages and becomes further removed from the post-vaccine era, many of these diseases seem non-threatening to new generations. The low perception of threat is often weighed with the risk of vaccines [127, 245]. Vaccine-hesitant parents often view threat of vaccine injury as an unnecessary risk [195].

Health Theory and Vaccination Intentions

There are few studies that have investigated antecedents of vaccination behavior from a theoretical perspective. Health behavior theories can be very helpful by providing a framework for an investigation when little is known about a particular health behavior or population [97, 99].

Health Belief Model (HBM)

A review of the literature exploring how people make vaccine decisions indicates that the health belief model (HBM) is the most frequently used theory [266, 291]. The HBM postulates that perceptions of susceptibility and severity will lead people to make decisions that they believe will have the least harm [292]. In the health field, many assume that health decisions are logical [242]. Often, public health professionals use strategies to educate patients with facts and

information so that they will have the knowledge to make the right health decision. Assumptions such as these assume that the logical conclusion is that if vaccine-hesitant parents were only exposed to the right vaccine information, then they would naturally accept the information and be willing to comply with the recommended schedule [293]. However, these assumptions are flawed as they minimize the significant role that emotions, intuition, and irrational fear has on their decision [294-296].

One example of this phenomenon is the results of a study by Ritov et al. [269]. Ritov et al. [269] asked people to respond to a hypothetical situation where disease X had a mortality rate of 10 in 10,000 and the vaccine to prevent it had a mortality rate of 5 in 10,000 [269]. People showed significantly greater preference for getting the disease rather than receiving a vaccine that had any negative effects, regardless of how benign or severe those effects were. Ritov et al. [269] referred to this as parent's preferring negative consequences as a result of an *act of omission*, as opposed to an *act of commission* [269]. Essentially, people prefer taking a chance on a negative outcome, even when those odds are much greater that the outcome will occur, if it means that it was not a result of an action [95].

Limitations of the HBM. Although the HBM has been one of the most popular health theories used to explain and predict health behaviors, it is not always the best choice for each health behavior [102]. There are several constructs in the HBM that may not be useful in understanding influential factors for vaccination behaviors. Rosenstock et al. [119] created the HBM on the basis that an individual must feel at risk for a health outcome before they will be motivated to take action to make a change that will avoid or prevent it. According to Rosenstock et al. [119], there are two specific constructs, perceived severity and perceived susceptibility, that have been used to explain parents' childhood vaccine decisions [67, 99].

Perceived severity and susceptibility. There is speculation that it is because vaccinations have been so effective in eliminating diseases, that later generations no longer feel threatened by them [245]. Some experts believe that many parents who are currently alive in the US have likely never had first-hand experience with many of the once pervasive diseases [85, 297]. Some have theorized that people no longer feel threatened by certain diseases and thus, the risk of having their child vaccinated unnecessarily is outweighed by the potential risks that they attribute to vaccines [127, 245].

Lago et al. [290] conducted an online survey of 110 parents of children younger than 2 years. According to the results, perceptions of disease severity and susceptibility were the major contributors to parent's vaccine decisions. Both of these factors indirectly influence feelings towards threat appraisal, an important construct to predict behaviors within the HBM [8].

Although the HBM asserts that health behaviors are the result of an individual's decision, it has been used in studies where the participant is a proxy decision maker for another person [254]. Essentially, perceived susceptibility helps to explain a parent's decision to behave in a certain way based on their perceived risk assessment to potential consequences [67]. If people do not feel that their children are vulnerable to becoming infected with a disease, and/or if they feel that the disease is not dangerous, then they will not be inclined to risk the threat of a vaccine injury [298].

However, other constructs of the model such as (1) self-efficacy and (2) cues to action have not seemed to contribute to statistical models seeking to explain vaccine behaviors [98]. Therefore, it may be a better theoretical strategy to combine threat appraisal (*perceived risk and perceived susceptibility*) with constructs of a different health theory.

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) is a modified version of the Theory of Reasoned Action (TRA) created by Fishbein and Ajzen [299] to predict people's behavior [101, 111, 300]. The TRA model consists of constructs Attitude and Subjective Norms (SN), of which both were considered direct predictors for behavioral intentions, the direct predecessor to action [300]. The TRA does not consider obstacles in a person's environment, either perceived or concrete, therefore Ajzen modified the TRA to include Perceived Behavioral Control (PBC). As a result, the TPB model has three constructs Attitude, Subjective Norm (SN), and Perceived Behavioral Control (PBC) [299, 301]. Intention has remained the strongest predictor and direct predecessor to action [111, 299].

Attitude. The construct Attitude is determined by two variables. The first, Strength of Belief, is a person's perceptual evaluation of the likeliness that an outcome will happen as a result of an action [299]. Second, Behavioral Outcome Evaluation, is an assessment about the degree to which an outcome is good or bad [104]. Some compare this to a risk and benefit analysis of what could potentially happen if a particular action or decision was made [99].

Subjective Norm. The second construct in the TPB is Subjective Norm (SN), which is defined as a person's perception of whether society, or most importantly their peers, accepts or rejects their behavior [103]. The SN construct is determined by two variables: Injunctive Normative Beliefs and Motions to Comply. Injunctive Normative Beliefs (INB) can be described as perceptions of how their peers and salient others accept or reject their behavior and to what degree of influence this will have on a person's behavior [103]. People often have a number of influential people in their environment; however, the ones that are more influential than others are considered salient [103]. Additionally, Descriptive Normative Beliefs (DNB) is a person's belief about what their peers and referent others are actually doing [301]. In other

words, some people believe that there are societal, normative standards but that those whom are closest to them are not following those standards [103]. In this case, a person is more influenced by what those closest to them are doing instead of following the normative. Xiao and Wong [301] describes this as the belief about how prevalent a behavior is among one's peers. Gerend et al. [99] points out the importance of considering peoples' health decisions and actions a social decision, where one's social environment is a stronger influence on behavior than other health theories support.

Perceived Behavioral Control. The third construct Perceived Behavioral Control (PBC) describes a person's perceived ability or capability to successfully perform a behavior change or make a health decision [103, 301]. Some argue that Azjen's PBC was created on similar concepts of Albert Bandura's Social Cognitive Theory construct self-efficacy [234]. The literature is divided when it comes to how well the PBC predicts behavioral intentions [98, 111, 300]. Past research has not found it to be a strong predictor of behavioral intentions [111]. However, Xaio & Wong [301] recently completed a meta-analysis of vaccine-hesitancy and PBC, wherein they found that PBC significantly predicted 54.3% of variance in intention [301].

Gaps and Weaknesses in Existing Literature

Disproportionate Focus on Anti-Vaccination Behaviors

The literature shows a disproportionate number of studies focusing on anti-vaccinators rather than hesitant-vaccinators [123]. Up until the turn of the 21st century, most interventions aimed at improving vaccine uptake targeted anti-vaccination parents because they were largely viewed as the most at-risk group [126, 277]. However, the combination of many failed interventions and the identification of the vaccine-hesitant parent has led many in the field to

recognize the benefit of focusing on a population that is also at-risk for not vaccinating and is also more amenable to behavioral change [39, 55, 302].

Assumptions

McClure et al. [50] reviewed literature on vaccine hesitancy from 1999 to 2017. Most of the previous studies had approached parent's hesitancy as a result of their lack of knowledge. According to McClure et al. [50], this approach is centered on the Information Deficit Model (IDM) created in 1983 [50, 303, 304]. The IDM assumes that if people just had the right information given by an expert in the field (e.g., physicians, CDC), they would accept childhood vaccinations. However, as McClure et al. [50] points out from the literature, this approach has not been successful with vaccine-hesitant parents [304]. As Ritov [269] discusses, the vaccination decision is not always a logical one. In addition, although vaccine-hesitant parents have said that lack of information causes a lack of confidence in making a decision, the type and source of information directly affects how it is received. Therefore, it is incorrect to assume that studies founded on IDM principals would improve vaccine uptake [50].

Issues with Timing of Vaccine Information Delivery

Studies have found that physicians typically wait until children are old enough to get vaccines before providing parents with information about vaccines and/or addressing their concerns [87, 110]. Typically, this is at the 2-month check-up. However, it has recently been found that this is not the optimal time to begin the vaccine discourse with concerned parents.

Studies show that mothers have said that they would prefer to receive physician provided information about vaccines much earlier than their child's first checkup appointments [93, 305]. Glanz et al. [88] stresses the importance of providing new mothers with scientific evidence-based information on vaccines at the time that they are most open and receptive. This would appear to

be when they are pregnant and are not feeling pressured to make an immediate decision [91]. The importance of timing of delivery of vaccine information is key to making parents feel more informed and confident in making a vaccine decision. Physicians appear to be one of the greatest influencers on antenatal women's vaccine perceptions. From this, one can gather that it would make logical sense that the sooner physicians and parents can begin the vaccine dialogue the greater the chance for compliance [102, 306].

First-time Expectant Women and Vaccine-Hesitancy

Weiner et al. [307] investigated first-time expectant mothers and their intentions to vaccinate. There were 22 participants in the study. Seventy-five percent of the participants planned to comply with the ACIP vaccination schedule. The other 25% were on the fence or undecided [307].

A cross-sectional study by Corben et al. [90] surveyed 231 expectant mothers at an antenatal clinic in Australia between 2015 and 2016. Participation was not dependent on the number of previous pregnancies. Using the PACV and the Decisional Conflict Scale [308], first-time expectant mothers were three times more likely to be vaccine-hesitant than mothers who had already had children [90]. One hundred participants agreed to allow researchers to pull their child's vaccination history in the future. Corben et al. [90]. Corben & Leask [90] found that any affirmation on the question "Overall, how vaccine-hesitant are you?" Was associated with a nine-fold greater likelihood of having refused or delayed the timing of their child's vaccinations.

Conclusion

In conclusion, it is imperative that researchers find more effective ways to improve childhood vaccination rates. Historically, the past efforts have not been as successful as hoped for [19]. The literature indicates that first-time expectant mothers are an ideal population to

target intervention efforts, since they are more hesitant and unsure of vaccines compared to more entrenched anti-vaccination mothers [34, 305]. Therefore, the purpose of this study is to conduct a qualitative exploration into the reasons that first-time expectant mothers are hesitant towards childhood vaccines. In doing so a fundamental understanding of what drives them to doubt vaccines can be established and future interventions can be better tailored to address their concerns, during a more optimal time which is when they are still pregnant [305].

Chapter III: Research Design and Methods

Introduction to Research Design and Methodology

This study investigated factors related to vaccine-hesitancy in first-time expectant mothers in the United States (US). Using a qualitative research design based on health theory constructs, 50 participants meeting the study criteria participated in semi-structured, in-depth interviews. Chapter three includes the research questions and rationale, study design, instrumentation, research procedures, sampling procedures, data collection and management, and thematic analysis.

Research Questions and Rationale

Rationale

Vaccine-hesitancy is described by the World Health Organization, Strategic Advisory Group of Experts on Immunization (WHO SAGE) as delay, refusal, or disapproval of childhood vaccines at the recommended time despite availability and access to vaccines [249]. Parents who are vaccine-hesitant are more likely to have children who are under-vaccinated [130, 139, 140]. Under-vaccinated children are more likely to become infected with vaccine preventable diseases (VPD) such as measles, mumps, and pertussis “*whooping-cough*” [11, 165]. Studies show that the vaccine decision for a child is made during pregnancy [90, 91]. Studies also show that first-time expectant mothers are more vaccine-hesitant than parents who have children [91]. Although research is promising, there are few studies that have explored in-depth first-time expectant mothers’ factors related to vaccine-hesitancy. This information can be useful for physicians and other clinicians to develop a meaningful conversation with them about childhood vaccinations.

Research Questions

Research Question 1: What are the perceived barriers and facilitators for intentions to *fully comply* with the ACIP schedule for second or third trimester first-time expectant participants who are vaccine-hesitant?

The purpose of this research question was to identify and categorize things that promoted the acceptance of vaccines (facilitators) or made difficult the acceptance of vaccines (barriers). Two questions were directly asked about barriers and facilitators of deciding to accept or refuse all vaccines. The rest of the questions did not directly ask about barriers and facilitators, but many responses could be grouped into one of these categories.

Research Question 2: What are the factors influencing second or third trimester first-time expectant vaccine hesitant participant's intentions to not comply with the ACIP schedule?

The purpose of this question was to better understand first-time expectant participants' lived experiences and perceptions that influenced them to not comply with the ACIP schedule. There was not a question that directly asked about factors influencing their intention to be non-compliant. However, this research question was addressed through questions inquiring about their background factors that have led them to feel the way that they do about vaccines.

Research Question 3: Are there differences in how first-time expectant participants perceive measles, mumps, and rubella (MMR) vaccine compared with the other mandated childhood vaccines?

The purpose of this question was to explore differences in perceived threat of certain vaccines. As Gowda et al. [309] points out, vaccine-hesitant parents have been known to have more hesitancy towards the MMR than other vaccines. However, at the time of this study there was not literature on whether or not this hesitancy is seen in first-time expectant women. To

answer this question, the student investigator directly asked if some vaccines posed a greater threat than others.

Research Question 4: What, if any, are the similarities and differences between vaccine-hesitant first-time expectant participants and what is known about vaccine-hesitant mothers who already have children?

The purpose of this question was to identify unique differences between first-time expectant mothers and women who had two or more children. This information was collected through question probes and previous peer-reviewed literature on childhood vaccination beliefs in mothers.

Study Design

To answer the research questions above from the perspective of the participant's "lived experiences," a qualitative approach was used. There are few studies that have looked at vaccine hesitancy in first-time expectant mothers and only a small number of them have used qualitative methodology. Qualitative research probes the depths of people's lived experiences and makes available rich descriptive information that reflects a person's feelings and thoughts about a phenomenon, in their own words [173, 310].

This study used theoretically-based semi-structured interviews that allowed first-time expectant mothers to describe their thoughts, ideas, and emotions around their vaccine hesitancy.

Rigor

Trustworthiness. Lincoln & Guba ([114] p 315-319) have suggested four broad measures to document the rigor of qualitative studies, 'credibility', 'transferability', 'dependability', and 'confirmability' [114, 311]. This study sought to maintain credibility, operationalized as the degree to which the findings truly reflect the perceptions of barriers and

facilitators for impending childhood vaccine uptake in first-time expectant mothers. To manage this, the question path was designed to allow each participant to provide rich description of their perceptions and experiences in their own words. Verbatim transcription is essential to maintaining credibility so that the information gained remains in the participant's own words [311, 312].

Transferability is the qualitative equivalent of quantitative terminology of generalizability, or the to the extent that findings accurately portray a group of people [114]. Qualitative researchers must generate common themes in order to make contextual sense of first-time expectant participant's experiences to help further explain their rationale for vaccine hesitancy [312].

Dependability is similar to reliability in quantitative studies [114]. This study sought to establish dependability by providing clear, concise, and easily repeatable methodology instructions (e.g., design, sampling procedures, data collection, and data analysis) [312].

Lastly, confirmability is similar to objectivity in that there are some steps that an investigator can take to enhance it [114]. These steps include controlling for limitations or confounding factors found in other similar studies, ensuring that findings are representative of overall impressions of the interviews, and if the interpretations make logical sense contextually. One way to strengthen confirmability is to check for biases of the student investigator that could influence how the data is collected and analyzed ([114] p 315-319). They suggest using an audit strategy wherein the original raw data (e.g., audio recordings, verbatim transcription, and field notes) are checked by an outside investigator ([114] p 318-319). In this study, the faculty advisor served as an auditor for the student investigator.

Auditing. Auditing is a systematic process used in qualitative research to ensure rigor and quality procedures [313]. Two measures were implemented as auditing measures. First, pilot interviews were conducted to test the question path and questionnaires. At the end of the pilot interviews, the student investigator probed participants for their guesses about the investigator's personal beliefs about childhood vaccines. None of the participants attempted to guess, all saying that they had no idea. Second, the student interviewer transcribed each interview directly after the interview, and the transcript was reviewed with the faculty advisor before scheduling the next interview. The faculty advisor was active in the data analysis process but not in the interview sessions. Both of these actions are to ensure that the student investigator, who conducted the interviews, was not influencing or biasing the interview sessions with predisposing beliefs about childhood vaccines.

Theoretical Foundation

The mission of this qualitative research was to provide a contextual setting so that first-time expectant mothers could express their perceptions about the factors that were impacting their hesitancy towards childhood vaccines. When little is known about a particular population, applying a health theory can help structure this contextual setting [313]. Conceptually, applying theoretical constructs from other well-established health theories, particularly from a predictive model, can help explain and or give meaning to factors that impact intention to vaccinate which is a precursor for their vaccine decision behavior. Therefore, constructs from the TPB (attitude, subjective norm, behavioral control, and intention) and two of the constructs from the health belief model (HBM) (perceived severity and perceived susceptibility) were used as a framework.

The Theory of Planned Behavior (TPB). The Theory of Planned Behavior (TPB) is a robust condensed model that has been widely used for its ability to predict future health

behaviors [101, 103]. Foundationally, the TPB hypothesizes that three constructs attitude, subjective norm, and perceived behavioral control influence peoples' intentions to perform a particular behavior and subsequently, the actual action of the behavior [101, 111]. Attitude was operationalized for the purposes of identifying how first-time expectant mothers *feel* about vaccinating their child in accordance with the ACIP schedule [103, 111]. Subjective norm is an individual's perception of how their peers, loved ones, and general society are behaving in comparison to their self. Subjective norm was operationalized in this study to explore participant's beliefs about how their peers and salient others feel and act towards them in the past, present, and future [99, 103]. Azjen [101] defines perceived behavioral control as how capable and able a person believes they will be to make a health decision. Perceived behavioral control was operationalized as the participants' perceptions about external forces that would or would not prevent them from choosing to vaccinate how they wanted [103, 111].

In general vaccine-hesitant parents' reason for hesitancy is highly complex, diverse, and unique. Danchin et al. [91] found the complexity to be even more pronounced in first-time expectant mothers. Thus, it is necessary to delve into the history of each participant to help explain influential factors. The TPB allows for this to be done through background factors. Background factors directly influence attitude, perceived control, and subjective norms, which in turn directly influence intentions. Some of these factors include individual factors (e.g., lived experiences, exposures to vaccines and/or vaccine preventable diseases, etc.), demographic factors (e.g., age, sex, income, education level, occupation, geographical location, religious affiliation, type of medical care), and societal factors (e.g., political climate, current outbreaks, media coverage, celebrities endorsements) [103, 130, 314]. Background factors were

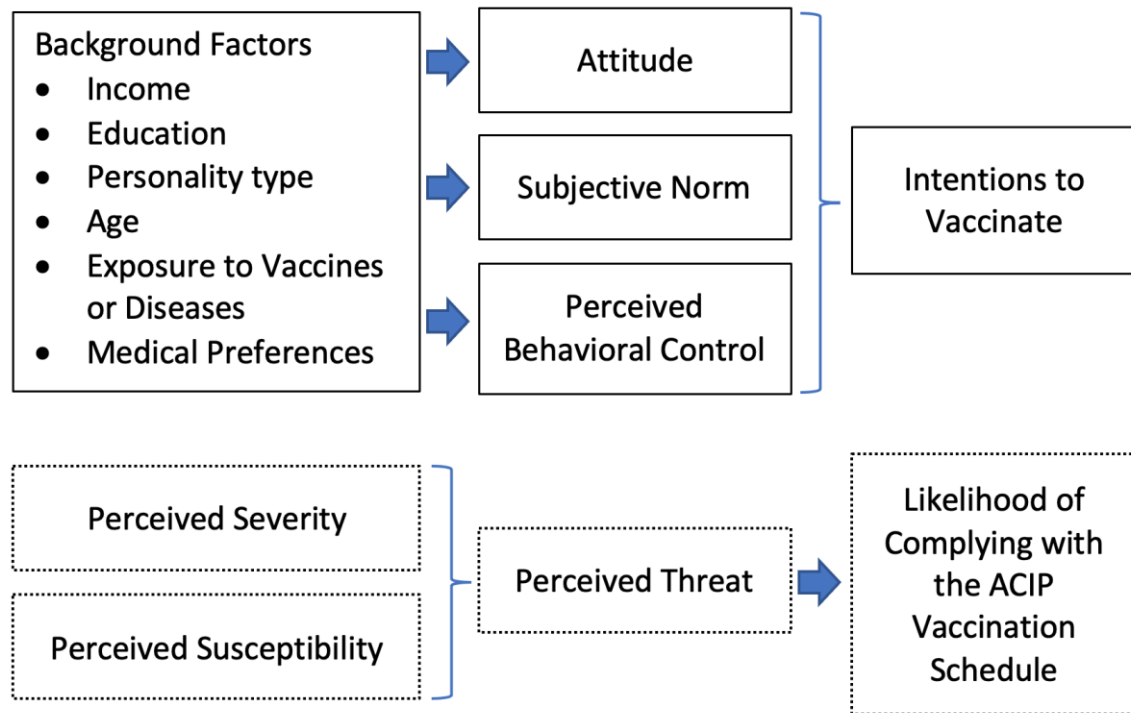
operationalized as pre-existing experiences or occurrences that strengthen and drive beliefs, attitudes, and feelings towards impending childhood vaccines [53, 103].

The Health Belief Model (HBM). The Health Belief Model (HBM) has demonstrated good ability to predict health behaviors. It has three domains: modifying factors, perceptions, and likelihood of action. Like the TPB the HBM also incorporates background factors as having influence on people's perceptions which indirectly impacts their behavioral action.

According to Rosenstock et al. [119] an individual must feel that there is a threat associated with a particular behavior or lack of behavior before they will be motivated to take action. Perceived threat is a powerful motivator in the vaccination decision [40]. To assess overall perceived threat the two constructs *perceived severity* and *susceptibility* from the HBM were included [119]. This was necessary because vaccine hesitant parents are “fence-sitters” and could go either way so it was important to explore perceived threat in both directions [37].

Perceived severity was operationalized as the degree to which first-time expectant mothers perceive an adverse health outcome, social consequence, or emotional trauma could occur as a result of their vaccination decision [119]. Perceived susceptibility was operationalized to assess their perceptions of the likelihood a disease exposure or vaccine injury was to happen [119]. Therefore, to assess perceived threat, these two constructs from the HBM were also added to the study [315]. The entire TPB and HBM constructs with their respective questions on the question path can be found in Appendix B.

Figure 1 The Study Conceptual Model



Instrumentation

The study included a demographic questionnaire and the Parents Attitude About Childhood Vaccines, modified (PACV-m) administered online through Qualtrics software.

Qualtrics. Qualtrics is an online software program that creates, distributes, and analyzes data from questionnaires and surveys. The informed consent, demographic questionnaire, and PACV-m survey were administered through Qualtrics. A copy of these documents are found in Appendix C.

Demographic Questionnaire. After consent was obtained, a demographic questionnaire was administered for two purposes. First to confirm that participants did not have any extreme conditions that may skew the data. Second, to explore potential relationships between certain background factors and factors of vaccine-hesitancy. Types of demographic information obtained included age, weeks' gestation, income, level of education, occupation, rank order of

preferred sources to obtain vaccine information, and relationship status. The student investigator exported Qualtrics responses to an Excel table and then to SPSS-28 statistical software. The 14-item demographic questionnaire was administered through Qualtrics online immediately after consent was obtained and took approximately 10 minutes to complete.

The Parents Attitudes About Childhood Vaccines-modified (PACV-m). As a screening tool to identify vaccine-hesitant participants, a modified version of the Parental Attitudes about Childhood Vaccines (PACV) was used. The PACV was validated through mailed out surveys to parents of children ages 19 to 35 months old [41]. The original 15-item PACV has demonstrated good construct validity and reliability for the three 3 scales (safety and efficacy, general attitude, and behavior), resulting in Cronbach's alpha of .74, .84, and .74 respectively [41]. The PACV is a 15-item survey that converts scores from Likert scale responses to a "zero", "one", or "two". The raw scores are summed and converted to a composite score on a 0-100 point scale [316]. According to Opel et al. [41] a composite score of ≥ 50 is the threshold of vaccine-hesitancy and significant indicator of under immunization. The original validation study excluded responses of "don't know" and "not sure," as these responses were considered poor recall instead of factors of hesitancy. The original PACV is found in Appendix C.

The PACV was modified in this study because the original survey includes two behavioral questions that ask about parents' past decisions for children. The survey has been used with expectant mothers in other studies (n=610), some of whom were first-time mothers (n=309) [317]. Cunningham et al. [317] changed the wording of one question for all participants, and additionally advised first-time expectant mothers to skip the two behavioral questions. The two excluded behavioral questions were: "Have you ever delayed having your child get a vaccine

that was not seasonal influenzas or allergy shot?” and “Have you ever decided not to have your child get a vaccine, not including a seasonal influenza or allergy shot?” The modified question originally stated, “If you had another infant today, would you want him/her to get the recommended childhood vaccines?” and was changed to instead read, “Do you want your baby to get all of the recommended childhood vaccines?” [316, 317]. Therefore, first-time expectant participants in the Cunningham et al. [317] study answered 13 PACV items, having skipped the two behavioral questions. The 13-item modified PACV is found in Appendix C. According to Opel et al. [41] and Cunningham et al. [317] excluding these two questions make the raw score range from zero to 26 [317]. The lowest accepted raw score for this study was 11 which was converted to a 42 on the scale. A score of 26 would be converted to 100 the highest rating of vaccine-hesitancy possible. The modified scale that first-time expectant mothers used in this study is shown in column C of the converted scale found in Appendix C.

This scale and the scoring instructions were emailed to the student investigator directly from Douglas Opel. The scoring instructions are found in Appendix C. The PACV has been self-administered in other studies and was self-administered in this study [120, 121, 318]. To distinguish between the original PACV and the modified PACV for this study, the modified version is hereon referred to as the PACV-m.

Because so few studies have focused on vaccine-hesitant first-time expectant mothers, a priori chose a lower PACV-m score as part of the study inclusion criteria, so as to ensure that all potential vaccine-hesitant first-time expectant mothers were not overlooked. Other studies have accepted lower cut off scores for the PACV, such as Williams et al. [120] who used a cut off score (e.g. ≥ 40) as an acceptable score for vaccine-hesitancy. However, if a score was less than the previously validated ≥ 50 [316], the participant had to also answer “Very hesitant” or

“Somewhat hesitant” to the question “Overall, how hesitant about childhood vaccines are you?” Corben et al. [90] found that any affirmation of hesitancy was associated a nine-fold greater likelihood of delaying or refusing vaccines [90]. Because so little research has been done with this group, it was decided to combine the accepted score of ≥ 42 and attestation to being hesitant as acceptable criteria for identifying vaccine-hesitancy. This combination has not been used in other research; however, both methods have been used individually in other studies [90, 120].

The student investigator used the scoring feature available on Qualtrics to assign each Likert response on the PACV-m a “zero”, “one”, or “two” for automatic calculations. This allowed the student researcher to quickly confirm that a score of ≥ 42 or an affirmative response to the question “Overall, how hesitant about childhood vaccines are you?” was obtained before proceeding on to the interview.

Question Path. During the development of the question path, special care was taken to ensure that questions appropriately addressed research questions from the perspective of theoretical constructs of the TPB and HBM. The question path was initially developed based on literature review of other theory-based studies focusing on vaccine-hesitancy [111, 300], and qualitative studies [83, 296]. The student investigator discussed the literature with the faculty advisor at length, through a repeated process of creating, discussing, and editing until an acceptable draft was created to pilot.

The first draft was made readable at an eighth-grade level and was initially piloted with two vaccine-hesitant first-time expectant mothers. Following each interview, the student investigator asked a series of questions to guide their feedback. This guide is shown in Table 2. After the first two pilot participants, the student investigator discussed the feedback with the faculty advisor, at which point changes were made based on the feedback. A new version of the

question path was created and retested on two new participants from the target population. The process of receiving feedback and discussing suggestions with the faculty advisor was repeated.

Table 2 Guide to Collect Feedback for Pilot

1. Now that we have completed the interview, what feelings are you experiencing right now?
2. What did I not cover?
3. Explain what I should do differently in the study?
4. What would you change about this interview?
5. What did I leave out of the interview?
6. Can you tell what my personal opinions are on this matter?

An audio recording of the interview for first two pilot participants was used. Although not necessary for a pilot study, the student investigator chose to record the first two pilot study interviews to identify potential problems (e.g., biases, leading questions, audio recording errors). The first interview lasted 42 minutes and the second lasted about 30 minutes. The other three interviews were not audio recorded; however, notes were taken during the interview.

The student investigator reviewed field notes and audio recordings from the pilot participants. Pilot participant one and two identified the need for a visual image of the ACIP vaccine schedule because they were not familiar with the schedule having not had children yet. The student investigator and faculty advisor agreed that a visual image of the schedule should be added to the demographic questionnaire and Parents Attitude About Childhood Vaccines, modified (PACV-m) survey. Therefore, a current copy of the 2018 ACIP schedule was added to Qualtrics. The first two pilot sessions also identified redundant questions and vague language that either confused the subject or diluted the richness of their response. For example, under the subjective norm construct of the TPB there were initially three questions asking about how the participant perceived “pro”, “anti”, or “partial compliance” vaccine behaviors of other parents.

The pilot study found these responses to be the same for each question and to facilitate parsimony these questions were consolidated to ask, “What do you think drives other parents to make their vaccine decision?”

Prior to the pilot participants, the question path had 44 questions and 30 prompts. These interviews averaged 38 minutes long and were then followed up with a feedback session that extended this time. The most drastic change to the question path was the reduction in the number of questions. The question path was reduced from 44 to 25 questions and from 30 to 21 prompts. The revised question path was then tested on one more pilot participant and accepted as a final version to be used in the study.

After the question path was used in the first seven interviews, the student investigator and faculty advisor discussed the absence of the participants’ partner's role in the vaccine decision, the desired parent and pediatrician relationship, perceptions of actual threat, how their peers perceive them, and the impact of celebrities in the vaccine decision. Therefore, it was decided to modify the question path so as to include “Tell me about the role that the father plays in the decision”, “How are you different from the pro- and anti-vaccinators”, “What kind of relationship do you hope to have with your child’s pediatrician?”, “What impact, if any, do celebrities have in people’s vaccine decisions?”, “How do you think other mothers would feel about you if they found out how you had vaccinated?”, “How likely do you think it is that the worst case scenario would happen?” No questions were removed at this point, but prompts were reduced from 21 to 19. Participants eight through 50 were asked 31 questions. The question path is located in Appendix B.

Recruitment

Incentives

The student investigator applied for the Robberson Research Grant and was awarded \$1,000 to apply to incentives for participation. A \$20 Amazon gift card was electronically sent immediately following the completion of the interview.

Recruitment Locations

Participants were recruited nationally through large outreach resources, such as Craigslist, Facebook personal and paid advertisements, Facebook mom groups, Twitter, Instagram, Snapchat, and two online forum-type groups (e.g., Mothering, The Bump). Other than word of mouth, additional recruitment material included a flyer, a mass distribution email through the student's university system, Facebook site, a Craigslist posting, Twitter handle [*dannielleayers@OUvaccine2018\(2019\)*](mailto:dannielleayers@OUvaccine2018(2019)), and Twitter flyer. Recruitment material can be found in Appendix D.

Out of all of the recruitment locations, the greatest response was through Facebook mom groups and Facebook paid advertising. Some of the Facebook groups were Facebook Essential Oils, Facebook Natural Parents, Facebook Health, Wellness, and Fertility, Facebook Parents of Fort Worth, and Facebook Fit Parents of Kansas City.

Recruitment Material

All recruitment material such as flyers and/or online media, provided general information about an active study looking for first-time expectant mothers in their second and/or third trimester, who were at least 18 years or older, and had concerns about childhood vaccines. The flyer instructed those interested to contact the student investigator through email. The flyer was the primary recruitment material and was mostly posted through online sites. The mass email was sent through the student investigator's university system. A copy of this email is found in Appendix D.

