THE IMPACT OF SOCIAL MEDIA USE ON MATERNAL VACCINATION DECISIONS

by

Natalie Flynn

Liberty University

A Dissertation Presented in Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

Liberty University

2024

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APPROVED BY:

Dr. Laurel Glover, Committee Chair

Dr. Lindsay Egli, Committee Member

Dr. Sheila Davis, Committee Member

ABSTRACT

This quantitative study aimed to explore the impact of social networking sites (SNS) on maternal vaccination decisions. Utilizing purposive sampling, the study ensured a representative sample of mothers or expectant mothers over 18 years old, with at least one child under 18, residing in the United States. Participants completed a composite survey consisting of three individual surveys assessing social media usage, vaccination decisions, and information-seeking behaviors. Descriptive statistics were employed for comprehensive analysis, investigating the influence of accessing social media platforms on maternal COVID-19 vaccination decisions. The Shapiro-Wilk test assessed the normality of age, while frequencies, percentages, median, and interquartile range (IQR) were calculated for household income, an ordinal-level variable. Frequencies and percentages were reported for all nominal and ordinal-level demographics. The results of the study indicate that mothers aged 30-39, married, with some college education, full-time employment, and higher household incomes, particularly those using Facebook, X, and Instagram, spend 30-59 minutes daily accessing health-related information. Additionally, these mothers exhibit increased confidence in vaccination benefits, heightened concern about vaccination risks, and enhanced perceived self-efficacy in vaccination decision-making.

Keywords: social networking sites (SNS)

Acknowledgments

I extend my heartfelt gratitude to my dissertation committee for their invaluable support and guidance throughout the completion of my dissertation. I am deeply appreciative of Dr. Glover for her unwavering assistance, encouragement, and wealth of knowledge shared with me during this dissertation journey. I am also indebted to Dr. Egli for her expertise in the influence of social media on mental health, which greatly enriched my work. Additionally, I am thankful to Dr. Davis for her insights into maternal and child health, which significantly contributed to the depth of my research. I am forever grateful for the help and support provided by my dissertation committee during this challenging endeavor.

I would like to also express my sincere appreciation to the participants who generously volunteered to be part of this study, thus contributing to the expansion of knowledge on social media's impact on maternal vaccination decisions. Lastly, I extend my thanks to the administration for their supportive role throughout this process, which has played a crucial part in my success.

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CHAPTER ONE: INTRODUCTION

Overview

In recent years, people increasingly used social media and the internet to gather information, prompting interest in the association between social media usage and attitudes toward public health interventions, notably COVID-19 vaccinations (Cascini et al., 2022). Understanding the threat posed by anti-vaccination campaigns on social media is imperative, given the need to sustain global immunization programs (Wilson & Wiysonge, 2020). Scientists and healthcare professionals have raised concerns about the impact of the COVID-19 pandemic on pediatric and adolescent immunization rates. Routine vaccination programs have been significantly disrupted in at least 68 countries, affecting more than 80 million children worldwide, primarily in developing nations, according to the World Health Organization (WHO) (Seyed-Alinaghi et al., 2022).

Public health officials use social media for epidemic surveillance, including information tracking, identification of potential outbreaks, emergency management, and measurement of disease awareness and responses to official health communications (Fung et al., 2015). However, as the pandemic has progressed, misinformation about vaccinations via social media has risen, making it more difficult to distinguish between fact and fiction and compromising vaccine coverage (Al-Uqdah et al., 2022). Mothers, whom society views as the family's primary healthcare decision-maker, should be targeted to increase vaccine uptake (Al-Regaiey et al., 2021). The importance of determining the influence of social media on maternal vaccination decisions cannot be overstated, given that the negative impacts of social media primarily affect women (Qadir, 2021). Research is necessary to understand social media’s role in healthcare decisions and the impact on maternal attitudes and beliefs. The benefit of a foundational

understanding of this topic is to ensure that mothers are provided with accurate healthcare information to make informed decisions regarding their children's health. To ensure a full exploration of the topic, the remainder of this chapter will introduce the relevant background information, a social and theoretical context overview to support further the study's significance, the research questions guiding this study, and applicable terms and definitions.

Background

With social media usage among U.S. adults increasing from 50% in 2011 to 72% in 2021, concerns about how this may influence parents' decisions to vaccinate their children exist (Pew Research Center, 2021). Although anti-vaccination advocates' methods of communication have changed because of the internet, the attitudes and beliefs that underpin vaccination rejection have remained consistent. The development of digital technology has transformed how society interacts, establishes connections, shares information, and upholds beliefs. Because there are few barriers to using these digital tools, regular internet users can publish and disseminate anti-vaccine content online (Germani & Biller-Andorno, 2021). While early opponents of vaccination were solo activists seeking to convince others of the dangers of vaccines, social networks now allow these individuals to connect with like-minded people online, validate their anti-vaccination beliefs, and spread divisive content. Today, shrewd marketing operations purposefully take advantage of racial minorities' past frustrations with governmental healthcare organizations to help anti-vaccine activists spread mistrust of vaccines in communities of color.

Opponents of vaccination play on the public's concerns that vaccine components are artificial and dangerous. Many of these online marketing campaigns specifically target mothers, who are typically the primary caregivers for children. Vaccine hesitation among parents appears to be increasing despite the effective strategies to prevent or lessen the prevalence of infectious

diseases (Baker & Walsh, 2022).

Mothers frequently play a significant role in making decisions regarding their children's health care, including immunization (Kyprianidou et al., 2021). Although a mother may choose not to vaccinate her child for several reasons, there is rising evidence linking the use of social media as a health information resource to vaccine refusal or reluctance (Al-Regaiey et al., 2021). Mothers are among the most vocal opponents of vaccinations and are frequently singled out by the anti-vaccination movement on social media (Baker & Walsh, 2022). Accurately assessing the prevalence of maternal vaccine hesitancy requires an investigation of the circumstances influencing their decisions.

Personal beliefs, religious beliefs, mistrust in medical professionals, lack of confidence in scientific research, safety concerns, and the increased use of social media may all play a significant role in international vaccine coverage (Waring et al., 2022). In addition to examining the multifactorial causes of vaccine hesitancy amongst mothers, future approaches to increase immunizations should address the spread of misleading information by targeting the anti-vaccination community on social networking sites (SNS).

Historical Context

The 18th century saw the earliest instances of vaccine resistance. Over the years, several vaccination debates have been due to the opposition of legal, political, and religious groups (Hussain et al., 2018). The phrase "anti-vax" was first used to characterize smallpox vaccine reluctance in England in the early 1800s (Gallegos et al., 2022). The word "vaccine" comes from the Latin word *vacca*, translated as "cow" in English. During the 1800s, cowpox material simulated an immune response against devastating smallpox infection. This discovery is the first communicable disease vaccination program that effectively stopped infection and spread of the

pathogen (Roberts et al., 2022). Despite the vaccine's long history of effectiveness, several political parties and religious groups joined the anti-vaccination movement to question the legitimacy of the smallpox vaccine, with an emphasis on its creation and composition (Gallegos et al., 2022).

Between 1900 and 1998, the development of vaccines for diseases such as poliomyelitis, pertussis, yellow fever, tetanus, and tuberculosis resulted in a considerable decrease in childhood mortality from 61.6% to 2% (Bhatia et al., 2019). In the 1950s, poliomyelitis, a paralytic disease often impacting children, was a severe public health concern. Following the release of the Salk vaccine in 1954, poliomyelitis cases in the U.S. decreased from 13.9 cases per 100,000 people to 0.5 cases per 100,000 in 1965 (Ehrenfeld et al., 2009). Increased global public support of vaccines followed the eradication of endemic poliomyelitis in 1970. The last case of domestically acquired poliomyelitis was recorded in 1979 (Modlin et al., 2021). Nonetheless, concerns regarding the vaccine’s effectiveness and general safety have persisted (Nuwarda et al., 2022).

Approximately 229.8 million people aged five years or older, which accounts for over 69.2% of the U.S. population, have received the COVID-19 primary vaccine series (Centers for Disease Control and Prevention [CDC], 2023). In addition, more than 52 million (15.8%) have received additional doses or the booster, which were advised for immunosuppressed individuals in August 2021, all individuals aged 65 or older in September 2021, and all individuals aged 18 or older in November 2021 (Mbaeyi et al., 2021). A cross-sectional study conducted to examine COVID-19-associated hospitalization amongst vaccinated and unvaccinated U.S. adults revealed that unvaccinated individuals were 10.5 times more likely to be hospitalized for COVID-19-related illnesses. In addition, vaccinated individuals without a booster dose were 2.5 times more

likely to be hospitalized than those who received a booster dose (Havers et al., 2022). Vaccination against COVID-19 averted 14.4 million deaths in 185 countries and territories between December 2020 and December 2021 (Watson et al., 2022).

Despite the COVID-19 vaccine's remarkable accomplishments, several countervailing concerns still jeopardize mass vaccination. United States public health professionals can be better prepared to respond to impending pandemics and epidemics by identifying vulnerable populations and comprehending human behaviors. Given American history, myths regarding vaccinations will continue to endanger global health, despite the abundance of scientific data demonstrating their effectiveness. Also, social media will continue disseminating health information to individuals with low health literacy. Accordingly, it is crucial to analyze the impact of social media utilization on health choices and outcomes (Gallegos et al., 2022).

Social Context

Social media usage has significantly increased recently, particularly among young adults. Eighty-eight percent of Americans between 18 and 29 use social media, with Facebook and Instagram accounting for 80% and 71% of this usage, respectively (Ilakkuvan et al., 2019). In 2018, an estimated 2.23 billion monthly active users on Facebook, of which 54% were between 18 and 34 (Wilson & Stock, 2021). Particularly noteworthy is the rise in the time adolescents and young adults spend on SNS, e-games, texting, and other online activities. In 2020, due to enforced lockdown orders and social distancing strategies implemented in response to the COVID-19 pandemic, the average time U.S. users spent on social media increased to 65 minutes daily compared to the previous year with an average of 54 minutes daily (Dixon, 2022).

Parents use social media platforms to obtain health-related information, including preconception health advice and pregnancy-related information (Skouteris & Savaglio, 2021).

Mothers use social media more frequently than the broader adult population. Only 69% of all American adults use Facebook, whereas 79% of parents and 87% of mothers use this platform (Waring et al., 2023). Additionally, according to a 2018 Pew Research Center survey, 11% of adults altered their health-related because of what they saw on social media (Moon et al., 2019). Women of childbearing age are more inclined to consult social media for advice on newborn care. They may regard the information found as more trustworthy than recommendations from friends, family, and medical professionals (Moon et al., 2019).

Social media can provide a platform to express ideas, debate viewpoints, and obtain new knowledge. Creative expression can help younger individuals feel self-assured and confident in their daily lives. Experiencing global exposure can also help one learn about various cultures, traditions, languages, lifestyles, and eating customs. Users with social media access can easily retrieve information, making it simple to acquire learning materials, adapt their views as necessary, and share it effortlessly (Akram & Kumar, 2017). Through numerous SNS like Facebook, Pinterest, and Instagram, students can share information and learn from various educational sources (Ansari & Khan, 2020). In addition, most university students in the modern era follow many academic websites on SNS to engage themselves with the university's community and form professional connections. The more actively students participate in collaborative learning through social media, the more open discussions they initiate with their peers. This engagement can improve students' academic achievement (Oguguo et al., 2020). Among 360 undergraduate students in Eastern India, a 9.72-point increase in academic performance occurred with a 10% increase in social media utilization (Ansari & Khan, 2020). Implementing social media within an academic setting enables students to connect dynamically and creatively with instructors globally, encountering interactive, improved techniques for

learning (Ansari & Khan, 2020).

Social media has changed its users' individual and societal behavior in addition to group interaction (Ostic et al., 2021). Increased connectivity, enhanced learning opportunities, updates on current events, advertising, charities, and other noble causes are just a few of the beneficial aspects of social media (Akram & Kumar, 2017). Keum et al. (2020) revealed that most teens who utilized social media reported feeling more connected to their peers, engaged with a broader range of people, and felt supported by their online communities. Social media may encourage improved well-being among gender minority groups by offering outlets for identity exploration resources related to lesbian, gay, bisexual, and transgender (LGBT) topics (Craig et al., 2021). Additionally, research has demonstrated how increased interaction with personal social media content could develop self-knowledge and a stronger sense of continuity between one's present and past selves (Keum et al., 2022). These findings highlight the potential for social media platforms to prompt reflection.

On the contrary, social media can harm society, tarnishing reputations, facilitating hacking, acting as a platform for cyberbullying, reinforcing addictive behaviors, and increasing the risk of fraudulent activity (Akram & Kumar, 2017). The addictive nature of Facebook and other SNS may be responsible for detrimental psychological effects. Social media encourages individuals to critique issues and inadequacies (Damota, 2019). Research supports the claim that social media can increase a person's risk of developing depression or anxiety when misused (Karim et al., 2020). Passive social media use, such as reading posts, is more strongly linked to depression than active use, such as posting personal content. Social media is a prevalent source of stress for its users. Among 7,000 users of Facebook, 42% reported stress related to their use of the site (Damota, 2019). Furthermore, adrenaline is released when an individual continuously

monitors SNS for new messages or content (Damota, 2019). The detrimental psychological consequences of social media utilization increase with excessive use.

Theoretical Context

Due to prevalent use and influence, research on social media has recently become a particularly fruitful area of study. A review of factors prompting social media use determined that the primary motivators of users include upholding relationships, tracking what is happening in others' lives, and reducing stress. Follow-up studies demonstrated correlations between habits and phenomena such as anxiety, depression, and diminished well-being (Shaw et al., 2015). This newly formed peer-reviewed research on social media mirrors previous arguments regarding the compulsive use of emerging technology (Singh et al., 2020; Benson et al., 2018; Aladwani et al., 2016).

A broad theoretical framework does not currently explain user behavior on social media due to methodological bias and weak integrative theoretical frameworks in existing research (Muthukrishna & Henrich, 2019). An integrative theoretical framework allows researchers to conclude from general premises. A broad theory needs to support the findings within a study to be meaningful, as is the case with cumulative social media research (Muthukrishna & Henrich, 2019). As such, the social capital theory, the uses and gratification theory (UGT), the presentation of self-theory, and the Health Belief Model (HBM) have all contributed to the phenomenon of social media influence and empirical research.

The social sciences have utilized the social capital theory to explain social groupings and interpersonal relationships since 1916 when Lyda Hanifan first proposed the idea. Social capital, a subset of intellectual capital, can refer to giving social interactions worth. In the early 20th century, social capital described the importance of social networks. Later, the theory was

employed to understand socioeconomic inequalities. Social capital has recently been applied to social media (Carmichael et al., 2015). Connections between social media usage and perceived individual social capital because of the Web 2.0 era and the following SNS creation will be further examined (Poecze & Strauss, 2020). Understanding the underlying motives for using such platforms is crucial.

Empirical research validates the relevance of strategy in microblogging. Microblogging involves deliberately choosing what to post, what to share, and what individuals to share it with, with the understanding that the post may go viral (Qi et al., 2018). The control of this self-image or self-presentation relies heavily on these tactics. When used strategically, publishing content on social media sites builds social capital from other users and the metrics and data that make up the network itself. Because of the enormous number of people who can be instantly reached, online social capital differs from the traditional definition of social capital. However, virtual and traditional engagement methods are a subset of social capital. In brief, this idea explains that the primary goal of social media is to increase social capital, which could eventually translate into other forms of capital and increase the overall value of self (Qi et al., 2018).

Attributed to researchers Katz and Blumler in 1974, the UGT aims to understand media users' needs, motivations, and gratifications. According to the UGT, people seek media content to achieve their objectives. Application of this concept allows examination of the motivations influencing media formats, including print media, the internet, and SNS. According to the UGT, individuals engage with specific media to gain gratification. Examples of gratification include fulfilling learning needs, interaction with others, and entertainment (López et al., 2017). The theory consists of five fundamental tenets: (1) that media use is goal-oriented; (2) that audiences actively participate in the media they consume; (3) that media contests with other sources to

fulfill needs; (4) that audience members are conscious of their incentives for using media; (5) that only audience members can assess the worth of media content and the pleasures derived from media use. Furthermore, the application of the UGT established that the wants and aspirations that drive media involvement and consumption differ according to the platform (Falgoust et al., 2022).

Empirical social media research revealed that individuals utilize SNS to depict themselves as better than they are (De Kosnik, 2019). Online personas differ vastly in creativity and imagination compared to the daily in-person persona. Young adults often simplify their lives by tailoring their social media activity to appeal to a particular audience while using social media platforms as their stage. This development of the virtual self on SNS connects to Goffman's theory on the presentation of the self (De Kosnik, 2019). Every human being, according to Goffman, plays a role in daily life, and there are numerous reasons why someone would strive to manage others' impressions of them. Part of their actions is a sequence that is displayed or repeatedly performed. An individual tries to preserve this impression, which entails playing their part and maintaining consistency throughout that performance. Social relationships will develop when a person or performer depicts the same role before the same audience on separate occasions. This theory is applied to social media to explain daily societal performance via social media platforms. Goffman refers to the impressions or roles played within a social media environment as identities. Several social media theorists have expanded on Goffman’s theory of how identity equates to performance to explain how an individual’s identity is repeatedly presented online (De Kosnik, 2019).

Finally, the HBM has been used in studies to investigate how individual health behaviors connected to COVID-19 may differ (Barattucci et al., 2022; Limbu et al., 2022; Zewdie et al.,

2022). According to the model, certain beliefs affect an individual's decision to engage in healthy habits, including perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy, and cues to actions (Mao et al., 2023). HBM is one of the most frequently used theories to explain health behaviors among individuals. Research has identified the model as an indicator of influenza vaccination coverage, depending on epidemiological parameters and national context (Seangpraw et al., 2022).

During previous infectious disease outbreaks, the HBM has been used to describe how social media users' content affects the general public's health behaviors. Responses to epidemic communication initiatives, namely on social media sites like X, formerly known as Twitter, and Instagram, have also been investigated using the model (Hu et al., 2022). Following the COVID-19 outbreak, researchers utilized HBM constructs to determine how people perceived COVID-19 and its health measurements. By analyzing the frequency of these perceptions, they could quantify the development of COVID-19 health beliefs (Wang et al., 2020; Karimy et al., 2021). These studies showed that HBM could be used to promote health online. However, the relationship between the health promotion tactic employed by health departments and public reaction is unknown due to the exploration of public perception alone (Mao et al., 2023). Understanding the effect of HBM structure on maternal COVID-19 vaccine acceptance may improve vaccine uptake and decrease hesitation.

Problem Statement

Throughout the 20th century, large-scale, systematic immunization programs that included creating, licensing, and using vaccines began addressing widespread health imbalances. The likelihood that a vaccine-preventable disease will spread is reduced if the entire population is immunized or if a population reaches herd immunity (Rodrigues & Plotkin, 2020). Vaccine

misinformation disseminated via social media is a threat to public health. Furthermore, mothers who encounter anti-vaccine messaging online may persuade women who are undecided about vaccinations to refuse them. The impact of increased parental guidance content on social media platforms, and lessons learned during the COVID-19 pandemic, demonstrate the impact on vaccine hesitancy (Frey et al., 2022).

A correlation has been established between social media use and vaccine hesitancy (Wilson & Wiysonge, 2020). Numerous studies explore how specific internet media (such as various social media platforms) affect parents' attitudes toward the immunization of their children (Melovic et al., 2020; Al-Regaiey et al., 2021). However, questions remain regarding the impact of social media on maternal vaccination attitudes and the likelihood of refusal. Mothers are always at the forefront of familial healthcare decisions, making over 80% of health-related choices (Matoff-Stepp et al., 2014). Accordingly, addressing the factors contributing to a mother's decision not to vaccinate her children is imperative. At this stage in the research, social media influence is the ability to impact another individual's thinking within an online social community. The impact of social media utilization, including frequency of access, on maternal vaccinations is representative of a gap in research.

Purpose Statement

This study explores whether social media sites for information related to vaccination impact maternal vaccination decisions. A quantitative study design will gather information to describe social media use and vaccine hesitancy among mothers. The variables of interest are the type of social media source accessed to obtain information related to COVID-19 vaccination, the amount of time spent accessing these media sources, maternal socioeconomic factors, and maternal vaccination hesitancy or refusal.

Significance of the Study

A large body of literature indicates that vaccination is the most significant public health achievement of the last century (Rodrigues & Plotkin, 2020; Echeverria-Londono et al., 2021; Nandi & Shet, 2019; Pollard & Bijker, 2020; El-Elimat et al., 2021). American birth cohorts which receive the recommended childhood vaccines avoid an estimated 20 million illnesses and more than 40,000 deaths, saving approximately $70 billion in healthcare expenses (Ventola, 2017). Vaccination helps patients and caregivers avoid out-of-pocket medical expenses, expenditures associated with providing healthcare, and lost wages. A positive correlation between vaccination, cognitive abilities, and academic performance suggests benefits for long-term increased economic production (Nandi & Shet, 2020). The measles vaccine may enhance immunological memory and prevent co-illnesses, enhancing health, cognition, schooling, and productivity results into adulthood in low-income settings (Nandi & Shet, 2020). To lower pediatric morbidity and mortality, the CDC's Advisory Committee on Immunization Practices (ACIP) annually releases guidelines for childhood and adolescent vaccines. Despite these recommendations, parents may forgo or postpone immunization. Additionally, parents may impose alternative immunization regimens citing medical, religious, philosophical, or socioeconomic reasons (Ventola, 2017).

Since 2020, the COVID-19 pandemic has impacted access to and the quality of healthcare services worldwide. Although the exact effects of the COVID-19 pandemic on current public health are unknown, the global influence on childhood immunization rates is particularly significant (Itiakorit et al., 2022). The use of SNS correlates with vaccine reluctance, which may prevent the broader society from implementing childhood immunization programs (Seyed-Alinaghi et al., 2022). Strategies to combat the dissemination of false information intending to

cast doubt on vaccine efficacy have been developed based on findings relating to the effects of social media on parental views and behaviors (Barrett et al., 2022). However, additional research is essential to facilitate maximum childhood immunization coverage and generate an understanding of maternal attitudes and behaviors regarding vaccine decisions. The proposed investigation will describe the social media habits of vaccine-hesitant mothers. Finally, it will be critical to identify the factors mothers consider when declining vaccination for their children and what role social media plays in solidifying their decisions. The rapid decline in vaccine uptake worldwide warrants exploration of the proposed topic (Seyed-Alinaghi et al., 2022).

The study's outcome will provide a deeper understanding of the socioeconomic factors contributing to vaccine hesitancy amongst mothers to encourage public health officials to address any noted gaps. This fundamental understanding will also assist healthcare providers in identifying opportunities to lessen vaccine hesitancy through improving health literacy and combating misinformation on social media. This study contributes to the existing knowledge base by showing its theoretical, empirical, and practical significance for public health officials.

Research Questions

RQ1: What social media platforms are mothers accessing to gain information related to vaccination?

RQ2: How does accessing various social media platforms affect maternal vaccination decisions?

RQ3: What are the sociodemographic characteristics of mothers who refuse childhood vaccines?

Definitions

1. *Vaccine Hesitancy* – A delay in accepting or refusing immunizations (Shen & Dubey,

2019).

2. *Vaccine Literacy* – Educating the public about vaccinations, fostering dialogue, and raising vaccine interest (Badua et al., 2022).
3. *Vaccine-Preventable Disease (VPD)* – A contagious illness for which a reliable vaccine exists as a prophylactic measure (Hinman et al., 2011).
4. *Echo Chamber* – The concept that individuals interact in environments that expose them to beliefs that reflect their own, reinforcing confirmation bias (Jiang et al., 2021).
5. *Social Networking Site (SNS)* – A web-based service that enables users to (1) create a public or semi-public profile within a confined system; (2) list other users with whom they have connections with; and (3) browse and navigate their list of connections as well as those made by others within the system (Boyd & Ellison, 2007).
6. *Health Care Provider (HCP)* – A person or organization that offers medical assistance or treatment, including physicians, nurses, midwives, physiotherapists, other allied healthcare professionals, clinical and health psychologists, pharmacists, and dentists (Patey et al., 2022).
7. *Social Support* – The mental and emotional support offered by a social network to assist people in managing stress (Fasihi et al., 2017).

CHAPTER TWO: REVIEW OF RELATED LITERATURE

Overview

A review and analysis of existing literature addressing vaccine hesitancy among mothers and the impact of social media on childhood immunization support the proposed study. In the first section, the theoretical health belief model (HBM) explains the decline of disease-preventative measures and screening tools for early detection. Synthesis of recent literature includes a review of historical childhood immunization, the anti-vaccination movement, vaccine hesitancy, and the impact of social media on healthcare. Additional literature addresses the social norms of motherhood, the physician-maternal relationship, and the factors influencing parental vaccine choices. The absence of research examining vaccine-hesitant mothers' perceptions of healthcare highlights a practical need for this specific analysis.

Theoretical Framework

Researchers and public health officials have increasing concerns regarding the circumstances that harm parents' decision to vaccinate their children, such as the politicization of vaccines and vaccine misinformation. There is a general understanding that vaccine hesitancy is a complex issue that a single approach cannot solve. Theories surrounding behavioral change combined with social media technologies can assist in designing programs aiming at enhancing vaccination uptake. Several studies have used the HBM to explain vaccine health behaviors, primarily with Ebola, swine influenza, influenza, hepatitis B, and COVID-19 (Zampetakis & Melas, 2021; Limbu et al., 2022; Chen et al., 2021).

Trent et al. (2021) employed the theory to identify barriers to Australian adults' willingness to receive the seasonal influenza vaccine. Results suggest increased vaccine uptake occurs in those believing personal vaccination protects friends and family (Trent et al., 2021).

The HBM was used to assess pregnant women's perceptions of hepatitis B and the health behaviors associated with those views. The study found that few pregnant women believed they had a significant lifetime risk of contracting hepatitis B and liver cancer. The majority believed they had a low chance of developing liver cancer even if they contracted hepatitis B. High perceived self-efficacy, of which location and religion of the participant were influential factors, was linked to the desire to get screened and seek treatment for hepatitis B (Nankya-Mutyoba et al., 2019). Due to its ability to concentrate on disease-preventative health behaviors and their psychosocial and cognitive drivers, the HBM has been helpful in research that aims to guide health promotion (Mao et al., 2023; Jones et al., 2013; Zewdie et al., 2022).

The main contention of the HBM is that an individual's perception of the risk, the severity of illness, and susceptibility to disease influences their tendency to engage in health behaviors as well as their convictions regarding the efficacy of advised actions (Hossain et al., 2021). In terms of perceived severity, it is the idea that contracting the illness would negatively affect the patient and others. People who feel threatened or believe they are at a high risk of contracting COVID-19 are more likely to express strong intentions to get the vaccine. The idea of perceived susceptibility explains that an individual believes there is a significant probability of contracting the disease. The degree to which an individual feels that a poor health outcome is possible determines their perception of severity and susceptibility (Zampetakis & Melas, 2021). The HBM can also forecast behavioral trends by positing that a human must believe that the intended health conduct will bring significant benefits (Chen et al., 2021). The model contends a fourth predictor of health behavior, which explains that people are less likely to embrace preventative actions if they believe that significant obstacles are in their way. The last component of HBM is a cue to action, whereby certain additional factors encourage the person to

engage in preventive behavior (Zewdie et al., 2022).

Several health issues, from preventative behavior to behavior aimed toward more advanced illnesses and their necessary treatments, have been explained by the HBM (Jones & Wallis, 2022). The model has been successfully investigated multiple times regarding its capacity to explain and predict various behaviors linked to favorable health outcomes (Karl et al.; 2022, Zewdie et al.; 2022, Li et al., 2022). Notably, this model will guide the theoretical framework for this study, focusing on predicting vaccination receipt amongst mothers, particularly with the COVID-19 vaccine. By using the HBM in the context of vaccine decision-making, it might be possible to encourage health officials to target mothers who rely on social media as a source of health information with preventative interventions designed to help them adopt healthy behaviors that will stop the spread of disease.

Related Literature

Anti-Vaccination Movement

Vaccine hesitancy and the relevant theories surrounding vaccine apprehension are not new concepts within our history. One of the first oppositions towards preventative disease therapy dates to Reverend Edmund Massey and his 1772 sermon, The Dangerous and Sinful Practice of Inoculation. He described vaccination as a demonic procedure, “an attempt to oppose God’s punishments upon man for his sins” (Hussain et al., 2018). In 18th-century Britain and New England, the introduction of pus on the epidermis of a healthy individual following the removal of the infectious material from an active smallpox pustule is representative of the first efforts in variolation. According to this concept, the body develops immunity against a disease after exposure to the pathogen. Dr. Edward Jenner, who came to be known as the ‘father of the smallpox vaccination,’ observed that individuals infected with cowpox were immune to

smallpox. Dr. Jenner's smallpox vaccine, or cowpox inoculation, would soon replace variolation as it was safer and more effective (Breman, 2021). Despite evidence supporting the safety and efficacy of the smallpox vaccine, many were skeptical of its use (Millward, 2019).

From 1840-1853, Great Britain passed a series of Vaccination Acts to enforce vaccination requirements and extended government authority into areas traditionally known to have civil freedom. Nonetheless, the Anti-Vaccination League subsequently formed and defended perceived rights violations due to enforcing Parliament's vaccination laws. Due to the pressure and influence exerted by the league, the British Parliament passed an act in 1898 that eliminated penalties for individuals and parents who refused to vaccinate themselves and their children, respectively (Millward, 2019). As disease and vaccination rates have increased over the past few centuries, opposition to vaccines has not abated, and opposition is expressed worldwide due to skepticism, religion, and personal beliefs. (Hussain et al., 2018).

The trend of people resisting vaccinations has been ongoing for several decades, as documented in an article published in 1974 by a group of doctors from Great Ormond Street Hospital. The report found a potential connection between the pertussis vaccine and brain damage. This publication's attention from the media sparked a significant public debate and an immediate drop in parents' willingness to vaccinate their children due to fear of neurological reactions. This rapid decline in vaccination rates resulted in a pertussis outbreak in the United Kingdom (U.K.), which placed an immense burden on the National Health System. After the government released a reevaluation of vaccine effectiveness, which reaffirmed the benefits of vaccines and offered financial incentives for healthcare providers (HCPs) to achieve desired vaccination rates, public opinion shifted back towards acceptance of vaccinations and a decrease in disease rates (Hussain et al., 2018).

A historical example of unfounded vaccination concerns is the perception of a causative link between the measles-mumps-rubella (MMR) vaccine and autism. After researcher Andrew Wakefield published a controversial study in The Lancet falsely linking the vaccine with this disorder, the anti-vaccination movement experienced a resurgence (Callender, 2016). This publication significantly contributed to the anti-vaccination movement. It coincided with the growth of Google and online media coverage, increasing accessibility and excerption. Wakefield's claims relating to autism and vaccines have been disproven. However, he perpetuates his harmful anti-vaccination beliefs through social media and self-made films. Moreover, his films seek to interrogate vaccine safety and the motives of the government and pharmaceutical firms (Baker & Walsh, 2022).

The anti-vaccination movement has been widespread for some time now, but the way in which activists communicate their message has constantly evolved due to innovations in technology (Bucher & Helmond, 2018). Digital technology has transformed how individuals communicate, interact, share information, and develop social values. Social media platforms are popular for anti-vaccine content; users can upload information freely without repercussions. The ease of dissemination has increased online vaccine misinformation circulating online (Muhammed & Mathew, 2022). There was once a time when individuals opposed vaccination through word-of-mouth communication. However, this process is no longer effective since more people can now share their views online and form communities that support the same ideologies. Consequently, online communication creates an amplified platform for airing dissenting viewpoints on vaccines (Baker & Walsh, 2022).

Anti-vaccine activists use SNS to promote hashtags and viral posts that attract a wider audience. This strategy maximizes the reach and impact of the anti-vaccine message. They can

also spread misinformation by accusing pharmaceutical industries of using harmful substances to make their vaccines and suggesting connections between vaccines and subsequent ailments (Wawrzuta et al., 2021). Vaccine demonization contributes to disease outbreaks and inhibits national and international progress toward elimination and eradication. Nevertheless, immunization rates that plummet below 96% risk the chance of countries not achieving herd immunity and averting future disease outbreaks (Hussain et al., 2018).

Factors Contributing to COVID-19 Vaccine Refusal

The COVID-19 pandemic has prompted numerous calls for vaccine coverage in societies. Since the coronavirus vaccine first became widely available, there has been a growing fear that vaccine reluctance and anti-vaccination sentiment will hinder this availability. Vaccine hesitancy has numerous explanations (Azarpanah et al., 2021; Callender, 2016; Nuwarda et al., 2022; Shen & Dubey, 2019). Anti-vaccination materials frequently mention vaccine risk, mercury exposure, and the autism connection, as previously noted. Moreover, the decreased prevalence of infectious diseases has resulted in a perceived relaxation of the need for vaccination. Throughout the COVID-19 pandemic, anti-vaccine searches on Google have persisted and become more prevalent, raising concerns about how this may impact vaccine acceptance (Pullan & Dey, 2021).