Content of the first response email. The student investigator responded to each potential participant's first email within 24 hours. The response briefly explained the purpose of the study and study requirements. It also contained some questions to broadly screen them prior to setting up a time for them to take the Qualtrics surveys and a 2-hour interview. These questions asked where they lived, their current age, number of weeks pregnant, how many children they have, if they considered themselves pro, anti, or vaccine-hesitant, a phone number at which they could be reached, and available times for the 2-hour interview. If the potential participants responded to the initial screening questions with ambiguity regarding their vaccine stance, the student investigator allowed them to move on to the next screening phase. People who did not meet the criteria for participation were thanked for their time but did not move ahead any further. A copy of the initial screening email can be found in Appendix E.

Data Collection

The data collection took place in fall 2018 and spring 2019. Fifty vaccine-hesitant first-time expectant mothers completed the consent form, demographic questionnaire, PACV-m survey, and the interview. The following describes how these participants were selected, the methods of data collection, and an explanation about potential participants who did not complete and/or qualify for the study.

Sampling

Following approval by the Institutional Review Board (IRB) at a university in the Midwest, the recruitment process began. A purposive-sampling technique of vaccine hesitant first-time expectant women was used to select participants. According to Patton (313, p 230-233) purposeful sampling selectively chooses participants that have specific characteristics aligned with the focus of the research in order to gain rich information and answer the research

questions [313]. Because the focus of the research was to understand factors of vaccine-hesitancy in first-time expectant mothers, it was believed that this sampling procedure was the most appropriate and would generate the most information about vaccine-hesitancy in first-time expectant mothers. Thus, a judgment was made based on the limited, but promising, literature that shows the target population as a distinct group [91, 112].

Interviews

Potential participants who met the initial study criteria were scheduled for a 2-hour interview. A couple of hours prior to the interview time, the student investigator sent the Qualtrics link and password for access to the consent form, questionnaire, and survey. The student investigator intentionally sent the password and link just shortly before the interview was scheduled to begin. This was done to ensure that the participants had recently viewed the ACIP schedule and were mentally prepared to discuss vaccines. Because Qualtrics summed the PACV-m immediately upon completion, the student investigator was able to confirm that the score was ≥ 42 and that they had affirmed their vaccine-hesitancy on the PACV-m. Those that passed the second screening phase continued on to the interview immediately. Those that did not meet the criteria did not participate further. Twenty-two potential participants completed the informed consent, demographic questionnaire, and PACV-m survey, but were not interviewed. Mostly, these were cases of potential participants whose ambiguous answers about their vaccine stance from the first email screening response led to an invitation to take the Qualtrics portion. Although some did score ≥ 42 on the PACV-m, many did not respond to the student investigator to set up a time to interview. Fewer cases were potential participants who did not meet the PACV-m score criteria and were unable to continue on to the interview.

Interviews were conducted using the same question path format, although some changes to questions occurred after participant seven. The probing questions differed slightly depending on the flow of the interview. All interviews were done online through video chat (e.g., Skype, FaceTime). The average length of the interviews was 52 minutes. The student investigator transcribed each interview verbatim and sent them in small batches to be reviewed by the faculty advisor. The faculty advisor continued to advise the student investigator so that interview techniques were improved as the study progressed. For example, after the first few interviews the faculty advisor made the student investigator aware that the student's language was leading the participants to respond a certain way, thus threatening bias. The student investigator continued to discuss better techniques with the faculty advisor until the student's interviewing technique was optimal.

Data Analysis

Transcription

The student investigator checked each written transcription for errors by reading through the transcript while playing back the audio recording. This checking process was done for each interview. Aliases were removed from the transcript Word documents and labeled using their number only. The student investigator removed any distinguishable words that could identify the participant. Each transcript was then uploaded to qualitative software NVIVO 12 Pro.

Coding Process

According to Miles et al. (319, p 71), "Codes are labels that assign symbolic meaning to the descriptive or inferential information compiled during a study" [319]. As the student investigator sought to organize the rich descriptions of the participant's lived experiences, a deductive approach using a priori coding was first used to develop an initial code book.

According to Lochmiller [320], a priori coding is appropriate when there are theoretical bases. Thus, the first codes identified were based on the framework provided by the TPB and HBM constructs. Similar to Lochmiller [320], Miles and Huberman [321] encourage starting analysis under the lens of the theoretical concepts [320]. They also support methodology used to perform a *a priori* approach in the identification of data that coincides with theoretical constructs [321]. Conversely, Miles et al. [321] suggest a gradual incorporation of emergent codes outside of the theoretical constructs.

Code Book. According to Patton (313, p 454), qualitative research often begins with a deductive approach and switches to inductive as the patterns and themes emerge outside of theoretical constructs [313]. Therefore, a code book that included theoretical constructs from the TPB (background factors, perceived behavioral control, subjective norms, attitude, and intention) and HBM (perceived threat, perceived benefits, and perceived barriers), as well as three non-theory-based codes (conspiracy, parental rights, and movie) was created. Using the first version of the code book which had eleven nodes, the student investigator, an outside coder, and the faculty advisor met together to code two interviews, discussing discrepancies until consensus was met. Following the completion of coding the first two interviews, two more codes were added, *healthcare provider influence* and *fatalism*. The student and the outside coder then independently transcribed an additional transcript with good agreement. The rest of the transcripts were independently done by the student investigator and outside coder. The team met regularly to discuss coding. During the coding process, meaningful text that was not adequately captured in the existing code book was identified, and two more codes were added, *information seeking* and *celebrity influence*. The final version of the codebook had 15 codes.

The coding process included the student investigator randomly selecting five transcripts to be coded at a time. The student investigator coded first and sent the NVIVO file to the outside coder with the coding stripes turned off. The outside coder blindly coded the five files and sent back to the student investigator. This coding process continued until all interviews were coded. The coding process took place between November 2019 and May 2020.

Following completion of all coding, intercoder reliability between the student and the outside coder was calculated by the faculty advisor. The intercoder reliability was 92%. At this point, both coders met together over the course of several meetings to go over any disagreements in coding found within each transcript. Coders discussed each discrepancy until 100% agreement was reached. The final coded transcripts were then analyzed for themes.

Thematic Analysis

The final coded transcripts were then used for thematic analysis. The student investigator, the outside coder, and the faculty advisor met together to discuss potential oversights among the fifteen codes of the codebook. A new code emerged from the data, and it was agreed that a sixteenth code for ingredients should be added and that the transcripts should be recoded. Each code with participant quotes was saved as an individual Word document, or node.

The student investigator, the outside coder, and the faculty advisor began thematic analysis by examining each node separately and discussing merging patterns across and within the nodes. According to Patton (313, p. 453), thematic analysis refers to a broad range of qualitative analysis techniques, aimed at reducing large datasets into meaningful concepts commonly shared by the sample population. According to Patton (313, p 465), one of the greatest challenges to qualitative research is *convergence*, the ability to thoroughly explore the

data and effectively “weed out” the random information [313]. Having three people participate in the thematic analysis was to enhance rigor. There is not a universal standard for dictating how a theme is determined. However, in this study an idea was only considered a theme if it was mentioned by at least twenty-five percent of the participants. Using a twenty-five percent threshold of acceptance has been used in other studies [322].

Seven major themes were initially identified. These themes were Different from the Pro- and Anti-Vaccinator, Factors that Build Confidence, Objections to the ACIP Schedule, Risk and Benefit Assessment, Fatalism, Vaccine Messages in the Media. Multiple subthemes were identified in each major theme. Redundancy was observed across several of the nine themes. The student investigator discussed this issue with the faculty advisor, which led to a reduction of major themes and subthemes. Six major themes resulted from the reduction, Different from the Pro and Anti-Vaccinator, Factors of Confidence, Risk and Benefit Assessment, Fear, Objections to the ACIP Schedule, and Vaccine Messages in the Media. The student investigator discussed the six major themes with the faculty advisor and a decision was made to eliminate additional redundancy in some subthemes, and add a seventh major theme, Social Consequences and Subjective Normative Beliefs. Chapter four gives a description and the results for each these themes.

Chapter IV: Results

Introduction to the Results

Chapter four gives the results from the qualitative study conducted pre-COVID-19 between fall 2018 and spring 2019. Fifty first-time expectant mothers completed the consent form, demographic questionnaire and Parents Attitude About Childhood Vaccines-modified (PACV-m) survey, and a one-to-one interview. The average length of the interviews was 53 minutes. Seven main themes were identified with eighteen subthemes.

Demographics

Most participants were married, white and non-Hispanic, with an average annual income of \$50,000 to \$74,999, and some level of college education. Table 3 shows participant characteristics collected through the demographic questionnaire. Table 4 shows participants' age, weeks pregnant, and PACV-m vaccine-hesitancy score.

Table 3 Participants' Demographic Characteristics, Frequency and Percentages

Characteristic	No. (%)
Race	
African American/Black	2(4%)
Asian	1(2%)
Caucasian/White	45(90%)
Native American	1(2%)
Other	1(2%)
Ethnicity	
Hispanic or Latino Origin	1(2%)
Not Hispanic or Latino Origin	49(98%)
Highest Level of Education	
Associate Degree	5(10%)
Bachelor's Degree	14(27%)
High School Diploma	4(8%)
Master's Degree	10(20%)
Professional Degree	2(4%)
Some College, No Degree	13(27%)
Some High School, No Diploma	2(4%)

Table 3-Participant's Demographic Characteristics, Frequency and Percentages (continued)

Relationship Status	
Dating, Cohabiting	7(14%)
Married, Living Together	38(76%)
Separated	3(6%)
Single	2(4%)
State of Residency	
Arkansas	1(2%)
California	3(6%)
Florida	2(4%)
Georgia	2(4%)
Illinois	2(4%)
Indiana	4(8%)
Massachusetts	1(2%)
Michigan	1(2%)
Missouri	2(4%)
North Carolina	2(4%)
Ohio	1(2%)
Oklahoma	10(20%)
South Carolina	1(2%)
Tennessee	2(4%)
Texas	7(14%)
Vermont	1(2%)
Washington	6(12%)
Wisconsin	2(4%)

Table 4 Participants' Characteristics by Range, Average, Standard Deviation

	Range	Minimum	Maximum	Average	Standard Deviation
Age (Years)	23	19	42	28	5.04
Pregnancy (Weeks)	29	10	39	27	7.74
Parental Attitude on Childhood Vaccines-Modified (PACV-m)	54	42	96	66	16.01

The Parental Attitude on Childhood Vaccines-Modified (PACV-m)

Participants' vaccine-hesitancy score ranged from 42 to 96 on the converted scale of the PACV-m. A score of 100 indicates the greatest level of vaccine-hesitancy. Forty-two was the lowest accepted score for this study. A question on the PACV-m asks about the participants'

vaccine-hesitancy. Most participants answered that they were “Somewhat Hesitant” on the PACV-m (n=30), rather than “Very Hesitant” on this question. These results are shown in Table 4.

Vaccination-Hesitancy: Themes and Subthemes

An examination of participant interviews revealed seven major themes and seventeen subthemes that help explain factors of vaccine hesitancy in first-time expectant mothers. Each major theme was identified as an overarching theme that explained reasons for vaccine-hesitancy. Subthemes are identified as concepts and patterns that occurred under the scope of each major theme. Table 5 shows the breakdown of these themes, subthemes, and their operationalized definitions.

Table 5 Qualitative Themes and Subthemes

Major Theme	Description	Subtheme	Description
1. Different From the Pro and Anti-Vaccinator	Participants’ perceptions about characteristics of the pro- and anti-vaccinator that they differ in.	Different Because I am Undecided, Open-Minded, Respectful, and Neutral	Participants’ description of characteristics and behaviors that set them apart from both pro- and anti-vaccinators.
		Different from an Anti-Vaccinator	Participants’ descriptions of how they are different from an anti-vaccinator. Includes their description of characteristics of an anti-vaccinator and social stigmas attached to the label.
		Different From a Pro-Vaccinator	Participants’ descriptions of how they are different from pro-vaccinators.

2. Factors that Build Confidence	Participants' description of things that would build confidence in their vaccine decision.	Need for Satisfactory Information at the Right Time	Participants' descriptions of things that they need to feel well informed, at the most optimal time.
		Seeking Transparency and Accountability	Participants' desire to have the medical community, health agencies, vaccine labels, and pharmaceutical companies disclose important information about vaccines and assume accountability for injuries.
		Ideal Parent-Pediatrician Relationship	Descriptions of the kind of relationship participants want to have with their pediatrician to foster trust and confidence in the vaccine decision.
3. Objections to the Advisory Committee on Immunizations (ACIP) Schedule	Issues with following the ACIP immunization schedule.	The Schedule is Unsafe	Beliefs that following the ACIP schedule is not safe for a number of reasons.
		Unfamiliarity is Unpredictable and Alarming	How previous experiences with a vaccine or a disease is factored into the decision. Includes distrust for newer vaccines or changes in the dosing of older vaccines.

4. Risk and Benefit Assessment	An evaluation of the potential risks and benefits associated with different vaccine decisions.	Weighing the Risks of Accepting Vaccines	Participants' assessment of the severity and susceptibility of vaccine risks.
		Weighing the Benefits of Accepting Vaccines	Participants' perceptions about beneficial factors related to accepting vaccines.
5. Fear Driven Decision	An encompassing feeling of being fearful of making a vaccine decision that could harm their child socially, physically, or emotionally.	Fatalism	An emotional state of feeling that harm is inevitable regardless of their vaccine decision.
		Fear of the Unknown	Participants' generalized fearful state of unknowns. Related to their being first-time expectant mothers where every decision is new and has unknown outcomes.
6. Social Pressures and Subjective Normative Beliefs	Perceptions of social pressures associated with vaccines. Includes participants' beliefs about how their peers are navigating the vaccine decision.	Modern Day Mothering	Factors related to vaccine-hesitancy based on mothering guilt, social judgment, and mothers as the sole protector of their child.
		Social Consequences	Participants' anticipation for negative social outcomes related to their vaccine decision.
		What Others are Doing	Participants' belief about how the majority of other mothers are vaccinating, how they would view the participants, and how they made their decision.

7. Vaccine Messages in the Media	Participants' beliefs, experiences, and impact on their vaccine-hesitancy from the different vaccine-related messages on different media sites.	Vaccine and VPD Related Messages in Mainstream News	Participants' reaction to mainstream news content and coverage of vaccine and VPD.
		Vaccine and VPD Related Messages on Social Media	Participants' experiences with Facebook and mommy blogs related to vaccines, vaccine information, and disagreements between the pro and anti-vaccinator.
		Power of the Personal Story	What other peoples' stories of vaccine injury or VPD infections has on the participant's attitude and beliefs about vaccines and VPD.

Intention to Vaccinate

At the start of each interview participants were asked “How do you intend to vaccinate, fully, partially, or not at all?” Half of the participants said that they would do some, but not all of the vaccines. A few intended to delay vaccines and/or spread them out over time. Twenty percent said they would vaccinate fully. Only one said they were going to refuse all. There were inconsistencies in the responses for some participants. For example, some would answer that they were going to vaccinate fully, but then describe doing a delayed schedule. Others who said they would fully vaccinate added stipulations, such as additional information or results of personal research.

P28 Fully. Um, and this might be a later question, but I, as of this point, I do plan to do a delayed schedule or an alternative schedule.

P9 I'd say as of today without doing any um, and having not completed my research or fact finding, I would say fully, but with the caveat that that might turn to partially if by what I read says there are things that aren't necessary.

P16 I feel like I will fully vaccinate the baby, but I don't, what I don't know and I want to look into more is about the timing. Like delaying some or spreading them out.

Some were confused about the definition of “fully” because they did not know which vaccines were recommended and which ones were mandated on the Advisory Committee on Immunization Practice (ACIP) schedule. Influenza and human papilloma virus (HPV) vaccines were the most common examples of vaccines whose status was particularly unclear for participants.

P4 Like flu shots for instance. Like I don't know. Should I do it? Should I not? I have never had a flu shot and I've never had the flu. So it's kinda like should I do full on vaccinations, or should I do the partial you know, or should I just see what happens and hope for the best?

Some participants did not give a clear answer about which direction they were leaning. Those who were unsure about committing to any decision showed distress in outward ways when responding to this question (e.g., pulling their hair, making facial expressions, throwing their hands up, raising their voice). Many of the participants who were unsure, verbally demonstrated their fluctuation between different options for vaccine choices in their response. Table 6 shows the breakdown for participants' intention to vaccinate.

P31 I think that in the beginning you might have a lot of self-doubt of, are you making the right choice? What is the right choice?

P37 Um, it's, it's uneasiness or anxiousness or uncertainty more than anything... there's so much conflicting information and you have one crew over here that's very strongly opposed to vaccines in one crew that's very strongly for them. Um, and there's not a whole lot of middle ground and I'm normally a person that finds myself in the middle ground.

Table 6 Vaccine-Hesitant First-Time Expectant Mothers' Intentions to Vaccinate

Intention	No. (%)	Representative Quotes
Fully	10 (20%)	<i>I anticipate, uh, vaccinating fully, um, I, I don't have a lot of information on em, actually at this point. Uh, so, I would want to gather more information before I jump into that necessarily. Um, I, I think it's important that they're vaccinated against all these horrible diseases, but at the same time, it's like I have to analyze the risk, the risk versus the reward, you know?- P46</i>
Partially	25 (50%)	<i>Um, at this point I'd say partially, um, I want to, I want to research everything. I'm a researcher, so I want to research anything before I commit to doing it. So I would say at this point, like partially.-P32</i>
Not at all	1 (2%)	<i>Um, so at least right now the plan is to not vaccinate. Not, I don't want to say not at all. Because I am not opposed to potentially looking into it in the future. Um, but right now based on what I've found I would say not at all, um. -P1</i>
Unsure	8 (16%)	<i>I, I don't really know what I want to do yet. I want to do what's best for my child and I'm confused on what to do because there's so many mixed um, reviews and, and reports and things out there that it's really hard to find what's been publicly like put out there by medical reviews or what's, you know, just fake news and all that stuff too. And it's just, I just want to know what's the best thing and I, I have such anxiety. I have a natural anxiety and PTSD, so figuring out what's best for my child is just so confusing and I get really anxious about knowing what to do. So I honestly don't know what to do. I just want to do what's best for my child in the end and finding that answer really. -P42</i>
Delayed	6 (12%)	<i>Um, right now, partially, but maybe on a delayed schedule, um, is what I'm leaning towards, but it, I mean, it changes on any given day depending on my mood. I really feel like I'm up against a time crunch here cause I need to make a decision really soon, um, and I'm not really getting more information like I should be.- P47</i>

Theme 1. Different from the Pro- and Anti-Vaccinator

Vaccine-hesitant participants explained characteristics that defined hesitancy and set them apart from pro- and anti-vaccinators. The results show that participants described themselves as having characteristics of a person with high emotional and intellectual intelligence, not intentionally threatening herd-immunity, but desiring to protect their own child. Differences from the pro- and anti-vaccinators broadly included the other two group's rigidity, judgmental attitude, extremism, clearly defined vaccine beliefs, and certainty in their position. Overall, many participants viewed pro- and anti-vaccinators as mean-spirited, while they viewed themselves as nice, tolerant, and accepting of different opinions. Three subthemes were identified in this theme.

P27 Hesitancy isn't stupidity and it's not, um, an intentional effort to screw other people over, but an intentional effort for individuals to take responsibility for their bodies and their families and the bodies of their children and, and make an informed decision as best as they can. Something that challenges conventional thought, not for the purpose of being disruptive, but for the purpose of, maybe, because of the recognition that things only continue to grow in a healthy manner when they are challenged. I explained ... people who are hesitant about vaccinations in a different light, not as crazy hippies who are seeking to disrupt, um, herd immunity or who are completely stupid, but people who are seeking to take personal responsibility.

P8 Like I say one camp is either they're mildly implying let's keep the herd healthy and then you have more aggressive version where they show you, oh my God they're outbreaking! Like it's a zombie apocalypse if you don't vaccinate, we're going to all die in the next 3 weeks!

P4 So I'm just somewhere, just somewhere in the middle. I haven't, I'm not polar, you know, against vaccinations. Um, but I also am not one to just blindly follow and, you know, get a bunch of injections for my kiddo.

Different Because I am Undecided, Open-Minded, Respectful, and Neutral

It was important for participants to emphasize their openness to having conversations with people who had a spectrum of vaccine beliefs, including healthcare providers. Furthermore, some believed their ability to amicably engage in a conversation with people of diverse vaccine stances is what separated them from pro- and anti-vaccinators, who could not get along with each other or anyone who disagreed with them.

P12 I feel like I am open minded. What I feel like that makes me a person who could have a two-way conversation, like without it getting heated, like I'm genuinely interested in what your view points are and why, um, but only if they're open to like hearing like my side of the story.

P25 I have not picked a pediatrician yet. I would hope that, um, they would understand my, my hesitancy and be willing to educate me further.

They viewed themselves as unbiased, active learners who wanted to ask questions about vaccines. Some were afraid to ask questions or express concerns to others, fearing they would be verbally attacked for vocalizing their concerns. Some were also deliberately seeking to understand other mothers' reasons for their vaccination choices. They were interested in the background and what led others to their vaccine decision. Understanding why and how other

mothers made their decisions was part of vaccine-hesitant first-time expectant mothers' personal research.

P45 I kind of have an array of influences. I don't have just like one-sided people. I, I don't have just one group of people that this is it. I kinda get lots of opinions from all over the place. Um, but the sad thing is, I've kinda kept my vaccine preferences quiet, because I feel like it's such a hot topic. It's almost as bad as when you tell people what you're going to name your kid and they lose their minds, you know.

P14 So, um, I think for me I would like to hear it from both sides. Like why are you an anti-vaxxer and why? You, you know, why are you a pro-vaxxer and sometimes, uh, a vaccinator?

P21 Um, I think that I'm different in that...I think that there's so much animosity between both sides, you know? Um, and I don't, I don't have, I don't share that animosity at all. I just think that you have, you should do the research and you should make the decision for what's best for you and your family and I don't think that you should be judged for either which way you choose to go about it for your family. That's your choice and you have a right to that. And I don't have any right to tell you that you're right or you're wrong. I'm just, as much as you don't have a right to tell me that I'm right or I'm wrong.

They viewed pro- and anti-vaccinators as close-minded, hostile when encountering someone with a different point of view. Also, unwilling to change their mind for any reason. Participants described themselves as having an understanding that circumstances change, new

evidence is discovered, and what seems right at the time may end up being wrong. They expressed the importance of exploring different perspectives, keeping an open mind and being flexible as part of their journey to figuring out the best vaccine-decision for their child.

P43 I try to keep an open mind as much as I can to any new information that comes to me. I don't necessarily shut down just because it goes against what I believed before. And just being okay to say, okay I was wrong in this case and this research proves it, or this experience proves it, and now I need to remodify my behavior and my...beliefs from that point forward.

P5 The big reason why I still have doubts and concerns is because it seems like things change so quickly. And you know, one second coffee is the devil and the next it's actually good for you in small doses, and then the next it has 23 different carcinogens in it...at some point doctors were telling pregnant women, you know, they were like, hey, if you're going to smoke, smoke Lucky Strike...we've done so many things in the past that we now know are dreadfully toxic to our bodies. But back then, doctors were convinced that they were fine and they were doing the right thing.

Many participants had witnessed both sides attacking one another in hateful ways, not only questioning the other's intelligence, but also their love for their child. They viewed these interactions as appalling and disgusting.

P16 I've seen some contentious posts from like, like I said, like peripheral friends who are like posting like just articles that are like anti-vaccine or just like, you know, sharing new stuff. Um, and sometimes they are, they're some back and forth on those, like those people's threads and

they're, they can get pretty intense! And usually it just ends with people like saying you're dumb. Basically both sides just don't agree. So they both kind of like think that it's a lack of understanding/intelligence/willingness to face the facts.

P6 I see it all the time online. You, I think they're both aggressive to a degree but usually with anti-vaxxers they're more aggressive in the aspect of they're like "here, here's the science, here's the links, here's the information" and they're just spewing the information at you and then you've got pro-vaxxers that will insult you like "oh, you're a little B, you're a POS, oh what you're doing is abortion with extra steps", like that's [profanity] rude, you don't say that to people, man what are you doing? So I think both sides are aggressive, but it's a matter of what type of aggression we're looking at because pro-vaxxers can be pretty nasty to anti-vaxxers.

Being respectful of other mothers' parenting choices, even if it was different than their own, was important to participants. Judging others was a thing that participants did not want to be perceived as doing. When asked how they feel about other mothers who chose to vaccinate or had refused all vaccines, many included statements about not being judgmental in their responses. Nearly half of the participants made statements about believing that all mothers are doing what they feel is best for their child. They acknowledged that they would not always know the reasons behind other's vaccine decisions, but they believed that the motives were pure and not malicious. Taking this position gave the participants feelings of having more self-awareness, being able to manage emotions, and not react to others who criticize and judge their choices.

P17 Um, and you know I'm not sure whether some of them really dig into the topic and that's concerning, but if that's what they feel is best for their child, I see nothing wrong with that it. And I don't think that they should um, um talk badly or hate on others because they choose a different option than them. Um, I feel that everybody, whatever their decision needs to respect and understand somebody who has a different opinion

P42 There's a lot of people I feel that are just way too judgmental out there. I think we're all just like, I keep saying, I feel like everyone's just trying to do their best. And so I don't see the point in yelling at a mom if she breastfed or didn't breastfeed or vaccinated or not vaccinated.

P40 I don't feel like any parent should be shamed for their decisions...um, not every decision is black and white and we won't always know what is the absolute best answer or decision. And we'll just have to make a decision and hope that that was the right one for us.

Many vaccine-hesitant participants viewed themselves as a neutral party in the vaccine debate. They described their ability to see other mother's perspective as distinctly different from the shortsightedness of the other two groups. Additionally, participants said that they agreed partially with arguments on both sides. There was not a clear consensus about which arguments they agreed with. However, generally they spoke about valid points made by both sides. Sometimes the points were regarding vaccines and vaccine preventable diseases (VPD) and sometimes the arguments were about the opposite group. For example, a few participants agreed with anti-vaccinators who said that if pro-vaccinators truly believed that vaccines were effective, then they would not worry about their unvaccinated child being a risk. Unfortunately, the

student investigator did not probe more deeply into the perceptions of exactly which arguments were valid on both sides.

P13 I guess because I could see, I can see, they usually can't see the other side at all, and I can see both sides. I can see their pros and their cons from both sides.

P6 For the pro-vax arguments I think they just imply “vaccinate your kid, it’s for the greater good even if your kid has an adverse effect it’s for the greater good, now your kid can’t infect our kid”. When it comes to the anti-vaxxer arguments, the biggest message I get is “be scared, be leery”, you know. Be aware of what you’re sticking into your kid before it comes back and you lose your child and your kid loses a limb because of it...so you know, both sides have a lot of valid arguments and both are very scary to look at.

P46 I never like to jump head-long into something I don’t fully understand. Again, whether it’s pro or anti, I’m not, I don’t have enough information... I do think, though, having friends on both sides of the spectrum is interesting, because I get to hear both sides, but at the same time, uh, I can’t take sides at this point, uh, just because, I again, I don’t have all the information. I know that there’s information out there to support both, both sets of it, both sets of opinion.

Different from the Pro-Vaccinator

Although many believed that all mothers were motivated by doing what they felt was best for their child, a number of participants also described poor mothering as someone who followed the ACIP schedule without question. Participants described these mothers as “sheep”, “blind

followers”, and “irresponsible”. Questioning vaccines are what responsible parents do. To accept vaccines without skepticism was negligent. However, if a mother conducted her own research and expressed hesitation to accepting them, then her vaccine-decision, regardless of the decision, was respectable. Although participants clearly stated that they did not agree with judging other mothers for their parenting decisions, many implied judgments on any mother who did not investigate vaccines before making the vaccine decision.

P43 I don't think anyone should do anything without hesitation. I think that it's our job as parents and as consumers and just as humans to put the research in and not just fully trust anything one way or the other. So, I think, again I would be concerned about the outcome of their kids if they're not even gonna stop and think about things like that and they're just gonna trust something wholeheartedly.

P27 I think I do probably tend to feel like a lot of people who make a decision toward vaccination, um, unwittingly? They just kind of do it cause that's what you do, not because they're actually choosing it. Um, so I, I internally sometimes want to encourage people to think about it a little bit more. But especially if people have thought about it and have researched it and have talked about it, even if we end up disagreeing completely. I, I have a tremendous amount of respect for that because they at least are making an intentional decision rather than just going with the flow.

P5 At one-point doctors were totally okay with women drinking and smoking during their pregnancies. Um, doctors were, you know, four out of five doctors recommend, you know, this

brand of cigarette. So it's hard for me to just totally blindly be like, yes sir, I am assuming that you know everything about everything and whatever you say I'm going to go with because I'm sure as a doctor you have all this free time to sit around and keep up with recent studies that come out each week on everything medically related. And so I'm sure you're up to speed and I'm sure you know everything. That's hard to, hard to do. So I feel like that's just a sheep mentality.

Pro-vaccinators were also referred to as traditionalists who were following a schedule because they were raised to not question medical doctors or the health field. Some participants believed physicians lacked comprehensive vaccine knowledge because their medical schooling was outdated or had been limited. There was a parallel between pro-vaccinators who were mindlessly following the doctor's advice, and doctors who were doing the same with their training. A few vaccine-hesitant participants described themselves as having an inquisitive personality that makes them question how things work. In this aspect, the vaccine-decision was seen as one of the most important health decisions that a mother could make and asking questions was a natural part of their vaccine-decision making process.

P35 There's also a lot of people that don't want to question the system, they just want to be sheep, they just want to do follow, do whatever they're told because it's way easier, way easier than actually doing the research and trying to get your own opinion.

P1 So I am, I am one who likes to ask who, I like to get all of the information that I can. And I don't like that I feel like I can't ask those questions just in general...but um yeah when I think about it, I think it would, when I think about it, I am picturing the you know, the vast majority of

the population on a conveyer belt just getting stuck. Like they are supposed to. Like their doctors tell them to.

P29 I think many parents trust everything that their doctors say at face value and um, unfortunately I think that the doctors often just trust everything that they've been taught or told, um, without question as well. So it's just something that people aren't thinking about. Um, so they may just say, okay, well I don't know about this, I'm not educated about it but my doctor is, so I'm just going to do everything they say. And then in a lot of cases, you know, the doctor is educated about it, but they never questioned where this education actually came from.

Different from the Anti-Vaccinator

The greatest perceived difference between participants and anti-vaccinators was their belief that vaccines were important and necessary to prevent some diseases. Many participants made statements acknowledging vaccines' historical role in eliminating once common childhood infectious diseases. According to participants, anti-vaccinators were absolute in their opposition to all vaccines, narrow minded, and unwilling to consider that they may be wrong in their stance. Vaccine-hesitant participants did not agree with this position. They believed that some vaccines were necessary (e.g. polio) and that some vaccines may be necessary if circumstances in the environment (e.g., outbreak) put children at a real risk for a disease infection.

P1 I think as far as the, you know, the moms that you'll be interviewing, or, or talking to, I think I'm probably one of the more fluid ones in that I, you know, I'm not completely opposed to. I'm not so far into the anti-vaccine camp that we are never, never going to do it. I think more studies need to be done, I think they need to be safer and then it is something we will look into. It's not,

you know, a conspiracy theory to the point where I'm like don't ever do it. We can't ever trust them. But I mean, I think there is work. There is work to be done to make them safer and to make them more transparent.

P44 I'm aware that vaccinations are important and that they should, they're there, they should be done, so I guess on the aspect, I'm against the non-vaccinations.

As vaccine-hesitant participants explained the reasons that they were uncomfortable with following the ACIP schedule, it was important for them to clarify that their concerns did not make them an anti-vaccinator. Being labeled an anti-vaccinator was a bad thing because participants did not relate to this groups' extreme positions and aggression towards other mothers who vaccinated differently. Others talked about a social stigma attached to the label "anti-vaxxer" or to someone who didn't vaccinate.

P22 I don't want to be judged or feel like I would be a bad parent for not vaccinating or choosing not to vaccinate against certain diseases. Um, but I haven't really like opened up that can of worms too much with them because just mainly because of the judgment and you know how it is today with people saying, oh well you're anti-vaxxer or you don't believe in vaccinations and then you get that stigma with it.

P21 Well it's obviously it's pro-vaccine, but it's very aggressive in, that it's very aggressive and judgmental and, um, I just think it's very negative...I guess like my big thing is, is that I, I feel like I should be able to choose what's best for my child. You know? I as a parent should be able

to make that choice and I don't think that you should, you know, force a decision on me and I don't think that you should force, you know, a stigma on me or anything like that ...I feel like it's negative in the fact that like, I feel like a lot of our rights as parents are being taken away to choose what's best for our parents- or for our children.

P12 I don't want to sound like an anti-vaxxer because I do believe in modern medicine and vaccines, but you know when the swine flu was getting to be a big deal, like ten years ago or something? So I am from Norway and I was living in Norway and the Norwegian government ordered like two and half doses per citizen. So they ordered like a ton of vaccines to protect against the swine flu and I it is my understanding that that vaccine was developed pretty quickly and there were a lot of people in Norway... that had all these negative side effects from the vaccine, like losing their taste sense, or their sense of taste, like all of these weird things that happened after they got the swine flu vaccine. So, I guess I was glad that I didn't get that vaccine because again I kind of feel like that falls into the flu vaccine category even though the swine flu was pretty severe for the pregnant, or the elderly, or the ill, I feel like that's what led me to have kind of like mixed opinions on some but still be all for vaccines.

Vaccine-hesitant mothers were interested in the personal stories of others who chose not to vaccinate, wondering if their child having a vaccine injury led them to become anti-vaccination. However, participants felt like anti-vaccinators were not likely to have civil conversations about these things. Lastly, throughout the interviews several participants stereotyped anti-vaccinators as health fanatics or “crunchy” moms. There were differences in how this term was used and there were also some variations with the wording (e.g. crunchy

granola, granola, granola-y). Being “crunchy” sometimes referred to an anti-vaccinator and sometimes was used to anyone who preferred a natural lifestyle (e.g. non-genetically modified organic foods, Lysol free homes, essential oils). This lifestyle was talked about as being a newer trend and socially cool thing to be. Being “crunchy” was never used to describe someone who vaccinated their child. A few participants also did not relate with anti-vaccinators because they were viewed as conspiracy theorists.

P4 Like the anti-vaxxers they're very, I call them just like you know the health nuts, because most of them are the crazy gluten free, not for my child type of mothers. And then the ones who are full pro-vaccination are very, they are very aggressive about it. Whenever you go to talk to them about it, both sides are, but it's more of they're just very aggressive like oh well here's what you should do and feeling like you're being persuaded and kinda just not sure that's what you want to do but it's just because they are so hard core into it.

P33 I would like to think that I'm more open minded. Um, less judgmental. I try to be way less judgmental and not judge anybody on either end of the spectrum. Um, I would also say I'm not like a lot of mothers that a lot of people that choose not to vaccinate are super crunchy granola. And I'm not that way. Uh, we're all gonna die at some point. And if that means that I want to eat a brownie, made with gluten and sugar, I'm going to do it because I'm going to be happier. Um, I mean, I'm not 100% one way or the other, so I think that just sort of puts me different automatically, um, and maybe not as like crunchy as mothers who are anti, um, and trying to trust the medical community maybe more than they do, um, I'm sure they all have lots of very definite reasons why they choose not to vaccinate, though.

P38 I think some parents distrust the medical community. That's a big part of what I've seen in general. Just really distrust Big Pharma in general. Um, I think others, have done some research, um, like myself. Um, I do think that there is now a trend of people in their early twenties who were not vaccinated and so that's just kind of their heritage, almost.

Theme 2. Factors That Build Confidence

Participants described confidence as a feeling of certainty that an outcome will occur as expected if they chose to accept, refuse, or delay vaccines. Confidence was also described as a feeling of assurance knowing they were making the right vaccine decision. None of the participants said that they felt confident in their vaccine decision. Low confidence was influenced by several factors. These factors included feeling uninformed, struggling to find reliable sources of vaccine information, feeling overwhelmed with the amount of information online, and seeing or hearing conflicting information. Three subthemes were identified in this theme.

P19 I'm stressed out, I'm concerned. I want to make the dire, I want to make the right decision and I'm not exactly sure which direction I need to go 100% like I would love to feel 100% confident, like I'm making the right choice and I don't feel that way at this time because I'm still indecisive or I'm still not 100% sure which route is going to be the safest route long term.

Need for Satisfactory Information at the Right Time

Most participants said that they did not have enough information or knowledge about vaccines and/or the VPD to feel confident in a vaccine decision. Information that they were

lacking included understanding the reason and purpose for vaccines on the ACIP schedule, vaccine schedule, ingredients in vaccines, and risks associated with their child receiving a vaccine.

P49 I can't decide. I, I have like opinions from both sides where I'm like, this could be really beneficial, but also it can be very harmful. So I think both sides, you know... like they know what they're going to do. I have no clue. I have so much research to do. I have so many people to talk to you. I have so much to think about and read about and process before I can even like think about saying yes or no.

P31 I mean I'm kind of a person that likes to be informed of all the choices, um, you know, for myself and then, um, our child...hypothetically I feel like if I got all the information that I needed to beforehand, I would be less hesitant and just say, okay.

P39 I feel like I want to understand what's going into my child's body and I want to understand what it's there for, and understand the purpose of it, and hopefully able to make an educated decision as far as to, you know,...I didn't have to put my child through because it wasn't necessary...but if there was something that I was able to give my child that was going to help keep them healthy, and going to prevent them from getting some of these diseases, then that would be, you know, my way to go as well. But I don't, I don't feel like I'm on either extreme because I want to understand it, good or bad.

Many said that they were in an active state of researching vaccines and VPD.

Participants mostly described any kind of Internet search, YouTube video, or documentary as a form of research. None of the participants talked about when or how they would know that they had completed enough research (e.g., hours spent in research, medical books used in search, speaking to different healthcare providers). Satisfaction with research appeared to be subjective feelings of accomplishment and not connected to specific goals or benchmarks. Some described features of good research. One aspect of good research was using reliable sources. However, there was no clear consensus about what made a source reliable. For example, a few participants referred to popular documentaries as trustworthy sources (e.g., Vaxxed). Others mentioned the Center for Disease Control and Prevention (CDC) as a reliable source. Another feature of good research was the length of time spent in research. According to participants, good research meant putting in the effort to perform Internet searches, to ask others about their vaccine decisions, and to get input from family and friends. Duration of time spent in research was not talked about in units of time but were in general descriptions of “not enough”, “enough”, “adequate”.

P22 Well, uh, obviously I'm going to use the CDC website because that's one of the most well-known sources. Um, I would like to stay away from people's opinions and family member's opinions.

P34 I feel like I'm uneducated is honestly what it boils down to. I don't, I haven't done enough of the research yet. I've been more focused on like how big are his fingernails so far, you know? Um, and I'll figure out the rest of it when it gets there.

P40 I do know a way to decipher if the source is a good source. Um, a lot of times if it's dot.org in the website, it is usually a better source. dot.edu is a good source. Um, those in the link are really important because if they don't have one of those two things, they're not backed by anything. If it just says.com could be anything, cnn.com, it doesn't necessarily mean it's a reputable source because it's a news station. So I guess that's how I base it. But I can't think of a website off the top of my head.

P17 For me, personal stories are huge. Um, so 'Vaxxed' is one, uh, research that I've been using a lot because it is solely personal stories.

P33 Research is definitely key. Um, obviously there's a lot of rhetoric out there that can be false, but, um, I think it's up to us as moms, like we do have Google as a tool. We do have the internet as a tool now. We have books and articles and things as tools that we can use to make a very educated, informed decisions.

Participants talked about several challenges to getting vaccine information. For example, the Internet was talked about as a source where a lot of information existed, yet “weeding” through the mass amount of misinformation was overwhelming. Nevertheless, the Internet was the main source for personal research discussed during the interviews. This was in contradiction to many who ranked physicians as their number one preferred source for vaccine-related information on the demographic questionnaire. The most common reasons given to not

trust a physician was believing their medical school training was outdated, or that they were profiting off of the vaccines.

P18 You know, cause it's such a broad topic and there's so much to read. Like, I mean every time you click on a vaccine thing, I'm like, see, see, it's like 45 pages of stuff you cannot understand... I don't know how people can be, so like 100% informed either way, you know? But like, where do you, where does one get like a good education on vaccinations as a early 20-year-old person? You know? Other than the Internet, which has so many different, you know, views and standpoints even, and the government websites sometimes they're hard to navigate and read 45 pages on one vaccine.

P42 Um, so I just want someone who's going to be honest and say, this is, this is important. This is what you need to do. And um, or say, you know, oh, like this is helpful, but it does have this adverse effects. I just want you to be honest with me. That's really what I want. I don't want you to profit off of me. I don't want you to give me this sample because it's the newest sample and you can sell that product or something like that. I really want you to think about what's best genetically and what's going to work best with our bodies and really thinking about our symptoms and our, our issues at the end of the day.

P43 I think it depends on where we're getting our information from, um, and who we prioritize our information from and who we trust the most. So, I would say I am less likely to trust the medical community because there's so much money in vaccinations and I know that some doctors get benefits for providing vaccinations, um. If that wasn't a factor, if money wasn't an

issue, and it was just we really believe this is what's right, I think I would be more persuaded by those.

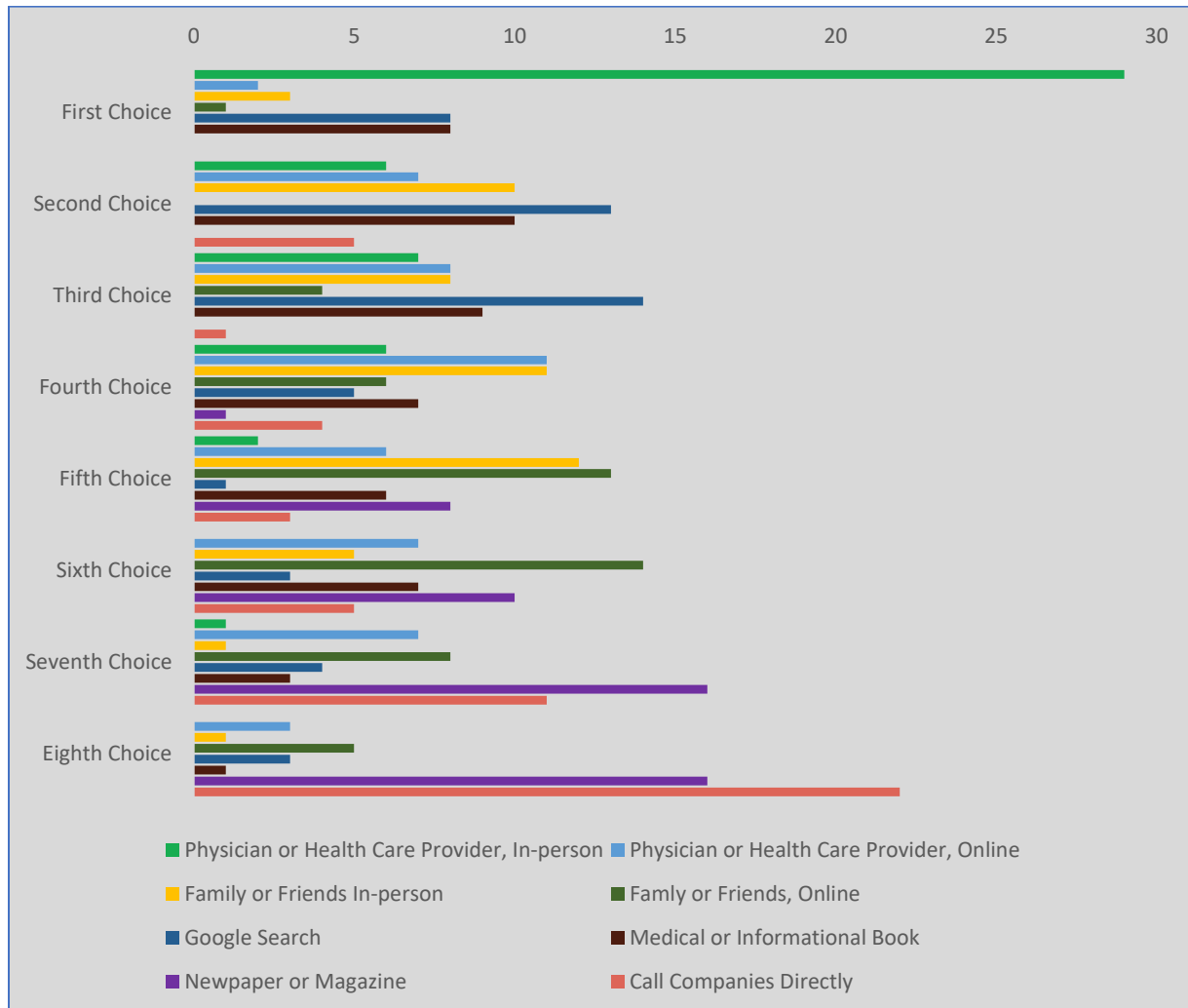
Personal research was an individual process, procedurally done at the mother's discretion. It was also viewed as a foundation to accepting and trusting vaccine information from other sources. For example, doing personal research was a necessary antecedent to being able to trust what the pediatrician would say. Seeking vaccine information from friends or family online was most marked as a sixth choice for preferred source. However, this too was in contraction to what participants said in the interviews. For example, although participants ranked low family and friends online, they made many statements during the interview indicating their influence was greater than how they were ranked.

P13 Well, I will be honest, I haven't done my own individual like research and I'm one who totally believes, don't, you know, don't listen, don't believe everything. You hear this or that, but you can't help when you can't help it getting in your mind when you're inundated with it all the time. You know, in social media, TV, this or that. It's, it's thrown at you so much. Granted I have, I am fully admitting I don't have more knowledge than just what's been thrown at me in those situations. And before I made a full-on choice, I obviously would research it more, but that's, you know, it's thrown at you like that. You're just, you can't help it kind of get it in your head and then you start manifesting things and yeah.

P14 I mean, even with the people around me that would be pro-vaccinators. So, um, for a while there I was like, yep, we're 100% going to do the vaccines uh whatever's required... but then, uh, my husband's talking to me about his friend that's a anti-vaxxer, so I've been kind of thinking more like maybe I should look into this a little bit more. So I think, yeah, being around people kind of, does influence my thoughts and feelings about it quite a bit.

Information about vaccines in newspapers or magazines was consistently ranked low in the demographic questionnaire and the interviews. One participant mentioned a Time magazine article on autism that led her to believe that vaccines do not cause autism. No other magazines or newspapers were mentioned. Although not asked in the interviews, one participant was a graduate student who used peer reviewed articles available through her academic institution. Table two shows preferred sources of vaccine information ranked by participants from first choice to last choice.

Figure 2 Rank Order of Preferred Vaccine Information Sources



Some participants said that their pregnancy marked the first time in their life they had ever thought about childhood vaccines. For some, vaccine safety wasn't something that they had questioned until becoming pregnant. All participants in the study were in their second and third trimesters. Many were in state of turmoil over not having made an official vaccine-decision. The duration of the pregnancy was the allotted time to make a life-changing decision, which some felt was not long enough. Even though many participants were not sure how they would

vaccinate, they anticipated deciding before their child was born because vaccines begin in the postnatal ward at the hospital.

P50 I should have did more research. I feel like time is ticking for me. I'm due in August and so I have to make these decisions faster. So I feel like a little scary, uninformed, um, I feel um just not ready to make the decision yet.

P28 Since I've become pregnant, um, talking with family members and friends, some of who are medical professionals themselves. Um, you know, I, up until this point, I had never even questioned the safety of vaccines. Um, so yeah, really, it's since I became pregnant, that I started to kind of question and say, is this something that I want to do?

*P29 For me, I had never even questioned it up until a year ago, um, before I got pregnant with my first child. Um, and when I did get pregnant... when my husband and I announced that we were pregnant, you know, he, he also is my eye doctor. He was bringing it up to all his patients and he does have a patient who is a physician who recommended, um, a book that we read and that book was *The Vaccine Friendly Plan*, by Dr. Paul. And a lot of that was just, um, information on all the current vaccines that are available for our children. So once we read that, we really started to get intrigued by the science and the pros and the cons that are out there.*

The student investigator did not directly ask a question regarding the information received during pregnancy; therefore, it is unknown how many did or did not receive vaccine

information during their pregnancy. However, unprompted, approximately a third stated that they had not received information from a physician at the point of the interview.

P2 I'm not that far along yet I am only 27 weeks... I am almost in the third trimester. But they haven't talked to me yet about vaccinations yet. Like especially vaccinating after delivery or things like that. But if they were to talk to me then I would be comfortable with them because I have been very confident in the midwife's knowledge.

P31 I just find that to be so interesting that they're worried about what I'm intaking as a mother but not necessarily worried about informing me on the process after that my child's born... most doctors believe that vaccinations are the most important thing to prevent and improve health of, especially in infants. That they don't mention anything about it or in my case they haven't, so I just find that to be like kind of strange. Especially since like they should be their own biggest advocates on vaccinations. Um, so in my case I just find it just odd because, that, if our pediatricians, and OBs, and you know, medical professions think that it's the best practice for medications, then they should really be more informative.

P37 I think, you know...at this point in my pregnancy it hasn't been talked about. So I think that that's really interesting that, you know, in the world we live in...it's out there that it's important. And the schools think it's important and it's a requirement for some now in childcare as well. So I, I've just found that to be a little interesting my pregnancy that, um, hasn't yet gotten brought up yet.

A few said that since becoming pregnant, their chiropractor had voluntarily given them information about vaccines and VPD. Chiropractors were respected for their combination of medical expertise and holistic treatments. In all cases where chiropractors had given vaccine-related information the materials encouraged alternative vaccine schedules or not vaccinating at all.

P17 Um, I have a chiropractor that's talked about him doing his own research and has shared his thoughts. Um, and that was really awesome for me because it was somebody in the health field of some sort that you could see has done their own research and, you know, was getting references and, you know, suggestions on books to read and stuff like that.

P15 Like the definition of a chiropractor is someone who's allowed to use natural methods and means. They are allowed to use herbal plants and things like that to heal the body from a whole perspective. Whereas someone in just, uh, solely practices medicine, someone who is a medical doctor. They've, they know what they've learned in school and that's that, and they're not necessarily, they're allowed to use pharmaceuticals in surgery to, to heal the body, but they're not really allowed to, to explore outside methods. Um, and just seeing the things that I have seen in these holistic alternative based clinics, versus traditional medicine.

Seeking Transparency and Accountability

Many participants felt that critical information was either not available to them or was purposely hidden from the public's view. Participants expressed a desire to have full disclosure of the risks associated with vaccines, the make-up of vaccines, and the number of vaccine

injuries reported to the Vaccine Adverse Event Reporting System (VAERS). The pharmaceutical companies were the most untrusted health agents involved in the vaccine decision; the medical field was second. Some participants also felt that pharmaceutical companies were not only negligent in the manufacturing of vaccines, but also failed to take responsibility for the injuries documented in VAERS. Some felt like children were collateral damage to pharmaceutical companies who cared about money rather than safety. One participant accused them of cutting corners with vaccine ingredients, using the cheapest rather than the safest. A few felt powerless and bullied by big corporations who forced vaccines by imposing mandates.

P44 I don't trust the companies that are making the product. I don't think that the, the good,. the high-quality ingredients are there. I do think that they're trying to make money and they're covering that up by just saying, oh, yeah, here's a vaccine we want, you don't want your baby to die or get sick, but it's more than just that. It's also about money and cheap ingredients.

P1 If you, if there's a recall on your car or you're injured because of a manufactured defect on your vehicle you get to sue the manufacturer for them, for them injuring you. You can't sue the pharmaceutical companies. You can't sue the manufacturer of that drug that hurt your child. The doctor is not liable, the pharmaceutical companies are not liable. You are liable and you can, you can, you can go to vaccine court and you, you can use the VAER system, and you can report it, but the pharmaceutical companies don't pay out. The taxpayers pay it. Right? So that, that doesn't make any sense to me either. Why are, why are they not held accountable for the

drugs that they, they are giving, giving to us that aren't safe?...We can't hold people accountable who need to be held accountable.

P21 I wonder about the push for vaccine, why they're all pushed by doctors and medical professionals... I just am really concerned about a lot of the loopholes that are in there, and I understand why they're in there. Because you know, if, you know, a company's constantly getting, you know, lawsuits about, you know, people who have, you know, have been injured by these vaccines and stuff, they, they go bankrupt... So it's like, I understand both sides of it, but it's still like, there's a lot of like lack of responsibility on the vaccine companies' parts. They have a lot of loopholes in the laws.

P38 So if there is a vaccine injury or reaction, um, doctors are supposed to be mandated to report it. Um, widely estimated that that's not happening. Um, there are a lot of, um, practices that are part of a hospital or a larger system that have fully admitted, one of them admitted to me that based upon how many patients that they are immunizing they receive compensation for that. And I don't think that that's right. Um, for 50, 60% of their patients are, at the pediatrician clinic get vaccinated, they receive a certain amount, 80% back, or even more.

Some participants were suspicious of vaccines because they did not come with warning labels like other medicines. They felt like all potential side effects should be disclosed prior to their consent for a vaccination. Often, this was discussed as an inconsistency in the medical

field. Most participants acknowledged risks with any type of medicine, including vaccines. Transparency and full disclosure of potential adverse effects would lessen their hesitancy by making them feel more informed. Lack of transparency led some to question what they were trying to hide.

P31 I mean, they tell you every side effect of a medication and oh, you can't, you know, drink alcohol or drive a car, um, you know, operate machinery. But vaccinations, I feel like they're not like, oh, well this might be a side effect and you shouldn't do this in this many frame of hours. Like that's just not said.

P43 Probably more transparency from the CDC with why the vaccines are recommended. Um, you know, at these certain intervals. What all is in the vaccine. Um, you know, if there's different options for different preservatives or not to be in the vaccines. Um, not that just this is the only one you have to get. If there's different manufacturers, that you don't really know if there's any difference between different manufacturers. Or what's in the vaccine. How it's made. Um, and then just, you know, why some places are doing it one way and other places are doing it different ways. So just probably more transparency from the people providing the vaccinations and um, maybe even more options from those governing bodies as well, that are providing it. Um, because for healthcare I don't think everything is a one size, you know, cookbook medicine. So why is it for vaccines? So that would help me

Ideal Pediatrician and Parent Relationship

The majority of vaccine-hesitant first-time expectant mothers said that they wanted to be able to ask questions to their child's pediatrician without obligation to do what the physician says, and without consequences for not following recommendations. These consequences included being stereotyped as an anti-vaxxer, being judged, having child protective services called, and having the pediatrician discharge their child as a patient. Some participants stressed the importance of a mutually respectful relationship grounded in trust and good rapport. A few participants used previous experiences with other healthcare providers as a comparison for the type of relationship that they did or didn't want in a pediatrician.

P48 I don't want to get yelled at or anything or bullied into anything like that cause I don't do well with communicating with doctors and stuff. They're pretty intimidating to me and I tend to uh, just let them do whatever and then I question it later.

P5 I don't have a pediatrician yet, but my OB, um, you know, I found him specifically when I got pregnant, so I didn't have a prior relationship with him... but I don't feel very close to him ... I still feel very just separated and he's very clinically, you know, he's the doctor... I, I don't call with questions. I, I look stuff up because a, I can look it up faster, then I can receive a call back. I'm okay with the relationship I have right now with my OB being so cold and clinical sort of, because I only have to deal with him for nine months. The pediatrician is in charge of my, my babies' life for a much longer span of time. And so, I want it to feel more comfortable asking questions about specific, um, vaccines that they're wanting to give my child. And I don't want, I

mean, the second that I see a pediatrician kind of roll his eyes or you know, take a deep breath and be like, okay, vaccines are good, blah, blah, blah, then I'm not gonna see them anymore. Um, you know, I, I know that they've probably explained it many times and instantly in their head they're like, oh, good a hippie. But you know, I need someone that's going to take the time to explain why I need to put this foreign substance into my newborn or my one-year-old.

All of the participants in the study described characteristics that they wanted in their child's pediatrician. Of all characteristics described, trust was at the core of the subthemes. Having trust in the pediatrician was an essential component to believing and accepting vaccine information given. Many participants talked about the importance of having trust in a physician as the foundation to not only being receptive to the vaccine-related information, but also to other health decisions. Additionally, some participants expressed feeling like they were putting their faith in the pediatrician with their child's health and wellbeing on the line.

P40 I believe in a very strong relationship, very strong relationships need to be built between parents and pediatricians. I'm not a very trusting person, so for me to trust someone with my child is a big deal and, I need to have a strong relationship with them to give me information on both sides.

P32 I would want a, um, one of my trusted doctors I think to show me a study that, um, they really, they say this is really a credible, um, the doctors that I really trust are my specialists that I see more than just like regular family physician, you know, the ones who have, um, made the most difference in my health. You know, they're the ones that I guess that I trust the most. And

um, so it would probably take one of them, um, feeling comfortable with a certain study and saying this is what I'm comfortable doing with my family basically.

P13 I love my OB and I trust her and I've been through a lot with her. So, um, yeah, I can see that. If, you know, I can definitely see trusting, you know, you're, if you're close with a doctor and you trust them, you know, you, it definitely impacts how you feel about things because you, if you trust them then you trust their opinion and if their opinion goes one way or another, then you know, it's just natural for that to happen in. And yeah, if my OB was very like, you have to do this, I still would think about it, but I maybe thinking about it a little bit less just because a doctor I trust is now saying, yes, this is, this is what you need to do with your baby.

Most participants described a good relationship as one where the pediatrician listened to their concerns and took the time to explain things without judging the mothers. Good pediatricians were respectful and presented unbiased information, and ultimately recognized the mother as the final decision maker. Unprompted, a few participants said that time spent with parents during office visits was indicative of a good pediatrician.

P31 She is aware that parents have a lot of questions and one thing that I, the reason that I would love for us to be able to have this pediatrician, is that she really takes the time to explain things. So, I think that's a very key element, especially for first time parents that, we're just as curious as everyone else and, um, and even having multiple children, you can never know enough, and every child is different and every pregnancy is different. So um just having that

information of, um, and taking the time to really talk to the parents and, um, explain backgrounds and, um, symptoms and, um, side effects.

P30 I've had the same OBGYN since I was 17 and I trust her 100%. I trust that if she urges me to make a certain decision in regards to me or my child, that it is in my best interest. And so, um, if she urged me to vaccinate, I would trust that opinion from her simply because I've been through so much with her over the past five years as a patient. And I've never had a negative review of her, never had a negative relationship with her personally. So, I definitely feel like I trust her opinion as a doctor.

P39 I hope that they'll be pretty, you know, pretty open with explaining, you know, any of the, cause everything that you do, it comes with the side effects. So I hope that they would be able to explain some, you know, some of the, the worst-case scenarios as well as the best scenarios, you know, things go and um, kind of giving us a pretty nice, you know, ratio as far as what, you know, what those pros and cons are to each individual vaccine as well as to, you know, grouping everything as a whole, just that they'd be able to talk to us about it and not just, you know, give us an option as to a yes or no.

Only a few participants mentioned physicians' knowledge and vaccine expertise as a characteristic of a good doctor. However, some participants talked about physicians' medical

training as flawed, limited to books and education that was outdated and inadequate in the subject of vaccines and VPD.

P1 We're left to, you know trust, trust our doctors who also don't study them and can't tell me the ingredients. I can ask for the insert, but they can't tell me. That's, that's frustrating. So, I'm not, I'm not, it's irritating that we're to the point that we're like, I just have to put my stock and my trust in this person who has not studied them. And then when you study them and you ask questions, well then you are a conspiracist theorist at that point. When really, you're not.

Many participants were actively searching for the right pediatrician. Finding a pediatrician that was pro-parental rights was highly desirable, but difficult to find. Some participants were using word-of-mouth or posts on local Facebook groups to find pediatricians open to alternative vaccine schedules. If options for pro-parent pediatricians were not identified through word of mouth, having a conversation over the phone was the next best. Ultimately, some participants wanted to discuss concerns about vaccines and the option of an alternative schedule before meeting the pediatrician face-to-face to avoid an uncomfortable situation.

P29 It is nerve wracking. You know, you hear and read a lot of things about doctors who will, you know, refuse to see you in their practice if you decide not to do everything according to the current schedule. Um, so that makes me nervous about, you know, how that conversation's going to go. But doing research now to find doctors that might have more of a similar mindset to my husband and myself, is something that's important so that we can avoid any hostile situation.

P7 I don't want to go to a pediatrician where I have to fight for my rights and fight for my choices. So, I'm actually, I'm just in one of those like crunchy granola moms Facebook groups and that was where I asked for recommendations. Because I do want a doctor that I can trust and talk to...and I don't want it to be a fight each time about vaccines. So it's important to me that I get a pediatrician that I can talk to.

P16 I've seen a lot of it on like Facebook mom groups that I'm in. Like people will post and say like, I'm looking for a pediatrician who, they'll like, they'll post with a disclaimer, like no judgment, please. And then they'll ask for pediatrician recommendations who are, who like don't make you vaccinate or whatever or who are open to delaying vaccines. So I know that it must be a conversation that's going on with local pediatricians.

Some mothers in the study were concerned about being dismissed as a patient or having their pediatrician be dismissive of their concerns. Being dismissed as a patient was talked about as an embarrassing thing that participants wanted to avoid. It was also described as a personal rejection which would hurt them emotionally. None of the participants talked about personal experience with being dismissed from a physician, but referenced personal stories of other mothers who had. Some participants said that they wanted to have a pediatrician who was not dismissive of their worries if something bad did happen. They recounted reading about personal stories online and/or knowing someone who said they were ignored by doctors when their child was vaccine injured. Participants wanted the reassurance that if their child had a reaction to a vaccine they would be taken seriously by their doctor. The thought that their child could be ignored when they were injured and in need of medical attention was a concern.

P17 I have seen stories of, you know, people getting denied health care because they won't vaccinate. And I feel like that should raise a lot of questions for a lot of people.

P26 I think it's, the scary thing is that you hear, um, there are some side effects that have been, happen from some other vaccines. Um, sometimes you know, a child will be fine and then a parent says they got a vaccine and then, you know, um, this is what happened right after and a lot of those parents are not listened to, or dismissed, or just said that that's not because of the vaccine. But it's really hard when a parent really believes that to be true.

P48 I've heard stories on the Internet of people just like pediatricians just dropping you because you want to delay or anything. That if you don't go with what's written down from em' that they'll just get rid of you.

Many participants felt that they were capable of finding and deciphering vaccine information based on their educational background, critical thinking skills, and experience doing research. This qualification was not equated with a degree or certification, but was a self-appointed based on time, effort, and interest given to vaccine research. Some talked about science classes in high school or college that gave them insight that others did not have. The opinions about vaccines from family members with science or medical training were also viewed as an extension of education for the participants. They wanted pediatricians to know that they were smart, skilled, and had given a lot of thought to the vaccine decision.

P2 Being a masters student for social work, I do so much research, and uh, and basically like researching is just embedded in my brain, and so just looking at statistics, is it like a 1/3 chance or a 1/1,000 chance? I mean, I feel like that's where it's different. Because I will see stuff on Facebook and see people share it. If it is from like a true article, like I said, the CDC or something, or like a news article, like the New York Times or something like that, then I would be like, oh that's really interesting, I will have to look more into that. I am just so used to, to just researching how far is a statistic.

P35 Hopefully they understand that we are educated, and we are not just afraid of autism, and that we are not just watching famous people say that they don't vaccinate their kids, and that we actually did the research. That, that we actually care, and that we are using science to make our decision, and that they respect us for our decision, and they respect us for having a choice, and they don't badger us. They just accept that we want to do a delayed schedule and that we want to skip certain vaccines. I mean that would be ideal. I know that's probably not gonna happen, but it'd be great.

Theme 3. Objections to the ACIP Schedule

Most of the participants in this study were not comfortable following the ACIP schedule in its entirety. Overall, the schedule was viewed as a non-individualized list that lacked consideration for unique circumstances and individual differences. Many believed following it was not the best way to protect their child from harm. Two subthemes were identified within this theme.

The Schedule is Unsafe

Protecting their child from a VPD was important to most participants. However, many said that the current ACIP schedule was not the safest way to do that. To these participants, the ACIP was dangerous because of the number vaccines on the schedule, the amount given in a short time, the use of combination vaccines, and the number of vaccines given in one visit.