Across the pandemic's many stages, the causes of vaccination reluctance or rejection have remained the same. Several studies exploring COVID-19 vaccine refusal revealed that not receiving the influenza vaccine the previous season, having a low or nonexistent perceived risk of contracting the virus and having a lack of confidence in the government were all contributing factors (Caserotti et al., 2021; Phillips et al., 2022; Soares et al., 2021; Osuji et al., 2022). Furthermore, women are more likely to postpone vaccination, and younger individuals are more likely to refuse immunization. (Troiano & Nardi, 2021). Younger individuals are more likely to

refuse because they believe and perceive that they are healthy and hence less likely to get the virus or that, even if they do, they can recover from it. On the contrary, individuals that are highly concerned about being infected are less likely to decline vaccination (Osuji et al., 2021)

Low education has also correlated to reduced vaccination uptake and hesitation (Dhanani et al., 2022; Fridman et al., 2021); however, when both the mother and father have lower educational attainment, the likelihood of both vaccination hesitation and outright refusal of immunizations increases (Osuji et al., 2021). Due to historically occurring racism and discrimination in health care, African Americans have a lower acceptance rate of several preventative health services, including vaccination against the novel COVID-19 virus (Fridman et al., 2021). Research indicates that vaccine skepticism is a coping mechanism for these experiences in such communities (Bogart et al., 2021). Vaccine-related mistrust remains a multilayered construct encompassing uncertainty in the vaccine, government, and health care practitioners.

Individual Republican affiliation correlates with a lower likelihood of accepting the COVID-19 vaccine (Osuji et al., 2021; Soares et al., 2021; Fridman et al., 2021). Exposure to media channels and social networks could explain the asymmetric polarization between Democrats' and Republicans' vaccination belief idealizations. In addition, systemic campaigns of disinformation regarding COVID-19 targeted Republicans. Therefore, Republicans were more inclined than Democrats to accept false information against vaccinations. Conservatives became increasingly skeptical of the scientific community, in part because of the risk that right-wing populists' rhetoric poses, which frequently pits ordinary people against corrupt elites (Bolsen & Palm, 2021).

The COVID-19 pandemic increased vaccine hesitancy among healthcare workers, a

phenomenon not present during the introduction of earlier vaccine campaigns. A global survey conducted in 23 countries to observe adults' perceptions of the COVID-19 vaccine revealed that amongst all HCPs who responded to the survey, one-sixth reported some degree of vaccine hesitancy, which included a small proportion of individuals who strongly or somewhat disagreed with vaccinating against COVID-19. Physicians were more likely to accept the vaccine, whereas community health workers and other HCPs reported higher degrees of vaccine hesitancy (Parsons Leigh et al., 2022). Several HCPs, like the public, had concerns that the development of the vaccine was too rapid, with insufficient data to support its safety and efficacy. In addition, many HCPs distrust employers, the government, and the healthcare system. Lack of trust in pharmaceutical companies and experts is common between HCPs and the public (Khubchandani et al., 2022). Furthermore, at the height of the pandemic, the COVID-19 regulations, which included mask mandates, social distancing, and vaccination requirements, left HCPs feeling as though these regulations infringed upon their personal rights and personal autonomy to vaccinate. Lesser concerns of HCPs included being coerced by fellow employees and administrative staff for their resistance, resulting in further reluctance towards mandatory vaccines and vaccine acceptance (Caiazzo & Stimpfel, 2022).

Vaccine Hesitancy

One of the most important forms of preventative medicine to protect communities from the burden of pandemics brought on by the spread of illness is vaccination. Immunizations prevent 2-3 million deaths annually and, with more widespread coverage, could avert an additional 1.5 million (Erchick et al., 2022). Dr. Edward Jenner's development of the smallpox vaccine in 1978 demonstrated the importance of vaccines, leading to the eradication of smallpox. Healthcare organizations have emphasized safer, more efficient, and more moral options

available to the general population as preventative medicine has evolved, shifting from theories of variolation to the smallpox vaccine. Vaccines have helped to lower the prevalence of common pediatric illnesses and, in some instances, have even eliminated some of those that were widespread in the past, including smallpox, rinderpest, and virtually wiped-out malaria and poliomyelitis (Hussain et al., 2018). During the COVID-19 pandemic, when the Omicron variant was dominant, two doses of the messenger RNA (mRNA) COVID-19 vaccine demonstrated 36% success in preventing COVID-19-associated hospitalizations amongst adults with immunocompromising conditions (Britton, 2022).

Historically, research has shown that the impact of vaccinations has made an essential contribution to decreasing the prevalence of widespread disease in the population, leading to an overall reduction in mortality rates (Larson et al., 2022). Regardless of the evidence to support the requisite and the safety of vaccines, vaccine-related concerns and skepticism are becoming more pervasive, and vaccine hesitancy has increased significantly within the past few decades. A vaccine-hesitant person is indecisive and apprehensive about immunization before deciding to proceed (Larson et al., 2022). Factors associated with vaccine reluctance in the U.S. during the COVID-19 pandemic include younger age, lower levels of education, poorer household income, living in rural areas, and not having health insurance (Othman et al., 2022). Increased awareness of vaccine hesitancy as a public health threat and declining international immunization rates led to identifying the phenomenon as a global health challenge. In 2019, the World Health Organization (WHO) ranked vaccine hesitancy among the top ten threats to world health (Larson et al., 2022). Additionally, depending on the vaccine, recent estimates show that parental reluctance results in 6.5% to 31.3% of children not receiving the necessary vaccines (Hill et al., 2023).

Being reluctant to receive a vaccine is a state of mind, whereas getting vaccinated is a proactive step that anticipates preventing disease transmission. Although vaccine reluctance can result in the decision not to vaccinate, this decision is not necessarily final, and individuals considered vaccine hesitant may later seek immunization. Media coverage of risks associated with COVID-19 vaccination and the perceived notion that the threat of infection has decreased impacts vaccination decisions (Muhammed & Mathew, 2022). The concern for vaccine hesitancy significantly impacting societal outcomes can increase as misinformation regarding clinical practice and vaccinations disseminates. During the phase of hesitancy and uncertainty, there is both a vulnerability and an opportunity, making this a pivotal time for the proper influencer to make their imprint (Larson et al., 2022). Continued monitoring will be necessary, and proper vaccination coverage is crucial in the era of rising antimicrobial resistance and international travel (Shen & Dubey, 2019).

Reasons for Maternal Vaccine Hesitancy

Increased incidence of vaccine-preventable diseases (VPDs) creates concern relating to maternal vaccine rejection. Several studies have uncovered the factors influencing parental hesitation, refusal, or postponement in vaccinating their children (Panchalingam & Shi, 2022; Damnjanović et al., 2018; Howell et al., 2022). According to the CDC, healthcare experts base their recommendations for vaccinations on CDC recommendations while also considering the patient's age, underlying medical issues, and other significant factors that may contraindicate the efficacy or safety of a vaccination (CDC, 2019). Despite the CDC’s and medical professionals’ advice, parental vaccine reluctance has recently increased, and the concern for long-term safety has become a significant issue. The reluctance of parents to vaccinate their children is gravely worrisome and can negatively affect the wider population. A 2019 national survey revealed that

more than one-fourth of parents noted they were hesitant to immunize their 19- to 35-month-old children, which may have resulted in 15% to 25% of those children having insufficient immunizations (Olson et al., 2020).

Parents display an array of immunization compliance, from adherence to routine vaccination, postponing immunizations, only objecting to certain vaccines, or objecting to all of them. Religious objections account for the majority of total vaccination refusals. At the same time, parents with strong opinions but lacking spiritual objections to immunizations are more likely to make accommodations and at least partially vaccinate their children (McKee & Bohannon, 2016). Other causes for parental vaccine hesitancy stem from philosophical considerations, safety concerns, and a need for additional information from HCPs. A high percentage of parents typically have reservations or questions regarding pediatric immunizations. Parents strive to do the best for their children, so learning that there might be safety concerns or that certain illnesses do not pose a serious threat to public health can make them reluctant to vaccinate their children. Therefore, it is essential for healthcare professionals and pharmacists to thoroughly comprehend the causes of vaccination reluctance to know how to educate their patients' families (Mckee & Bohannon, 2016).

Parents’ religious convictions are among the most frequently cited justifications for not vaccinating children (Mckee & Bohannon, 2016). Numerous religious communities, including Protestants, Catholics, Jews, Muslims, Christians, Amish, Hindus, and Sikhs, have recognized religious motivations for vaccine reluctance. Religious belief in supernatural healing and protection for Protestants, Catholics, Jews, and Muslims contend that vaccinations are incompatible with a disease's status as God's will. Using fetal cell lines in vaccine research and development is frowned upon in Amish and Catholic communities and presents ethical concerns.

Christians have linked the human papillomavirus (HPV) vaccine to sexual promiscuity, and Christian parents frequently refuse the vaccine because they feel it encourages a particular sexual lifestyle. Religious perspectives on healthcare will always exist, yet vaccine hesitancy motivated by religious convictions can harm global vaccination coverage rates (Kibongani Volet et al., 2022).

Personal or philosophical considerations are another typical explanation parents give for not vaccinating or postponing vaccination for their children. Divergent health-related beliefs, behaviors, perspectives, and attitudes contribute to understanding health and disease. For example, some parents believe that VDPs serve the purpose of strengthening the immune system. Parents who hold this viewpoint consider immunizations unnatural and damaging to the body. Some parents actively prefer that their children get diseases like measles or chickenpox while young, when symptoms may be more manageable. Nonetheless, the belief is that a childhood sickness may offer a more robust and "natural" form of protection than a vaccination (Nurmi & Harman, 2021).

The concerns about the risks and effects of vaccines provide a further fundamental understanding of parental vaccine hesitancy. As noted, the proliferation of false information has given rise to worries about the safety of vaccines. Parents continue to be skeptical about the safety of vaccines or the seriousness of VPDs. They may opt to postpone or refuse routine injections, despite the discrediting of earlier published articles that suggested potential hazards of childhood vaccinations. Adverse responses, the ingredients in vaccines, and a lack of purity are some specific worries parents cite. Concerns also included the possibility of long-term adverse effects like autism and autoimmune disorders (Smith et al., 2022). Parental fears often originate via media or socialization due to inundation with vaccination opinions via web-based sources,

television, family, and friends.

Socioeconomic Determinants of Vaccine Hesitancy

In wealthy and impoverished areas, people of all socioeconomic, cultural, racial, and religious backgrounds exhibit vaccine hesitation. Despite widespread tolerance of vaccination in low and middle-income countries, less accepting communities exist (Simas & Larson, 2021). The early COVID-19 immunization campaigns of 2020 included disparities in coverage. Socioeconomic vulnerability secondary to the pandemic correlates with poor health outcomes (Barry, 2021). To evaluate changes in urbanicity disparities with COVID-19 immunization coverage, the CDC reviewed the 2018 CDC social vulnerability index (SVI) data and the administration of COVID-19 vaccines. The percentage of adults over 18 who have received at least one dose of any COVID-19 vaccine authorized by the Food and Drug Administration (FDA) is the number of adults in a specific SVI category divided by the total adult population. The four themes of SVI include socioeconomic status, household composition and disability, racial/ethnic minority status and language, housing type, and transportation. In general, those with less education, women, members of racial and ethnic minorities, those who live in rural areas, and those who earn less money were found to be more hesitant (Barry, 2021). Financially struggling individuals may also lack access to healthcare facilities or healthcare insurance. In addition, socioeconomic factors of single parents act as barriers to accessing care (Ventola, 2016).

Existing literature on social inequality in COVID-19 vaccinations suggests socioeconomic determinants include transportation barriers and factors that impact economic insecurity, such as educational attainment (Lee & Huang, 2022). Inconvenient clinical hours can make it difficult for parents to schedule wellness visits for their children while also having to

arrange transportation, take time off work, and plan for childcare. Given that single parents are frequently the primary source of income, the cost of a single day's wages may not outweigh the need for regular well-checks and vaccinations. Additionally, the low educational status of the mother and the father is a reliable predictor of the outright rejection of all vaccinations. However, research reveals that this has little impact on vaccine hesitancy (Bertoncello et al., 2020). To date, the combination of financial hardships and paternal education is unknown.

Political opinions, or a broad ideological loyalty, also appear to significantly impact Americans' willingness to get COVID-19 vaccines in the U.S. Republican voters and some minority groups, particularly Hispanics and Blacks, lagged in receiving vaccinations during the early months of the COVID-19 national vaccination program. While racial disparities dwindled throughout 2021, the Republican-Democrat divide widened. Nearly 40% of Republicans were unvaccinated in October 2021, compared to about 10% of Democrats (Lee & Huang, 2022). However, accounting for a wide range of sociodemographic parameters reveals that the census areas with considerably more Biden supporters in the 2020 presidential race also tend to have lower vaccine reluctance. This conclusion emphasizes the effect of political polarization on public mistrust of government information and behavior, which aligns with recent observations. Democrats are likewise more prevalent among Latinx communities, and vaccination uptake is higher in areas with more minorities (Lee & Huang, 2022).

Ingredients in Vaccines

As concern for the safety and efficacy of vaccinations is apparent, it is essential to explore the ingredients that comprise a vaccine formula. Vaccines aim to familiarize the body with a specific germ to fight that same germ if it enters the immune system again. The immune system builds immunity and fights infections easier once a virus has already been introduced to

the body. Components of vaccines include adjuvants, antigens, preservatives, and stabilizers, all playing a specific role in providing immunity and allowing the vaccination to safely and effectively work for an extended period. Antigens are minuscule quantities of a pathogen that cause the body to build immunity towards a specific pathogen, and adjuvants modify the immune system's response to an antigen (Geoghegan et al., 2020). Preservatives help avoid vaccine contamination, and stabilizers help maintain effectiveness after the vaccine manufacture. Vaccines include residual cell culture material such as egg protein, residual inactivating ingredients such as Formaldehyde, and residual antibiotics such as Kanamycin (CDC, 2022). The ingredients found in vaccinations all serve a purpose and undergo rigorous evaluation for safety and toxicity before gaining regulatory approval from the FDA and being recommended by the CDC. Therefore, the close examination to determine the safety and efficacy of vaccines is a constant process among manufacturers and the FDA for any vaccine introduced to the public (Olson et al., 2020).

Childhood Immunization Overview

Between 1994 and 2013, the U.S. avoided 322 million cases of illness, 732,000 deaths, and 21 million hospitalizations because of childhood immunization, which has significantly decreased morbidity, mortality, and disability brought on by diseases that can be prevented by vaccination (Talbird et al., 2022). As of 2019, children under 10 in the U.S. receive routine inoculations against 14 VPDs (CDC, 2019). However, there has been a recent increase in the prevalence of VPDs, primarily attributable to parental opposition to the advised children's immunization schedule (Weithorn & Reiss, 2018). Indicating that legislative reforms may encourage higher immunization rates, empirical studies have shown a correlation between non-vaccination rates and permissive state vaccine exemption regulations (Bednarczyk et al., 2019;

Seither et al., 2022).

High childhood vaccination rates in the U.S. have decreased morbidity and mortality from diseases that immunization can prevent. Mandatory vaccinations for students entering schools have contributed to the success of immunization programs in reaching this high coverage (Bednarczyk et al., 2019). In 1809, Massachusetts passed the nation's first vaccination law, mandating smallpox immunization for the general populace (Smith et al., 2011). By 1855, the state implemented the first vaccination mandate for students to stop the spread of smallpox. States adopted similar legislation over time, and by 1963, twenty states required immunization records before letting children enroll in public schools (Weithorn & Reiss, 2018). All fifty states and Washington, D.C. enforce proof of vaccination before entering public elementary and secondary schools, though the requirements vary from state to state (Bhatti et al., 2022). Nonetheless, some states provide exceptions to these requirements that are not medically necessary, such as religious or personal belief exceptions, threatening public health initiatives aimed toward vaccine coverage (Bhatti et al., 2022). Due to this, several professionals in the industry are now urging the widespread abolition of non-medical school entrance exemptions, as has already been done in six states: Connecticut, Maine, Mississippi, West Virginia, California, and New York (Goldstein & Suder, 2022).

It is crucial to consider how exemption policies affect vaccination rates. States with more lenient exemption laws tend to have lower childhood immunization rates (Shaw et al., 2018). In states that permit personal belief exemptions, higher exemptions are linked to lower levels of MMR vaccination uptake (Olive et al., 2018). Increasing the difficulty of obtaining non-medical exemptions has been shown to favorably impact immunization rates in Washington in 2011 and California during the 2012-2013 academic year (Garnier et al., 2020). State laws affect

exemption rates, but to customize particular interventions, further policy implementation, the vaccination status of exemptions, and the underlying causes of spatial clustering must be investigated.