P30 I've looked at multiple different diagrams and things, kind of outlining the vaccines, showing you how many vaccinations there are, the courses, you know, how many years it takes to fully vaccinate your child. And that's like, once again, overwhelming, you know, to think that they might have 29 courses of vaccines by the time that they're 18. Very scary.

P6 If I went along with the CDC's recommendations I would be scared. Because like I said that's a lot and I know that's a lot. You know, I've done the math myself off their ingredients based off of their website, you know. This wasn't just anti-vaxxer group on Facebook, you know, this wasn't just some article that I'd read. Like this was actual hours of my time I put into reading and researching and that scares the hell out of me. Because at the worse I giving her a life that is going to be set up with dementia by like age 40 by letting them shoot all of that into her at once and I know that, I work with that first hand, I have a brain, I use it. But with my current thoughts on it and how I'm intending to do it with them a lot more spaced out, I'm a lot less scared of it harming her. I mean I am sure she will get sick from at least one or two of them, but she's supposed to, that's partially how you build an immune system.

Most participants planned to use an alternative vaccine schedule, where some vaccines would be accepted, while others would be delayed or refused. Participants did not have a clear plan for which ones they would be accepting, delaying, or refusing. The pediatrician's flexibility and willingness to work with them was key to them being able to do an alternative schedule. Finding a pediatrician who would do this was challenging. Some acknowledged that using an alternative schedule involved more trips to the doctor, but preferred this over their child having multiple injections at one time. Protecting their child from a lot of chemicals injected at once was the primary motivation for participants who expressed a desire to spread out vaccines over time.

P23 I'm 37 weeks and most of the pediatricians in our area require that you vaccinate within the schedule, and so we kind of have to like look for pediatricians that are okay with a delayed schedule. So that's been difficult.

P33 Um, so, at this point, based on all that information, um, I'm leaning towards vaccinating fully, but on a delayed schedule or like making extra trips to the doctor so that my child only gets one or two vaccinations at each appointment.

P4 There's sometimes they'll give one shot that has three or four vaccines in it, you know, it's not just one at a time. I'm looking into doctors actually in my area, excuse me, pediatricians that have, um, they do like single dose and, um, preservative-free vaccinations. So, I, if I can maybe work that out ahead of time, um, scheduling wise, it would do mean a lot more trips to the pediatrician, but if I can work that out, then then I would feel much better about it.

Participants believed that too many vaccines in a short amount of time, or the use of combination vaccines, could overwhelm their child's immune system and cause permanent damage or a chronic condition. The immune system was often talked about as the most important factor to fighting all infections. Damaging it at a young age meant having a reduced quality of life over their lifespan. Many wanted their child to be physically larger before being up to date on their immunizations. Participants described their baby as brand new and unblemished, vulnerable, susceptible to injury, and dependent on them to make the right decision. Participants used words to describe the sensitive state of a newborn such as fragile and helpless.

P14 I don't think that that is appropriate either per se, to load up the immune system like that. I mean, obviously babies are very, very fragile. Their immune systems reason why they tell you to, hey, you don't take your baby out in public.

P32 I think that I'm a little bit more hesitant about getting them for like a brand newborn than I am for later on in life. Just, I don't know, babies seem like so small and fragile and I'm like, they haven't even experienced anything yet. I'm not sure I want to put anything in them. You know, right away. Like give it a little bit of time before I do anything. Let them establish a little bit of their own immune system first after you know a little while.

P15 So I'm not receiving all of those vaccines. I think it's like two or three at the first two-month appointment. I mean they're, they're very, very fragile. Their immune systems are very fragile and I don't think injecting all of that foreign stuff is, I just don't think it's a good, I guess. I don't,

I'm not, I'm not ant-vax, but I'm not like, yeah, load my baby up with all of this stuff because it's, it is stuff.

Some participants said that they were focused on the more basic needs of their child, such as keeping them alive. A few participants said that vaccines were an unnecessary taxation on their body during their time of survival. Delaying vaccines for as long as possible, while allowing their child time to grow, was a common strategy. For example, the start of daycare, preschool or kindergarten was the deadline for when they would have to get their child vaccinated. Mostly, this was because it was the intersection between their child being the largest and vaccine requirements to attend daycare or school.

P24 For the first year, like they're just trying to frickin' survive. Like they're just trying to figure out what's that bright thing up in the sun. Like you don't need to introduce foreign bodies, foreign chemicals, and foreign things into them.

P6 We have like three different kinds of flu shots that we're supposed to give our newborns and it's like, first of all that's a lot for a little immune system to be taking on all at once you know. Not to mention the aluminum, mercury, and other ingredients you find in these vaccines like, the body can process it, it's just slowly usually it's very toxic.

P15 I plan on vaccinating according to public school standards, um, either in Kansas or Texas because that is where our child will be starting school. Uh, one or the other, um, and their requirements are a little bit different. Um, and according to the CDC, they recommend like four

or five vaccines according to age. But if you do it like after a certain age, then you could get away with four or you know, so forth. So I planned to do as little as possible.

The physical size and uniqueness of the child's genetic makeup was a key factor in participants' desire to skip or delay vaccines. Some participants wanted vaccine doses to be based on each child's height and weight. It seemed illogical to require other medicines to use a height and weight chart for dosing purposes, but not to do the same for vaccines. One participant felt that medicines had less risk and used stricter guidelines for safer dosing. A few participants also believed that everything in the medical field is individually tailored to people based on their unique circumstances (e.g., genetic predisposition, allergies, lived environment, particular risks). However, the ACIP schedule and the childhood vaccines given do not consider differences between children. A few participants explicitly stated that the schedule's one-size-fits all approach was risky.

P15 The immune reactions that are caused by these vaccines are not going to be the same from person to person, to person, to person. Everybody's genes are expressed in different ways, and that's something that you can't just blanket like a one size fits all vaccine for every single person. Um, because not everybody's body works the same way. Not everybody's body processes things the same way. Your metabolism is different. Like I said, the gene expressions that have an effect on how these vaccines actually affect your immune system. Um, so those chemicals, what may be an appropriate dose for one person, maybe way, way too much for another.

P44 Um, I'm not sure if I have a number on how effective I believe they are, but I don't believe that they're fully effective and one reason being, um not everybody's bodies the same. So, one vaccine shouldn't be a one size fits all. Um, so I don't, I don't feel that they are very effective, and I feel like there's a lot more research that could be done and that there's safer ingredients that they could probably use to make vaccines or that there is safer ways that we could use to prevent diseases.

P32 Um, so I guess I would, I would want to state that I am very grateful that vaccines exist and that we don't have to worry about, you know, for the most part, most of these serious diseases because we have vaccines. And I think like, I'm super grateful. Um, I would also say that I don't think there's a one size fits all. Everybody's bodies are different. Everybody responds to things different. And I don't want to discredit anybody's experience. And so, I would say, I would tell them what I was going to do and say this is to the best of my knowledge, the best way, um, that I can do this to keep my daughter safe, my family safe. Um, with the knowledge that I have basically.

Unfamiliarity is Unpredictable and Alarming

One way that some participants tried to be certain of an outcome, was to use past experiences as a predictor for what would happen to their child. Past experiences could be their own personal experiences, or could be their experiences watching someone else. Familiarity equaled comfort to some participants.

P17 Um, so the biggest thing though that influences is the amount of vaccines that are recommended now compared to when I was a kid even, or even when my parents were kids. Um, I can't remember what it was when I was a baby, but it's definitely, it just keeps increasing and increasing. Um, and I've seen that they have a new six in one vaccine coming out and people sharing about that and thinking it's a good idea. But I don't understand how six, like six things that are mixed together, like how, why would you want to do that? Even like, that'd be taking, say six different medications like Tylenol, Ibuprofen, Advil. It'd be like taking six different of those. You don't know how it's gonna affect you. Um, and that's very concerning for me.

Personal experience, or knowing someone who had a personal experience, with a VPD or vaccine-injury influenced how participants intended to vaccinate their child. Vaccines that the participants had gotten without complications were perceived as less threatening. Likewise, diseases that participants had experienced without serious health outcomes were seen as non-threatening. Additionally, diseases that the participants had not experienced for themselves, or did not know anyone personally who had, were perceived as not threatening. However, participants felt that newer vaccines had not had enough time to go through rigorous testing to accurately know their risk. Lack of safety was frequently mentioned as a reason to not trust vaccines.

P5 I look at stuff like the chicken pox. I know that I didn't get a chicken pox vaccine when I was a kid and I had the chicken pox and I'm okay.

P15 Well, I know polio can be a very serious one because of what I've seen in people I actually personally know. Um, and something like chicken pox, I, I don't think I've ever seen anyone have like a long-term side effect to that one. So for me, like I look at something like chicken pox as not severe.

P18 I've never come into contact with someone who has been severely affected by a serious disease that's preventable by vaccines, that I know of. Um, so I don't know. I mean, yeah, growing up with pretty much my parents doing the bare minimum, as far as like that goes, and then I don't know as an adult, like, do I really need to get vaccines? I don't know.

Other than the Varicella vaccine (i.e., chicken pox) participants did not give other examples of newer childhood vaccines. Most discussed this as a general concern for any vaccine that had not been around for a while. If participants, or someone that they knew, had a history of bad reactions to a vaccine they were against accepting it for their child. Although not a focus of this study, several participants mentioned influenza and Gardasil as examples of bad experiences with vaccines that made them hesitant towards childhood vaccines.

P6 I also think there's just some vaccines that are unnecessary like the chicken pox vaccine. That is a brand new vaccine, I never got that as a kid you know? If I didn't get it, then I don't want to put it in my child.

P22 I received the Gardasil shot probably, I think 10 years ago. Um, and since then I've had issues with, uh, endometriosis. So for me, that is one thing that I, it was something that it was

very heavily pushed upon by the doctors for me to get and I got it and then I ended up getting endometriosis from it. So that to me is the only thing that's kind of shaken my faith in it a little bit.

P42 I did take the Gardasil shots and I, I had extremely adverse effects to those and that was in college and that's when I started to question vaccines... really and question their reliability and are they really good for you and what are they really doing. And so I started to think less and less of them

Changes to the ACIP schedule since the participants were younger made them skeptical of the schedule. A few participants pulled up the ACIP schedule during the interview, listing the names of the diseases that they were familiar with and the ones that they were not. Some participants talked about how others had made them aware of the increase in the number of vaccines on the schedule, compared to the past. When participants were asked if some vaccines or diseases posed a greater threat than others, many indicated that they were not familiar enough with the vaccines, the schedule, or the diseases to answer confidently.

P31 I obviously want a healthy child and I feel like, you know, that's very important for the child's development, um, to be as healthy as possible and have a healthy living situation. Um, and I feel that to prevent certain diseases that some of the vaccinations are important, but I also feel like doctors don't do a great job of explaining like, why um, like I don't even know all the names. I was reading the information sheet on the survey. I don't even know all the names of

those shots or what they prevent and so I feel like, not necessarily that information is hidden from us, but if we really want to seek more information, we have to find out for ourselves.

P34 One of my mom friends has been kind of talking to me about it and about how they give them more, um, like more vaccines now than they ever did before. And so then that kind of makes me think like, you know why? So that would be confused as an emotion word.

Theme 4. Risk and Benefit Assessment

Nearly all participants talked about the vaccine decision as a risk-benefit assessment. They were actively searching for information and evidence to weigh in the decision. Participants did not view all diseases and their vaccines as having equal risk. For example, they believed that some vaccines were more dangerous than getting the disease and vice versa. Differences were also found in the participants' perceptions of what was viewed as a real threat. For example, some felt like high fever after a vaccine was serious while others were not concerned with fever. Likewise, some did not want to cause their child physical pain from an injection, while others did not care. Additionally, some participants were fine with receiving the TDaP during pregnancy but were hesitant to allow their child to get it. Two subthemes were identified in this theme.

P38 In terms of diseases, I think that there's a balance between, you know, how would, how perverse or impactful that would be to a child versus some of the other side effects of vaccines. So again, I think it's just kind of weighing those things. I, you know, in a perfect world you wouldn't have disease and the need for vaccinations and so it wouldn't be an issue. Um, but

that's not the case. And you can't completely isolate your child in a house with new exposure to any, any of them. For their foreseeable future, so I don't know.

P3 He [OB]gave me a choice with everything, you know, he gave me a warning and said you know at 32 weeks, or whatever it was, I think I got my TDaP at 31 last week and then I got my flu shot at 29. He was very open he was like this is your time frame, this is when we would normally give the Tdap...cause I was very honest about being unsure about things because this is my first pregnancy. ...P3 I don't think you were recording yet, but reading that ladies comment about how her infant died fourteen hours after getting the TDaP vaccine, like that stuff scares me. Like anything to do with like anything to do with her not making it would probably sway me in that direction.

Weighing the Risks of Accepting Vaccines

Participants were actively weighing the perceived risks and benefits of the vaccine decision to determine the best plan of action, with the least amount of harm to their child. Many talked about monitoring current measles outbreaks on the news. Some said that thinking about the national measles outbreaks made them feel an urgency to get their child vaccinated against measles. A few were not as threatened by national outbreaks because the outbreaks were not in their local community.

P13 A, a close case of a serious disease around me. You know, if there was like, there was a measles outbreak at Disneyland, not all that long ago, like there was a couple of cases of it. That's a little freaky. That's a big public area. That God knows how many people would have

been exposed to and spread to. Um, and I live an hour from there. So I mean that, that basically is some kind of case locally, that would definitely make me think about it seriously. Um, but I would say that'd probably would be the biggest thing that would push me that way.

Fifty-nine percent of the participants expressed concerns that vaccines cause children to develop autism spectrum disorder (ASD). Participants had mixed feelings about ASD. Some said that they would prefer their child to have ASD than a serious infection to a disease. Others felt that children with ASD could not live a fulfilling life and preferred their child to risk infection. The Andrew Wakefield article that implicated MMR as the causal link to ASD was brought up by a few participants as evidence for the autism risk. The documentary that Wakefield directed, *Vaxxed*, was mentioned as a source of information for a few participants. Only a couple of participants singled out the MMR as the vaccine that causes autism. Mostly, the threat of autism was talked about as a general threat from getting their child vaccinated.

P1 The Vaxxed documentary is very interesting. If you haven't seen it, I would recommend it. Um, but it talked about the dangers of those, of the, of those, of the child's ability to not be able to process the different toxins that are with them, is much slimmer when they turn three. So we are going to reevaluate when she turns three.

P46 However, again some of these diseases are fatal, you know? You, you you're not guaranteed to survive it, whereas autism you can cope with. So, it's more weighing okay, you can live with autism and yes it's difficult, but you get through it and it's not, it's not, it can't

necessarily be fatal on its own. So I do think that trying to weigh, how do you, how do you weigh your child's life against their quality of life?

P32 I had a, um, a friend who's younger brother right after getting vaccinated got really sick and was like a completely different person...and I mean, I saw it. I, you know, I was like, whoa, this doesn't seem like the same kid. I don't know what's going on here. You know? Um, and then he was diagnosed with autism. Um, so, and that was the first person I had ever heard who, cause you know, you hear the whole vaccines cause autism, you know, and I was like, I've never seen that before, you know? Um, and so then that, that really did make me question that because it was like something is different, but could it be a vaccine that caused that or was something else going on?

Many felt that an unvaccinated child would inevitably be exposed to one or more of the vaccine preventable diseases at some point in their life. The age of the child at the time of an exposure was an important factor in anticipated outcomes. For example, participants felt that if they were willing to keep their child in a bubble, then they could put off an exposure until their child was older. This was never talked about as a feasible way to protect their child, but as an example of the extreme measures it would take to protect their child from all diseases.

P4 I think just like that scared thought of like what happens if I don't do it? Then it's in and out of the hospital. Like what happens if you know they are at day care and or they're at school and someone kisses them in the hospital, and you know now they have an infection or are close to

death. Like that's a terrifying feeling of like, you know, you want to just throw them in a bubble and leave them there and make sure nothing happens to them.

P26 I think, I guess it depends on the disease and how you can contract it. Um, so like certain diseases that you just can't control if someone, you know, if your child's in a daycare, in a hospital or you're traveling, like who's in the airplane with you. So I think if, you know, some of those you really can't, um, you can't control. And then some of them like HPV, um, what those are vaccinating against. Um, you know, some of those are life decisions that, um, if you're having unprotected sex. So, I think it really depends on the vaccination.

For many, the risk of some vaccines was greater than the infection of a disease. Participants had different ideas about which vaccines or VPD were threats. For example, Hepatitis B was viewed as a serious disease, but low risk for infection since their child would not be using “dirty” needles or engaging in unprotected sex. Chickenpox was discussed differently than any other VPD. Most said that it was not a serious disease. It was also the only VPD that was viewed as a rite of passage in childhood. Most participants who had gotten chickenpox were not worried about their child getting it. A couple mentioned having a chickenpox party where they would intentionally bring their unimmunized child to an infected child's house.

P24 I mean, chicken pox. Why do we need to vaccinate chicken pox? Everybody's gonna get it. I mean, every child I've ever known is gonna get chicken pox at least once. I've had em' four times.

P8 Like it's silly that they vaccinate for Hep B. We're not vaccinated with Hep B in Europe. You're only vaccinated if you're a medical student, Hep A and Hep B actually. But here they vaccinate babies with Hep B, with a disease that is only transmitted sexually or by blood or something.

P45 I'd feel guilty and pretty mad at myself, probably, if something did happen, um, you know, but there are vaccines on there that I feel like, like the chicken pox vaccine, I kinda feel like, we, I mean, I had chicken pox, my brother had chicken pox, you know, I know they have, like, chicken pox parties for people, like make their kids get chicken pox and I feel like, um, some of the bigger ones, like polio and the things that are like absolutely crippling for your child, I'm more open to those than the ones that I know are just inconvenient, if that makes sense, so. I think that's why I kinda fall in the middle spectrum. I'm not completely anti-vax, and I'm not completely for it either.

All participants who mentioned polio felt that it was the most serious VPD. Most used polio as an example of a VPD where the vaccine saved lives. Some said that if polio came back, they would get their child vaccinated without hesitation. Many viewed measles as a serious disease with real threat due to the active outbreaks. Tetanus was perceived as a serious disease, but one that was easily controlled by getting a vaccine immediately following a laceration or puncture wound from a metal object. Rotavirus was mentioned by a couple of participants as a non-serious disease.

P1 When you got a newborn or an infant who can't advocate for themselves, we're, we as parents are left to be their advocate. Um, and the, the thought of her contracting one of those diseases, and I mean I am not talking about chicken pox, I had chicken pox and I am perfectly fine and I am immune to it now. But polio, it would be completely life altering. That is, that is a scary thought.

P8 Polio those horrible diseases I actually watched what's a lot of documentaries in my free time and read on all kinds of things and I reset I recently saw a documentary on polio and those iron lungs and I was like I don't want my child end up like that you know so that's a frightening disease that's a very frightening disease. Tetanus is also pretty bad like I said I'm not worried because the vaccines really good.

P44 So, I just don't; I think the flu is serious and does kill people, but I don't think the vaccine is effective in preventing it. Um, and then the rest of them, so the tetanus actually is one that I would consider giving if there was a reason. So, if my kid stepped on a rusty nail or something like, I would take them to get the tetanus shot. Um, I don't know why that one I put above the other ones, but there's something about the tetanus shot that I do. I think and I think part of it is because it's something you get after you've been infected.

Most participants were worried that their child could have a serious reaction to a vaccine. Ingredients in the vaccine were seen as the main cause for side effects to a vaccine. Reactions were described by some as an allergy but were also described broadly as any side effect or health issues that occurred following a vaccine. These side effects included fevers, seizures, autism,

neurological damage, generalized debilitation, and death. The chance of a side effect did not have to be likely to cause participants fear and hesitancy. When asked about the chance of a worst-scenario happening, many thought it was a very low risk. For example, several described the risk as numerically non-significant as .01, .001, .001, and so on. However, almost a quarter of participants said that any risk at all was enough to make them not want to vaccinate.

P14 I feel like it's not extremely likely because once again, they have the odd story of a child dying or getting extremely ill and you know, something permanent happening to them because they reacted to a vaccine. Uh, but more stories than not are the child's fine. So, the likelihood is probably not very high, but it still doesn't take away the, you know, fear because it's like that happened to one person. It could happen to mine, I don't know. And there's no way to find out before you just, I'm going to try this and then it's like, okay, well that didn't work.

P11 But you know, even if there is a low likelihood of something happening, um, it's, you know, it's not a 0% chance. There's still a chance. I think that's what has me concerned. Um, especially if that potential side effects or that potential adverse reaction is worse than the disease we're trying to prevent in the first place. Um, so I don't know. I don't think it's a high likelihood that something would happen to my child, but it's still that unknown factor that is concerning.

P27 Like you hear about autism, you hear about, um, allergies that are developed due to vaccines. You hear about, um, lack of tolerance for different things. So those are all things that

I'm sure have weighed into parent's decisions and I'm sure it will weigh into ours as we continue to do more research. For me, this isn't enough to make a decision, which is why I'm continuing to do research, for me my gut reaction is I don't want to put the necessary things in my body if I don't have to and I don't want to put unnecessary things in my child's body if we don't have to.

Some participants did not like the idea that there were vaccines that contained preservatives or virus particles. Preservatives were called unnatural substance that were particularly risky. Forms of the virus (e.g., live, attenuated, or dead caused) were believed by some to cause the disease or threaten immunocompromised or unvaccinated others through viral shedding. A few were concerned with children who were recently vaccinated with the MMR, as they could shed the virus to their unimmunized child. The MMR was the only vaccine that was singled out as a risk for viral shedding.

P21 Like you're injecting a, um, you know, deactivated, or even sometimes activate- active and living virus into you to cause you know, an antibody or an immune response to it so that your body can familiarize itself and defend itself. That's dangerous though. Like, you know what if you are never to come in contact with that strain of bacteria, or that disease, or that virus, but you just willingly like, you know, injected yourself with that.

P38 To me it'd be more of a, a testimony and a research and showing that there are not harmful ingredients, aluminum, mercury, or other things in these vaccines. If those were taken out and there have been, um, they have in recent years taken the mercury out of almost all vaccines

except for the flu. And I think that's a really good step in the right direction, but I think more work needs to be done there, um, to eliminate those types of preservatives from the vaccine.

P43 But I do think that there are certain chemicals in some vaccine, vaccines that I wish weren't in there. And when a baby is so malleable to whatever you put in it and so I, I, I just worry about the reactions. I guess my emotional, I guess I am, I am fearful in a way that it, if there was only the, the virus unattenuated or not, inside of the vaccine I would be, I would feel a lot better. But there's worse than that in it in some cases. And different chemicals and that's what worries me. But of course, I weigh the option with, you know, them getting the actual, the disease they're trying to prevent happening. So, with some cases, like polio, I intend to vaccine fully, because it's just a scary thing to get. Um, but, I also don't really trust the pharmaceutical companies for what they're choosing to put in it as well. I do, I do think that big Pharma is not good and, and I'm actually going into the medical field myself. I'm going to be a nurse, but I, so I'm aware of how much money comes into play and I just want to do the best thing for my son.

Seven participants objected to the use of aborted fetal cells in vaccines. These participants felt that accepting a vaccine that was created with something that they were morally opposed to, went against their conscience. Some participants did not like the idea of injecting unnatural substances into their child. They talked about their personal preferences of living a natural lifestyle. Some equated a natural lifestyle with better health outcomes, such as having a stronger immune system. Often this involved staying away from chemicals and toxins in food, medicine, and cosmetics. One participant said that she avoided aluminum in the deodorant for her arm pits and absolutely was not comfortable injecting it into her baby. Some felt that living a

natural lifestyle would strengthen their child's immune system. They also believed that this lifestyle would prevent their child from becoming seriously ill from a VPD. Vaccines were perceived as interfering with and weakening the body's natural ability to fight diseases. There were some who believed that vaccines were not compatible to the principals of living a natural lifestyle.

P7 But some of as far as the aluminum, some of them I know now not as many now have mercury and the, what is it,. The zorba, or glycol, I don't know. A lot of these things that I avoid in my deodorant and in my own diet, so I can't imagine injecting them into my child's muscle or into their bloodstream if I wouldn't even put it under my arms pits.

P36 So I have one friend in particular, she did like a really big study on what is in vaccines. And a lot of what she posted was like, I mean, because we are Christians and so a lot of things she would post would be like, well there's like aborted, um, babies like in vaccines. And it's like well is that really true? You know what I mean? Like is that true? Is like, you know, it just makes you question and wonder.

P27 My general approach toward health and wellbeing, um, definitely I would say is one of the strongest factors in my hesitancy toward just naturally assuming and accepting that we will do all vaccinations. Um, because while it is a preventative, measure it as a preventative measure using non-natural resources. And while they do, um, complete a very valuable, like they're, they're meeting a need and very valuable need, they're also, they're meeting that need using various synthetic, different types of, uh, means, um, that do have side effects. So just deciding

whether or not it's worth the side effect or if there are other ways of treating the potential disease or the potential difficulty, um, without putting your body under the strain of additional toxins.

Frequently, participants said that they wanted more options for vaccines. f Participants gave different reasons to mistrust the TDaP and the MMR. For example, they had misgivings towards the TDaP because tetanus seemed disconnected from childhood diseases. Suspicion of the MMR was mostly related to stories of vaccine injury online and in documentaries.

P44 I don't like that, because, like I said, you could, you won't, if you do have a reaction, you won't know which part of it you're getting it from. Um, just more, the combi, the combination ones is what kind of, it kind of makes me feel a little bit uneasy. I know they're trying to just get it in the system, but I don't think that they should be doing that at one, at the same time.

P38 So the TDaP vaccine presents for four things, prevents four things in one. But the only thing that we're really concerned about for the child is whooping cough, but yet they want me to have a tetanus, diphtheria, something else, something else. Just to prevent that one thing, because they don't make that one vaccine separate. And it seems like if I'm not having three of the four issues, but they really want the whooping cough as a preventative for me to pass to the child, why do we not make that separate? ... That's the kind of thing I'm talking about when I say it just doesn't seem like there's been a ton of effort put into why would we tax a pregnant mom's system to do four vaccines when she needs one.

P37 From what I have read and observed, but not necessarily personally like researched. Yes, it sounds like the MMR vaccine is one of the most dangerous, um, most potentially dangerous. I feel like that's better wording. Um, but that's really just what I had read of other moms in Facebook groups saying MMR is most potentially dangerous. Um, so as far as what I have personally researched, I would say, I don't know. Um, but as far as what I have just observed people saying, um, I seem to hear the most bad stories or negative experiences related to the MMR vaccine.

Weighing the Benefits of Accepting Vaccines

Two things were talked about as benefits to accepting vaccines. First, vaccinating avoided conflict with people and places that required it, such as schools and doctors. Many mentioned state regulations that made delaying or refusing childhood vaccines a more complicated decision. Most participants felt that the vaccine decision for a child was the right of the parent to decide. Mandates were viewed by some as a violation of parents' rights to choose what was best for their child.

P15 Um, I feel like ultimately in the end, the vaccine hesitation is not going to matter because the government is going to, to take over and tell you what you can or can't do with your body or your child. Um, and I think the governments definitely headed in that direction.

P17 Going back to the pediatricians in my area, there's no, there's no choice, there's no choice to, to do a delayed schedule or to not vaccinate. My friend had to go with a new pediatrician because hers had retired and she said they were grandfathered in as non-vaxxers but they're not

happy with their provider, and so there's not many out there. So, I think for the most part, most pediatricians require that their patients do get vaccinated. So, I think if you want a pediatrician, you're vaccinating.

P11 I'm in California and there's a lot of push right now to get, um, a lot of vaccinations mandated for school. They're trying to get rid of the possible exemptions, um, and so that's a little concerning, um, that there's going to potentially be no way of parents having that choice. I do think that parents should have the right to, you know advocate on behalf of their child, um, and do what they feel is best for them. But it seems, you know, some of the state and federal regulations, seem like they're trying to kind of strip parents of that, that choice.

P52 I'm in Illinois and there's a lot of push right now to get a lot of vaccinations mandated for school. Um, and they're trying to get rid of the possible exemptions and so that's a little concerning that there's going to potentially be no way of parents having that choice. Um, you know, cause I've always been in the, the camp of, you know, if you want to fully vaccinate your kids, go for it. If you don't want to vaccinate them, go for it. But I think it should be a parent's choice to make that decision based on evidence and educating themselves... I do think that parents should have the right to you know advocate on behalf of their child, um, and do what they feel is best for them. Um, but it seems, you know, some of the state uh, and federal regulations seem like they're trying to kind of strip parents of that, that choice. So, and that's a little concerning.

Some lived in states that no longer allowed religious and/or philosophical exemptions. When asked the question “What could push you towards refusing all vaccinations?” several participants responded that removing vaccine mandates would be all that they needed to refuse vaccines. Vaccine mandates were also considered unfair to those socioeconomically disadvantaged. Many participants planned to work outside of the home and would be relying on daycares, or public schools, that required up to date vaccines. Accepting vaccines as recommended by the ACIP schedule avoided conflict with their child’s enrollment and was thus a perceived benefit. However, most of the mothers who mentioned mandates, or strict non-medical exemption laws, believed that the government should not have created these policies in the first place. A few felt that the only people who could get around these policies were parents who had the financial means to stay home, homeschool, or afford private schools.

P35 I feel like I'm forced to, forced to give her, I'm forced to vaccinate her unless I have \$1 million and can homeschool her or put her in a private school that doesn't make me have vaccines.

P13 We plan on doing public school. We can't afford private school and you know, the schools really do dictate what they have to have to be allowed to attend school. So, I don't necessarily feel like I have a ton of control. I think ultimately they'll end up getting them, you know, if I, if I want to do homeschool, then I have all the control, but I work and so does my husband and there's no way we can homeschool our child. We don't have the time. So, you know, I don't, don't feel like I have a hundred percent control, but it doesn't mean I'm going to relinquish the power that I have and not use every bit that I can to make the best choices for my child.

P20 Well, as I said earlier, um, public schools require vaccinations. Unless you can prove or his reason that you have to go to the religious order and then the order has to um sign something. I think it is a whole process if you don't want your child vaccinated in public school.

Second, a benefit was preventing their child from some VPD. Throughout the interviews, participants talked about not wanting their child to get a serious VPD. Although there was discrepancy between which diseases were perceived as serious, a general desire was to protect their child from any harm. When participants were asked about how effective they believed vaccines were, many responded that except for Influenza their effectiveness was not in question. Participants often followed up any positive statements about vaccines preventing diseases with a pivot to the threat of vaccine injury or a factor of their hesitancy. Participants did not completely agree that vaccines preventing diseases was an actual benefit. Some viewed the “less serious” vaccine-preventable diseases as a part of life. Having an infection was necessary to acquiring natural immunity, which was viewed as being better than immunity from a vaccine.

P26 It's really scary...I think it's, you know, why we choose to vaccinate is because they're, you know, we don't want our children to get these diseases and so it's scary to think that if you don't, then there is a chance that they might. A big chance that they might. And thinking about that like day in and day out. Is my child playing with someone that maybe has, you know, the measles and you can't tell or something? And then, um, I think that, that, that fear of, you know worrying all the time that I chose not to vaccinate and now I have the fear that my child might get this disease if we go to a park or shopping mall and they might be getting exposed to this disease.

P27 I am just like, I, I don't think I've ever questioned the effectiveness of them. I anticipate that they're probably, probably effective. I can't say that I feel the same about all vaccines. I don't feel like flu shots are incredibly effective. Um, again, that's different than what you're talking about mainly. But I can't say that I remember questioning the effectiveness of like infant vaccines. It's more questioning how likely it is that the disease in themselves would actually be contracted if there were not a vaccine.

The effectiveness of vaccines was talked about somewhat in contradiction. On one hand many participants said that they thought vaccines as a whole were effective. However, when talking about the individual vaccines and diseases, many felt like some were ineffective. For example, the influenza vaccine was frequently used as an example of a vaccine that was not only ineffective, but also causes people to get sick. Over half of the participants said that they or their partner had gotten the flu after receiving the vaccine. Although influenza was not a focus of the study, participants used their experiences with it as a reason to not trust childhood vaccines.

P33 Um, I think they're pretty effective. Um, probably the kids who have problems with them still are, won't get, you know, you might have a problem, you know, you, you won't get rubella but you got autism. Um, I feel like they work pretty well, you know, even if there are side effects or whatever, I'm guessing that they, um, they seem to do a pretty good job because I mean, we could have been wiped out by all kinds of these illnesses and we haven't been. And, um, we've almost eradicated a lot of them. So I would say the vaccines are pretty, pretty good

P6 Depending on the vaccine, I actually do believe that a lot of them are extremely effective. I mean that's been proven we don't have polio outbreaks, I guess that's technically we do still have polio around, but it's not taking out the masses, you know. Other things like the flu shots, that's obviously not working fam. We still got the flu and it mutates every year and it still comes through and messes everybody up... there are some vaccines that I support 1000 percent and others that I'm like oh that's stupid and we can do better.

Overall, many felt that the majority of VPD no longer posed the same threat that they had several decades ago. First, because vaccines have worked so well in the past, they have been effectively eliminated from our environment. Second, because so many children were vaccinated that if there was an outbreak their child would be protected by herd immunity. Third, the belief that there were things they could do to boost their child's immune system naturally. These things would give them additional protection to avoid infection and/or be able to effectively fight off the infection if they did become sick. Some of the ways that they could provide this booster were having a healthy lifestyle, making sure that their child had proper nutrition, and using essential oils that naturally boost immunity. Using other methods to protect their child made some participants feel like they had control. Fourth, some believed that modern medicine could be used to prevent side effects and/or cure infections if they happened. Advancements included genetic testing, personally tailored vaccines, and diagnostic tests to better predict adverse outcomes, and a cure if their child did get infected.

P43 I think that some of them, the chances of them even contracting those diseases are just really slim to none. Um, some of em I think even they did contract them, are not as dangerous as

people are making them out to be, especially that we live in a first-world country where our medical systems are a lot better, and our sanitation is a lot better. Um, so, I think the risks of the vaccination, at least in my mind right now, are outweighing the benefits of getting vaccinations against diseases that I, I don't consider to a big concern.

P21 I mean, a lot of these diseases are not prevalent in the United States. Um, which I think gives me a lot of, you know, I think assurance to not vaccinate. Um, you know, you just, you don't see kids with mumps and polio and rubella and like, you know, these things, it's just not common. I mean, they happen of course, but it's just, it's not like an everyday occurrence, like it was in like the 1950s and sixties. Um, and so, um, but um, I also feel like if she was to contract one of these diseases that modern medicine would be able to, you know, cure her.

Theme 5. Fear Driven Decision

Participants expressed many reasons contributing to their hesitancy toward intentions to accept, delay, or refuse childhood vaccines. Regardless of which direction the mother was leaning, they expressed fear of potential outcomes. Throughout the interviews, participants described distressing emotions and physiological effects surrounding the vaccine decision (e.g., anxiety, insomnia, panic, sadness, worry). Two subthemes emerged from this theme.

P47 It's fear, I mean it's all, it's fear one way or the other. I'm afraid of them, I'm afraid of these diseases coming back from the dead basically and being widespread like they once were. But I'm also afraid of autism. That's I know that's a lonely life for a child and for a parent, so, it's all fear-based.

P45 Um, it's laced with fear, um, because I, I have mixed emotions about it and I feel like, um, I know that right now there's this big push about, like well vaccines don't cause autism and everybody thinks that anti-vaxxers are about autism, when for me it's not about the autism spectrum at all, it's about what am I injecting into my child that causes issues later on that have nothing to do with autism. Um, you know, and you know, some immune issues, or anything really, and so I feel like it's just a lot of chemicals to push into an infant, um, so early.

Fatalism

Many participants felt like something bad would inevitably happen regardless of which vaccine decision they made. Nearly three fourths described feelings of hopelessness and dismay from having to make a decision where the only options available could harm their child. Several of them used the exact phrase, “damned if you do and damned if you don’t” to describe the fatalistic state they were in with the vaccine decision.

Almost half said that they felt *equally* torn between risking vaccine injury and risking infection from a vaccine-preventable disease. All participants wanted to protect their child from harm and were distressed at having to choose between options that were not risk-free. Overall, serious vaccine injuries were not discussed as being common, however, being seriously harmed from a VPD

P30 I've been doing a lot of research on the vaccines themselves and the risks that come with them and stuff. Um, and of course there's some things that are kind of concerning with

vaccinating, but there are things that are also equally concerning with not vaccinating, so kind of just struggling to make the right decision for my kid at the moment.

P31 Honestly, I feel a little scared that, you know, if I supposedly don't vaccinate my child, that my child could eventually get one of these diseases or be expo- you know, more exposed than other children not receiving them. And then at the same time, I feel a little scared on the opposite end if, that if I give them all these vaccinations, what are going to be the outcomes? What are going to be the side effects of them receiving them?

P19 I think it's a fifty percent. There's always a risk. Either I do or I don't, but either way, there's a 50% chance they could be harmed either way. There's always risk, there's risk if you don't do it and then there's risk if you do do it. You know, there's no there's no perfect answer to that. There's no choice. There's no choice. That's going 100% guarantee that your child is going to be safe.

Fear of the Unknown

Most participants felt that exposure to at least one VPD was inevitable, they did not believe that their child would be exposed to all the diseases on the ACIP schedule. Not knowing which ones their child would encounter was a source of distress for participants. Essentially, if they knew which diseases their child would be exposed to, they would accept the vaccines for

those diseases. However, without knowing this meant they would be risking a vaccine injury for “no reason”.

P23 It's scary because it's like if I give it to her and she has a reaction, what, what then? If I don't give it to her and then she gets sick because she didn't get it, what then? So, it's like, damned if you do, damned if you don't. Um, so it's, it's scary. Um, so it's, it's scary. It's like, it's a scary like game of Russian roulette that we're going to have to play. Like, is it worth it? Look at the risks.

P22 I think a lot of it is probably just scared of what is in the vaccines themselves and the unknown. You know, the what ifs, what if, you know, my kid doesn't get sick. What if my kid isn't exposed to, uh, polio or other things...what if, what if I'm not put in this situation of infecting my child and I just gave them a vaccine that has harmful ingredients for no reason at all? You know, what if they actually are healthy and fine and they grew up to have a great life and don't have any of these diseases?

Some participants felt like every decision they were making while pregnant had the potential to have a life-altering outcome. There was worry about how things as simple as taking pregnancy-safe over-the-counter medicines could have long term consequences for their child. Some expressed being in a constant state of dread, anxiety, and emotional turmoil since becoming pregnant.

P46 I feel like, you know, the decisions I make now are impacting my kid and worry, anxiety, I think fear does drive a lot of that decision.

P37 It's just, it's, it's an uneasiness. It's just an anxiousness that I'm like, I don't know which way to go. And there are enough, uh, feelings of anxiousness about just keeping a tiny human alive once she comes out anyway.

P21 Um and, um I don't know yeah, I mean, anxious I guess and nervous is kind of like the top emotion. Um, and not real, and kind of dread, I guess um about just the entire situation.

Others specifically said they feared the unknown. Some felt that vaccines were largely unknown products, relating to their ingredients and manufacturing. Some talked about a generalized fear of the unknown related to being a first-time mother, where every decision for their child was new. A few talked about being unable to sleep at night because of their anxiety and worry about messing their child up for life.

P36 Like my first reaction is this is a little overwhelmed of like how much it's going to be going in his body if we follow this. Um, so that's why it kinda just, and again I think it's that mother protection thing of like, I don't, because it's not my field of profession, like I don't know what is going into what goes into each vaccine and honestly what all of them are for, we're looking into

all of that. So, my first response is like overwhelmed, I guess, of what he'll all get of its first couple of years.

P22 So, um, it's just, it's a really uneasy feeling, you know, being obviously a new mom and having all of this information presented to you with kind of just like, where do you go from there? Do you do it, do you not do it? Like what is right, what's not wrong? And do you follow the schedule, that kind of thing.

P37 I was like, oh, I'm like making myself so nervous reading these things, um, that I'm not sleeping and I haven't slept well my whole pregnancy.

Theme 6. Social Pressure and Subjective Normative Beliefs

Three subthemes were identified in this theme. First, participants described social pressures to make a vaccination decision that pleased others around them and their child. Pressures included feeling that they would cause conflict regardless of their decision and worry that their child would pay the price. Second, participants described how they thought most other mothers were vaccinating, how they thought they would view them if they found out about how they had vaccinated their child. Third they discussed how outspoken anti-vaccination celebrities impacted mothers' vaccine decisions.

P49 I do think that, for some of my friends, they would be disappointed because they feel like that my decision wouldn't be right, no matter which side I would be on.

Social Consequences

Social consequences seemed inevitable for many participants. It was particularly difficult for participants whose child had members on both sides of the family with opposing vaccine views. They worried that they would upset someone no matter what they chose. Others felt that family members were pressuring them to make a choice that they were not comfortable with. For example, one participant cried during the interview recounting a time that her mother had pulled her husband aside to tell him to vaccinate their child behind the participant's back. The pressure was distressing to participants as they felt torn between doing what they thought was best, while also considering family members who would have a stake in their child's health and well-being. Some participants had been made aware that their child would not be allowed around friends and family if they chose to vaccinate their child a certain way. To these participants, it felt like a rejection of their child. It also created family conflict involving their child who they wanted family members to form close bonds with. A few said that they had already decided with the father to not to disclose their child's vaccination status with anyone.

P15 There's a huge push from, um, from my mother in particular. Um, and then also my significant other whose side of the family I mean his grandfather is a medical doctor and his family. I mean, they believe in the traditional medicine aspect of it. They kind of called the holistic alternative medicine voo-doo, which kind of offends me a little bit. Um, because it's something that I believe in. Um, it's the, it's something that I've seen work. Um, and then my mom, I found out that she actually pulled him to the side one day, um, shortly after she found out

that we were expecting and she said, you're going to have to fight her on vaccines. Um, and for her to say that kind of really, really bothered me.

P5 I think that my mom would immediately call me and say, look, what the heck, what are you doing? What are you thinking? Do you not, you're going to get my grandson sick. And I mean, I think that she would not accept it and she would be so angry at me.

P21 I mean, my husband and I have really decided to keep it between me and him- our, our medical decisions for her. Um, and that's just how we plan to keep it.

Not only were they wanting to preserve family relationships, but a fourth of participants worried that other mothers would not let their children play with their child if they knew their vaccination status. Stories circulated online about mothers who checked the vaccine status of other children before allowing their own child to be around them. The concern that their child would be emotionally and socially hurt by this, worried participants. A few vaccine-hesitant mothers had contradictory views on this subject. When asked how they would feel about their child playing with an unvaccinated child, some said that it would not bother them. Others said that it would only bother them if their child was not vaccinated. However, a few participants said that they would not be comfortable with it.

P43 I think that more and more it's becoming at least socially mandatory. Where people are asking a lot more if your kids are vaccinated before you're allowed to go anywhere. I know a lot of moms in my prenatal groups that are refusing to let anyone see their kids if they're not

vaccinated. So from a social standpoint, I feel like it's becoming mandatory, and then I think it's only a matter of time before there's governmental, um, laws that are even more strict than they are now put in place.

P19 Like I'd rather have my child in a room of 50 kids who were vaccinated, then in the room with 50 kids who were not vaccinated because there's more likely of a chance that they're going to catch something from the non-vaccinated kids.

P21 I mean it's going so far now where people won't even let their kids play with your kids if they're unvaccinated. Um, you know, they want to say that you're a terrible parent. Like, you know, all these things that you hate your children. And um, so it's just, yeah, I think that that's, that I know that that's what I would have to prepare myself for.

Modern Day Mothering

Many participants felt that they would be the primary health decision maker for their child. Some felt that mothers were the most capable and qualified person to make the vaccine decision, because they would know their child better than anyone. Participants talked differently about the father's role in the vaccine decision. Most participants said that they would consider the father's point of view, but if the father's view was different than theirs, then they would have the final say. Many participants used "I" statements regarding making the vaccine-decision and bearing the responsibility of the decision.

P9 Yes, he absolutely should get a say, but he is not nearly as um research focused as I am? Nor nearly as opinionated as I am. So he gets a say, but also it needs to be an informed say if it differs from mine and it will be, so it's my say.

P6 If I do the vaccines how I believe is right and now something is wrong. If I give my child permanent seizures and she can't walk because something went wrong with the vaccine doses, or if she gets the crazy fever, or if she dies in the middle of the night, that, that is not acceptable.

P28 If I didn't give my child the vaccine and she would end up getting sick, I would feel lot of guilt as I think maybe most women, mothers would.

A fewer number said they would work with the father to make a collaborative decision. Participants described differences between mothers' and fathers' roles in their child's health decisions. Several described fathers' roles as passive. For example, they said that fathers were not as dedicated to research, but instead preferred to be told what the participants had found. Some participants said that the fathers trusted them to make the right decision.

P17 Um, and I think trying to get on the same page is very important. But I also, like I said, I feel like I'm the one doing most of the research and looking into this whereas he's like, no, I just think it's going to be important and then end of conversation. Um, so I don't feel that that his opinion is quite valid because he hasn't jumped in to try and do the research with me. Um, but I still value it because he is the father. Um, so his role in it, um, I want him to be confident in

whichever decision we make. Um, but I feel like I'm the primary one who's really trying to learn about it and he's more of, you know, um, and MMR is the measles, mumps, and rubella?

P11 Me and the father pretty much stand on the same ground, we're not exactly anti-vaxxers but we're not pro the current vaccine schedule either. Um, he trusts me to make the right decision, as he calls it the mommy instinct, you know, and I'm gonna have to just trust myself on that too, you know.

Fathers were not discussed as being accountable for the vaccine decision if a disease or injury occurred. The guilt from making the wrong decision was discussed as a burden for the mother only. Additionally, mothers were expected to know instinctively which decision was right for their child. Intuition was explained as knowing the right decision based on emotions and senses, rather than logic and facts. It was expected to be respected by others, including pediatricians.

P30 Um, I think I would absolutely blame myself in the event that my decision results in her becoming harmed. I think that it would be very difficult for me to grasp that even though I felt I made the most educated decision possible, watching my child in pain or watching my child become sick because of the choice that I made. I would absolutely blame myself for that.

P21 I think each mother knows what's best for their child and I don't think that that motherly instinct is to ever be in question.

P32 I haven't picked out a pediatrician yet, but one of the top criteria is that they are okay with, um, not pushing me and letting me make my own decisions when it comes to, really any medical thing, and I really need to feel, because my history, I need to feel respected by a doctor and for them to see me as the mother with intuitions about my child.

Faith that their mothers' intuition would spontaneously be activated when their child was born, provided reassurance to undecided participants who were close to their due date. A few participants said that they would rely on their intuition if they were not confident in a decision. A couple explained their flexibility in the decision, indicating that they could change their mind on vaccines even after making a previous decision.

P6 The mommy instinct, you know and I'm gonna have to just trust myself on that too, you know. Because the biggest thing that I do keep on encountering with the bad stories that I've heard and I've read, you know they always say you know, I had a feeling. You know I had a feeling that she wasn't going to do well with it. Something told me, I, I did try to protest, and it just got shut down like reading what I have read. If I get that feeling, then I'm not gonna just let that happen. Mothers do know. That instinct is real.

Participants felt that it was mothers' job to be the sole protector of their child. If their child was harmed from the vaccine decision, they anticipated feeling like a failure. There were different degrees of mothering guilt. For example, it was talked about as a normal part of motherhood and embedded in society. Those who talked about mom guilt discussed it as something that was unfortunate and unavoidable.

P33 Probably guilt cause, you know, what do moms do, but feel guilt about everything, every choice that they make.

P32 Um, I would feel incredibly guilty, I think either way, because I would feel like all of that was on me.

P42 I don't, I really don't know what I would do if my kid were ever harmed because of a vaccine or not because of a vaccine. It's, it's, it's your job, it's your job to take care of your child. And I would feel like I've completely failed and that I didn't do anything right, or I didn't do enough research.

Socially expected mom guilt did not have the same impact on quality of life of the mother as the anticipated guilt from their child being harmed from their vaccine decision. Participants assumed their role as their child's primary protector and health decision as a huge responsibility where they did not want to let their child down. Some believed that guilt from an injury related to the vaccine-decision would be a constant in the mothers' life, changing them forever.

P34 So like if you can do something so simple that will protect your child for the rest of their life and then you opt not to and then your child gets whatever that big, bad, scary disease is, then I don't know how you'd recover from that. Like I feel I personally wouldn't be able to, I personally would self-blame and self-shame myself and guilt trip myself and not be able to continue as a

person. There would be a lot of, why didn't I do everything in my power to prevent this to protect him? Why am I a bad mom? Why would I have taken that risk with his life?

P23 I would never be able to forgive myself. Uh, if she were to be negatively impacted by my decisions because she can't make those decisions. You know, I, she can't make them. I'm making them for her. I'm, you know, I'm putting vaccines in her body or I'm not putting vaccines in her body. I'm choosing to do something to her or to not do something to do, to not do something to her, which you know, ultimately is doing something to her. Um, so if something were to happen based on my decisions, I would be at a loss of, I think it's, I mean I would hate, I never liked that, I would love, love, I wouldn't want to think of the idea of losing a child, but I feel like that would be really high up there with losing a child is like you've let your child down in a really big way.

Participants expressed anticipating greater guilt if they chose to vaccinate and an injury occurred, opposed to doing nothing and a VPD occurring. An injection was viewed as a risk just by its nature of being injected directly into their child's body. Nearly thirty percent said that the worst-case scenario for their vaccine decision was a permanent injury to their child, whom they would then have to watch suffer for the rest of their life knowing that they had caused it.

P47 I'm just worried about hurting her. Cause I get scared at shots now or like taking my blood, but I know what to expect and it still freaks me out and she doesn't know anything. So, it's like fresh and new and terrifying, I guess. And I don't, I don't like putting her through that or the idea of it and uh, yeah, that's a little, that's a little terrifying. Yeah, I don't, I don't like causing other people harm.

P17 I'm not comfortable with the fact that there is in some of the vaccines, um, aborted fetus cells... also like things like mercury and stuff like that... and like aluminum is another one that just, I'm not sure that it, what good it could do for our body. Um, so I, I question why they're in those vaccines and what would make that, um, worth injecting into your body. And the other big thing is that it is being injected. So, it's going, it's different than like obviously inhaling, like, so it just enters your body differently. And I feel like the effects that it can have is feel like the effects that it can have is just, it needs to be talked about. Um, and the amount, yeah, it's okay in small amounts. Then you have that amount in 16 vaccines and you're getting all these 16 vaccines. What is that amount added up going to do to your immune system or your body in general. Um, so that's, that's concerning.

What Others are Doing

Over half of the participants believed that the majority of other mothers still choose to fully vaccinate their children according the ACIP schedule. Having this belief was reassuring to vaccine-hesitant participants who believed that other children's immunity would prevent diseases from reaching their unvaccinated child. Participants were asked about how celebrities influence people's vaccine decision. Celebrities were discussed as elitist who had the financial resources to afford the best care if their child became sick. Some named specific celebrities who they knew were anti-vaxxers (e.g., Jenny McCarthy, Kat Von D, Justin Timberlake) because of their public statements. However, most participants said that their vaccine beliefs were not influenced by celebrities, but they did however believe that other mothers were.

P49 I imagine most people just do the normal scheduled vaccinations. I imagine there's some people that don't get one for some odd reason or another, but I imagine that most people stay on the schedule for them.

P19 Like I know that Justin Timberlake and his wife, I know they're anti vaccine and um, I think that, you know, people look up, people shouldn't, but people look up to celebrities. They are like, oh, celebrities are being bougie and they're not getting vaccines let's not give vaccines ourselves. You know, but they're rich. They can afford to stay in a little bubble and not be around other people. So, their kids stay safe, you know, they can do that. They can hire a nanny and the nanny doesn't go anywhere and they can just stay inside the little bubble. Versus the everyday, the average person has to go grocery shopping. Their kid has to go in a shopping cart. Fifty million kids have went in that shopping cart, in that shopping cart's lifetime. There's bound to be an illness on that shopping cart. So, you know, I just, I think that celebrities do influence how a lot of people think. They shouldn't, but they do.

P11 I do, I think this, you know, celebrities that take a stance either way. Um, in a way I think they kind of add to that polarization of the argument and the issue. Just because they do have such a public voice and so many people you know, see them, and hear them. Um, so for me personally, I don't let that dictate my decision-making process. Um, for some it may.

Theme 7. Vaccine Messaging in the Media

Many participants said that social media and news media showed different sides of the vaccine debate. Social media was said to mostly be a platform for anti-vaccination agendas,

whereas the news media was pro-vaccination. When participants were asked about the kind of vaccine messages they saw in the media, they often asked for clarification about which media source we were talking about. According to participants, their answer about the kind of vaccine message would depend on the source. Three subthemes were discovered in this theme.

P35 I guess it depends on like where I'm looking at. Like if I'm looking from like a news source, like CNN or Fox or whatever, I feel like a lot of its pro, you know, like just media recording on what's happening, you know, like an outbreak. Um, if it's anti, I see a lot of it on Instagram, a lot of anti vax. I feel like most of the large media outlets are reporting like pro. Personnel media, like people's own social media, is a lot of anti-vaccinations.

P16 I've seen a lot of anti-vaccination stuff in the media, more social media than like the news media. And most of them are implying that people who choose to vaccinate their kids are making a mistake and they're kind of being blind to a larger risk and they're being brainwashed in a way, by like the government.

P47 It's honestly 50/50. If it's the mommy stuff that I go to, like I do have some mommy sites that I follow and things like that, like natural, like crunchy-type moms, um, all of them are like vehemently opposed to the vaccinations. But if I look at, you know, places like Reddit or if I look at individual like news articles, then the comments are really pro-vaccination.

Mainstream News

Mainstream news refers to traditional public news channels that is largely accessible to the masses of people (e.g., newspapers, local news channels, national public radio, and national news). Participants felt differently about the kinds of messages that were presented on the news. Many participants were skeptical regarding the accuracy of vaccine information that was shared on the news. For example, some felt that pro-vaccine messages were paid for by pharmaceutical companies and government agencies. A few said that messages that used fear tactics, pushed them in the opposite way that the message intended. For example, a few participants said that fear messages used in media to promote vaccinations pushed them away from accepting vaccinations.

P1 It doesn't matter which station you listen to because they all have to have sponsors, right? And if you pay attention to the commercials that come up or the sponsors who are listed on the page, I, I say that a good majority of the time you can tie those back to pharmaceutical companies and I think that's a problem. Like, again, I think there is information that we as consumers don't have, because we don't have any control who sponsors that news program and we don't have control over the information that is presented. And guess what? If they're providing a good source of funding for that, for that news station, they are probably not going to be talking about anti-vaccinations, right? They're going to be talking about the things that make the pharmaceutical companies' money and that's vaccinations. So, I think the vast majority, especially the news like you mentioned, is going to be pro-vaccine, because that is all we hear.

News coverage of vaccine preventable diseases (VPD) was perceived differently than vaccine promotion messages. Many participants believed the news accurately portrayed information about current outbreaks. Some participants said that the news coverage made them want to have their child vaccinated.

P37 I feel like what has been occurring has made me kind of like, um, I'm seeing like the epidemic of the measles, like breakout on the news and stuff. So that is something that is pushing me to fully vaccinate.

P20 You know, I was in the middle for quite a while, but currently in New York City I read there's a measles outbreak and I didn't even know about that. I just heard on my news this morning and I saw that. I mean that really changed my mind a lot. I mean, I think definitely I was going to say partial because there are some vaccines that I hear, they cause autism, and I really don't want my child to become autistic because there's autistic people in my family and they have a harder time. So, I know I definitely want, but definitely measles, that vaccine, they will get that one.

P5 Um, before these news outbreaks, I probably would not have been very worried. Um, because it's, we just have a mentality of like, you know, well, it couldn't happen to me. Nothing will happen to my kid. And so, seeing all these news reports of real people getting sick, it kind of puts you on a little higher alert.

Social Media

Many participants mentioned Facebook as a common site where information about vaccines was shared. However, it was talked about inconsistently. For example, some said that vaccine information shared on Facebook was not to be trusted, but then later referenced a post that impacted their vaccine beliefs. Most participants talked about viewing the posts without participating in the commentary. There was disgust associated with becoming involved in an argument online. Many did not think that it was emotionally safe place to ask questions or make comments about childhood vaccines. It was particularly more dangerous for participants who were in the middle. They could be attacked from both sides of the vaccine debate.

P3 Seeing, I don't know if you've seen this online at all, but I saw it pop up on my Facebook once and then I did some research. But the polio-like diseases that are like coming back and there's I know there's some in Oklahoma, I forget the other state that I was reading about. That's scary. That makes me want to vaccinate with everything just in case especially when they say it's polio-like. Oh, it's not polio? There's something else now?

P32 Ah, would be tough because I know so many people on both sides that I know that um, no matter what I say I feel like I would get somewhat attacked. Um, cause it's so, I don't know, it's such a touchy subject right now.

P6 I got online and I did a poll you know, I was like anti-vaxxer or pro-vaxxer ... of course the comment threads come and people were bashing people back and forth and I actually have lost

social media people because they freaked out when I commented. I was like look at the end of the day some of these vaccines are good and some of them are bad and you don't have the right to sit here and tell a parent that their experience is wrong because you didn't experience it yourself, you know? So when I actually talked about it....I guess I am actually considered an anti-vaxxer because I don't agree with the current schedule so I don't believe in all the shots and that actually got me bashed online which was kind of weird experience because I've never actually been like attacked online.

Even general questions perceived as vaccine related could result in an argument online. A few talked about having recently received unexpected public criticism from making a Facebook post that they thought was non-controversial. For example, one participant said that her brother accused her of being anti-vaccination after she made a post about her intention to use cloth diapers. Some participants felt that the topic of vaccines was as controversial as religion and politics. A topic that was not to be brought up socially because of conflicting opinions.

P17 I had posted a picture of a cloth diaper because I plan to cloth diaper and just like randomly he was like, oh, so do you plan to be one of those anti vax mothers too?

P13 I would probably try to avoid telling people unless I had to. Because it's just one of those things like I keep, it's seriously like it, it's like politics. I keep my lips, my political opinion to myself because, you know, I don't want to hear everyone else's opinions about this and that. Like I have my opinion and it is my right. But I don't need to shove it down other people's throats. And so, I just keep it to myself. And that's kind of how I probably would handle that. Unless I

had to, you know, tell them, I would definitely try to avoid. Because I wouldn't, I don't want to deal with that conflict because it's not going to be fun.

P29 My sister-in-law is an OBGYN and she's on the complete other end of the spectrum from us. Um, we have very good friends that are also primary care doctors and radiologists, who we once tried to broach the subject of vaccinations with them, and it was very interesting how fast things got heated and passionate. I did not realize that the topic of vaccines was something that can be very, um, controversial as, as, as controversial as like politics or religion. It makes me hesitant to want to discuss it and talk about it. Because of the kind of backlash or shaming that can happen, not to do things according to the standard way.

Having adequate knowledge about vaccines was equated with gaining confidence to defend their vaccine decision. A quarter of the participants said they would be more willing to post about vaccines if they had done enough research to justify their position. Some felt that being uninformed when making a post made a person deserving of backlash. Online arguing between a pro and an anti-vaccinator had been witnessed by the majority of participants. According to some, the arguments often escalated causing site administrators to intervene. Some participants expressed greater sympathy for anti-vaccinators who became aggressive on social media, believing their anger was justified if their child had been vaccine injured.

P28 From the anti-vaxxers you know, there's a lot of, um, I guess sympathy, empathy, you know when, when they like this, the couple of stories I've heard from families who have had terrible,

um, they've gone through terrible side effects and, and all kinds of problems with their children because of vaccines, um, there doesn't seem to be a whole lot of support for them.

P3 If I had to tell everyone and deal with people who didn't necessarily agree with me, as long as I'm really confident in my decision, and did enough research, and had enough information to believe that I was making the best decision for my child and my family, then I don't think it would necessarily bother me that people didn't agree with my decision.

P25 I would probably do more research before making that post, just because I would want it to be something that I was firm in and not, um, trying to cause a controversial argument or um fight between anybody that I care about. If I were to go one way or the other, I think that there would be strong, strong opinions on both sides. Um, so I would really just want to have the education and the research to back my decision.

Some participants perceived pro- and anti-vaccination mothers who already had children as having more parenting experience that made them more knowledgeable and wiser in making a vaccine decision. Having experiences to draw upon were desirable to vaccine-hesitant participants who viewed these experiences as essential to knowledge and confidence in the vaccine decision. In some ways, participants admired more experienced mothers and wanted to talk to them about their child's journey with vaccines or vaccine-preventable diseases (VPD). Some felt that learning from other mothers about their vaccine choices would give them greater insight in potential risks and benefits associated with the vaccine decision.

P19 Before I ultimately make my decision and tell them what I'm going forward with. But I'd still like to get the opinion of others. So that way could help, you know, guide me to the right decision with valued input from more experienced parents.

P4 But then also the older adult moms who are choosing, you know not to vaccinate, it kinda of brings a little bit of okay well, they're older they are wiser. They have been you know around longer. Should I listen to them or to my friends who had their babies at a young age, and they choose to do that, and I think it's kind of just being able to sit down with mommies and be like okay like I need advice. Like I want to hear your opinions on if I am doing the right thing or not and being able to confide in them. Versus having both sides being very aggressive about should they or should they not.

Social media was also a platform for memes that depicted graphic imagery of children harmed by a vaccine decision and bold statements about people's characters. A few participants described memes that made them question vaccines or VPD. For example, one participant talked about a meme of a teddy bear with every vaccine on the ACIP schedule sticking it to illustrate the number of vaccines on the current ACIP schedule. A couple of participants talked about a meme that compared not vaccinating to an abortion with extra steps. Facebook was the most common social media platform used by the participants. Throughout the interviews some of the mothers talked about not agreeing with censorship of messages that portrayed vaccines as dangerous. A few thought that the censorship was a reason to believe that vaccines were dangerous and that the government and pharmaceutical companies were trying to hide the dangers.

P12 Um, I did see this kind of funny meme on social media and it was like a new term for like people who are anti-vaxxers, they're not really anti-vaccines, they're just pro-plague.

P47 I actually get bothered by them, like the pro-vaccine messages that are really like pushing hard, like when I see that, um, there's a company, what was it, Amazon?...or maybe it was Facebook, that was no longer gonna allow anti-vaxxer information to be put on their website ...but I just, my immediate thought was, like, well, then you have this biased information going out. We should, we should, whether the information we're getting is crap or not, I still should have the choice to read what I want to read. If I want to read anti-vax then it should be my prerogative, like I feel like the information shouldn't be kept one way or the other. It should all be freely available to everyone.

The Power of the Personal Story

Hearing other peoples' stories of children who were vaccine injured (e.g., autism, seizure, rash, high fevers, developmental delay, or regressions, etc.), or had a VPD, was brought up by nearly all of the participants in the study. Most often the examples of personal stories were seen on Facebook, but it was not always made clear if the stories were from individual posts, newsfeed items, or in Facebook groups. Personal stories were a significant part of most mothers' vaccine research. Additionally, personal stories were talked about as having the most impact on vaccine-hesitancy. Some participants said that they were pro-vaccine until becoming pregnant and hearing testimonies of vaccine injuries from other mothers, at which point they became vaccine-hesitant.

P26 I think just learning, you know, learning about other peoples' stories, um, online. Or you know, just hearing about other peoples' stories where their children had a really severe, they had a vaccine and then, you know, the next day they had these, like they had a really severe side effect...so I think just, like doing research or like reading on things and just like looking at both sides of the coin.

P32 I do have one friend who had the measles and ended up with partial hearing loss...and so that has influenced my thinking. Um, for the most part, I think it's, it's mostly just like hearing stories from different people, you know, like that's where most of my influence comes from.