Vaccination Coverage Among American Children

The CDC annually evaluates childhood immunization coverage in the U.S. using two surveys. First, the CDC conducts the National Immunization Survey (NIS), which collects information from parents on the vaccination status of children between the ages of 19 and 35 months, 13 and 17 years, and specifically for influenza vaccine coverage for children aged 6 months to 17 years (Roper et al., 2021). Second, state vaccination programs assemble data about children's immunization history and exemptions from the school-entry rule and return this information to the CDC for review (Bednarczyk et al., 2019). By comparing children who reached milestone ages before the pandemic to those who reached the same ages during the pandemic, the most recent NIS data demonstrates no consistent or sustained decrease in vaccination coverage attributable to the COVID-19 pandemic among all children in the U.S. (Hill et al., 2023). However, among children living in rural regions or below the federal poverty level, the coverage rate for the combined 7-vaccine series by age 24 months fell by 4-5 percentage points.

MMR coverage for children who turned 13 months old between April and May 2020 was 10% lower than for children who turned 13 months old before and after this period. However, coverage approached pre-pandemic levels when children turned 19 months (Hill et al., 2023). The impact of the pandemic on childhood immunization coverage remains unknown. However, the upcoming 2022 NIS will include children born immediately before or during the epidemic, enabling a more in-depth examination of trends in vaccination coverage during this time (Hill et

al., 2023).

As previously noted, vaccination coverage decreased for children in rural or low-income areas during the pandemic, creating a significant sociodemographic gap in coverage. Rural counties in the Midwest and South regions have some of the lowest completion rates for the COVID-19 vaccine, with immunization rates continuing to fall below 20% (VanWormer et al., 2023; Saelee et al., 2022). A decline in childhood vaccination rates, especially in areas with poor coverage, may increase mortality and morbidity from illnesses like poliomyelitis, measles, and others that vaccination can prevent. Outbreaks may occur when vaccination rates drop, increasing strain on the COVID-19 era's already overstretched healthcare system (DiRusso et al., 2021). Societies require universally high coverage rates of up to 95% to prevent pandemics. However, maintaining this uniformity is difficult because those who refuse vaccinations tend to congregate in specific geographic locations (Attwell et al., 2019). High immunization coverage is critical to reducing excess morbidity and mortality in underserved regions, predominantly rural areas (Tan et al., 2022).

Children Vaccination Recommendations

The Salk vaccination studies demonstrated that the injectable poliomyelitis vaccine was highly successful in preventing paralytic poliomyelitis, significantly advancing vaccine recommendations and laws for students attending schools. The successful development of the poliomyelitis vaccine led to the passing of the Polio Vaccination Assistance Act of 1955, which provided funding for the Communicable Disease Center (now known as the CDC) to assist states and local communities in obtaining and dispensing vaccines. Furthermore, President John F. Kennedy passed the Vaccination Assistance Act into law in 1962, enabling the CDC to support widespread immunization campaigns and launch maintenance programs (Roper et al., 2021).

The ACIP, American Academy of Pediatrics (AAP), and American Academy of Family Physicians (AAFP) implemented a formal vaccination schedule over 100 years after establishing vaccine requirements for school attendance. In 1995, these three organizations released the first suggested schedule, comprising vaccines for diphtheria, tetanus, pertussis, measles, mumps, rubella, poliomyelitis, Haemophilus influenzae type b, and hepatitis B (Gindler et al., 1995). The Surgeon General appointed the ACIP in March 1964 as a technical advisory committee to the U.S. Public Health Service in response to the development of numerous new vaccines and biologics and a growing realization that only one reliable government body was required to produce recommendations on the use of vaccines in the U.S. civilian population. The ACIP was established as a national advisory group in 1972, chartered and subject to rules regarding open meetings, transparency, and public input and reporting. The U.S. government worked to create a permanent system in the 1970s to give complete immunization services to American children and impoverished and minority communities previously impacted by health disparities relating to vaccination (Attwell et al., 2019). The ACIP of the CDC currently continues to release recommendations and guidelines for childhood and adolescent vaccines every year to lower pediatric morbidity and mortality. Nonetheless, some parents choose not to vaccinate their children, delay vaccinating them, or adhere to alternate immunization schedules for socioeconomic, religious, or philosophical reasons (Ventola, 2016).

Social Media's Role in Healthcare

Social media has significantly altered how individuals socialize. Social networks influence perceptions of current events or societal issues. Businesses use social media to market and interact with their customers, and the public uses it to communicate their political objections to their leaders to encourage political reform. During the COVID-19 pandemic, social media was

a primary source of healthcare information for many. According to the Digital 2022 Report, 58% of people worldwide use social media, suggesting social and cultural shifts that the pandemic may have expedited (Carneiro, 2022). The U.S. was ranked third in the world on the scale of social media use, totaling over 302 million social media users (Dixon, 2022).

Additionally, 26% of hospitals use social media in some capacity, and 80% of U.S. state health departments have accounts on various social medial networks (Chen & Wang, 2020; Surani et al., 2017). Information surveillance, disseminating accurate information and halting the spread of false information, health intervention, and social mobilization are the primary uses of social media for health organizations. Social media can allow newly diagnosed patients to interact with people who share their conditions, which can help them feel less alone and enhance their general psychological well-being (Smailhodzic et al., 2016). Furthermore, the COVID-19 pandemic demonstrated that social media could be used to forecast the onset of diseases and offer precise case number counts. (Chen & Wang, 2020).

Social media users may communicate encouraging or educational messages to a specific audience. However, the technology carries risks. Social media can harm mental health, increase cyberbullying, create unrealistic expectations, and inhibit in-person connections (Pang, 2022). In addition, because many social media platforms permit, to an extent, free public speech, false information can travel across the internet. Despite social media's benefits for healthcare organizations, research has shown that about 43% of the false information about healthcare on social media is related to vaccines. The likelihood of vaccination refusal or vaccine reluctance was also higher in people who admitted to utilizing social media as their primary source of vaccine information (Nuwarda et al., 2022).

Social media became a crucial means of maintaining connections among people

throughout the pandemic due to the rise in social rules, such as physical distancing, quarantine measures, and travel bans. Given that social media networks have the potential to transmit false information and promote reluctance, especially among populations that are already predisposed to higher hesitancy rates, this increased dependence on them raises some alarm. Previous studies have indicated that vaccine-hesitant organizations on social media have a startling presence and that a significant amount of the content regarding vaccines on well-known social media platforms contains anti-vaccination themes, which increases user involvement (Germani & Biller-Andorno, 2021; Ortiz-Sánchez et al., 2020). Another crucial aspect is the prevalence of the echo chamber effect on social media platforms, which draws people together and surrounds them with those who share their ideological viewpoints. On social media sites like Facebook, some echo chambers have revealed a connection between attitudes toward and against vaccinations and the polarization of user beliefs (Cascini et al., 2022). Thus, analyzing networked communities on social media will be pertinent to understand further the scope of online debates and public attitudes on vaccine hesitancy and how they may affect society and scientific communities.

Maternal Patterns of Social Media Use

Most individuals view parenting as a new experience in which they need more expertise or knowledge. Parents frequently seek guidance and support from outside sources, as parenthood can be challenging and daunting. Historically, parents have received support and direction from their family, friends, and medical experts (Boelsma et al., 2021). Nonetheless, as the internet has become a primary source of guidance and sustenance for health care information, it has also become a significant resource for parenting advice. Social media, including online SNS like Facebook, blogs, and mobile phone apps, has recently emerged, establishing new avenues for

seeking knowledge and other people's opinions; these interactive platforms have been especially useful for parents. Moon et al. (2019) discovered that using such platforms to obtain parenting and health information surpasses family and friends' influence on behavior modeling, norm-setting, and decision-making in parenting and health.

Most American parents who use social media feel it provides valuable parenting advice, and over half report receiving assistance for parenting-related concerns (Waring et al., 2023). Women are more likely to seek advice and support from various sources, while men are more likely to rely almost entirely on their spouses. The significance of internet searches and online discussion forums in assisting pregnant women in finding health information and making decisions is also supported (Javanmardi et al., 2018; Skouteris & Savaglio, 2021; Smith et al., 2020). According to Waring et al. (2023), mothers are likelier to use Facebook, Instagram, Pinterest, Snapchat, and TikTok, whereas men use X and Reddit more frequently. Younger parents are more likely to use Instagram, Snapchat, and TikTok and, infrequently, will use Pinterest. When compared to women of the same age who are not parents, most American women aged 18 to 39 who are parents use YouTube, Facebook, and Instagram more often (Waring et al., 2023).

Maternal social media usage patterns are associated with several factors, making this group more vulnerable and needing healthcare literacy initiatives and protection from encountering false information. Women who use various platforms for health care information throughout pregnancy and postpartum might benefit significantly from social media. Studies suggest women actively seek knowledge during the perinatal period, both during pregnancy and after giving birth, to acclimatize to their new position as mothers (Lu et al., 2021; Slomian et al., 2017; Caddy et al., 2023; Zhu et al., 2019). Pregnant women seek knowledge to help them

psychologically and physically prepare for giving birth. In order to accommodate their new position as mothers, they also create and re-construct their identities using information from various sources. Childbirth classes, close friends and relatives, television, literature, print media, and healthcare professionals were all traditional sources of knowledge. As a result of the widespread availability of internet connection, parents now have access to an almost endless variety of online informational resources, covering topics including preconception health, infant care, and toddler behavior. These websites include information from both professionals and other mothers. Online tools allow mothers to blog, interact with other women on message boards, or purchase baby necessities (Zhu et al., 2019).

Mothers often like having access to a limitless amount of information instantly via social media and the internet to avoid waiting until their child's next health appointment with their pediatrician to address any pressing concerns. They also appreciate the obscurity of the internet, which enables them to express questions they might otherwise feel uncomfortable asking in person. Mothers enjoy crowdsourcing information to acquire viewpoints from many sources (Moon et al., 2019). While making decisions, mothers typically rely on intuition and their judgment, and they are more confident in their choices if there is general agreement from outside sources on them. This assurance and confidence are likely made possible by the internet's availability to a large variety of perspectives (Oviatt & Reich, 2019).

Pregnant women use digital media for several reasons, including social and emotional support, health information, and a better understanding of the fetus's development and what to expect during their pregnancy. Although obtaining social support is a frequently reported reason for using social media, which may act as a protective factor against mental health concerns, social media is associated with higher levels of self-criticism and lower social quality of life.

Scherr and Brunet (2017) found that Facebook use was associated with depression through their analysis of users, 74% of whom were female. Diversion and relationship-building mediate the association, however. These findings demonstrate the tendency of women to use social media to divert themselves from their depression symptoms and to build relationships to increase social support.

Vaccine Content on Social Media

Social media channels receive praise for their transparency and participative nature, act as a popular way to learn about health, facilitate the exchange of vaccine information, and allow users to obtain emotional support during difficult times. Users can learn more about a new disease, how it spreads, and how to take precautions. In contrast, social media can be a source of false information which is a significant factor in vaccine hesitation (Ngai et al., 2022). The word "infodemic," coined by the WHO, describes disseminating false or manufactured news, photos, and videos (WHO, 2020). Inaccurate vaccine information has decreased immunization objectives and uptake (Loomba et al., 2021; Basch & Maclean, 2019; Ortiz et al., 2019).

Vaccine-related content exists on every social media platform, and the critical content is typically associated with material previously published on anti-vaccination websites (Schmidt et al., 2022). Wawrzuta et al. (2021) determined, through analysis of anti-vaccine social media users, that negative social media reactions to vaccine-related posts (likes, shares, and retweets) were more common than positive ones. Several themes are associated with antivaccine misinformation on social media, including safety and efficacy concerns and conspiracy theories. Concerns regarding the safety of vaccines can push anti-vaccine activists to claim that vaccines are dangerous or even fatal and do not provide protection to the public. This issue of disseminating false information on social media has increased, mainly due to the perception that

COVID-19 vaccinations were produced rapidly without adequate evaluation of the side effects and, therefore, risky (Ngai et al., 2022). In a recent Australian survey of parents, 24% of participants were reluctant or unsure about receiving the COVID-19 vaccine, and 89% expressed worries about vaccine safety (Rhodes et al., 2020). Consequently, the concern about vaccine safety hazards outweighed the perceived severity of VPDs in high-income countries with successful vaccination programs (Ngai et al., 2022).

Exposure to false information on social media is associated with conspiracy theories. Specific conspiracy theories may include fabricated allegations of fraud; cooperation between the pharmaceutical industry, governments, and doctors; and the presence of microchips and poison in vaccinations (Islam et al., 2021; Jamison et al., 2020). The perceived safety of vaccinations and the desire to receive them were inversely correlated with believing in COVID-19 conspiracy theories in the U.S. This is explained by decreased perceptions of the threat and safety concerns (Romer et al., 2020). Conspiracy theories are pervasive, hard to refute, and associated with a tendency to disregard scientific experts' advice, discouraging vaccination uptake. Conspiracy theory views are frequently linked to other conspiracy theory beliefs, suggesting that regardless of the content of these ideas, the public is more inclined to believe them (Ngai et al., 2022).

Concerns for efficacy argue that vaccinations are unnecessary, highlighting their failure and implying that disease incidence rises after vaccination. For instance, the perception that vaccination increases the individual risk of contracting COVID-19 rather than avoiding the infection. One study examined arguments made on anti-vaccination websites to gauge the extent of misinformation found on digital media. Much of the content demonstrated the ineffectiveness of vaccination by promoting the idea that people who developed VPDs were those who had

received vaccinations (Kata, 2010). Another recent large-scale online study in the U.S. indicated that 70% of parents were confident in vaccine efficacy, and 40% were worried about childhood vaccine safety (Kempe et al., 2020).

Societal Pressures on Mothers

Mothers significantly impact children throughout their childhood. However, maternal figures who do not embrace idealized parenting standards presented via media sources experience increased scrutiny. The good mother philosophy maintains that mothers are "good" if they adhere to the standards set forth by the dominant parenting paradigm, such as intensive mothering ideology, which places the child's needs and childrearing first. In the modern definition of a good mother, nurturing and raising children are often seen as instinctive behaviors for women with these qualities already inborn (Williamson et al., 2022). In addition, a study of maternal standards identified five different types of mothers and the normative expectations that apply to each: the present mother who must provide the best care for her child; the future-focused mother who must ensure her child becomes successful; the working mother who must balance raising her children and her job; the public mother who must exert control over her mothering in connection to numerous individuals depending on her informed status; and the happy mother who must be satisfied with her role (Schmidt et al., 2022).

The reality is that there is no such thing as the ideal mother, which puts unrealistic and impracticable pressure on modern women who frequently balance motherhood with employment, school, and various other responsibilities. According to research, striving to be the perfect mother can harm family and professional outcomes by causing stress, guilt, and exhaustion (Meeussen & Van Laar, 2018). Mothers often seek social support to validate and affirm their parenting abilities. Social support is significant to mothers, especially first-time or

postpartum mothers, and can be critical to mental wellness and preventing psychological distress (De Sousa et al., 2020). Often new mothers need more background knowledge of raising children, and motherhood can become overwhelming without support or guidance. However, due to technology and social media development, mothers find support groups through new communication channels, including forums and blogs on social media and mobile phone apps (Yamashita et al., 2022).

On social media, groups can offer a variety of support. Emotional support meets a person's emotional or affective needs, and esteem support boosts their self-esteem or belief in their capacity to overcome a hurdle. Information support provides valuable data and network support to give people a sense of community and network support (Smailhodzic et al., 2016). These support groups also serve as a supplemental source of health information for all stages of motherhood, giving mothers additional confidence. However, at times, the pressure to parent successfully is not eliminated by the social support that a mother receives (Moon et al., 2019). At times, virtual social support does not reduce parental pressures on mothers. Social support obtained via social media can confuse mothers in various directions, particularly in healthcare. As online sources can contain misinformation, social media can negatively impact the attitudes and behaviors of mothers toward vaccinating their children (Melovic et al., 2020).

Parents may decide not to vaccinate their children for many reasons, including religious beliefs, personal beliefs, or philosophical reasons. A primary source of fear is the safety of vaccinations, as mothers try to discern factual versus fictitious information. Mothers are overwhelmed with information, reports, and opinions from others that can cause uncertainty about the safety of vaccinations. They cast doubt on both immediate unfavorable effects and the potential for long-term harmful effects (McKee & Bohannon, 2016). These apprehensions about

protecting their offspring can cause mothers to decline vaccinations altogether. Therefore, it is essential to explore the negative impact of social media on mothers' choice to vaccinate their children.

Maternal Trust in Medical Professionals

To ensure that vaccine communication occurs and vaccination rates are high, physicians, physician assistants, nurses, and other pertinent medical professionals play a vital role. The relationship that healthcare professionals (HCPs) create with parents must be intentional if parents are to receive the support and information that they require to make knowledgeable decisions about their child's healthcare. A national study was done in 2014 to assess the importance of HCPs' input in parents' decision-making. The results showed that parents who were skeptical about vaccinations were more likely to accept HPV vaccination if they received superior recommendations. However, the study also discovered that only 33% of those parents had received recommendations of this quality, and 50% claimed to have had no recommendations for the HPV vaccine (Badur, 2020).