P36 I was vaccinated, my husband was vaccinated. We grew up in a community that never, you know, was very, both of us small towns in Oklahoma and Texas. So, um, yeah I was never really questioned. And then as we got older, um, I think, I mean I've had, I've worked with a teacher who I was very close with and her son has autism and so she really questioned whether it came from vaccines and I had never really, I'd heard that before, but I'd never really thought of it before then. So just having that like personal connection with someone that, you know, like kind of put the thoughts in my mind. And then also, I mean we live in a very era of social media, which I know is not always truthful or accurate or things like that. So just having people um, that I know and that I trust like post things or their own experiences with children really. That's kind of what like, not changed my mind, but just made me start to question more about what, what is best for my child, you know.

For many, personal stories shared by other mothers were the best indication of their child's real risk for potential vaccine injuries. In some cases, learning from personal stories was easier than navigating the amount of conflicting and trying to decipher which sources of vaccine information were reliable. Personal stories were sometimes preferred over medical professional's recommendations for two reasons. One, the person sharing the personal story was perceived as more trustworthy because they did not have ulterior motives for sharing their story. Some participants hoped that their pediatrician would factor in personal stories of vaccine injury when making recommendations. One participant questioned physicians' competency if they did not consider personal stories. Two, because personal stories were real-life experiences that represented what could happen to their own child. In this aspect, they provided some level of predictability for first-time expectant mothers who had none otherwise.

P34 Um, for me personally, firsthand experiences will always influence me more than like an unbiased study. So, if I see it, if I see a statistic that says, you know, like 65% of people who eat eggs grow wings, then you know, that's whatever. But if I had a friend who ate a chicken egg and then all of a sudden grew wings, that's going to mean a whole lot more to me.

P27 I do think it's easy as parents to be overwhelmed by the wealth of information and the massive life change, especially for a first-time parents and to just say, okay, I'm just going to trust that this person, is telling me a thing that is good and do that thing.

P24 Um, me seeing something else that a child got sick from, or hearing something dramatic from one of the actual in life experiences of a child, you know? That would make me not vaccinate at all.

The relationship to the person with the personal story did not have to be close to have an impact on hesitancy. It also did not have to be someone that the participant had ever met. For example, one participant's hesitancy came from hearing about her baby's father's friend's parents who had a child who developed autism after getting a vaccine. Another referenced her hairdresser friend's client's daughter who had seizures after a vaccine.

P30 Um, as far as the adverse reactions that I have personally researched that concern me, um, febrile seizures, are one of those. Uh, I have a friend that told me she used to cut a ladies' hair and her daughter, she had seizures for years. Anytime she would run a fever, she would have seizures after her vaccines. They did a metal detox to get all the metals that vaccines would leave in her body out and after that the child no longer had seizures. So, um, the seizures are definitely main concern for me.

Summary of Findings

The primary objective of this study was to explore factors related to hesitancy for childhood vaccines; seven major themes with multiple subthemes emerged. Themes highlight the uniqueness of the vaccine-hesitant first-time expectant mother, their commonly shared fears, concerns, beliefs, and attitudes that influence their intentions to vaccinate their child.

This study showed that vaccine-hesitant first-time expectant mothers explained highly complex and multifaceted reasons for their hesitancy, driven primarily by fear, social expectations of a mother's role, and emotions. Fear of adverse outcomes from a vaccine decision was paralyzing to their ability to make a confident vaccine decision. Many described feeling helpless and stuck between decisions that were not risk free. Feeling uninformed was a prominent reason for feeling unready to make a decision; however, participants described challenges to becoming informed. Avoiding conflict with others who disagreed with how they would vaccinate extended beyond just family members and friends, but also to pediatricians and their child's future friendships. Having a good relationship with healthcare providers, specifically pediatricians, was important to participants. Yet, vaccine-hesitant first-time expectant mothers anticipated conflict if they expressed their concerns about vaccines. Social expectations for mothers' role as the primary health decision maker for the child led to anticipated guilt and failure as a mother if their child was injured from the vaccine decision. Judging mothers for their parenting decisions was talked about as being a regular part of society, embedded in culture. Although it was common, it was still viewed as a bad thing to do and to experience.

There were perceived differences between how mainstream media and social media presented vaccine and VPD information. Social media, primarily Facebook, was not viewed as a place for reliable sources, nor was online advice from family and friends ranked high as a preferred source in the demographic survey. Nevertheless, personal stories and news items about vaccines shared on Facebook changed the way participants felt about vaccines. Mainstream media was trusted if the message was informing the public about diseases, but not trustworthy if it was promoting vaccines. In this aspect, advice from family members and friends who were in

the health field was held in high regard. Physicians were the preferred choice of source for vaccine information; however, participants were worried that they would be shamed, dismissed as a patient, or have their concerns invalidated if they asked questions about vaccines. A number of participants had not yet received any vaccine information from their obstetrician or midwife, even though they were in the midst of making the vaccine decision.

Chapter V: Discussion

Introduction to the Discussion

Vaccine-hesitant first-time expectant mothers provided details about the underlying factors of their reluctance for their child to comply with the Advisory Committee on Immunization Practices (ACIP) schedule. They also provided descriptions about the things that set them apart from the pro- and anti-vaccinators, such as being nice and respectful to other mothers, and a willingness to learn about vaccines from others. Socioeconomic factors were identified related to the mothers' perceived financial disadvantages, such as restrictions to the affordability to choose from daycare and school options without mandates. Federal and state vaccination policies were viewed as an infringement on parents' rights to choose what is best for their child. Parallels of mothers' hesitancy to childhood vaccines and current reasons to refuse or delay the COVID-19 vaccines are made. Healthcare providers were found to have an important role in mothers' vaccine decisions, particularly related to the timing and communication of giving vaccine-related information. Hesitancy was deeply rooted in a fear of making a decision that would harm their child. Things that mothers believed would make them less fearful included feeling informed about vaccines, asking questions without social consequence, and spacing vaccines out over time. Mothers were actively searching for vaccine information but were experiencing challenges, such as finding reliable sources. Physicians were considered a reliable source by many, but Google searches and Facebook were talked about as the most accessed sources for information. Mothers were not directly asked about their prenatal healthcare providers sharing childhood vaccine information, but over a third stated that they had not received information to date. Although mothers wanted this information, none had communicated this with their providers. Worry that their child would be dismissed as a patient

or that they would be judged as a bad mother for asking questions were additional challenges to talking with the pediatrician.

First-time expectant mothers believed they were in a more anxious and state of psychological distress compared to mothers who had already had children, due to unfamiliarity with circumstances around the vaccine decision. Mothers in this study distinguished themselves from pro- and anti-vaccinators because of their flexibility in the vaccine stance, amenability towards and respect for other mothers, desire to learn from different points of view, and conducting personal research before deciding. Mothers felt stuck between a decision where the only options had risks and potential to cause relationship conflicts with friends and family. Social normative standards implicate the mother as solely responsible for the vaccine decision and any adverse outcome. Making a decision that resulted in harm would cause intense guilt and feeling like a failure as a mother. In this chapter, these findings and results are expanded in discussion and related to other literature. Public health and clinical recommendations and implications are provided, and limitations are addressed.

Different from the Pro- and Anti-Vaccinator

Although vaccine behaviors are often polarized between pro- and anti-vaccinators, it is not a clearly defined position for vaccine-hesitant first-time expectant mothers. Consistent with research in similar cohorts, vaccine-hesitant first-time expectant mothers fluctuate between ideas and beliefs expressed by both sides without fully agreeing with either one [132, 247, 249]. Additionally, they have compassion and relatability with other mothers, regardless of the vaccine beliefs, because of the difficulties that mothers face in a judgmental society. Furthermore, as others have found in similar cohorts, although aggressiveness and hostility between pro- and anti-vaccinators online is common, it is disparaging to vaccine-hesitant first-time expectant

mothers who think it is important to get along with other mothers [124, 323]. Furthermore, the hostility between the two groups was a reason to avoid asking vaccine-related questions on Facebook, as the mothers believed they would be attacked by pro- and anti-vaccinators. As a result, mothers in this study were more likely to view other peoples' posts but were not likely to make a post themselves. This is important for two reasons. One, the results show that the vaccine-hesitant first-time mothers are seeking to avoid conflict with others who disagree with their vaccine beliefs. Like others have found, vaccine-hesitant mothers avoided conflict not feeling like they could express themselves without being "bashed", was confirmation of anticipated social conflict with others who disagreed about their vaccine choices [324, 325].

Mothers' avoidance of making posts on Facebook is inconsistent to a recent study that explored the content of vaccine-related posts on Facebook made by first-time expectant mothers [325]. Bradshaw et al. [325] study results indicate that some do feel comfortable making public posts about their vaccine-related beliefs and concerns [325]. This inconsistency could be due to the differences between public posts and those posted in private group settings. For example, the mothers in this study were asked what it would be like for them to make a public post on Facebook. However, most of the posts by vaccine-hesitant first-time expectant mothers in the study by Bradshaw et al. [325] were in Facebook groups where membership was required. It is possible that the mothers in the study by Bradshaw et al. [325] felt safer asking vaccine-related questions in a Facebook group where the audience was limited, and the settings were more private. These findings are important for a few reasons. First, a review of the literature indicates that no other study has qualitatively explored vaccine-hesitant mothers' perceived differences from pro- and anti-vaccinators and thus, contributes to filling a gap in the literature. In this aspect, knowing these differences will allow researchers to gain a better understanding about the

mindset of vaccine-hesitant first-time expectant mothers, thus providing key information when conducting research. As Lochmiller [320] states, learning about their defining traits and characteristics in their own words and descriptions is a fundamental basis for why qualitative research is valuable. Additionally, their differences continue to provide rationalization for why public health should recognize them as a unique group, rather than assigning them to anti-vaccine groups [52, 326]. Second, a study to further explore if vaccine-hesitant first-time expectant mothers are more comfortable posting their questions about vaccines in semi-private groups on Facebook would be valuable. Particularly for researchers involved in utilizing digital platforms to reach more a specific cohort [327-329]. One thing to consider doing in future research is to create a Facebook group where clinicians and public health experts have administrative power to moderate, answering questions and guiding discussions.

Third, knowing about their amenability can provide some level of assurance to clinicians who may be avoiding conversations about vaccines, or dismissing patients who do not immediately accept them [330-333]. In this respect, the findings of this study should be encouraging to healthcare providers who have previously experienced conflict with mothers regarding childhood vaccines [53, 334]. Additionally, the mothers indicate that they are flexible, thus physicians could perhaps find motivation to engage in vaccine-related conversations knowing that the conversation may lead to them accepting childhood vaccines.

Factors that Build Confidence

Need for satisfactory information at the right time. Over half of participants (58%) ranked physicians as their number one preferred source for vaccine information in the demographic survey, but unprompted a third said they had not received childhood vaccine information to date. Although there was a want to have their obstetrician or midwife talk with

them about vaccines, neither the providers nor the mothers had initiated this conversation. Consistent with other studies, mothers in this study assumed that the providers had a set plan for how each visit would go and trusted that one of the visits included time to discuss childhood vaccines [335, 336]. Some of the mothers in this study, particularly those who were closer to their due date, were surprised that it had not yet been brought up. In spite of wanting vaccine information, mothers gave no indication that they had intentions to initiate asking their doctors for it. Noting, however, that some of the mothers stated that the interview made them want to ask at a future appointment. It is possible that the mothers' passive role in asking for childhood vaccine information is evidence of a non-equal distribution of power between mothers and providers found in other studies [307, 335, 337]. This idea is supported by what one mother in this study said about not asking doctors questions because they were intimidating. This could point to an issue of unequal social power similar to what Goodyear-Smith et al. [338] found in previous research with patients and physicians. Research shows that a collaborative approach, with equal social power, between patients and providers can lead to greater trust, rapport, and confidence in vaccines [339, 340]. However, more research exploring imbalance of social power is needed with this cohort to see if this is true. Additionally, another consideration for researchers is to include the perspective of prenatal healthcare providers on this topic. Exploring both perspectives would provide clarity about the dynamic between the two, and help to address issues with sharing vaccine-related information in the early stages of the vaccine-decision making process [305].

Although vaccine-hesitant first-time expectant mothers *wanted* to receive vaccine information from physicians they were actually *getting* it from the Internet (e.g., Facebook, Google), and family and friends. Likely this is because of how easily accessible, and they are.

Consistent with Rosso et al. [341], the Internet in general was an easy way to access a lot of vaccine information at any time of day. As one mother explained, the Internet provides instantaneous answers, whereas mothers may wait for days after asking a physician a question through a patient portal.

From the results assumptions are made that Google and Facebook's accessibility took precedence over the mothers' views that the information had a high propensity for being unreliable. Other studies have had similar results that support this assumption [74, 123, 342]. However, much is still unknown on this subject. For example, although mothers consistently specified Facebook as the social media source to learn about vaccines, Google was often referenced as a general search tool. This is important, because studies such as Rosso et al. [341] and found, social media is frequently used to describe numerous different sites (e.g., Facebook, Pinterest, Twitter). However, in research studies these sites should not be grouped together under an umbrella term of "social media", because according to Kata [70] there are differences in how vaccines are portrayed on different sites. This study found that in almost all cases, Facebook was the social media site the mothers were using. From this finding, future research could consider focusing their social media interventions to Facebook when trying to reach vaccine-hesitant first-time expectant mothers. In addition to this, a suggestion is for other studies to specify the social media platform in research studies, rather than using general terminology of "social media". Doing so would allow research to refine the details of the exact nature of online searches by first-time expectant mothers. Similarly, the study results did not allow for the identification of which Google results the vaccine-hesitant mothers were choosing. To best understand the mothers' childhood vaccine search patterns and processes, it would be beneficial to know their selections and the reasoning behind it. Others have documented vaccine-hesitant

mothers accessing the Internet and social media to research vaccine-related information, however, the details of mothers' searches (e.g., social media site, search words, discernment of reliable sources, Facebook group memberships) is often ignored in quantitative surveys [281, 341]. For example, Peretti-Watel et al. [84] found that mothers have more trust in vaccine-related stories and information when coming from another mother. It would be interesting to know if vaccine-hesitant first-time expectant mothers are more receptive to Facebook posts if the original poster is another mother. Asking these questions in future research would align with the premise that vaccine-hesitancy is highly complex and multi-faceted, requiring finely tailored interventions to truly explore the depths of their complexity [47, 52, 247, 298]. Lastly, knowing their search patterns would allow researchers to see if confirmation bias is a factor, as other studies have found in similar groups [273].

Additionally, this study found that pregnancy marked the time that mothers began thinking about the childhood vaccine decision. Conversely, it was also the point that many of them first started actively searching for vaccine-information. From these findings one can presume that getting childhood vaccine information to prenatal women, particularly those that are first-time mothers, is an ideal intervention point for information delivery [307, 337]. However, this study found although the average pregnancy term was twenty-seven weeks for the mothers in this study, over a third stated that they had not yet received childhood vaccine information from a direct care provider, excluding a chiropractor. It is important to note that these statements were mostly made in response to a question asking how healthcare providers influence mothers' perceptions about childhood vaccines. This, coupled with many who said they did not have enough vaccine-information and were actively seeking information, leads to an assumption that had the mothers been directly asked about receiving information from a prenatal

healthcare provider, the number would have been much higher. With this in mind, an important thing to consider in future research is how many vaccine-hesitant mothers are receiving childhood-vaccine information from a prenatal healthcare provider during pregnancy.

The research literature on this subject is limited and somewhat inconsistent. Navar et al. [343] conducted a phone survey with 16 obstetric offices and found that only 23% had a policy of giving childhood vaccine information to their prenatal patients. On the other hand, one study reported 66% of antenatal women had received vaccine-related information during their pregnancy [91]. However, Danchin et al. [91] used a survey to ask about vaccine information that included maternal vaccines, such as influenza and Tdap. The results of this study found that some of the first-time expectant mothers were comfortable receiving maternal vaccines during their pregnancy but objected to childhood vaccines even when the vaccine was the same kind (e.g., Tdap, DtaP). Therefore, it is possible that studies such as Danchin et al. [91] could potentially be misinterpreted by those reviewing the literature, leading some to incorrectly believing that a higher percent of women are receiving childhood vaccine information during pregnancy. Future research could clarify with obstetricians and midwives if the vaccine information given in prenatal visits is for maternal or pediatric vaccinations.

As Rosso et al. [344] found, prenatal healthcare providers may not recognize childhood vaccine information as part of their practice. It would be understandable, as the American Academy of Pediatrics does not currently have a recommendation for obstetric prenatal visit to address childhood immunizations obstetricians do not typically give newborns vaccines in the hospital. It is also possible that as Navar et al. [343] suggests, they do not have the necessary training or education material to feel comfortable engaging with prenatal women. Furthermore, the American Academy of Pediatrics (AAP) recommends that expectant women have one

pediatric visit prior to birth, at which point many pediatricians choose to discuss childhood immunizations, though many women do not take advantage of this [337, 343]. As Salmon et al. [345] encourages, it is critically important to get first-time expectant mothers' vaccine-information early in their pregnancy that is reliable and accurate, so that they can feel informed and make a confident vaccine decision. Others, such as Glanz et al. [88] and Kaufman et al. [346] point out, obstetricians and midwives should be recognized by public health and the medical field, as the "first line of defense" to address and reduce vaccine-hesitancy [88, 110, 346]. This is not to suggest that obstetricians and midwives replace pediatricians as a source of vaccine information, but rather in addition to.

While prenatal healthcare providers were not providing some of the vaccine-hesitant first-time expectant mothers in this study vaccine-related information, others in the mothers' social environment were. Examples of neighbors, chiropractors, and eye doctors giving the mothers sources of alternative vaccine schedules were found. An interesting comparison is made between the lack of initiative from obstetricians to engage in childhood vaccine conversations while other types of clinicians, not directly involved in prenatal care, initiated conversations, and provided mothers with educational materials.

Study findings suggest that from some of the mothers' accounts, chiropractors recognize the need to provide prenatal women with vaccine-information during a critical time in the vaccine decision making process [125, 347]. However, in this study all of the information shared by other clinicians were in favor of alternative vaccine schedules. Consistent with other research, chiropractors were seen by some of the mothers as a good combination of (1) medical training and expertise, and (2) expertise in homeopathies[347, 348]. These findings are important as they suggest a vortex of issues where vaccine-hesitant mothers would prefer

vaccine-information from their physicians but are not getting it, are using other more accessible sources known for unreliable information, such as Facebook, and are provided unsolicited vaccine-information from health experts prone to complementary alternative medicines (CAM).

Additionally, this study found that vaccine-hesitant first-time expectant mothers anticipated their child's pediatrician talking to them about vaccines in the future but had concerns about how that would go. First, they were concerned that the pediatrician would not give them unbiased information. From the mother's perspective, unbiased information would give the risks associated with vaccines along with the benefits. As other studies have found, some of the mothers anticipated not trusting a pediatrician who did not incorporate vaccine risks into the vaccine discussion [83, 222]. Mothers were specifically interested in knowing about the side effects, the ingredients, and the real risks for a disease exposure. Without learning about the risks associated with vaccine uptake, mothers would not feel adequately informed to make a confident vaccine decision [260, 264]. Therefore, it is recommended that prenatal healthcare providers and pediatricians present vaccine information balanced with vaccine risks and benefits to vaccine-hesitant first-time expectant mothers [349]. Although in theory it may seem counterproductive to include vaccine risks to mothers who want to minimize risk to their child, studies such as Betsch et al. [350] show that this has not been the case.

Second, the findings indicate that mothers wanted a close, trusting relationship with the pediatrician. One mother described a past experience with a physician who was "too clinical" to feel comfortable asking questions. Like this mother, others also described doctor's unapproachable dispositions as a reason to not feel close with them. Interestingly, the study results also show time and difficult trials as a precursor to feeling close and building trust with a physician, two factors that the mothers did not have with a pediatrician yet. Mothers' previous

experiences with trusted doctors were established through a process of care. This is consistent with Smith et al. [351] who found that parents' trust in a physician is established over time and not immediately present in the beginning of care [352]. Unfortunately, consistent with other studies, very few mothers in this study intended to have the first face-to-face meeting with the pediatrician until after the child was born [343]. Waiting until the child is born is problematic, as the ACIP schedule recommends that newborns get the hepatitis B vaccine in the hospital. Thus, if trust has not begun between the pediatrician and a vaccine-hesitant mother, research indicates a greater chance for vaccine refusal [83, 352, 353]. One recommendation for future research is to explore why expectant mothers are frequently not meeting with the pediatrician for the prenatal visit as recommended by the American Academy of Pediatrics. It is possible that as Carlos [354] points out, expectant mothers may not be aware of the prenatal pediatric visit. Additionally, another thing to consider is for public health officials, researchers, and clinicians is to give special attention to the promotion and awareness of this visit in their practice and in interventions [343].

Even so, there are things that pediatricians can do to mimic the features of a long-standing well-established trusting relationship to build trust early on. For example, pediatricians can ask expectant mothers to discuss the vaccine decision when they are asked to be the child's pediatrician, spending extra time if there is inclination that the mother is vaccine-hesitant. Consistent with clinician recommendations by Clarke et al. [355] and Kempe et al. [230], pediatricians who will spend time listening to concerns and answering questions about vaccines, were seen by the mothers in this study as more caring and trustworthy sources of vaccine information [53, 230]. Therefore, based on the findings of this study and consistent with other research, it is believed that pediatricians who exhibit patience and leisure during visits can

increase vaccine confidence and uptake in vaccine-hesitant mothers [83, 330, 356, 357].

Additionally, many mothers in this study were concerned that expressing concerns about vaccines to the pediatrician would have consequences. Consistent with Opel et al. [358] stories of other mothers being judged, dismissed as a patient, or turned into child protective services for asking questions about vaccines scared the mothers in this study [358]. As others have suggested, reassuring vaccine-hesitant mothers that they are safe to express their concerns without consequence is a key feature of a trusting relationship [72, 84, 359].

The study also found that vaccine-hesitant first-time mothers wanted pediatricians to give information without obligation to do what the pediatrician recommended. Pediatricians who recognize the mother as the final decision maker were highly desirable by mothers in the study. Some of the mothers in this study made references to an ideal pediatrician as pro-parent, or for parents' rights. The use of this exact term has not been documented in existing literature; however, the meaning is similar to what others have described as an approach where a physician presents vaccine-related information, while taking cues from the mother and maintaining her role as the primary decision maker [246, 339, 359]. Mothers gave examples of previous experiences with physicians that they trusted, where the physician presented risk and benefits of a health choice and encouraged the mothers to think about risks before deciding. This approach was ideal to vaccine-hesitant first-time expectant mothers in this study who were conducting their own risk and benefit assessment of accepting vaccines. Conversely, the results found that pediatricians who would pressure mothers into accepting vaccines was viewed by some as a bully tactic. Some of the mothers indicated that if they were not satisfied with the relationship with the pediatrician, they would find a new one, or in the case of one mother, not take the child to a pediatrician at all.

As Glanz et al. [87] suggests, how a pediatrician communicates with a vaccine-hesitant mother has an impact on how well mothers trust a pediatrician and the vaccine-information they give. Thus, if using different communication strategies will help first-time mothers gain trust in their child's pediatrician, the implication is that vaccine uptake would be more likely to occur. Existing literature has explored motivational interviewing communication, which centers the patient and their belief system as a focal point, with vaccine-hesitant mothers as a way to build trust with physicians [50, 132]. However, it is not clear if motivational interviewing techniques are the same thing that first-time mothers want when they say they want a pro-parent, or for parents' rights pediatrician. Conversely, even if first-time mother's contextual meaning does align with motivational interviewing techniques, there is still an issue with convincing pediatricians to learn and implement new style of communication. As Smith et al. [351] observes, some physicians may not have the training or education to confidently use this new communication strategy. In this aspect, because the results in this study highlight a need for a collaboration between mothers and pediatricians, it is important to consider the needs of both parties. There is evidence that shows some pediatricians are more inclined to dismiss patients who refuse vaccines rather than deal with the complications they may present [332, 360, 361]. As Diekema et al. [360] argues, dismissing mothers who do not immediately accept vaccines contributes to the division between parents and pediatricians, and adds to anti-vaccine narratives such as "us versus them" identified in other research [74, 324, 362]. On the other hand, as McClure et al. states, long term and frequent exposure to vaccine-hesitancy is associated with earlier burnout and occupational fatigue of physicians. In addition to this, Block [332] describes pediatricians as ethically conflicted to accept unvaccinated children in their office and risk an exposure, when they are committed to protecting the health of their patients. Thus, pediatricians

may be reluctant to entertain vaccine refusal or delay out of concern for the health of other patients. One possible suggestion that could help find a balance between what pediatricians need and what vaccine-hesitant mothers need is to consider asking these questions in a focus group setting, similar to what Opel et al. [92], to gain a better understanding of both perspectives.

Seeking transparency and accountability. Most of the vaccine-hesitant first-time expectant mothers in this study felt that ingredients in the vaccines were unsafe. The issues were rarely related to the virus itself. Concerns about the chemicals, preservatives, aborted fetal cells, and other toxic substances in vaccines has been well documented as a reason to refuse or delay vaccines across multiple studies [57, 74, 232, 336, 363, 364]. This study found that some mothers felt there was a contradiction between the lack of ingredient and warning labels on vaccines and the existence of them on other prescription medicines, which led some to believe that the dangers of vaccines are intentionally hidden so that mothers won't refuse them. A suggestion is for physicians to provide vaccine-hesitant mothers with a detailed list of the ingredients, possible side effects of the ingredients, and reasons that they are in the vaccines as part of comprehensive vaccine education during prenatal and pediatric visits. Although ingredients can be difficult to read and understand because of the scientific language, studies show that vaccine-hesitant mothers are typically educated and have good health literacy [89, 259, 336]. As the issue with ingredients continues to be brought up as a factor of vaccine-hesitancy, a suggestion for future research is to approach this topic from a new perspective. For example, the literature has not explored which ingredients vaccine-hesitant mothers would be comfortable with. Asking this question in this way could provide a better understanding of the kinds of solutions that vaccine-hesitant mothers are seeking. Additionally, although vaccine ingredients are publicly available online through the Center for Disease Control and Prevention (CDC), a

few of the vaccine-hesitant first-time expectant mothers in this study did not trust the CDC.

Overall, there exists a need to have different health agents and practitioners provide this type of information to vaccine-hesitant mothers.

Objections to ACIP Schedule

The schedule is unsafe. Very few of the mothers in this study intended to follow the ACIP schedule. None of the mothers had a clearly defined plan of which ones they would accept, delay, or refuse. However, as other studies have found, most of the mothers were concerned with the number of vaccines given at one time, a non-individualized schedule, the early age that they begin, and combination vaccines [47, 56, 107, 365]. First, as others have found, mothers in this study were not comfortable with the ACIP schedule because it did not take into account individual differences, such as genetic predispositions or size of the child [97]. Similar to Rodriguez [366], mothers in this study worried that the number of vaccines would overwhelm their infant's immune system. Mothers in the study felt that their newborn was susceptible to injury from toxic chemicals and wanted to protect them from harm. Similar to perceptions of contradictions between lack of transparency for vaccine side effects and other pharmaceuticals, mothers felt that it was also a contradiction to require medicines to be dosed according to size and weight, but not to require the same for vaccines. Fearing that an onslaught of chemicals and foreign ingredients injected into their fragile newborn would cause serious damage was a reason to delay or spread-out vaccines over time. Some of the mothers provided descriptions about the manner in which too many vaccines will damage their baby's immune system, such as causing food allergies, or a weakened immune system to fight diseases. Because of these descriptions, these findings are somewhat inconsistent to Hulsey et al. [56] who found that mothers were unable to explain how their child's immune system would be overloaded by

vaccines. It is possible that the field does not have a unified definition of what is recognized as adequate knowledge regarding damage to the immune system. One thing that future researchers should consider, is further exploring this mismatch to clarify how researchers are defining mothers' understanding of a damaged immune system. Conversely, this is also an opportunity for clinicians to insert medical expertise into setting a standard definition that could be used in future research.

Unfamiliarity and unpredictability are alarming. Consistent with Chantler et al. [367] the results of this study found that lack of familiarity with some of the vaccines and an ACIP schedule that was different from the one they used as a child, was a source for low confidence and high skepticism [367]. As Corben et al. [90] and Danchin et al. [91] points out, personal experience is an important factor in feeling comfortable and confident in the vaccine-decision. Although this study did not include vaccine-hesitant mothers who already had children, the first-time expectant mothers in this study believed that they had greater concern and hesitation than mothers who have experience making the vaccine decision for other children [46, 90, 91, 357, 367]. Exploring this further could further assist in creating well-tailored interventions aimed at improving vaccine-hesitancy in first-time expectant mothers. Additionally, remembering this point is important for health care providers giving direct care to first-time mothers and their child.

The results of this study found that vaccine-hesitant first-time expectant mothers had greater skepticism for newer vaccines, particularly the Varicella vaccine, than other older ones. Like others have found, reasons for the mothers' distrust centered around beliefs that the vaccines have not had sufficient time to test for safety. Consistent with Mendel-Van Alstyne et al. [260] distrust for newer vaccines are because of their insufficient safety tests that can only be

done over a long period of time through many trials. It would be interesting to revisit this point in relation to the COVID-19 vaccines to see if first-time expectant mothers express the same concerns in this study with one that focuses on COVID-19 vaccines. Additionally, physicians could try to alleviate the worry about a newer vaccine by providing additional support in the form of information, reassurance, and time allotted for questions when children are due for what may be considered a newer vaccine.

Risk and Benefit Assessment

Vaccine-hesitant first-time expectant mothers were considering the vaccine decision using a sort of risk and benefit analysis. Corben et al. [90] found that first-time expectant mothers were five times more likely to believe that the risks of vaccines outweighed the benefit of disease. Consistent to Macdonald et al. [298] the cost benefit assessment is a combination of an emotional and perceptual evaluation of the susceptibility and severity of outcomes associated with the vaccine decision. Chicken pox, hepatitis B, and rotavirus were diseases that mothers did not see as worth the risk of vaccine injuries. Similar to what Rozbroj et al. [131] found, hepatitis B vaccine is viewed as an unnecessary vaccine based on how the virus is transmitted and dangerous because of the age that it is given. Conversely, some studies imply that a logical and mathematical strategy is used [195, 368], however, this study found that a great deal of illogic was incorporated into the mothers' assessment. For example, much of the interviews was spent talking about the threat of vaccine injury or a disease. However, one of the last questions asked about how likely they believed either was to occur. Overwhelmingly, most felt that the risk for either was miniscule (e.g., .001, .0001). Yet, this was in retrospect to expressing numerous concerns and hesitation to making a vaccine decision. One recommendation for future research

is to consider replicating a study by Ritov [267] to see how omission versus commission factors into perceptions of risk with the vaccine decision in today's society.

Weighing the risks of not vaccinating. Like Brown et al. [107] found in four studies in a systematic review of literature exploring underlying factors of refusing combination vaccines, there was speculation that many first-time expectant mothers in this study would express concerns that the MMR causes autism spectrum disorder (ASD). Instead, it was found that there was a generalized fear that vaccines could cause ASD, an elevated concern for combination vaccines, but very few mothers singled out MMR as the cause of ASD. This is consistent with what Rodriguez [366, 369] found in a qualitative study looking at online conversations about vaccine-safety centered on autism. A few of the mothers in this study mentioned Andrew Wakefield, the author of an infamous article published and retracted in the Lancet and equally discussed was the VAXXED documentary that he directed [61, 294, 359]. Again, these comments were limited to a small number of mothers in the study. Although this study result could be interpreted that fearing the MMR is no longer a factor in vaccine-hesitancy or refusal, mothers still expressed a generalized fear that vaccines could cause ASD [370].

These findings are particularly interesting, because they indicate that public health campaigns to discredit Wakefield's claims against the MMR have had some success. A well discussed topic around vaccine-hesitancy has been the ineffective strategies to increase vaccine confidence, particularly as it relates to fear of ASD [15, 73, 89, 371]. Thus, the study findings are encouraging as they show a minimization of the once widespread fear of MMR. One thing not considered is why vaccine-hesitant mothers do not hold a widespread belief that the MMR is a causal link for ASD. Having this understanding would be beneficial to public health marketing agents who have experienced challenges in effectively reaching the vaccine-hesitant population.

In addition, another interesting thing to explore is why mothers felt that the MMR was the most dangerous when they did not believe that it caused ASD. Altogether, these findings are not what was expected prior to conducting the study but do trigger a question about why this might be the case.

Weighing the benefits of vaccinating. Although Gidengil et al. [372] found an underpinning of vaccine-hesitation related to views of vaccines ineffectiveness, this study found something different. Vaccine-hesitant first-time expectant mothers felt that the greatest benefit to vaccinating was preventing diseases, and with the exception of the influenza vaccine, most credited vaccines effectiveness for why diseases were no longer a threat. The mothers' account supports what Bradshaw et al. [342] states, "vaccines appear to be a victim of their own success". Perceptions of vaccines effectiveness is somewhat inconsistent in the literature. Through observations of anti-vaccination social media messages online, Kata [70] found that a commonly shared belief among those resistant to childhood vaccines is that they are not effective in disease prevention. Some of the studies in a systematic review by Brown et al. [107] found similar beliefs. Although Gidengil et al. [372], Kata [70] and Brown et al. [107] used different methodology, the inconsistency in the results between those studies and this study should be further explored. It is possible that quantitative research is not capturing the differences in perceptions of effectiveness between the different vaccines. If some vaccines were perceived as more effective than others, a suggestion would be to focus on the underlying beliefs of those particular vaccines. Again, as previously stated, the issue of vaccine-hesitancy is complex and research that unravels some of the interwoven factors is best suited to advance what is known in this field of study [105, 148, 373].

Additionally, the study results found that vaccine-hesitant first-time mothers felt that a benefit was avoiding social conflict with people and places that required vaccines (e.g., schools, physicians, family, and friends) [236, 254]. As other studies have found, mothers felt that vaccine mandates have made it difficult to not vaccinate according to the ACIP schedule [211, 374]. The results found that vaccine-hesitant first-time expectant mothers viewed vaccine mandates for public school and daycare attendance as an infringement on parents' rights to decide what was best for their child. However, the research on parents' perspectives of vaccine-mandates is limited and inconsistent with what this study found. For example, Maltezou et al. [357] found that 81% of the pregnant women in their study agreed with vaccine mandate policies to attend school. However, Maltezou et al. [357] used quantitative methods, included women who had other children, and did not limit the participants to only vaccine-hesitant [357]. A suggestion for future research is to compare the level of first-time expectant mothers' vaccine-hesitancy with the state mandates and exemptions laws in respective states, to see if what other studies have previously found applies to this group [1].

Fear Driven Decision

Fatalism. Vaccine-hesitant first-time expectant mothers were hesitant to make a vaccine decision where the only options had risks. Several mothers called this fatalistic position as being “damned if you do and damned if you don’t”. These results highlight the incredibly difficult position that first-time expectant mothers are in and provide justification for why patience and understanding from healthcare providers is necessary. Furthermore, fatalistic beliefs have not been widely discussed in childhood vaccine-hesitancy literature, however, Vanderpool et al. [375] found that fatalistic beliefs were significant predictors of women not completing the human papilloma virus (HPV) vaccine. It would be interesting to further explore this in future

research to see which direction the fatalistic beliefs lead a mother in the vaccine-decision, “resignation and accepting vaccines” or “resignation and refusing vaccines”.

Fear of the unknown. This study found that vaccine-hesitant first-time expectant mothers were scared of things that were not explicitly tangible. Consistent with Blaisdell [302] et al. and Hulseley [56] unknown ingredients in vaccines were frequently mentioned as a cause to fear vaccines [56, 302]. A suggestion for healthcare providers is to provide as much clarity about the components in a vaccine and their purpose. Future researchers may consider comparing the findings in this study with vaccine-hesitant mothers who have children, to see if fear of the unknown is also a factor for experienced mothers.

Social Pressure and Subjective Normative Beliefs

Modern day mothering. The result of this study found that first-time expectant mothers are unconcerned with how their vaccine decision affects others, or community health. Arguing against Flanigan [376] who compares vaccine-refusers to “Typhoid Mary”, this study found that first-time expectant mothers are not malicious or intentionally threatening community health, rather they are focused only on the assignment of protecting their child, or as Reich [377] refers to as “neoliberal-mothering”, or an intense mothering [376, 377]. Consistent with Peretti-Watel et al. [84] and Berezin et al. [257] mothers no longer consider the village when raising their child, because the village is not responsible if something goes wrong [84, 257]. As others have found, the role of the mother includes being the researcher of health information, the judge of what is truthful, the intuitive when an answer is unclear, and perhaps most impactful to the vaccine decision, the only one responsible if something goes wrong [83, 233, 263, 378].

Additionally, studies frequently refer to “parents” in their vaccine-hesitancy studies, when in actuality the participants are predominantly mothers only [47, 370, 378]. Consistent

with discussion points made by Lee et al. [378] many fathers leave the vaccine decision up to the mother, viewing her as the most qualified and competent of the two to make the decision [378]. Similar to what Carrion [379] found, this study found that mothers' intuition is viewed as a special phenomenon that directs mothers to the right decision in times of uncertainty [379]. In this respect, this study also found that the lack of shared responsibility extends to pharmaceutical companies.

As Peretti-Water et al. [84] discusses, mothers diligently anticipate and control hazards in their child's environment, yet are expected to have faith in a system where they were not involved in production of the vaccines, the safety studies conducted, or legislative mandates stripping their parental rights. Consistent with other studies, this study found that the burden and guilt if a child has an adverse outcome to a vaccine-decision is unequally assumed of the mother [91, 94, 233, 378]. In this aspect, the mothers in this study were already feeling overwhelmed and anxious about making the wrong decision, but on the other hand discussed this distress as an expected thing for all mothers.

The study results show that mothers believed that all mothers were the most competent person to make the vaccine decision. The reasons were that they would know their child the best because they spent the most time with them, had mothers' intuition to direct them to the right decision when they were unsure, and put the most time and effort into researching health decisions. Interestingly, mothers in this study felt that it was important to include other points of view in their decision-making process. However, getting social support was tricky as mothers compared the topic of vaccines was compared to politics and religion, where voicing concerns or opinions provoked confrontation. However, as the mothers in this study explained, talking with the father, their family and friends, and other mothers in Facebook mothering groups about

vaccines, and healthcare professionals was taken into consideration and factored into their personal research. One thing to consider in future research, is further exploring this dynamic to better understand if social influences are continuously present in the ongoing vaccine-decisions, or if they are restricted to part of the initial research. Additionally, some studies suggest that mothers search for vaccine-information in a way that will confirm their own vaccine beliefs [53, 273, 380]. One of the characteristics of the vaccine-hesitant mothers in this study was their undefined position on vaccines. Therefore, in addition to exploring which key words and websites vaccine-hesitant first-time expectant mothers use in their online searches, it would also be interesting to know if some advice is more salient based on who the person giving advice is socially situated [381].

Social consequences. Socioeconomic class was talked about as a determining factor for having the option to not vaccinate according to the ACIP schedule. Some of the vaccine-hesitant first-time expectant mothers in this study felt socially disadvantaged because they could not afford to stay-at-home with their child or afford private schools. In this aspect, it meant that they would be forced to follow vaccine mandates set by their child's daycare and public school, whereas people with more money did not have to follow the same rules. This result supports McNutt et al. [382] findings that children in high-tuition private schools were 20% more likely to have approved personal exemptions. The difference in vaccination choices based on social economic standing was evident in other ways. For example, one participant intended to vaccinate her child in a more affluent neighborhood clinic because their vaccines used premium ingredients. As Berezin et al. [257] states, affluence gives parents the option of vaccinating how they want, while being financially disadvantaged takes away that option. Health equity is often discussed as having equal opportunity to health choices and outcomes [373, 383].

What others are doing. Socioeconomic class was also discussed in relation to outspoken anti-vaccination celebrities. This study found that celebrities were perceived as unrelatable and unrespectable related to the vaccine decision. Mothers felt that celebrities had the luxury of risking not vaccinating because they could afford the best doctors if something went wrong. Freed et al. [384] found that 24% of parents reported some level of trust in vaccine messages shared by celebrities. However, Freed et al. [384] used quantitative methods with parents of children ≤ 17 years of age. Although some studies have found a positive correlation between anti-vaccination celebrities and vaccine-hesitancy [45, 244], this study found that mothers did not value their opinions or report being influenced by their statements. An interesting observation was related to the comments about social influencers rather than celebrities. It was noted that a few participants in this study mentioned social influencers as having greater impact on mothers' vaccine decisions opposed to typical celebrity movie stars. A recent study by Leader et al. [385] talks about the effect of influencers on vaccine-hesitancy, however, this study did not probe deeper into this topic. In a world where socialites are often ranked high in terms of social power and hierarchy, it would be worth exploring whether or not there are differences between types of celebrities (e.g., influencers, movie stars, musicians) and their impact on vaccine-hesitancy [244, 385]. Additionally, mothers in this study believed that their peers' vaccine decisions were influenced by celebrities. This is an interesting finding as it suggests personal acknowledgment of not following others based on their social standing but believing that others do. A suggestion for future research is to consider asking first-time expectant mothers why they believe their peers are influenced in this way. Knowing this would provide insight into how vaccine-hesitant mothers function in the social world and how they perceive others as functioning.

This study also found that vaccine-hesitant first-time expectant mothers felt that most people still choose to vaccinate their child according to the ACIP schedule. A review of the literature indicates that no other study has explored their perceptions in this way, but it does highlight another possible reason that mothers felt that diseases did not pose a significant threat. Believing that others are the “herd” and will protect your unvaccinated child is something that needs to be explored further in research [23, 181].

Vaccine Messages in the Media

Mainstream news. The findings from this study show a difference in how mothers perceived vaccine messages on the news and on Facebook. Vaccine-hesitant first-time expectant mothers thought messages that promoted getting vaccines on the mainstream news was untrustworthy as the content was paid for by pharmaceutical sponsors. These findings could help to explain why Getman et al. [328] found pro-vaccine messages on mainstream media to be ineffective at increasing vaccine confidence in vaccine-hesitant parents [328]. On the other hand, coverage of disease outbreaks (e.g., measles) on the mainstream news were perceived as truthful. Many of the mothers in this study were actively monitoring measles outbreaks on the news and weighing likeliness of an exposure. Interestingly, this dynamic was not the same for Facebook. The logical ebb and flow of how information is shared, perceived, accepted, and influential would normally lead to the assumption that information viewed as unreliable would not influence attitudes, beliefs, and behaviors, as the mothers indicated with news channels. However, the study results show that although vaccine-hesitant first-time expectant mothers did not believe that vaccine-related stuff on Facebook was reliable, it clearly increased their hesitancy. The messages were so impactful that some said they weren’t vaccine-hesitant until becoming pregnant and seeing vaccine-related stuff on Facebook.

These findings support research by Brashier et al. [386] on the power of seeing repetitive messages. Marketing strategies have long understood that the more frequently a person sees a message, the more truthful it becomes [386]. Social media uses algorithms to show mothers stories and advertisements in their newsfeed based on key search words that they have used, or groups that they have joined [77, 387]. Nearly all of the first-time expectant mothers were members of Facebook parenting groups, either locally or based on natural lifestyles (e.g., Young Living Essential Oils, Natural Parenting, Doterra Essential Oils, and Fit Pregnancy). As studies have found alternative and complementary medicine groups have increased vaccine-hesitancy in mothers [127, 231, 388]. This study found that first-time expectant mothers feel uneducated, uninformed in making a vaccine decision, and were seeking vaccine information online. Using key words such as “vaccine”, “vaccine injury”, “MMR” would have generated mostly anti-vaccine media on their personal pages [70, 266, 387, 389]. All participants had seen vaccine information on Facebook which was said to be mostly anti-vaccination. The disproportionate amount of anti-vaccination versus pro-vaccination content on Facebook corroborates Kim et al. [390] findings which showed that 74% of messages on Facebook were anti-vaccination [390]. Consistent with Peretti-Watel et al. [84] although they did not believe stories and posts on Facebook were from reliable sources, they continued to use it and be influenced by what they viewed [84].

Because of the easily available misinformation on the Internet, some have suggested that public health campaigns should allocate funding to increase pro-vaccine messages on Internet sources [391]. Others suggest a more extensive look into what kind of misinformation is allowed to air on the Internet [70, 265, 272, 392]. However, some of the mothers in this study felt that censoring vaccine information on Facebook was an effort to hide the truth of vaccines dangers

from the public. Again, as Bedford [349] and Betsch [350], vaccine-hesitant mothers are more likely to believe information about vaccines is true if it is balanced with the risks. As Dempsey et al. [261] asserts, the Internet has a significant role in vaccine-hesitant mothers' vaccine decisions, thus interventions are encouraged to incorporate the Internet and social media platforms into their design [261, 323]. The findings of this study suggest focusing these efforts on Facebook when working with vaccine-hesitant first-time expectant mothers.

This study found that some first-time expectant mothers in this study believed that pediatricians' medical school training was limited and outdated. This was a reason to discredit future vaccine recommendations from the pediatrician if they were not flexible with an alternative vaccine schedule. There was an observable parallel between how some first-time expectant mothers viewed pro-vaccinators and pediatricians. Both were said to be blindly following a medical tradition of complying with the ACIP schedule without giving thought to it. Although, the belief that physicians are recommending vaccines without knowledge about their make-up, or their function, has been found in other studies [342] this study points to vaccine hesitant mothers ideology that they are free thinkers, while others are followers. However, this result is inconsistent with Danchin et al. [91] and Freed et al. [384] who found mothers trusted physicians' knowledge about vaccines [91, 384]. It is noted, however, that both of the latter studies used quantitative methods with mothers who already had children. It would be interesting to see if the degree of vaccine-hesitancy on the PACV was correlated to the belief that physicians were sheep.

Most of the mothers in this study were planning to use an alternative vaccine schedule, where they would choose which childhood vaccines they would accept, refuse, or delay. Similar to other studies findings, their ability to do this required finding a pediatrician who would

accommodate a schedule different from the ACIP schedule, which was a difficult task [307]. Asking other mothers for recommendations about parent choice physicians was preferred over randomly selecting a physician and asking about their vaccination policy. Additionally, some believed older practicing pediatricians were more likely to have outdated training and less flexibility to work with mothers. Interestingly, this belief is not consistent with Make et al. [353] who found older practicing physicians to be more open to working with parents and less likely to use persuasive language techniques that approach vaccines from a position that assumes the mothers will accept vaccines [353]. It is suggested that future research accurate perceptions about the communication style of longer practicing pediatricians in relation to childhood vaccines. Additionally, although in a review for clinicians Jacobson et al. [15] encourages clinicians to use persuasion and follow-up techniques to encourage parents to vaccinate their children, based on the results of this study this communication strategy would be ineffective and could backfire as Pluvion et al. [393] states.

Social media. There was an expectation to find that most vaccine-hesitant first-time expectant mothers would believe that Facebook was a reliable source of vaccine-information. The pre-study assumption was based on the number of vaccine-hesitant studies that have found this to be the case [123, 342, 394]. However, this was not true for the mothers in this study. This study found that although Facebook is frequently mentioned as a platform for vaccine-related information, mothers did not believe that the information is inherently reliable [393]. Additionally, there was an expectation to find mothers reporting a higher trust in Facebook groups where physicians were active commentators as found by Orr et al. [394]. However, unlike what Orr et al. [394] found, mothers were mostly concerned with what family or friends who were in the medical field would think about them if they made a public post about vaccines

[394]. In this aspect, vaccine-hesitant first-time expectant mothers avoided judgment, or sounding “dumb” by not sharing concerns and thoughts about vaccines publicly on Facebook. As Facebook continues to be a popular platform for social interaction and discussion around many health topics, it is important to understanding the ways that is used by first-time expectant mothers during the vaccine-decision making stage. Knowing this could benefit researchers, particularly those involved in creating digital intervention tools, by guiding them to socially appealing language

Power of the personal story. Vaccine-hesitant first-time expectant mothers favored personal stories from other mothers’ vaccine-decisions and outcomes as a source of information in their personal research [342]. Personal stories have been recognized as an important component to developing communication tools aimed at increasing vaccine confidence vaccine-hesitant parents [60, 278, 283, 359, 369]. These results are somewhat inconsistent with Brunson [64], who found that mothers in the searching phase of the vaccine-decision making process do not value personal advice and opinions from others [97]. However, these inconsistencies could be the result of differences in the study population as Brunson [97] included fathers and didn’t limit participants to vaccine hesitant. Because personal stories had such a profound impact on the mothers in this study, it would be good to explore what it is about the personal stories that makes them so impactful to first-time expectant mothers. A suggestion for future researchers is to consider asking this question to this cohort. Additionally, as other researchers also support, healthcare providers may consider adding a personal stories narrative into their discussions with hesitant mothers [278, 366].

Suggestions for Future Research

Health theory. The purpose of this study was to explore influential factors of vaccine-hesitancy in first-time expectant mothers. It was expected that the participants would be able to explain their reasons for hesitancy in their own richly descriptive words under the scope of the theoretical framework Theory of Planned Behavior (TPB), and two constructs from the Health Belief Model (HBM) (e.g., perceived severity, perceived susceptibility) [254, 395, 396]. These expectations were partially met. First, the TPB asserts that health decisions/behaviors are the result of a linear decision-making process with intentions being the immediate precursor to action. Thus, it was expected that participants would describe a logical flow of attitude, subjective normative, and perceived control leading up to their vaccination intention. However, this study found that this was not the case. Instead, research showed that their intentions to vaccinate were not linear, but instead a dynamic fluctuation between logic, emotions, environment, and spontaneity.

Secondly, the HBM would argue that first-time expectant mother's likelihood of accepting childhood vaccines is explained by the models' constructs (e.g., perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cues to action, self-efficacy). For the purpose of this study, only perceived severity and susceptibility constructs were used as part of the theoretical foundation to explore factors of hesitancy. Consistent with other studies perceived susceptibility and severity of vaccine injury, risk of disease infection, and adverse health outcomes resonated throughout the interviews [96, 290]. Conversely, although the HBM's construct perceived benefits was not initially included in the theoretical foundation for the study, it was found that perceived benefits of vaccination were part of a risk and benefit assessment. Participants talked about the benefit of vaccinating thematically in two ways,

avoiding disease and avoiding social conflict. Interestingly, vaccinating their child according to the ACIP schedule was viewed as normative standard behavior. Diverting from what they believed was the typical vaccine decision, elicited explanations for their reasons not to follow the standard decision but did not elicit the same for following the schedule.

Public Health Implications

COVID-19. The data for this study was collected just prior to the COVID-19 pandemic hitting the US. However, many of the reasons that parents are choosing not to accept a COVID-19 vaccine for their child were found in this study. For example, vaccine-hesitant first-time expectant mothers were opposed to their child receiving vaccines they perceived as newer. As other studies have found, they believed that newer vaccines had not had time to be safely tested and were concerned that their child would be a “guinea pig” [271, 379, 397]. Additionally, this research found that there was a substantial amount of mistrust for pharmaceutical companies, specifically their lack of culpability for injuries and their motives. Furthermore, historically impactful events such as the later retracted Andrew Wakefield’s article published in the Lancet continue to be used as evidence to distrust vaccines [45, 61]. Wakefield has been called a “whistle-blower” for bringing light to the dangers of the MMR vaccine. Similarly, current public figures, such as Joe Rogan, have also been referred to as “whistle-blowers” for speaking out on the dangers of the COVID-19 vaccines [398, 399].

Distrust for COVID-19 vaccines and childhood vaccines are often rooted in similar conspiracy beliefs. Studies such as Burke et al. (2021) have found that belief in conspiracy theories are a predictor of vaccination intentions [400]. Although this study is qualitative and not able to statistically predict vaccination intention, conspiracy beliefs were common among the participants [400]. Additionally, social media has facilitated the spread of misinformation

creating widespread false beliefs in what some call an info-demic [77, 401]. This study found similar results to Cinelli et al. [401] where on one hand the vaccine information on social media is recognized as coming from non-credible sources, but on the other are believed enough to increase vaccine-hesitancy.

Conversely, this research discovered mothers morally objected to childhood vaccines because of a belief that they contained aborted fetal cells. Although the number was small ($n=7$) it is still worth noting as none of the questions in the interview asked about moral objections or about specific ingredients, and this same belief has extended to the COVID-19 vaccine [402]. Researchers have published commentaries explaining the details of two cell lines used in the manufacturing of many vaccines, including Janssen COVID-19 and AstraZeneca vaccines derived from aborted fetuses from 1970 and 1980 [363, 402]. The intent of the commentaries is to provide transparency and dispel misinformation. However, the pandemic has brought this argument to the forefront of discussions like childhood vaccines have not been able to do [403, 404]. With the rise in COVID-19 cases, researchers are discussing how ethical objections to vaccines are infringed upon with removal of religious exemptions across the nation [405].

Additionally, prior to COVID-19 some researchers were suggesting that public health marketing strategies focus on reducing vaccine-hesitancy by changing public dialogue to language that promoted vaccinating to protect the “herd” [257]. Berezin et al. [257] suggested using language such as “We are all in this together” to promote shared responsibility in the vaccine decision [257]. However, this strategy has been found ineffective in public health discourse regarding COVID-19 [406]. Some may point to the culture of individualism as the reason for the ineffectiveness of using this strategy, however, mothers in this study were focused on protecting their child and not their self.

Lastly, this study found that first-time expectant mothers did not perceive all VPD as serious. Non-serious diseases were viewed as not worth the risk of a vaccine injury. Weighing risks versus benefits has also been a significant contributor for the refusal of a COVID-19 vaccine [407]. Importantly, this research found that many of the reasons for not accepting the COVID-19 vaccine were preexisting to the pandemic. Even the politicization of vaccines existed prior to COVID-19 [81]. Thus, public health agents and healthcare providers would benefit from approaching vaccine-hesitancy from an historical perspective instead of a capsulated moment of time. Therefore, it is suggested that the complexity and time-spanning nature of vaccine-hesitancy is best addressed by first understanding the roots.

Limitations

These findings should be interpreted within the study limitations. First, this study included mothers only and thus, cannot be generalized to other types of parents, including fathers, grandparents, or other primary caregivers. Including other types of parents would have given better insight into how societal roles of mothers are perceived by others involved in the health of the child. Second, although Opel et al. [40] developed the PACV survey to identify levels of vaccine-hesitancy using a 15-question survey with a cutoff score of ≥ 50 , this study accepted a score of ≥ 42 and a vaccine-hesitant affirmative on the question “Overall how vaccine hesitant are you?”[41]. Although the first PACV validation study suggested that ≥ 50 was associated with under-immunized children, it was validated with a sample population comprised of a different sample population [316]. For example, Opel et al. [92] validated the instrument on parents who already had toddler-aged children and who lived in the same geographical region. However, this study focused on a demographically different population, first-time expectant mothers residing in various states across the nation. Additionally, a modified version of the

PACV-m was used for this study because the original PACV asks retrospective questions about the vaccine decision.

Third, this study was qualitative which has inherent limitations, such as the inability for findings to generate quantitative results such as the strength of certain beliefs [313]. Fourth, participants were mostly recruited online followed by interviews conducted through video chats. Due to HIPAA standards which protect health information, the study investigator was not able to confirm if participants were indeed pregnant. In that respect, it was assumed that participants were truthful but medical confirmation was not obtained. Fifth, eighteen different states were represented as residency for the study participants. Because state laws vary across the US, these findings, particularly regarding exemption laws and policies, are not generalizable to all states. According to Omer et al. [1] mothers who live in states that allow non-medical exemptions are more likely to be vaccine-hesitant. Therefore, it is possible that the heterogeneity of the state residences could have impacted how some of the participants responded in the interviews. A sixth limitation is the lack of ethnic and racial diversity in the study participants, who were primarily non-Hispanic whites. One of the only two African American participants talked about vaccines that were especially created for the black community as a way to “kill them off”. This has been found in other studies, which leads to the hypothesis that more racially diverse participants would have provided additional data not captured in this homogenous group [408, 409]. Although there weren’t enough comments to meet the subtheme threshold of 25%, it highlights that having a mostly demographically homogenous group has overlooked cultural differences in vaccine-hesitancy.

Lastly, there was a natural desire for first-time expectant mothers to avoid social judgment regarding the vaccine-decision. A number of mothers talked about feeling judged for

decisions they made during pregnancy. Thus, it is possible that they did not truly open up to the full depth of their hesitancy for fear of social judgment.

Conclusion

The focus of this study was to better understand the underlying factors of vaccine-hesitancy in first-time expectant mothers. Most studies looking at vaccine-hesitancy have used quantitative methods, focusing on identifying vaccine-hesitancy, rather than using qualitative methods to learn about the reasons in words and descriptions from first-time mothers [89, 341, 346]. Vaccine-hesitant first-time expectant mothers described characteristics that set them apart from other mothers, and from the pro- and anti-vaccinators. These differences can be used as a point for researchers and healthcare providers to start meaningful and effective discussions. All of the mothers in this study wanted to make the right decision for their child and believed other mothers were motivated by the same. Findings suggest that there is an elevated stress and pressure that is inherent with being a new mom. An overarching theme throughout the interviews was fear that they would make a decision that would harm their child. Related to this was anxiety, stress, and anticipated guilt from having to choose between options that were not risk free. Mothers felt like their unborn child was a stranger and wanted time to get to know them after they were born, before vaccines started. Lack of confidence was a factor in deciding one way or another. Feeling informed would improve their confidence, but finding reliable, unbiased resources was a challenge. Healthcare providers are their number one preferred source of information, but few had received vaccine-information at the point of the interview. Facebook was often used to learn about vaccines, and although it was considered unreliable, the information (particularly personal stories) impacted the mothers' vaccine-hesitancy. In addition, social norms set a standard that good mothers question vaccines. However, this conflicted with

their fears of being dismissed as a patient, being judged as a bad mom, labeled as an anti-vaxxer and were thus, reasons to avoid asking questions. Findings from this study contribute to ongoing justifications to focus on educating prenatal healthcare providers, such as obstetricians, midwives, and doulas [344]. Familiarity with vaccines or diseases is not a well-known factor of vaccine-hesitancy in the literature, and so this study contributes to the limited but promising studies [367]. One of the greatest travesties found in this study is the ongoing struggle of mothers trying to avoid judgment while at the same time, resigning oneself to it. Although expected, it is none the less damaging to the psychological and emotional state of new mothers. Concerns about vaccines causing autism spectrum disorder remain but have shifted from fearing the MMR to a general concern for vaccines and combination vaccines. From this study a number of parallels can be drawn from factors of hesitancy towards childhood vaccines and towards COVID-19 vaccines.

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Appendix A. Recommended Immunization Schedule for Children and Adolescents Aged 18 Years or Younger—United States, 2018

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19-23 mos	2-3 yrs	4-6 yrs	7-10 yrs	11-12 yrs	13-15 yrs	16 yrs	17-18 yrs
Hepatitis B ¹ (HepB)	1 st dose	2 nd dose					3 rd dose										
Rotavirus ² (RV) RV1 (2-dose series); RV5 (3-dose series)			1 st dose	2 nd dose	See footnote 2												
Diphtheria, tetanus, & acellular pertussis ³ (DTaP; <7 yrs)			1 st dose	2 nd dose	3 rd dose			4 th dose				5 th dose					
<i>Haemophilus influenzae</i> type b ⁴ (Hib)			1 st dose	2 nd dose	See footnote 4		3 rd or 4 th dose	See footnote 4									
Pneumococcal conjugate ⁵ (PCV13)			1 st dose	2 nd dose	3 rd dose		4 th dose										
Inactivated poliovirus ⁶ (IPV; <18 yrs)			1 st dose	2 nd dose								4 th dose					
Influenza ⁷ (IIV)																	
Measles, mumps, rubella ⁸ (MMR)																	
Varicella ⁹ (VAR)																	
Hepatitis A ¹⁰ (HepA)																	
Meningococcal ¹¹ (MenACWY-D ≥9 mos; MenACWY-CRM ≥2 mos)																	
Tetanus, diphtheria, & acellular pertussis ¹² (Tdap; ≥7 yrs)																	
Human papillomavirus ¹⁴ (HPV)																	

Appendix B. Theoretical Constructs with Question Path

Construct	Opening Questions, Non-Specific	Prompts
Behavioral Intention	1. How do you intend to vaccinate your child, fully, partially, or not at all?	
Attitude	2. Tell me about how you <i>feel</i> when you think about vaccinating your child. 3. You were able to look at the ACIP schedule that has the listed vaccines and their associated disease that they are meant to protect against. These diseases are called vaccine preventable diseases. I would like you take a moment to think about your child and then to think about those diseases Can you tell me about the emotions and feelings that you are experiencing right now? 4. Can you explain what things have happened in your life that have led you to feel the way that you do about vaccines? 5. Can you explain what things have happened in your life that have led you to feel the way that you do about the diseases that they are intended to prevent?	<i>Can you explain further?</i> <i>Do you have any other feelings or thoughts that are related to vaccines or diseases, that we did not cover?</i>
Subjective Norm	6. Tell me about the <i>people in your life</i> that have impacted how you feel about childhood vaccines. Ex. Significant other, friends, family, co-workers, etc. 7. Imagine that you have to tell all of your family and friends about your	<i>Are there some things that have had a greater impact on your decision, than others?</i> <i>Can you explain further?</i> <i>How so?</i>

	vaccination plans. What would that be like for you? 8. Some people report that their relationship with their health provider (OB, midwife, and/or pediatrician) impacts how they intend to vaccinate their child. Can you explain how your healthcare providers influence your thoughts, feelings, and opinions towards childhood vaccines? 9. Tell me about the kind of relationship that you hope to have with your child's pediatrician? 10. If you would, take a moment to reflect where you are at right now with the vaccine decision. Hypothetically speaking, what could occur that would push you towards accepting all vaccines, without hesitation? 11. Same question reversed, what could occur that would push you towards refusing all vaccines without hesitation? 12. How do you <i>feel</i> about other mothers who choose to refuse all vaccines? 13. How do you <i>feel</i> about other mothers who choose to accept all vaccines? 14. How are you different from these mothers? 15. Think back to the things that you have heard about vaccines on the news, from friends, family, Facebook, etc... From your own experience, what is the overall message that most of them are trying to get across? 16. Other than for medical reasons, what do you think is the MAIN reason that parents choose to NOT vaccinate their children?	<i>Can you tell me about the people that you would avoid sharing this information with? What could occur that would push you towards refusing vaccines without hesitation?</i> <i>Why is that? Can you explain further? What is it about you and your life that makes you different from them?</i> <i>Can you explain how you feel when you see these kinds of messages?</i>
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	17. Fast forward 3 years. Imagine you are at the park with your son/daughter. Other mothers are all around, sitting on benches, taking pictures with their phones, etc..... can you explain how you think the majority of these mothers have chosen to vaccinate? 18. Can you explain how other mothers would view you if they found out that your child was not fully vaccinated? 19. To what degree do celebrities influence peoples' vaccine decisions? What role does the father have in the decision?	
Perceived Behavioral Control	20. How much control do you feel that you have in making the vaccine decision? 21. This next question requires a bit of creativity and imagination. Please take a moment to reflect before answering. Movies tell stories. They usually have a beginning, then middle detail to support or explain the plot, and then a conclusion. If you were the writer, producer, and director of a documentary called "<i>Vaccine Hesitation: The Saga</i>" what would the documentary be like?	<i>How so?</i> <i>What would make it difficult?</i>
Behavioral Intention	22. Do you intend to have your child follow the recommended vaccination schedule?	
Health Belief Model		
Perceived Susceptibility	23. When it comes to vaccine preventable diseases, can you tell me about how likely it is that your child would become infected with one of	<i>Can you explain?</i> <i>How likely do you think it is that this would happen?</i> <i>Can you explain how likely it is that</i>

	the vaccine preventable diseases if he or he were not vaccinated fully?? 24. Can you explain if there are some diseases that are more or less a serious threat than others? 25. Overall, how effective do you <i>believe</i> that vaccines are at preventing the diseases that they are supposed to? 26. How likely do you think that this worst case scenario would actually happen?	<i>this event would actually occur, and/or affect your child?</i>
Perceived Severity	27. When it comes to vaccines can you tell me about your <i>thoughts and/or feelings</i> associated with your child being harmed from whatever decision you make to vaccinate? 28. Are some diseases more serious than others, how so? 29. Are some vaccines more dangerous than others, if so, please explain? 30. What is the worst thing that could happen as a result of your vaccination decision? 31. How likely is it that the worst-case scenario would actually happen?	<i>What about seriousness between the vaccines?</i> <i>How would you feel about your child playing alongside un-vaccinated children?</i> <i>How would you feel about your child playing alongside un-vaccinated children?</i>