The accessibility of a medical facility itself may contribute to the public's faith in it. It is unlikely that expectant mothers will interact with healthcare facilities and professionals if barriers to access exist, raising concerns relating to maternal healthcare systems. The proximity of a healthcare facility to a mother can influence whether she will use it and develop a rapport with the staff to get essential medical advice. The concept of trust can only exist if mothers and healthcare professionals first establish a relationship. The long-term impacts of a lack of trust can negatively affect maternal and child health (Badur, 2020).

Strategies to Address Vaccine Hesitancy

Health specialists, lay activists, and social media companies must work together to

mitigate the dissemination of false information on social media. Due to trials performed on the public, practical tactics to target specific groups impacted by vaccine hesitancy do not exist. General vaccine education campaigns can affect public attitudes toward vaccination. However, targeting high-risk or vulnerable communities requires specialized communication. Evidence-based, context-specific, culturally specific, and suited to the individual's place on the vaccination hesitancy spectrum are all essential components of effective vaccine communication (Rzymski et al., 2021). By interacting with specific groups based on their issues, discussions are focused and are more likely to be fruitful and less likely to become hostile (Tuckerman et al., 2022). In addition, Oviatt & Reich (2019) discovered that pregnant women and mothers of babies use social media to bolster their feelings of support or help to find humor in everyday mothering or pregnancy-related themes. Humor research has shown that it effectively improves information retention and health outcomes. Thus, using humor to provide health information to women about pregnancy and postnatal periods might be advantageous since users prefer humorous posts. Medical and public health experts can cease the spread of misinformation by using social media and public forums. Health professionals can clarify inaccurate posts using language that will sway those debating getting immunized. Furthermore, non-professional vaccine supporters can refute arguments against immunization with accurate information. If done as quickly as possible, rectifying inaccurate information on social media can prevent erroneous information from being further embedded online. Methods of combatting online misinformation are an area of research interest. One such study examined the effectiveness of an online game that pretends to propagate false and fake news to teach players the ease of online information manipulation (Roozenbeek & Van der Linden, 2019). Another explores using artificial intelligence (A.I.) to detect false information online (Hossain et al., 2020). Nonetheless, social media networks must cooperate to

stop the spread of false information. They are the gatekeepers to limitless online information (Garett & Young, 2021).

Summary

A thorough review of the current literature produced numerous investigations focusing on social media's impact on maternal vaccine reluctance. Additionally, the studies examined for this literature review have investigated the resurgence of VPDs, maternal perceptions regarding vaccine hesitancy, socioeconomic determinants of vaccine hesitancy, suggestions for strategies to address vaccine hesitancy, and the application of the HBM to vaccine hesitancy. This data provides insight relating to maternal vaccine refusal.

Several potential explanations exist for increased maternal vaccine hesitancy, ranging from perceptions of vaccine safety and efficacy, lack of trust in medical professionals and scientists, the influence of personal healthcare experiences, and misperceptions of current vaccination schedules. Mothers turn to social support groups on social media platforms that often support their already embedded perceptions regarding vaccinations. Society has pressured mothers to raise their children adequately and appropriately according to social norms. Social media has grown as a news and health information source for many. With women being the primary users, social media content and messaging regarding vaccines significantly impact mothers' vaccine intentions for their children. Healthcare professionals can better comprehend VPD and meet the needs of this population by being aware of the causes of reluctance. The current literature on vaccine-hesitant mothers' and social media's influence on vaccine choices is discontinuous. The existing literature does not fully explore the variables identified. Additional research will more accurately describe the impact of social media on maternal vaccination decisions.

CHAPTER THREE: METHODS

Overview

This descriptive study explores whether accessing social media sites for information related to vaccination influences maternal COVID-19 vaccination decisions. The variables of interest are the social media source accessed, the amount of time spent accessing these media sources, maternal sociodemographic factors, and maternal vaccination decisions. The study aims to provide a deeper understanding of the sociodemographic factors contributing to vaccine hesitancy among mothers to encourage public health officials to address any noted gaps. The secondary goal is to assist healthcare providers in identifying opportunities to lessen vaccine hesitancy through improving health literacy and combating misinformation on social media.

Research Design

The proposed research shall be quantitative and descriptive. Data collection will occur via a cross-sectional survey. This approach is well suited to describe the characteristics of the population of interest. Using a quantitative research method, the researcher may identify objective metrics and analyze numerical, statistical, or mathematical data gathered through surveys. Descriptive statistic calculations for all variables, including those relating to social media patterns of use, sociodemographic characteristics, and maternal vaccination decisions, will occur. A survey method is economical, allows rapid data collection, and can be disseminated virtually (Creswell & Creswell, 2017).

Research Questions

RQ1: What social media platforms are mothers accessing to gain information related to vaccination?

RQ2: How does accessing various social media platforms affect maternal vaccination

decisions?

RQ3: What are the sociodemographic characteristics of mothers who refuse childhood vaccines?

Hypothesis

The descriptive design will measure the distribution of the variables of interest without regard to causal or other hypotheses. The collection of this data may generate hypotheses related to factors leading to or protecting against maternal vaccine refusal.

Participants and Setting

Study Participants

The accessible population for the proposed research is the maternal population using social media. This population is representative of various geographic settings and cultural, ethnic, and political backgrounds. Participant recruitment will occur via a social media post.

Inclusion Criteria

Participants must be (a) current or expectant mothers, (b) older than 18 years, (c) have at least one child under the age of 18, (d) living in the same home as their child at least half of the year, and (e) currently residing in the United States.

Exclusion Criteria

Participants must not be (a) male, (b) under the age of 18, (c) live outside of the United States, or (d) refuse to provide informed consent to participate in the study.

Sampling Methodology

Social media distribution of the survey invitation to various individuals will occur. However, given the inclusion and exclusion criteria previously outlined, a specific population will be targeted by using purposive (non-probability) sampling. This sampling strategy will help

guarantee that the study's sample is representative of the target population.

Sample Size

The United States (U.S.) has approximately 104.43 million households with children under 18 (U.S. Census Bureau, 2021). This number excludes households where a male is a householder, and their spouse or partner is absent. Additionally, an estimated 308.27 million social media users are in the U.S. (Dixon, 2023). A sizable sample is preferable and more likely to represent the population of interest. A sample size of 385 respondents will generate generalizable data describing the population of interest with a 95% confidence level and a 5% margin of error (Charan & Biswas, 2013).

Instrumentation

The proposed research will utilize a newly developed survey instrument, the Social Media and Maternal Vaccination Decision Survey (see Appendix A), and previously established instruments, the Vaccine-Related Attitudes and Beliefs Measure (see Appendix B) and an adjusted version of the Information Seeking in Facebook Scale (see Appendix C). For this study, "Facebook" will replace "social media" in the Information Seeking in Facebook Scale (ISFS) to capture respondent use of all social media platforms and generalize data findings. The survey instrument consists of five items establishing inclusion and exclusion criteria, 10 items collecting demographic information, three assessing social media sources and time spent accessing social media sources, 18 assessing vaccine hesitancy, and 18 assessing information-seeking behaviors on social media.

Demographics

Study participant demographics will be assessed by requesting the respondent's age and personal income. This ratio level data will be presented in ranges. Sex, race, ethnicity, marital

status, employment status, and religious affiliation will be assessed nominally, with respondents able to choose an applicable option. The level of education obtained will be assessed ordinally.

Social Media and Maternal Vaccination Decisions Survey

The survey instrument will include a self-designed survey and previously validated instruments. Social media platforms accessed will be identified in a multiple-answer question. Time spent accessing social media sources will be identified by category in a multiple-choice format. Vaccination decisions will be reported in a multiple-selection and multiple-choice inquiry. The survey's last section, which explores information seeking on social media, will likewise have a multiple-choice style.

Vaccine-Related Attitudes and Beliefs Survey (VRABS)

The VRABS was initially used to investigate how an online platform with vaccine information and interactive social media components changed parents' attitudes regarding immunization. The initial development of the 19-item questionnaire was a constituent of a broader survey assessing parental attitudes and views regarding vaccine-preventable diseases, vaccination risk, and confidence they felt about choosing the best vaccinations for their children. The Health Belief Model and the Theory of Planned Behavior are the basis for these survey questions. After pilot testing and validation, focus groups and interviews improved the VRABS. The Cronbach's Alpha coefficient (α) indicates good internal consistency (Daley et al., 2018).

The VRABS employs a 5-point Likert scale, with response choices ranging from "strongly disagree" to "strongly agree" or from "not at all confident" to "absolutely confident." Responses were as follows: "strongly disagree" = 1, "disagree" = 2, "neither agree nor disagree" = 3, "agree" = 4, and "strongly agree." In addition, regarding questions that assess confidence

level, responses were as follows: “not at all confident” = 1, “not confident” = 2, “not sure” = 3, “somewhat confident” = 4, and “absolutely confident” = 5. A higher score reflects parents' increased belief in the value of immunizations and their perception of their decision-making abilities in this area. Scores are calculated by adding the items for each construct and then dividing by the number of contributing items to provide a mean score for every respondent within each construct on the 5-point Likert scale (Daley et al., 2020).

Information Seeking Through Facebook Scale (ISFS)

The ISFS aids in understanding information-seeking behaviors on the social networking site (SNS) Facebook. The assessment of the scale includes four steps: (1) construct articulation, (2) response format selection, (3) data collecting, and (4) psychometric analysis. The General Social Media Use Subscale, Online and Facebook Friendships Scale, Social Media Use Integration Scale, and the Facebook Intensity Scale, which measures time spent on the social media platform, prove validity for the ISFS. The Cronbach's Alpha coefficient (α) and the split-half method confirm the scale's reliability. Numerous studies utilize the ISFS (e.g., Kaspar & Müller-Jensen, 2021; Karademir Coşkun et al., 2020; Asghar, 2015).

The survey consists of 23 items that highlight the fundamental information-seeking techniques. It employs a Likert-type answer scale to indicate how strongly respondents agree or disagree with each proposition, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). Responses were as follows: "strongly disagree" = 1, "disagree" = 2, "neither agree nor disagree" = 3, "agree" = 4, and "strongly agree." A higher score reflects more significant information-seeking behaviors on Facebook (Asghar, 2016).

Permissions

Without obtaining formal consent, test content for both the VRABS and ISFS may be

duplicated and utilized for nonprofit academic and research endeavors. Distribution of the survey must be restricted and only provided to study participants or the researcher. The survey distribution will include a credit line with a source attribution and the copyright holder (Daley et al., 2020; Asghar, 2016).

Validity and Reliability

The survey will undergo pilot testing on a small sample size of 30-50 respondents. This technique will draw attention to any ambiguous questions and can forecast how respondents will respond to each survey question. After reviewing the preliminary pilot test's findings, adjustments to the survey questions may occur (Tsang et al., 2017). Additional pilot testing may occur, if necessary, before finalizing the survey draft. Reliability for the survey will be measured using Cronbach's Alpha coefficient (α), which commonly determines reliability in behavioral, social, and educational science studies.

Procedures

Institutional Review Board (IRB) Approval

Submission of an application for Liberty University IRB approval will occur. Data collection will commence after receipt of approval.

Recruitment

Study participant recruitment will occur via social media posts on various platforms. The post will include a link to complete the survey via SurveyMonkey (see Appendix D).

Data Collection

Study participant recruitment will occur through social media posts, including a link to complete the survey through SurveyMonkey (SM). After accessing the survey link, respondents will receive the Survey Participation Information (see Appendix E). Study participant

enrollment will be limited to the time it takes for respondents to complete the online survey, which is approximately 15 minutes. The survey will be open and accessible for approximately one month.

Data Analysis

The proposed research will include self-reported demographic data, data from the Vaccine-Related Attitudes and Beliefs Measure, Adapted Information Seeking Social Media Scale, and self-designed survey questions. Given the research methodology and design, all variables will be analyzed using descriptive statistics. Age, a ratio level variable, will be tested for normality through the Shapiro-Wilk test ($\alpha < .05$). Appropriate measures of central tendency and dispersion will be reported. Frequencies and percentages, and the median and interquartile range (IQR), will be run and reported for household income, an ordinal level variable. Nominal and any other ordinal-level demographics, including sex, ethnicity, race, state of residence, and educational attainment, will have frequencies and percentages reported. Appropriate descriptive statistics for participant demographics and characteristics will be presented in tables.

Frequencies and percentages will be reported for all the nominal and ordinal level variables to analyze the responses necessary to address all research questions. These study variables of interest will include the type of social media source accessed to obtain information related to vaccination, the amount of time spent accessing these media sources, maternal socioeconomic factors, and maternal vaccination hesitancy or refusal.

The participants' attitudes and beliefs on vaccinations and information-seeking behaviors on social media platforms will be examined using the VRABS and ISFS, respectively. The different degrees of vaccine reluctance among mothers will be addressed using the Likert responses from the VRABS. The ISFS Likert responses will gauge how frequently and to what

extent participants utilize social media for information seeking. Scores will be summed, and the computed total will be tested for normality through the Shapiro-Wilk ($\alpha < .5$). Appropriate central tendency and dispersion measures will be reported accordingly. All findings will be displayed in tabular format.

Data will be collected anonymously through SM. Data collected through SM will be accessible only through a password-protected account and encrypted. SM data will be downloaded through an Excel data file (password-protected) and stored on a password-protected computer in a locked office accessible only to the principal investigator and sub-investigator. The principal investigator will maintain the security and confidentiality of the data throughout all management stages. Data will be destroyed within three years of study completion.

CHAPTER FOUR: FINDINGS

Overview

This quantitative study investigated whether accessing social media platforms for vaccination-related information impacts maternal vaccination decisions. The study also applied methods to infer social media use and vaccine hesitancy among mothers. This chapter will review the research questions used to guide this study, showcase the descriptive statistics to describe the data obtained during the study, and the hypothesis derived from the study findings.

Research Question(s)

RQ1: What social media platforms are mothers accessing to gain information related to vaccination?

RQ2: How does accessing various social media platforms affect maternal vaccination decisions?

RQ3: What are the sociodemographic characteristics of mothers who refuse childhood vaccines?

Hypothesis

The descriptive design measured the distribution of the variables of interest without regard to causal or other hypotheses. Generate hypotheses related to factors leading to or protecting against maternal vaccine refusal will be addressed.

Descriptive Statistics

The results of the surveys were analyzed to determine the socio-demographic factors of participants, assess the utilization of social media sources, evaluate vaccine hesitancy, and understand information-seeking behaviors on social media. The survey was distributed across Facebook, Instagram, and LinkedIn, covering a range of survey items aimed at comprehending

the sociodemographic factors influencing vaccine hesitancy among mothers. The survey's broad spectrum, combined with the utilization of a newly developed survey instrument and two previously validated instruments, facilitated a comprehensive analysis to investigate whether accessing social media platforms for vaccination-related information impacts maternal COVID-19 vaccination decisions.

In total, 386 respondents accessed the survey. However, 3 (0.78%) individuals were excluded as they were not 18 or older. Furthermore, respondents were excluded from continuing the survey due to not living in the U.S. (n=18; 4.68%), not being a current or expectant mother (n=14; 3.64%), not having at least one child under the age of 18 (n=25; 6.49%), or if at least one of their children does not live with them for at least six months of the year (n=37; 9.61%). These factors resulted in a response rate of 81.6% and a completion rate of 70%. The final sample size was 315.

Of those who completed the questionnaire, the participants were aged between 18 and 60 and were tested for normality via Shapiro-Wilk ($p < .001$). The median age was 30 - 39 years (IQR = 1). The majority of the participants were White (n = 171; 54.29%) and did not identify as Hispanic, Latino, or Spanish (n = 259; 82.22%). Participation from 46 out of 51 United States was observed. Notably, Colorado had the highest response rate (n = 27; 8.82%), while states like Arkansas, Minnesota, and North Dakota showed lower response rates (n = 1; 0.33%).

Regarding relationship status, the majority of respondents indicated they were married (n = 263; 74.6%), with 30 (9.52%) reported as widowed, 15 (4.76%) reported as divorced or separated, and 19 (6.03%) reported as never married. Employment status varied, ranging from those employed and working 1-39 hours per week (n = 108; 34.29%) to those who were disabled (n = 2; 0.63%). In addition, the median household income was $61,000 - $90,999 (IQR = 1).

Education levels varied widely, ranging from those without a high school degree (n = 4; 1.27%) to those with graduate school completion (n = 116; 36.83%). Most respondents (n = 131; 41.59%) had at least a bachelor's degree. Religious diversity was also observed. One hundred and eight (34.29%) participants reported affiliating with Christianity, while 12 (8.89%) reported having no religion.

Over half (n=161; 51.11%) of the participants reported having two children (aged 17 or younger) for whom they are either the parent or guardian and who live in their household for at least half of the year. All participants reported having an account with at least one social media site, with 161 (51.11%) participants reporting having a Facebook account, 169 (53.65%) reporting having a X account, and 159 (50.48%) reporting having an Instagram account. Participants also reported using at least one social media platform to obtain information related to vaccination.

Table 1

Sociodemographic Characteristics of Participants

Sample Characteristic	*n*	*%*
Hispanic, Latinx, or Spanish origin		
Yes	259	82.22
No	56	17.78
Race		
American Indian/Alaska Native	8	2.54
Asian	7	2.22

Black/African American	58	17.78
Native Hawaiian/Pacific Islander	34	10.79
White	171	54.29
Other	7	2.22
Marital status		
Married	236	74.92
Widowed	30	9.52
Divorced	15	4.76
Separated	15	4.76
Never married	19	6.03
Education		
Less than a high school degree	4	1.27
High school degree or equivalent (e.g., GED)	4	1.27
Some college but no degree	16	5.08
Associate degree	44	13.97
Bachelor degree	131	41.59
Graduate degree	116	36.83
Employment		

Employed, working 1-39 hours per week	108	34.29
Employed, working 40 or more hours per week	141	44.76
Not employed, looking for work	33	10.48
Not employed, NOT looking for work	24	7.62
Retired	7	2.22
Disabled, not able to work	2	0.63
Household income		
$0 - $30,999	13	4.13
$31,000 - $60,999	43	13.65
$61,000 - $90,999	106	33.65
$91,000 - $ 120,999	115	36.51
$121,000 - $150,999	29	9.21
$151,000 or more	9	2.86
State of Residence		
Alabama	6	1.96
Alaska	4	1.31
Arizona	6	1.96
Arkansas	1	0.33

California	22	7.19
Colorado	27	8.82
Connecticut	5	1.63
Delaware	8	2.61
District of Columbia (DC)	1	0.33
Florida	21	6.86
Georgia	13	4.25
Hawaii	6	1.96
Idaho	2	0.65
Illinois	6	1.96
Indiana	4	1.31
Iowa	4	1.31
Kansas	4	1.31
Kentucky	12	3.92
Louisiana	4	1.31
Maine	0	0.00
Maryland	12	3.92
Massachusetts	2	0.65

Michigan	12	3.92
Minnesota	1	0.33
Mississippi	12	3.92
Missouri	3	0.98
Montana	4	1.31
Nebraska	2	0.65
Nevada	0	0.00
New Hampshire	0	0.00
New Jersey	13	4.25
New Mexico	3	0.98
New York	10	3.27
North Carolina	2	0.65
North Dakota	1	0.33
Ohio	10	3.27
Oklahoma	3	0.98
Oregon	1	0.33
Pennsylvania	2	0.65
Rhode Island	1	0.33

South Carolina	5	1.63
South Dakota	0	0.00
Tennessee	2	0.65
Texas	13	4.25
Utah	1	0.33
Vermont	4	1.31
Virginia	19	6.21
Washington	6	1.96
West Virginia	3	0.98
Wisconsin	3	0.98
Wyoming	0	0.00

Frequencies and percentages were reported for demographic characteristics and the top three most used social media platforms for vaccine-related information (Table 2). Participants aged between 30 and 39 were more likely to use Facebook, X, and Instagram to obtain information related to vaccination. They reported spending, on average, 30 to 59 minutes per day accessing health-related information on social media sites. Participants who were married, obtained a bachelor's or graduate degree, were employed and working 40 hours or more per week, and had an annual household income in 2022 of $91,000 to $ 120,999 were also more likely to use one of the three noted social media platforms to obtain vaccine-related information.

Table 2

Social Media Platforms Used to Obtain Vaccine-Related Information Related to Vaccination by Mothers by Demographics

Platform	**Facebook**		**X**		**Instagram**	
	n	%	n	%	n	%
Age						
18 - 20	3	0.95	1	0.32	1	0.32
21 - 29	10	3.17	10	3.17	15	4.76
30 - 39	76	24.13	66	20.95	61	19.37
40 - 49	47	14.92	39	13.38	25	7.94
50 - 59	7	2.22	3	0.95	5	1.59
60 or older	3	0.95	0	0	1	0.317
Marital status						
Married	114	36.19	85	26.98	74	23.49
Widowed	15	4.76	16	5.08	13	4.13
Divorced	6	1.90	4	1.27	6	1.90
Separated	4	1.27	6	1.90	8	2.54
Never Married	7	2.22	8	2.54	7	2.22
Race						

American Indian/Alaska Native	4	1.27	4	1.27	3	0.95
Asian	2	0.63	3	0.95	3	0.95
Black/African American	27	8.57	13	4.13	24	7.62
Native Hawaiian/Pacific Islander	14	4.44	22	6.98	15	4.76
White	82	26.03	64	20.32	39	12.38
Multiple Races	16	5.08	12	3.81	18	5.71
Other	1	0.32	1	0.32	6	1.90
Education						
Less than high school degree	4	1.27	0	0	0	0
High School degree or equivalent	4	1.27	3	0.95	2	0.63
Some college but no degree	6	1.90	3	0.95	7	2.22
Associate degree	16	5.08	23	7.30	21	6.67

Bachelor degree	58	18.41	53	16.83	44	13.97
Graduate degree	58	18.41	37	11.75	34	10.79
Employment Status						
Employed, working 1 – 39 hours per week	57	18.10	36	11.43	29	9.21
Employed, working 40 or more hours per week	61	19.37	58	18.41	47	14.92
Not employed, looking for work	12	3.81	12	3.81	19	6.03
Not employed, NOT looking for work	12	3.81	8	2.54	11	3.49
Retired	4	1.27	3	0.95	1	0.32
Disabled, not able to work	0	0	2	0.63	1	0.32
Annual household income in 2022						
$0 - $30,999	6	1.90	4	1.27	3	0.95
$31,000 - $60,999	18	5.71	16	5.08	16	5.08

$61,000 - $90,999	46	14.60	43	13.65	36	11.43
$91,000 - $ 120,999	59	18.73	43	13.65	39	12.38
$121,000 - $150,999	10	3.17	10	3.17	9	2.86
$151,000 or more	7	2.22	3	0.95	5	1.59

Survey items derived from the Vaccine-Related Attitudes and Beliefs Survey (VRABS) assessed attitudes and beliefs regarding the benefits, risks, and perceived self-efficacy of vaccination. Participants rated these items on a scale of 1 to 5, with 5 indicating strong agreement with the survey statement. Internal consistency was tested using Cronbach's alpha in the Statistical Package for the Social Sciences (SPSS), yielding an alpha value of 0.907, indicating a high internal consistency of the scale. The Shapiro-Wilk test of normality (S-W = .783-.841, $df = 315$, $p < 0.001$) was conducted, confirming that the dataset was normally distributed. The Q-Q plot showed data points falling within a straight line, and the boxplot did not display any outliers, further supporting the assumption of standard normal distribution.

Mothers' confidence in the benefits of vaccination yielded an overall mean score of 3.98, reflecting a higher-than-average confidence level. Concerns about immunization risks yielded an overall mean score of 3.94 among mothers, indicating elevated levels of concern. Regarding perceived self-efficacy in vaccination decision-making, mothers achieved an overall mean score of 4.06, indicating a higher-than-average confidence level. Additionally, mothers who were white, married, with at least some college education, employed and working 1-39 hours per week, had a household income in 2022 of $91,000 - $120,999, and aged between 30-39, also scored higher in all categories assessed within the survey. These results underscore notable levels

of confidence in knowledge of vaccines; however, concern regarding safety and efficacy was also evident among the surveyed mothers (Table 3, Table 4, Table 5)

Table 3

Results From Vaccine-Related Attitudes and Beliefs Survey (VRABS) - Attitudes and Beliefs Regarding Benefits of Vaccination

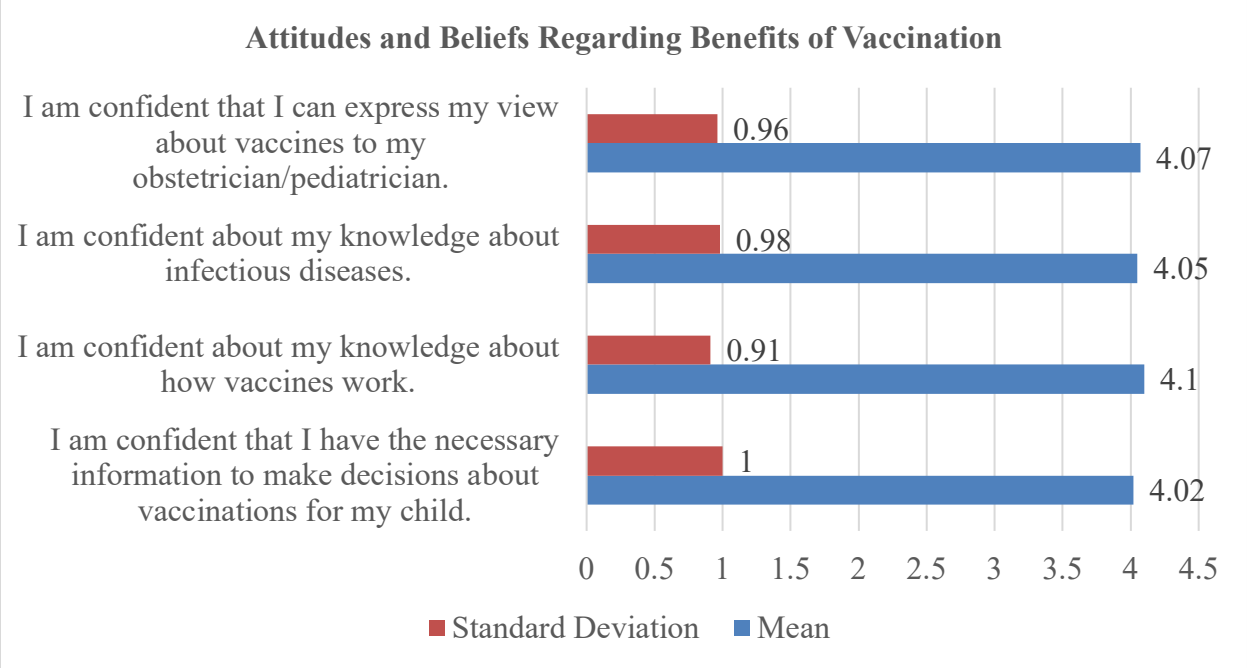


Table 4

Results From Vaccine-Related Attitudes and Beliefs Survey (VRABS) - Attitudes and Beliefs Regarding Risks of Vaccination

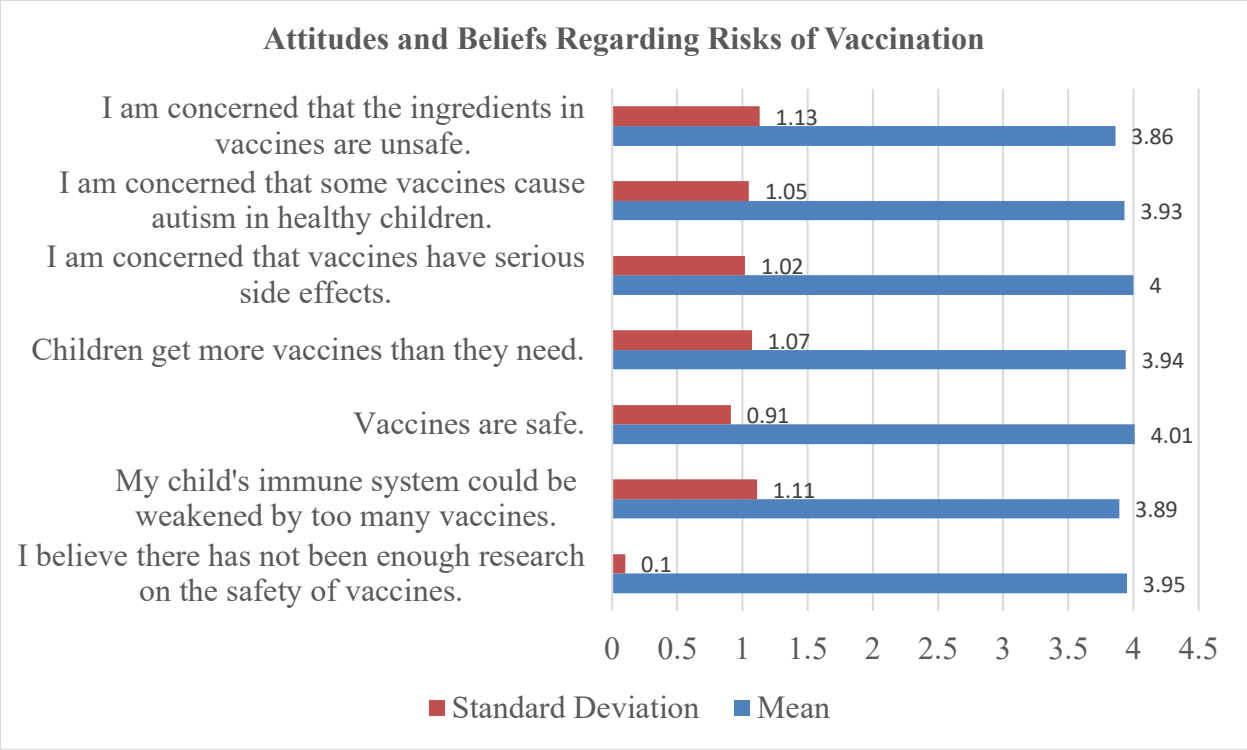
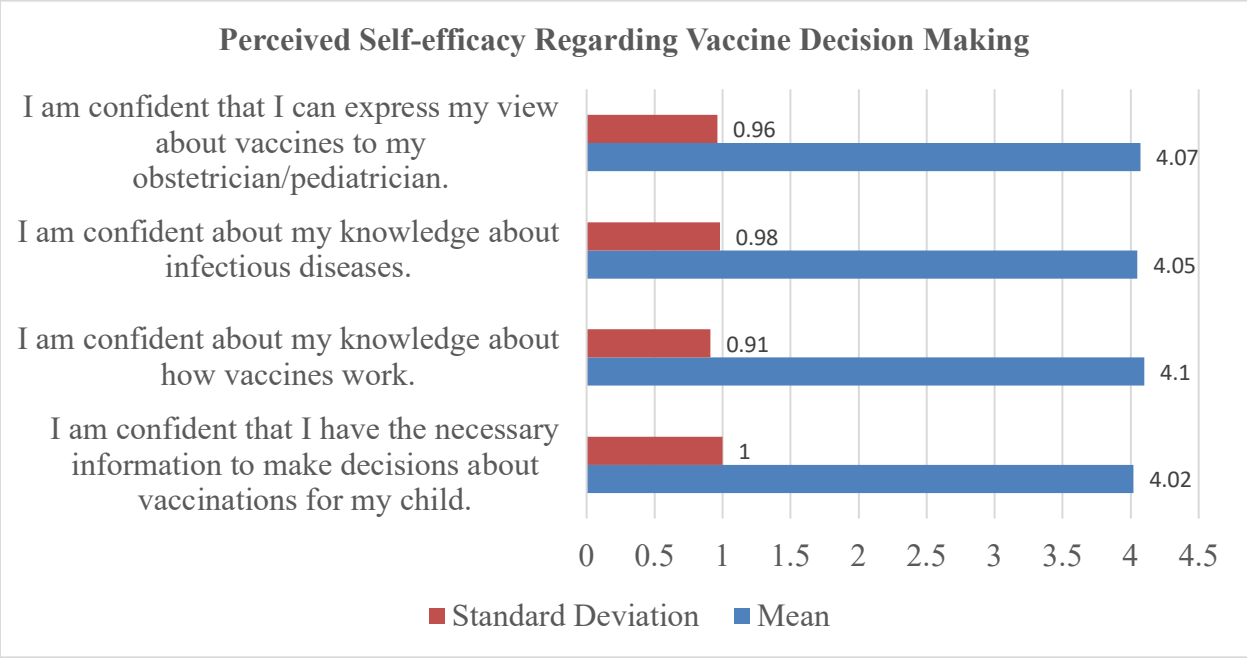


Table 5

Results From Vaccine-Related Attitudes and Beliefs Survey (VRABS) - Perceived Self-efficacy Regarding Vaccine Decision Making



For the descriptive examination of the Information Seeking and Social Media scale, participants' responses on survey items were assigned a mean score, and all responses were compiled for analysis using SPSS. To explore the scale's psychometric properties and circumvent fundamental assumptions underlying parametric statistics, the distributional shape of the scale was studied to ascertain the extent to which the assumption of normality was fulfilled. Skewness and kurtosis fell within the range of -2 to 2, and the Shapiro-Wilk test of normality (S-W = .836-.894, df = 313, $p < 0.001$) indicated that normality was a rational assumption. Moreover, a Q-Q plot exhibiting points closely adhering to the diagonal line further corroborated evidence of normality. Additionally, the boxplot suggested the absence of outliers. These indicators substantiate the fulfillment of the assumption of normality. Internal consistency was assessed using Cronbach's alpha, customary with Likert questionnaires. A Cronbach's alpha of 0.883 was observed, denoting a notable degree of internal consistency for the scale within this sample.