Appendix C. Data Collection Instruments

The Parental Attitude on Childhood Vaccines, Modified (PACV-m)

Item	Score
1. Are you expecting your first child? a. Yes b. No	N/A
2. The image above is of the 2018 recommended immunization schedule from the American Committee on Immunization Practices (ACIP). This is the schedule that is endorsed by most pediatricians and schools. As of today, how sure are you that following this vaccine schedule is a good idea for your baby? a. 1-10 scale, Not sure at all-Extremely sure	1, 2, 3, 4= raw score two 5= raw score one 6, 7, 8, 9, 10= raw score zero
3. The image above is of the 2018 recommended immunization schedule from the American Committee on Immunization Practices (ACIP). This is the schedule that is endorsed by most pediatricians and schools. Children get more vaccines than are good for them. a. 1-5 scale, strongly disagree-strongly agree	1, 2 = raw score zero 3= raw score one 4, 5= raw score two
4. The image above shows the vaccines and the disease that they are associated with, according to the 2018 American Committee on Immunization Practices (ACIP), which is endorsed by most pediatricians and schools. I believe that many of the illnesses that vaccines prevent are severe. a. 1-5 scale, strongly disagree-strongly agree	1, 2 = raw score zero 3= raw score one 4, 5= raw score two
5. Please choose the response that best describe you. It is better for my child to develop immunity by getting sick rather than giving them a vaccine to try to prevent the disease. a. 1-5 scale, strongly disagree-strongly agree	1, 2 = raw score zero 3= raw score one 4, 5= raw score two
6. Considering that some vaccines are scheduled to be given at the same time through combination vaccines (i.e. MMR, DTaP, etc.) or given as individual shots at the same doctor's visit, please choose a response that best describes you. It is better for children to get fewer vaccines at the same time. a. 1-5 scale, strongly disagree-strongly agree	1, 2 = raw score zero 3= raw score one 4, 5= raw score two
7. Please choose the response that best describe you. How concerned are you that your baby might have a serious side effect from a vaccine? a. 1-5 scale, Very concerned- Not concerned at all	1, 2 = raw score two 3= raw score one 4, 5= raw score zero
8. Please choose the response that best describe you. How concerned are you that any one of the childhood vaccines might not be safe? a. 1-5 scale, Very concerned- Not concerned at all	1, 2 = raw score two 3= raw score one 4, 5= raw score zero

9. Please choose the response that best describe you. How concerned are you that a vaccine might not prevent the disease? a. 1-5 scale, Very concerned- Not concerned at all	1, 2 = raw score two 3= raw score one 4, 5= raw score zero
10. Do you want your baby to get all the recommended vaccines? a. Yes b. No c. Don't Know	Yes= zero Don't Know= one No= two
11. Please choose a response that best describes you. Overall, how hesitant about childhood vaccines would you consider yourself to be? a. 1-5 scale, Very hesitant- Not at all hesitant	1, 2 = raw score two 3= raw score one 4, 5= raw score zero
12. Please choose a response that best describes you. I trust the information I receive about vaccines from doctors. a. 1-5 scale, strongly disagree-strongly agree	1, 2 = raw score two 3= raw score one 4, 5= raw score zero
13. Please choose a response that best describes you. It is important that I will be able to openly discuss my concerns about vaccines with my child's doctor. a. 1-5 scale, strongly disagree-strongly agree	1, 2 = raw score two 3= raw score one 4, 5= raw score zero
14. All things considered; how much do you trust your doctor? Please answer on a scale of 1 to 10, where 1 is do not trust at all and 10 is completely trust.	1, 2, 3, 4= raw score two 5= raw score one 6, 7, 8, 9, 10= raw score zero
15. Is there one or more of the childhood vaccines that you intend to skip your child having? (Note: this is different than delaying or just getting another time) a. Yes b. No c. Not Sure	N/A

The PACV Raw Scoring Instructions

1. Score each of the 15 PACV survey items (Q3-Q17; see attached scored version of PACV). Hesitant responses are assigned a 2, 'don't know or not sure' a 1, and non-hesitant responses a 0. The two items in which the 'don't know' response was excluded as missing data (Q3 and Q4) are scored as 2 for the hesitant response and 0 for the non-hesitant response.
2. Calculate the raw total PACV score by simply summing each item. The total raw score will range from 0 – 30 if all items have responses.
3. If there is at least one item without a response or Q3 or Q4 are answered as 'don't know' and therefore are excluded as missing data, the total raw score needs to be adjusted. For instance, if

there is one response missing or excluded, the total raw score will range from 0 – 28; if there is two responses missing or excluded, the total raw score will range from 0 – 26; etc.

4. Convert the raw score to a 0 – 100 scale using simple linear transformation accounting for items with missing values (see attached score conversion chart).

PACV Score Conversion Chart

A		B		C	
If both Q3 and Q4 are Yes or No and items Q5-Q17 have no missing responses		If either Q3 or Q4 are Don't Know or Q5-Q17 has one missing response		If both Q3 and Q4 are Don't Know or Q5-Q17 has two missing responses	
Raw Score	Converted Score	Raw Score	Converted Score	Raw Score	Converted Score
0	0	0	0	0	0
1	3	1	4	1	4
2	7	2	7	2	8
3	10	3	11	3	12
4	13	4	14	4	15
5	17	5	18	5	19
6	20	6	21	6	23
7	23	7	25	7	27
8	27	8	29	8	31
9	30	9	32	9	35
10	33	10	36	10	38
11	37	11	39	11	42
12	40	12	43	12	46
13	43	13	46	13	50
14	47	14	50	14	54
15	50	15	54	15	58
16	53	16	57	16	62
17	57	17	61	17	65
18	60	18	64	18	69
19	63	19	68	19	73
20	67	20	71	20	77
21	70	21	75	21	81
22	73	22	79	22	85
23	77	23	82	23	88
24	80	24	86	24	92
25	83	25	89	25	96
26	87	26	93	26	100
27	90	27	96		
28	93	28	100		
29	97				
30	100				

Qualtrics- Consent Form, Demographic Questionnaire, and PACV-M Survey

Q1 Consent Form to participate in a Research Study University of Oklahoma Health Sciences Center (OUHSC) Study Title: An Exploration of Factors Contributing to Vaccine-Hesitancy in First-Time Expectant Mothers: A Qualitative Study Sponsor: Health and Exercise Science: Health Promotion Department Principal Investigator: Dr Marshall Cheney Phone Number: 405-325-5211

you are being asked to participate in a research study. Research studies are voluntary and include only people who choose to take part. This consent form begins with a ‘Key Information’ section to provide important information to help you decide whether or not to participate in this study. More detailed information is provided after the key information. Please take your time, discuss this with family and friends, and ask the investigator and study team any questions you may have. **KEY INFORMATION ABOUT THE RESEARCH STUDY** **Why have I been asked to participate in this study?** You are being asked to participate in this research study because you are at least 13 weeks pregnant with your first child, you consider yourself somewhere in the middle with childhood vaccines, you are a US citizen and you are 18 years old or older. **Why is this study being done and how long will it last?** The purpose of this research is to learn more about why first-time expectant women are hesitant about their future child’s vaccinations. We think that you will be in the study for a couple of hours, which is the predicted length of time that the completion of this online portion and the interview is expected to take. **What will I be asked to do in this study?** You will be asked to complete this consent form, a demographic questionnaire, and a vaccine hesitancy survey, which could take up to 25 minutes to complete. Following the completion and outcome of the consent form, questionnaire, and survey you will then take part in an interview that can be done online through FaceTime, Google Hangouts, Skype, or Facebook Messenger. The interview could take up to 90 minutes, which when combined with the time it takes to complete the online portion, would equal about 2 hours of total participation time for this study.

Why might I want to participate in this study? You may find it helpful to talk about your worries and concerns regarding vaccines. So there could be some aspects of this research that you find personally beneficial. In addition you may find some of the vaccine information helpful if you have not already received this information elsewhere (i.e. vaccine schedule, diseases associated with the vaccines, and recommended age for children to get them, etc.). **Why might I not want to participate in this study?** The risks for your participation in this research are minimal. However, there is some risk that others may find out about how you feel about vaccinations and this could have a negative impact on you. Depending on your situation and specific interpersonal relationships this could potentially cause you emotional or social harm. I will take careful measures to conceal your identity by giving you an alias to use in all written material.

How will participating in the study affect me financially? There are no additional costs to you for participating in this study. You will receive a \$20 Amazon gift Card that can be used at all places that accept Visa. The gift Card will be sent to you through email within 72 hours of completing the interview. Please note that completing this consent form and the surveys hereafter, do NOT alone indicate completion of the study. The gift Card is for participants who

complete this online portion as well as the interview.

DETAILED INFORMATION ABOUT THE RESEARCH STUDY

Who will be in this research? No more than 75 expectant women will take part in this research.

What is involved in this study? If you agree to be in this research, you will be asked to affirm that agreement by signing this form. After that you will be given a questionnaire and a survey (both electronically) that will ask you about who you are and how you feel about vaccinating your child after he/she is born. After these are completed, you may or may not qualify to continue to the interview. I will ask you a variety of questions related to vaccines. I understand that this topic can be emotionally challenging, but I encourage you to be as open and honest as possible. There are no wrong answers.

Can I withdraw from this study? You may withdraw from this study at any time. However, if you withdraw prior to the interview being completed, you will not qualify for the \$20 Amazon gift Card.

What are the risks of this study? There are minimal risks involved in this study. However, depending on your situation, you may have a risk for emotional and psychological distress should someone overhear you participating in the interview. The researcher will always secure a private location to conduct the online interview. Therefore, this risk for emotional harm is entirely dependent on how private and secure the location is where you have chosen to do the interview. You are encouraged to do due diligence when selecting your time and location for the interview.

To what extent will my information be kept confidential? In research reports, there will be no information that will make it possible to identify you. Research records will be stored securely, and only approved researchers and the OU Institution Review Board will have access to the records. However, although the data collected via an online survey system has its own privacy and security policies for keeping your information confidential, no assurance can be made as to their use of the data you provide. You have the right to access the research data that has been collected about you as a part of this research. However, you may not have access to this information until the entire research has completely finished and you consent to this temporary restriction. **What do I do if I am injured?** If you are injured during your participation, report this to a researcher immediately. Emergency medical treatment is available. However, you or your insurance company will be expected to pay the usual charge from this treatment. The University of Oklahoma Norman Campus has set aside no funds to compensate you in the event of injury. **What are my rights as a participant?** Taking part in this study is voluntary. You may choose not to participate. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. If you agree to participate and then decide against it, you can withdraw for any reason and leave the study at any time. You may discontinue your participation at any time, however withdrawing will disqualify you for receiving the \$20 Amazon gift Card. **Do I have any other rights over my data?** Depending on where the sponsor for your study is located and other factors, you may have additional rights over your personal data collected in this study. For example, the European Union General Data Protection Regulation (GDPR) and some state privacy laws might apply. If the GDPR applies, generally you may have

the following rights: 1. the right to request the information collected to be corrected.

2. The right to withdraw your consent for the use of your personal information at any time.
3. The right, in some circumstances, to receive your personal information in a structured, commonly used, and machine-readable format and the right to provide your information to a third party.
4. The right to strict confidentiality of your personal data when it is used/shared.
5. The right to limit the use/sharing of your personal information in certain circumstances.
6. The right under some circumstances to request the erasure of your personal data.
7. The right to file a complaint with a privacy protection regulator if you believe any of the rights above have been violated.

You can receive more information regarding these rights in the Privacy Notice for Research Participants, located on the OUHSC Office of Human Research Participant Protection (HRPP) website at www.compliance.ouhsc.edu/hrpp/OUHSC/For-Participants/Privacy-Notice. If you have any questions and requests, please contact the HRPP Office at 405-271-2045. **Whom do I call if I have questions, concerns, or complaints?** If you have questions, concerns, or complaints about the study or have a research-related injury, contact Dr Marshall Cheney at 405-325-5211. If you cannot reach the Investigator or wish to speak to someone other than the investigator and for questions about your rights as a research participant, contact the OUHSC Director, Office of Human Research Participant Protection, at 405-271-2045.

Q2 Will my identity be anonymous or confidential? Your identity will be concealed, and you will be given an alias in all written and audio recorded material. Your alias will be your initials and the number of participant that you are, *for example*: Diann Chambers’s participant number 34 will be given an alias “DC34”. **Do you agree for the researcher to use your data, as long as it does not contain any identifiable information in future studies?**

☐ YES

☐ NO

Q3 Audio recording of research activities. To assist with accurate recording of your responses, interviews will be recorded on an audio recording device and then transcribed verbatim onto a word document file. All audio recordings will be stored on a password protected electronic device and deleted immediately after the study concludes, which is estimated to be around December 2019. You have the right to refuse to allow such recording without penalty. I consent to audio recording.

☐ YES

☐ NO

Your data storage. With the exception of your audio recording, your data and information will be transferred from this software site to an USB flash drive for secure storage for three years following the completion of this study. However, the researcher may want to review your information for six years which is a longer period of time. This could be valuable, especially if

you have consented to being contacted in the future, should the researcher be interested in finding out your actual vaccine choice after your child has been born.

- ☐ I wish for the researcher to retain my data and information for **three years and NO longer**.
- ☐ I give my consent for the researcher to retain my data and information for **six years instead of three**.

Will I be contacted again? The researcher would like permission to contact you again to see how you have decided to vaccinate your child. Your agreement for future contact is not a requirement for your participation in this study. You may choose to participate in this study and also choose to **NOT** be contacted in the future. In order for you to be contacted in the future, your name and contact information will be retained for six years, instead of the typical three years following the completion of the study.

- ☐ I give my consent for the researcher to contact me in the future.
- ☐ I do **NOT** give my consent to be contacted after this study concludes.

Future contact: You have indicated that it is OK for the researcher to contact you in the future. If this is not what you wanted, you may go back to the last question and check "NO". Please fill in your preferred email address or phone number for the researcher to contact you in the future.

Is it okay for you to receive text messages at the number that you provided?

- ☐ It is okay for someone from the research team to text me for this current research **ONLY**
- ☐ It is okay for someone to text me for this current research **AND** in the future. (Note: this is only if you have already given permission to be contacted in the future)
- ☐ It is **NOT** okay for anyone from the research team to ever text me.

Participants that complete the study will be sent a \$20 Amazon gift Card within 72 hours from the time they have completed the interview. Which email address would you prefer this sent to?

Please write your email address in the box below.



If you consent to participating in this study, please check the box below. If you do not wish to continue with the study, you may exit this screen without consenting below and your information will be deleted.

☐

I have read this consent form and I agree to participate in the study

By signing this form, you are agreeing to participate in this research study under the conditions described. You have not given up any of your legal rights or released any individual or entity from liability for negligence. You have been given an opportunity to ask questions. You will be given a copy of this consent document. **If you agree to participate, please sign your name below.**

Please print your first and last name:

Please print the date as of today:

End of Block: Consent

Start of Block: Hi.

What is your first and last name?

Are you expecting your first child?

☐ Yes

☐ No

Using your cursor, or your finger if you are on a touchscreen, please slide the bar to the correct number. There are approximately four weeks in each month. About how many weeks are you pregnant? (*Ex. 4 months=12 weeks*)

0 10 20 30 40 50 60 70 80 90 100

Weeks pregnant	
----------------	--

Using your cursor, or your finger if you are on a touchscreen, please slide the bar to your current age as of today.

0 10 20 30 40 50 60 70 80 90 100

Years old	
-----------	--

Which ethnicity do you most closely identify with?

- ☐ Native American
- ☐ African American/ Black
- ☐ Asian
- ☐ Middle Eastern
- ☐ Pacific Islander/ Native Hawaiian
- ☐ Hispanic or Latino
- ☐ Caucasian/ White
- ☐ Other

What is your highest level of *completed* education?

- ☐ Some high school, did not finish
 - ☐ High school diploma
 - ☐ Some college, no degree
 - ☐ Associate degree (e.g., AA, AS)
 - ☐ Bachelor's degree (e.g., BA, BS)
 - ☐ Master's degree (e.g., MA, MS, MEd)
 - ☐ Professional degree (e.g., MD, DDS, DVM)
-

What is your current employment status?

- ☐ Employed full time (40 or more hours per week)
 - ☐ Employed part time (up to 39 hours per week)
 - ☐ Unemployed and currently looking for work
 - ☐ Unemployed and not currently looking for work
 - ☐ Student
 - ☐ Homemaker
 - ☐ Self-employed
 - ☐ Unable to work
 - ☐ other
-

Sometimes it is difficult to know how much income your household makes. That's OK. If you are comfortable, please choose the answer that is closest to what you believe reflects your household's gross annual income. (**note: This information is confidential*)

- ☐ Less than \$20,000
 - ☐ \$20,000 to \$34,999
 - ☐ \$35,000 to \$49,999
 - ☐ \$50,000 to \$74,999
 - ☐ \$75,000 to \$99,999
 - ☐ \$100,000 to \$114,999
 - ☐ over \$115,000
 - ☐ I prefer to not answer
 - ☐ I do not know
-

What is your current relationship status?

- ☐ Single
 - ☐ Not married, but in a relationship and living separate
 - ☐ Not married, but in a relationship and living together
 - ☐ Married, or in a domestic partnership and living together
 - ☐ Married, or in a domestic partnership and living separate
 - ☐ Widowed
-

If you are employed, which option best describes the field for your employment? (****note: If you are not employed, answer "not applicable"***)

- ☐ Not applicable
 - ☐ Health provider
 - ☐ Business and finance
 - ☐ Education
 - ☐ Computer
 - ☐ Construction
 - ☐ Sales
 - ☐ Management
 - ☐ Clerical (office)
 - ☐ Industrial
 - ☐ Homemaker
 - ☐ Communications
 - ☐ Psychology
 - ☐ Law enforcement/ judicial system
 - ☐ Military
 - ☐ Veterinary
 - ☐ other
-

By clicking and dragging please organize these responses in rank order of which you would seek vaccine information about from 1st to last (#1 indicating your first go-to resource and #8 being the last resource that you would use to find answers).

- _____ Physician or health provider in person (i.e., family physician, OB, gynecologist, nurse practitioner, physician assistant, etc.)
- _____ Physician online (i.e., Ask a Doctor online, Doctor Live Chat, InstaDoctor, etc.)
- _____ Family members and friends in person
- _____ Family members and friends online (i.e., Facebook, Twitter, Instagram, SnapChat, etc.)
- _____ Online search (i.e., Google, Yahoo, Bing, Ask.com, etc.)
- _____ Book (i.e., dictionary, medical reference book, pregnancy book, etc.)
- _____ Newspaper or magazine
- _____ Call companies and resources directly (i.e., 1-800 numbers on medicine bottles, American Heart Association, etc.)

Do you have religious beliefs that prevent you or your future children from receiving medical care/treatments, such as vaccines?

- ☐ Yes
 - ☐ No
 - ☐ Somewhat
-

To the best of your knowledge, do you or your child have any suspected medical condition that would prevent either of you from being able to receive vaccines?

- ☐ Yes
- ☐ No
- ☐ Maybe

End of Block: Hi.

Start of Block: Block 1

Are you expecting your first child?

☐ Yes

☐ No

1. The image above is of the 2018 recommended immunization schedule from the American Committee on Immunization Practices (ACIP). This is the schedule that is endorsed by most pediatricians and schools. As of today, how sure are you that following this vaccine schedule is a good idea for your baby?

2. The image above is of the 2018 recommended immunization schedule from the American Committee on Immunization Practices (ACIP). This is the schedule that is endorsed by most pediatricians and schools.

	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
Children get more vaccines than are good for them.	☐	☐	☐	☐	☐

3 The image above shows the vaccines and the disease that they are associated with, according to the 2018 American Committee on Immunization Practices (ACIP), which is endorsed by most pediatricians and schools.

	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
I believe that many of the illnesses that vaccines prevent are severe.	☐	☐	☐	☐	☐

4 Please choose the response that best describes you.

	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
It is better for my child to develop immunity by getting sick rather than giving them a vaccine to try to prevent the disease.	☐	☐	☐	☐	☐

5 Considering that some vaccines are scheduled to be given at the same time through combination vaccines (i.e., MMR, DTaP, etc.) or given as individual shots at the same doctor's visit, please choose a response that best describes you.

	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
It is better for children to get fewer vaccines at the same time.	☐	☐	☐	☐	☐

6 Please choose a response that best describes you.

	Very Concerned	Somewhat Concerned	Not sure	Not Too Concerned	Not Concerned at All
How concerned are you that your baby might have a serious side effect from a vaccine?	☐	☐	☐	☐	☐

7 Please choose a response that best describes you.

	Very Concerned	Somewhat Concerned	Not sure	Not Too Concerned	Not Concerned at All
How concerned are you that any one of the childhood vaccines might not be safe?	☐	☐	☐	☐	☐

8 Please choose a response that best describes you.

	Very Concerned	Somewhat Concerned	Not sure	Not Too Concerned	Not Concerned at All
How concerned are you that a vaccine might not prevent the disease?	☐	☐	☐	☐	☐

Do you want your baby to get all the recommended vaccines?

- ☐ Yes
- ☐ No
- ☐ Don't know

10 Please choose a response that best describes you.

	Very Hesitant	Somewhat Hesitant	Not sure	Not Hesitant	Not Hesitant at All
Overall, how hesitant about childhood vaccines would you consider yourself to be?	☐	☐	☐	☐	☐

11 Do you intend to delay any of the recommended childhood vaccines? (Not including seasonal flu)

- ☐ Yes
- ☐ No
- ☐ Not sure

12 Please choose a response that best describes you.

	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
I trust the information I receive about vaccines from doctors.	☐	☐	☐	☐	☐

13 Please choose a response that best describes you.

	Strongly Disagree	Disagree	Not sure	Agree	Strongly Agree
It is important that I will be able to openly discuss my concerns about vaccines with my child's doctor.	☐	☐	☐	☐	☐

14. All things considered; how much do you trust your doctor? Please answer on a scale of 0 to 10, where 0 is do not trust at all and 10 is completely trust.

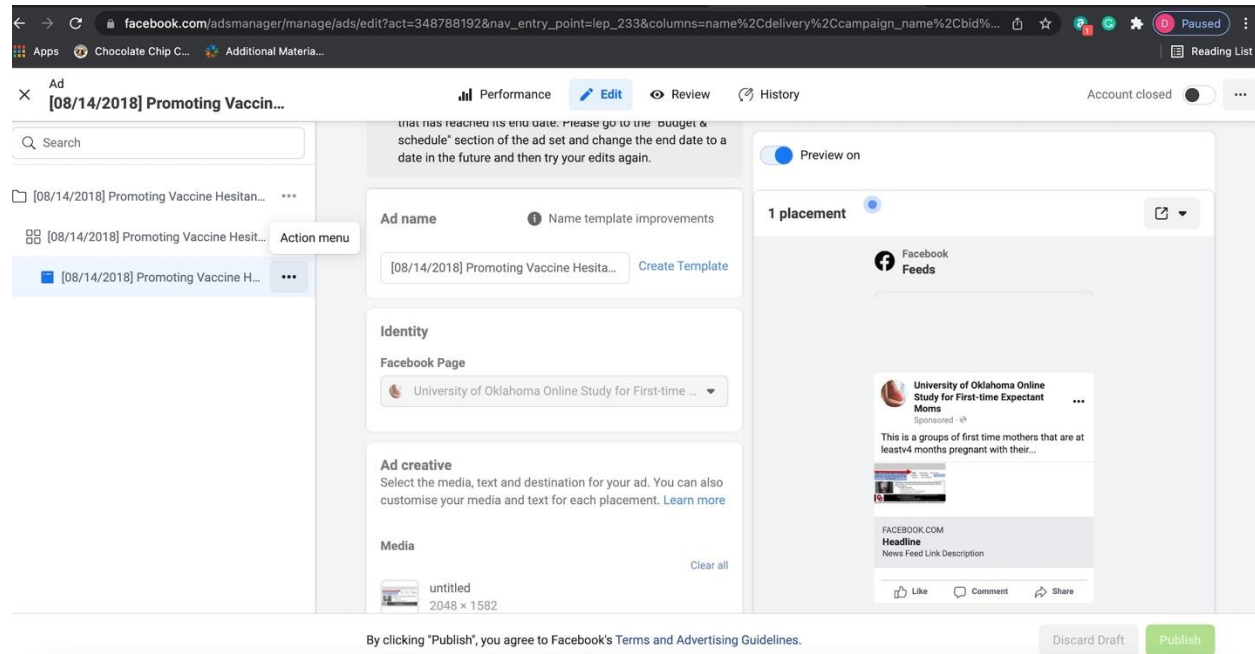
15 Is there one or more of the childhood vaccines that you intend to skip your child having? (Note: this is different than delaying or just getting another time)

- ☐ Yes
- ☐ No
- ☐ Not sure

End of Block: Block 1

Appendix D. Recruitment Material

Facebook Ad



Craigslist Posting

CL

reply

Posted 3 years ago

Pregnant With Your First Child? Enroll In A Study

Hello!
Thank you for your interest in this study.

I am a Ph.D. student at the University of Oklahoma.

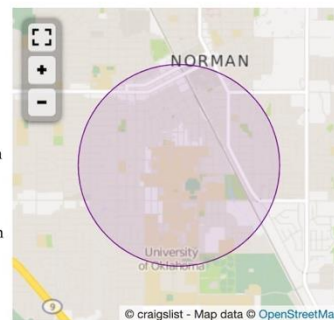
I am interested in learning more about how first-time expectant mothers feel about childhood vaccines. I understand that because you have not yet had to make a decision about your child's vaccines, you may or may not feel prepared to talk about them. However, this is exactly the reason that I want to hear from you!

About the Study:

- ◆ The study is a combination of an online survey and a one-time video interview (usually through FaceTime, Google Hangouts, FaceTime Messenger, or Skype).
- ◆ The interview takes on average 45-55 minutes and the online consent form + surveys takes about 10-15 minutes.
- ◆ Participants will receive a \$20 Amazon Gift Card shortly following the interview.

Interested and want more information?
Email dayers@ou.edu to get started. Please include answers to the following questions in your email.
Thanks!!

1. Are you pregnant with the first child that you will bring to term?
2. Would you consider yourself pro-vaccines, anti-vaccines, or somewhere in the middle? (pick one)
3. Are you a US citizen?
4. What is your age as of today?
5. What is a good contact number, day, and time that you are available for the interview?



Flyer

Facebook Page

The screenshot shows a Facebook page for the 'University of Oklahoma Online Study for First-time Expectant Moms'. The page is currently in a 'draft' state, indicated by a banner at the top that says 'This Page isn't visible. You can publish it when you're ready for people to see it.' and a 'Publish Page' button. The page header includes the profile picture (a pregnant woman), the page name, and the handle '@dannielleayers2019 · Educational research centre'. Below the header, there are tabs for 'Home', 'Reviews', 'Videos', 'Photos', and 'More'. The left sidebar shows the 'Manage Page' section with options like 'Meta Business Suite', 'Inbox', 'Planner', 'Publishing Tools', 'News Feed', and 'Business apps'. The main content area features a 'Page tips' section with a link to 'Get personalised ad recommendations for University of O...', a 'Free Facebook Business tools' section with a link to 'Add Appointment Bookings', and a 'Create Post' section with options for 'Photo/video', 'Get Messages', and 'Feeling/Activity'. A post from the page is visible, dated '1 April 2019', with the text: 'Are you pregnant with your first child? I am looking for first-time expectant mothers to interview about vaccines for my dissertation. I am really interested in those who are somewhere in the middle of...'. The URL at the bottom of the page is 'https://business.facebook.com/latest/content_calendar?asset_id=22908163782...'.

Facebook

Search Facebook

Home

9+

3

Dannielle

2

Manage Page

University of Oklahoma Online Study for First-time Expectant Moms

Meta Business Suite

Inbox

Planner

Publishing Tools

News Feed

Business apps

Home

News Feed

Messenger tools

Promote

This Page isn't visible. You can publish it when you're ready for people to see it.

Publish Page

Edit

University of Oklahoma Online Study for First-time Expectant Moms

@dannielleayers2019 · Educational research centre

Edit Send Message

Home Reviews Videos Photos More

Promote

Page tips

See all (1)

Get personalised ad recommendations for University of O...

Learn which types of ads are recommended for University of O... by answering a few quick questions.

Get Started

Create Post

Photo/video Get Messages Feeling/Activity

Create Live Event Job Offer ...

University of Oklahoma Online Study for First-time Expectant Moms

1 April 2019 ·

Are you pregnant with your first child? I am looking for first-time expectant mothers to interview about vaccines for my dissertation. I am really interested in those who are somewhere in the middle of...

https://business.facebook.com/latest/content_calendar?asset_id=22908163782...

University of Oklahoma Mass Email



Hello!

Thank you for your interest in this study.

My name is Dannielle Ayers and I am a doctoral student in the Health and Exercise Science: Health Promotion Department at the University of Oklahoma. I am interested in learning more about how first-time expectant mothers feel about childhood vaccines. I understand that because you have not yet had to make a decision about your child's vaccines, that you may or may not feel prepared to talk about them. However, this is exactly the reason that I want to hear from you!

About the Study:

- Participants are only required to meet one time for this study. It is a mixture of online surveys and either face-to-face interviews (local only), or through online video calls (i.e. Skype, Google Hangouts, or FaceTime).
- The study will take approximately 2 hours to complete.
- The purpose of this study is NOT to persuade you to make a decision about vaccines.
- The purpose is only to listen and learn from you.
- You will need 2 electronic devices and an Internet connection to participate in the video interview for this study (Ex. iPad, smart phone, laptop, tablet, or desktop).
- Participants will receive a \$20 Amazon Gift Card after the interview has been completed.

If you don't mind, it is important that I get some important information from you. Please take a moment to respond to all of the following questions:

1. What city and state do you live?
2. Is this your first pregnancy?
3. Would you consider yourself pro-vaccines, anti-vaccines, or somewhere in the middle? (pick one)
4. What is your age as of today?
5. What is a phone number that you can be reached?
6. When is a good day and time that you can be contacted about this study?

Dannielle Ayers, doctoral candidate
University of Oklahoma
Department of Health and Exercise Science
1401 Asp Avenue, Huston Huffman Center
Norman, Oklahoma 73019
fax: [405-325-0594](tel:405-325-0594)



Appendix E. Screener Email



Welcome and thank you for your interest in this study.

Hello! My name is Dannielle and I am a doctoral student at the University of Oklahoma. I am interested in learning about how first-time expecting moms feel about childhood vaccines. I know that you have not had to make the decision yet, as you are currently pregnant with your first child. That is exactly why I want to hear from you.

About the study:

- Participants are only required to meet one time for this study. It is a mixture of online surveys and either face-to-face interviews (local only), or through online video calls (i.e. Skype, Google Hangouts, or FaceTime).
 - The study will take approximately 2 hours to complete.
 - The purpose of this study is NOT to sway you towards one way or another for vaccines.
 - The purpose is only to listen and learn about your thoughts on childhood vaccines.
 - You will need 2 electronic devices and an Internet connection to participate in video interviews for this study (Ex. iPad, smart phone, laptop, tablet, or desktop).
- laptop, tablet, or desktop).
- Participants that complete the study will receive a \$20 Amazon gift card.

!!!!!! If you don't mind, it is important that I verify your email address. Please take a moment to respond to all of the following questions in an email message to me. !!!!!

1. What is your age as of today?
2. What city and state do you live in?
3. Excluding this one, how many other pregnancies have resulted in live births?
4. How many weeks pregnant are you?
5. What is a phone number that I can reach you at? (note: this will not be shared or distributed to anyone else)
6. Do you consider yourself pro-, anti-, or somewhere in the middle of childhood vaccines?

Thank you and I look forward to hearing from you!