The survey assessed information-seeking behaviors based on five factors: social searching, hedonic proclivity, social browsing, consumer trends, information, and general erudition (Asghar, 2015). Higher scores for the survey items which were reverse scored ("I do not read quotes shared through social media photos or statuses," "I do not use social media to follow a trend," "I do not find informative posts on social media," and "I do not use social media as a source of information") indicated greater information seeking on social media (Table 6, Table 7, Table 8, Table 9, Table 10). Mothers who were 60 years or older, white, had less than a high school degree, were employed and working 1-39 hours per week, and had an annual household income in 2022 of $30,999 or less also scored higher on the scale of information seeking. The frequency of information seeking is correlated with overall social media usage and integration.

Table 6

Results From Information Seeking in Social Media Scale – Social Searching

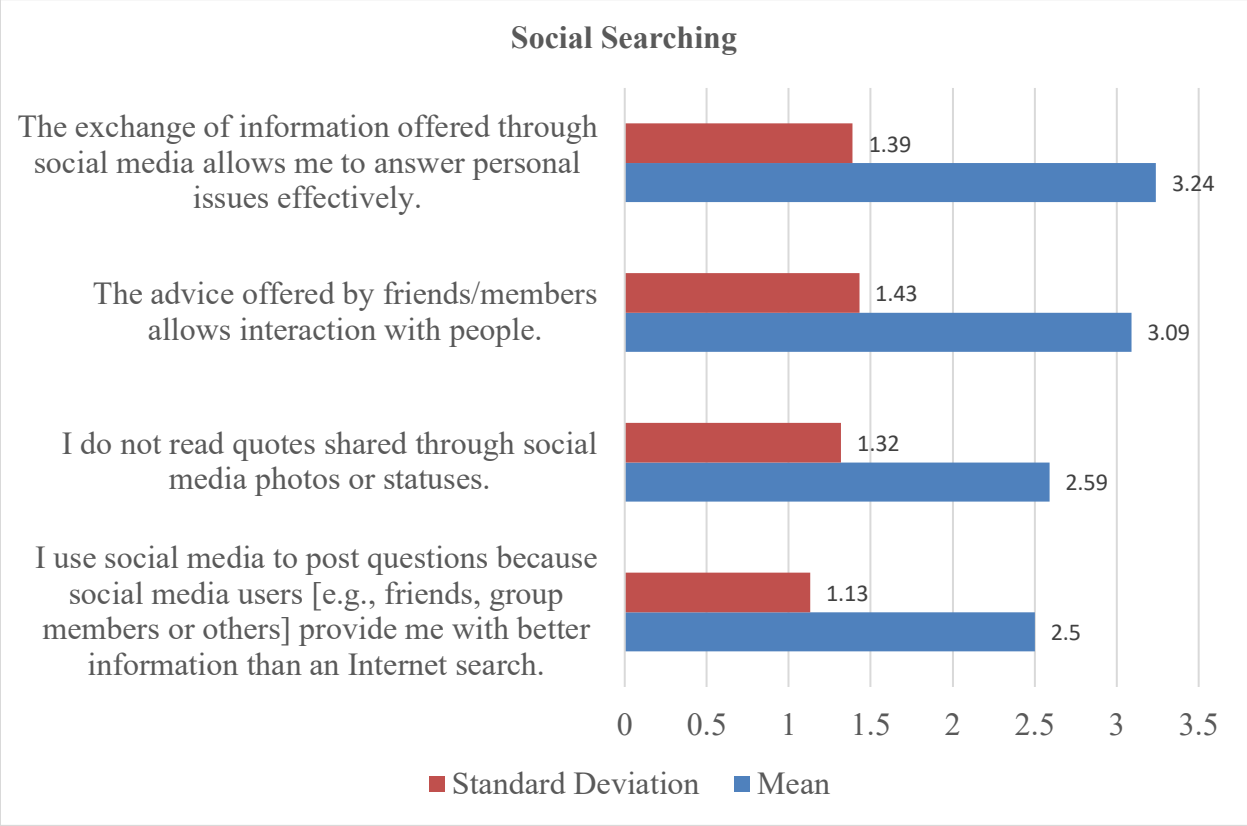


Table 7

Results From Information Seeking in Social Media Scale – Hedonic Proclivity

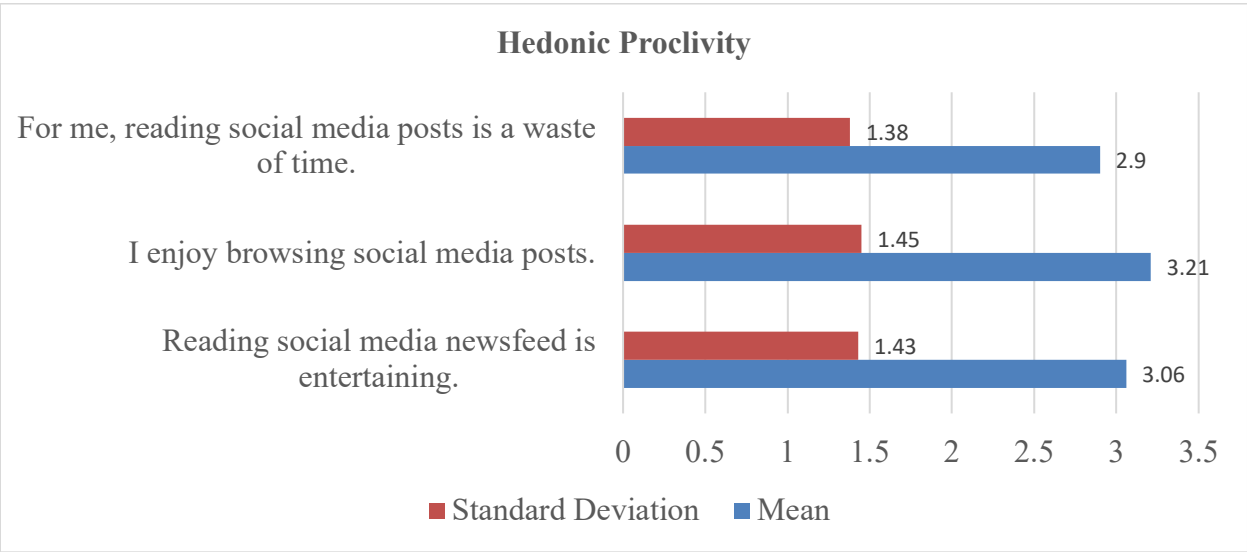


Table 8

Results From Information Seeking in Social Media Scale – Social Browsing

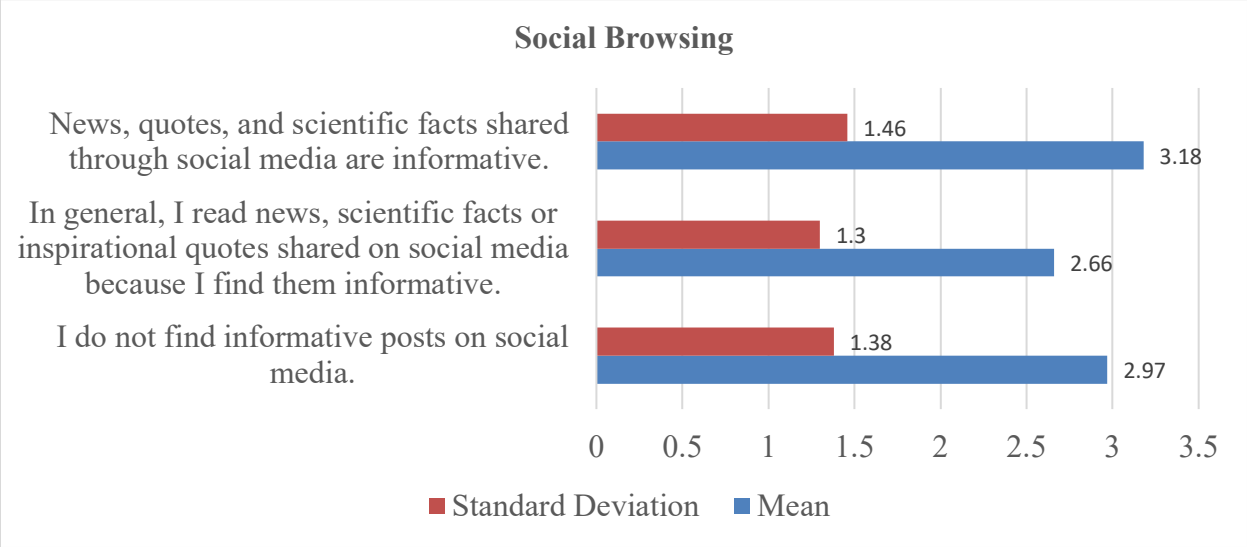


Table 9

Results From Information Seeking in Social Media Scale – Consumer Trends

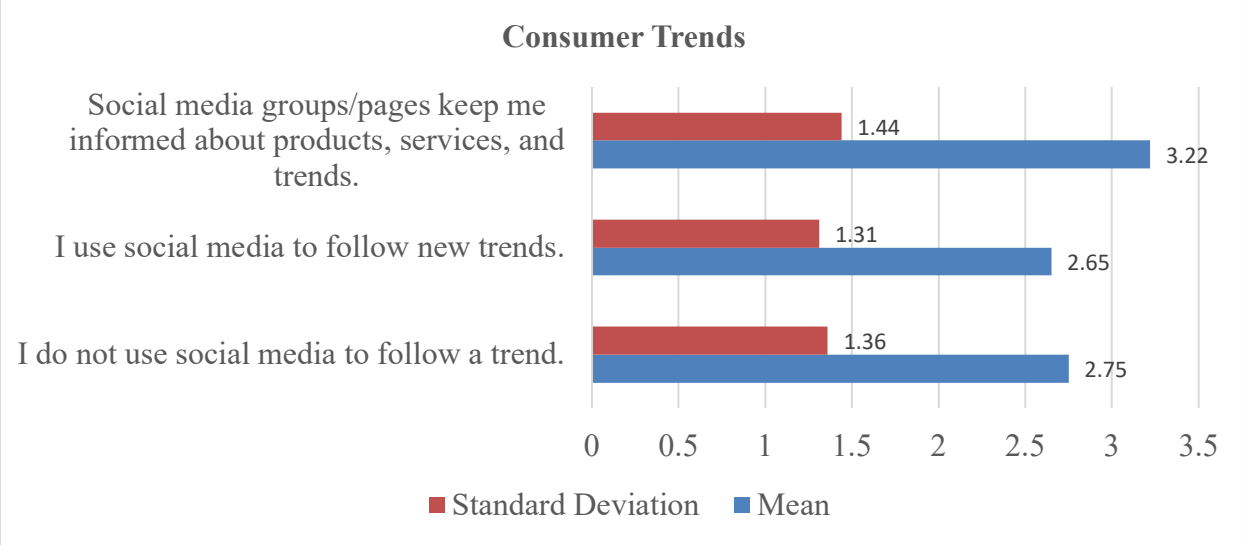
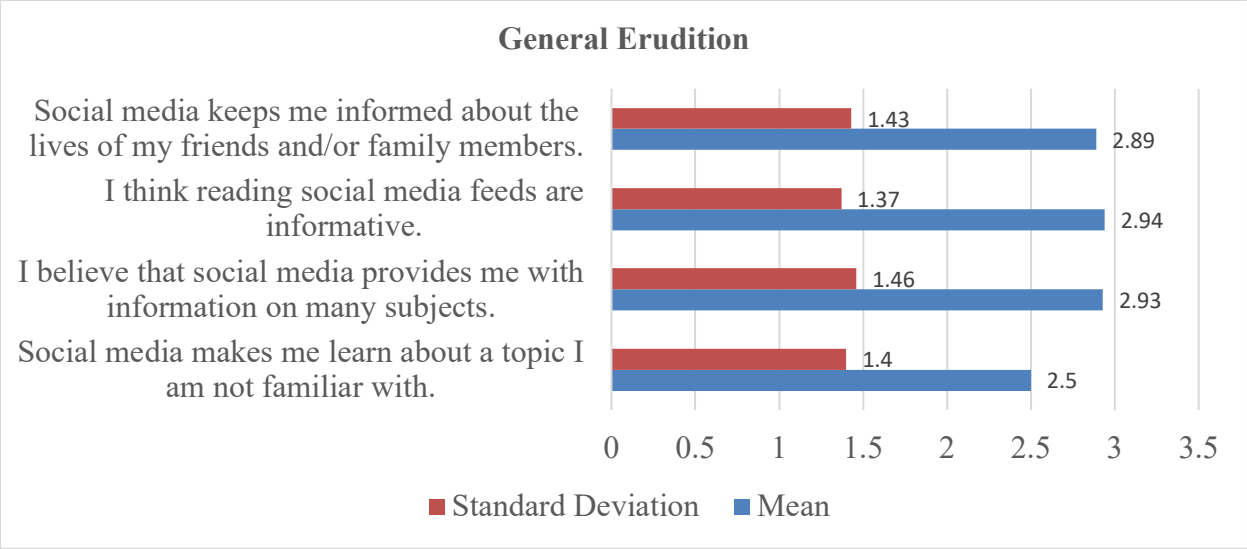


Table 10

Results From Information Seeking in Social Media Scale – General Erudition



Results

The descriptive design of the study facilitated the measurement of variables of interest without consideration of causal or other hypotheses. The findings, analysis, and interpretation of data in this study are used to help address the research questions identified. The findings suggest that mothers aged between 30 and 39, married, with at least some college education, employed full-time, and with a higher household income (between $91,000 and $120,999 in 2022) are more inclined to use Facebook, X, and Instagram as their primary sources for obtaining vaccine-related information compared to other demographic groups. Additionally, these mothers spend an average of 30 to 59 minutes daily accessing health-related information on social media platforms. Moreover, they demonstrate higher levels of confidence in the benefits of vaccination, greater concern about the risks associated with vaccination, and increased perceived self-efficacy in vaccination decision-making, as evidenced by their responses to the VRABS.

CHAPTER FIVE: CONCLUSIONS

Overview

Chapter Five presents the implications for healthcare professionals and policymakers, the limitations of this research, and recommendations for future research, which are informed by the results of this study. This chapter offers guidance on developing evidence-based strategies to encourage vaccine uptake, which may assist in public health initiatives targeted at averting vaccine-preventable diseases.

Discussion

This study aimed to explore whether social media sites for information related to vaccination impact maternal vaccination decisions.

Research Question One

What social media platforms are mothers accessing to gain information related to vaccination?

The ~~already~~ available literature supports the body of research on the specific social media platforms mothers use to learn about immunizations. According to Moon et al. (2019), mothers use social media the most compared to other adult groups, and 87% of them use Facebook to discover health-related information. Furthermore, according to a 2018 Pew Research Center survey, 11% of adults alter their health-related activities as a result of what they read on social media. Furthermore, women of childbearing age are more likely to turn to social media platforms for advice on newborn care because they believe they provide more reliable information than friends, family, or medical professionals (Moon et al., 2019).

The results from this study and previous studies help support the evidence of mothers' usage of social media as a source of information regarding vaccinations. The results corroborate

similar research demonstrating that mothers use Facebook, Instagram, and X most often. This is particularly true for married mothers who have higher incomes and are between 30 and 49 years old. Furthermore, the pattern of mothers using social media platforms to obtain health-related content for an average of 30 to 59 minutes a day is consistent with research regarding the frequency and duration of time spent on social media, which Dixon (2022) suggested increased as a response to COVID-19.

Additionally, the results confirm the existing understanding that mothers who are more active on social media express greater confidence in the benefits of vaccination, greater concern about associated risks, and perceptions highlighting their effectiveness in making vaccine decisions. These findings are consistent with previous research showing that individuals' engagement with health-related information on social media can influence the information they encounter, leading to changes in health-related attitudes and behaviors (Moon et al., 2019).

The findings of this research align with what can be inferred from previous studies, as they provide real-world evidence for how mothers use social media to learn about vaccines and how that impacts their views on vaccines. The results determined that mothers who obtain vaccine information from social media tend to have more concerns about vaccines. This correlates with current ideologies regarding the connection between where mothers look for vaccine information and their vaccine opinions and choices.

Research Question Two

What is the effect of accessing various social media platforms on maternal vaccination decisions?

A mother's decision to vaccinate her child might be influenced by social media use in both positive and negative ways. According to De Sousa et al. (2020), social media may be a

helpful tool for moms to request and receive social support, particularly for new or postpartum mothers who may not feel confident in their parenting skills. By giving moms emotional, intellectual, and communicative support, seeking social support on social media may also give women health updates along their parenting journey and increase their confidence (Smailhodzic et al., 2016). However, with the plethora of information available on social media, women may find it overwhelming, perplexing, and deceptive, particularly when it comes to vaccines and other health-related concerns. Furthermore, spreading misinformation on social media platforms may negatively influence maternal attitudes and behaviors toward children's vaccinations. This highlights the complex relationship between social support and the potential risks of accessing health information online (Melovic et al., 2020).

The study investigated the complex relationship between maternal vaccine choices and the usage of various social media sites. According to the study, mothers who are married, between the ages of 30 and 39, have a college degree, are full-time employed, and have a higher household income were more likely to primarily rely on social media platforms like Facebook and X for vaccine-related information, which can be validated with previous research.

The study's results also revealed that mothers utilize social media platforms to acquire health-related information for an average of 30 to 59 minutes per day, which may indicate that they are overexposed to overwhelming and confusing content. These results are consistent with current research, suggesting the dangers of false information that can be disseminated on social media and sway vaccination decisions by fostering skepticism and misunderstanding (Melovic et al., 2020). Overall, the study's results highlight the need for caution about the possible risks associated with misinformation and excessive exposure to online health information. However, some research suggests that it provides support and information-seeking pathways.

Research Question Three

What are the sociodemographic characteristics of mothers who refuse childhood vaccines?

According to the literature, those who are less educated, women, people from racial and ethnic minorities, people who live in rural regions, people with lower incomes, and people with lower levels of education tend to be more vaccine-hesitant (Barry, 2021). Furthermore, financially struggling individuals may find it challenging to get insurance or access medical facilities. The financial situation of single parents is also often considered since they frequently deal with excessive duties, exhaustion, and challenges in keeping up with routine health visits (Ventola, 2016). Moreover, studies show that although poor parental educational attainment has little effect on vaccine hesitancy, it has been a predictor of total vaccine refusal (Bertoncello et al., 2020).

The study results significantly overlap with the already published literature about the sociodemographic traits of moms who choose not to vaccinate their children. According to the research, mothers who use Facebook, X, and Instagram to look up information on vaccines had a higher likelihood of being married, working a full-time job, having a higher education, and being between the ages of 30 and 49. This contrasts with other studies that found vaccine reluctance was higher in those who reside in rural regions, have poorer incomes, and have less education (Barry, 2021).

Furthermore, although single motherhood was not a primary focus of the study, the findings suggest that socioeconomic conditions may influence attitudes and vaccination-related behaviors. Moms who made more money per household showed more faith in the advantages of immunizations. However, as the literature suggests, more investigation is needed to fully

understand the complex connection between vaccination rejection and being a single parent (Bertoncello et al., 2020). The findings of this study also highlight the need for more research into the intricate relationships between mothers' attitudes toward vaccines, their characteristics as parents, and their socioeconomic status, even though they largely support earlier studies on the sociodemographic factors associated with vaccine refusal.

Implications

The study's findings offer helpful information for stakeholders, legislators, and healthcare professionals. The following implications provide guidance for improving vaccine acceptance and uptake, improving research methodologies, and navigating ethical considerations to advance evidence-based strategies for promoting vaccination in diverse populations.

Practical Implications

Healthcare providers and public health experts can tailor vaccine-related social media campaigns on Facebook, X, and Instagram according to specific demographic groups (married, full-time working mothers, 30-39 years old, at least some college education, and higher household income). By focusing on these platforms and demographic groups, vaccination misinformation can be effectively reduced or even eradicated. Through efficient communication strategies to target audiences, crucial vaccine information can be disseminated to allow individuals to make informed decisions regarding their health.

Theoretical Implications

After examining social media platforms’ impact on health-related behaviors, such as vaccination decision-making, the study emphasized the need for further research to explore these connections. The association between social media usage, health behavior, and demographics

greatly influences individuals' information-seeking behaviors and views surrounding vaccines. This implies that future theoretical frameworks should consider this connection.

Methodological Implications

The surveys chosen for this study were used to show how individual's thoughts on vaccinations can be measured. Researchers can make further improvements to scales such as the VRABS to create a better understanding of behavior regarding vaccination. Descriptive research designs effectively obtain meaningful data regarding the characteristics and behaviors of populations without producing interpretations about their causes. Future research can utilize such scales, surveys, and research design as used in this study to identify characteristics of their target population.

Practical Recommendations for Stakeholders

Stakeholders in public health campaigns should develop focused messaging campaigns aimed at the demographic groups found in this study that use social media the most frequently to obtain health-related information to increase vaccine acceptance and uptake. The unique needs and preferences of women between the ages of 30 and 39 who have a higher income and have completed college should be the focus of these campaigns. Healthcare organizations and physicians should use social media platforms to actively participate in delivering reliable vaccine information. Healthcare professionals should concentrate on developing a strong online presence on platforms like Facebook, X, and Instagram to engage and communicate with target demographic groups effectively.

Social and Ethical Implications

The study findings imply that there may be differences in how various demographic groups get informed about vaccinations and how they use that information to inform their

personal health-related decisions. Aside from addressing specific challenges such as computer proficiency and financial status, measures must be implemented to guarantee that all populations have fair and equal access to reliable vaccination information. When distributing vaccination information on social media, healthcare organizations, and practitioners must follow ethical guidelines. This entails guaranteeing precision, openness, and responsibility for user privacy and autonomy.

Limitations

Potential limitations of the study were noted after the data analysis was completed. First, the recruiting method and the dissemination of the survey via Facebook, Instagram, and LinkedIn produced sample bias as women and younger users disproportionately access these platforms. Additionally, the survey instrument only included mothers or expectant mothers, excluding women wishing to become mothers. Only 315 respondents either completed the survey or were not excluded despite the intended sample size of 385. As a result, the findings may not apply to larger populations, especially for the demographic categories where the sample was underrepresented. Additionally, depending solely on self-reported measures, such as the VRABS and ISFS, could result in response bias and social prejudice, which could skew observations of vaccine-related attitudes and behaviors.

Furthermore, because the descriptive design restricts the ability to establish causal linkages between variables, longitudinal or experimental designs are required to investigate temporal correlations and causal pathways. Measuring social media usage based solely on self-reported frequency of use and amount of time spent accessing health-related content might not accurately reflect how users interact with social media posts regarding vaccinations. More inclusive sampling is required as the distinctive sociodemographic features of the sample

population restrict how extensively the results may be transferred to different demographic or geographic contexts. The study focuses on mothers' social media usage habits, demographic traits, and opinions regarding vaccines to highlight other potentially important aspects, such as access to healthcare services and trust in healthcare providers.

Recommendations for Future Research

Although this study adds to the body of information and data on this issue, future research can significantly benefit the public. Below are recommendations for future research that may help to contribute to the corpus of existing knowledge.

1. **Longitudinal Studies**

   Observe how different demographic groups' opinions and behaviors toward vaccines develop over time to gain insights into the long-term impact of social media on vaccine decision-making.

2. **Exploring Additional Variables**

   Investigate the impact of additional factors related to vaccine-related attitudes and behaviors, such as trust in medical professionals and accessibility to healthcare facilities, to gain a comprehensive understanding of the influencing factors.

3. **Comparative Analysis of Social Media Platforms**

   Examine a range of social media platforms independently to identify platform-specific factors that influence people's interactions with vaccine-related content.

4. **Cross-disciplinary Approaches**

   Promote cooperation among academics studying public health, communication specialists, and social media analysts to examine the connection between vaccine opinions and social media.

5. **Evaluation of Public Health Campaigns**

Analyze the effectiveness of public health campaigns to promote vaccine uptake and reduce the spread of inaccurate information on social media.

6. **Ethical Considerations**

   Examine the ethical issues surrounding health communication via the Internet to ensure the proper use of social media platforms to promote public health initiatives.

7. **Subgroup Analysis**

   Conduct subgroup analysis to determine the range of variations in vaccine attitudes across different demographic groups so that effective intervention strategies can be developed and implemented.

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Appendix A

Social Media and Maternal Vaccination Decisions Survey

Inclusion Criteria

1. Are you 18 years of age or older? [yes or no; if no, terminate survey]
2. Do you currently reside in the United States? [yes or no; if no, terminate survey]
3. Please select the best response that describes you. [current mother, expectant mother, or neither; if neither, terminate survey]
4. Do you have at least one child under the age of 18? [yes or no; if no, terminate survey]
5. Does one of your children live with you for at least six months of the year? [yes or no; if no, terminate survey]

Demographics

1. Age
    a. 18-20
    b. 21-29
    c. 30-39
    d. 40-49
    e. 50-59
    f. 60 or older
2. Are you of Hispanic, Latinx, or Spanish origin? [select one]
    a. Yes
    b. No
3. How would you classify your race? [select one]
    a. American Indian/Alaska Native
    b. Asian
    c. Black/African American
    d. Native Hawaiian/Pacific Islander
    e. White
    f. Multiple Races
    g. Other
4. Are you now married, widowed, divorced, separated, or never married?
    a. Married
    b. Widowed
    c. Divorced
    d. Separated
    e. Never married
5. What is the highest level of school you have completed or the highest degree you have received?
    a. Less than a high school degree
    b. High school degree or equivalent (e.g., GED)
    c. Some college but no degree
    d. Associate degree

    e. Bachelor degree
    f. Graduate degree
6. Which of the following categories best describes your employment status?
    a. Employed, working 1-39 hours per week
    b. Employed, working 40 or more hours per week
    c. Not employed, looking for work
    d. Not employed, NOT looking for work
    e. Retired
    f. Disabled, not able to work
7. How much combined money did all household members earn in 2022?
    a. $0 – $30,999
    b. $31,000 – $60,999
    c. $61,000 – $90,999
    d. $91,000 – $120,999
    e. $121,000 – $150,999
    f. $151,000 or more
8. In which state do you reside?
    a. Drop down box including all 50 states
9. How many children are you the parent or guardian for that live in your household for at least half of the year (aged 17 or younger only)?
    a. None
    b. 1
    c. 2
    d. 3
    e. 4
    f. More than 4
10. Do you identify with any of the following religions? Select all that apply.
    a. Protestantism
    b. Catholicism
    c. Christianity
    d. Judaism
    e. Islam
    f. Buddhism
    g. Hinduism
    h. Native American
    i. Inter/Non-Denominational
    j. No religion
    k. Other
11. On which of the following social media sites do you have an account? [select all that apply]
    a. Facebook
    b. X (Twitter)
    c. Instagram
    d. TikTok

e. Snap Chat
f. WhatsApp
g. LinkedIn
h. YouTube
i. Other

12. Which of the following have you accessed to obtain information related to vaccination? [select all that apply]
    a. Facebook
    b. X (Twitter)
    c. Instagram
    d. TikTok
    e. Snap Chat
    f. WhatsApp
    g. LinkedIn
    h. YouTube
13. On average, how much time per day do you spend accessing health-related information on social media sites? [choose one range]
    a. None
    b. <30 minutes
    c. 30 – 59 minutes
    d. 60 – 89 minutes
    e. 90 – 119 minutes
    f. 120 minutes

Vaccine-Related Attitudes and Beliefs Measure (18 items)

Attitudes and Beliefs Regarding Benefits of Vaccination

14. I believe it is better for my child to get the natural disease than to get a vaccine.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
15. I believe that vaccines strengthen the immune system.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
16. Getting vaccines is a good way to protect my child from infectious diseases.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree

    e. Strongly agree
17. Many of the illnesses vaccines prevent are serious.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
18. My child does not need vaccines for diseases that are not common anymore, like polio.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
19. My child could get a serious disease if he or she were not vaccinated.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
20. I can protect my child from some types of infectious disease by vaccinating them.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree

Attitudes and Beliefs Regarding Risks of Vaccination

21. I believe there has not been enough research on the safety of vaccines.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
22. My child's immune system could be weakened by too many vaccines.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
23. Vaccines are safe.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree

    d. Agree
    e. Strongly agree
24. Children get more vaccines than they need.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
25. I am concerned that vaccines have serious side effects.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
26. I am concerned that some vaccines cause autism in healthy children.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
27. I am concerned that the ingredients in vaccines are unsafe.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree

Perceived Self-efficacy Regarding Vaccine Decision Making

28. I am confident that I have the necessary information to make decisions about vaccination for my child.
    a. Not at all confident
    b. Not confident
    c. Not sure
    d. Somewhat confident
    e. Absolutely confident
29. I am confident about my knowledge about how vaccines work.
    a. Not at all confident
    b. Not confident
    c. Not sure
    d. Somewhat confident
    e. Absolutely confident
30. I am confident about knowledge about infectious diseases.
    a. Not at all confident

b. Not confident
c. Not sure
d. Somewhat confident
e. Absolutely confident

31. I am confident that I can express my view about vaccines to my obstetrician/pediatrician.
    a. Not at all confident
    b. Not confident
    c. Not sure
    d. Somewhat confident
    e. Absolutely confident

Information Seeking in Social Media Scale (18 items)

32. Social media makes me learn about a topic I am not familiar with
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
33. I use social media to post questions because social media users [e.g., friends, group members or others] provide me with better information than an Internet search
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
34. I do not read quotes shared through social media photos or statuses
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
35. I use social media to follow new trends
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
36. I do not use social media to follow a trend
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree

37. In general, I read news, scientific facts or inspirational quotes shared on social media because I find them informative
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
38. I believe that social media provides me with information on many subjects
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
39. Social media keeps me informed about the lives of my friends and/or family members
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
40. I think reading social media feeds are informative
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
41. For me, reading social media posts is a waste of time
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
42. I do not find informative posts on social media
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
43. Reading social media newsfeed is entertaining
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
44. I enjoy browsing social media posts.

a. Strongly disagree
b. Disagree
c. Neither agree nor disagree
d. Agree
e. Strongly agree

45. Social media groups/pages keep me informed about products, services and trends
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
46. The advice offered by friends/members allows interaction with people
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
47. News, quotes and scientific facts shared through social media are informative.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
48. I do not use social media as a source of information
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree
49. The exchange of information offered through social media allows me to answer personal issues effectively.
    a. Strongly disagree
    b. Disagree
    c. Neither agree nor disagree
    d. Agree
    e. Strongly agree

Appendix B

Vaccine-Related Attitudes and Beliefs Measure

PsycTESTS®

Vaccine-Related Attitudes and Beliefs Measure

Note: Test name created by PsycTESTS

PsycTESTS Citation:
Daley, M. F., Narwaney, K. J., Shoup, J. A., Wagner, N. M., & Glanz, J. M. (2018). Vaccine-Related Attitudes and Beliefs Measure [Database record]. Retrieved from PsycTESTS. doi: https://dx.doi.org/10.1037/t75922-000

Instrument Type:
Inventory/Questionnaire

Test Format:
Items are rated on a 5-point Likert scale, with response options corresponding to a scale of "strongly disagree" to "strongly agree" or "not at all confident" to "absolutely confident." For each respondent, scores on individual items within each construct are added, then divided by the number of contributing items, so that each individual has a mean score for each construct on a 5-point Likert-type scale ranging from 1 to 5.

Source:
Daley, Matthew F., Narwaney, Komal J., Shoup, Jo Ann, Wagner, Nicole M., & Glanz, Jason M. (2018). Addressing parents' vaccine concerns: A randomized trial of a social media intervention. American Journal of Preventive Medicine, Vol 55(1), 44-54. doi: https://dx.doi.org/10.1016/j.amepre.2018.04.010, © 2018 by Elsevier. Reproduced by Permission of Elsevier.

PsycTESTS™

doi: http://dx.doi.org/10.1037/t75922-000

Vaccine-Related Attitudes and Beliefs Measure

Survey items
Attitudes and beliefs regarding benefits of vaccination[a]
I believe it is better for my child to get the natural disease than to get a vaccine[b]
I believe that vaccines strengthen the immune system
Getting vaccines is a good way to protect my child from infectious diseases
Many of the illnesses vaccines prevent are serious
My child does not need vaccines for diseases that are not common anymore, like polio[b]
My child could get a serious disease if he or she were not vaccinated
I can protect my child from some types of infectious disease by vaccinating him or her
Attitudes and beliefs regarding risks of vaccination[c]
I believe there has not been enough research on the safety of vaccines
My child's immune system could be weakened by too many vaccines
Vaccines are safe[b]
Children get more vaccines than they need
I am concerned that vaccines have serious side effects
I am concerned that some vaccines cause autism in healthy children
I am concerned that the ingredients in vaccines are unsafe
Perceived self-efficacy regarding vaccination decision making[d]
I am confident that I have the necessary information to make decisions about vaccination for my child
I am confident about my knowledge about how vaccines work
I am confident about my knowledge about infectious diseases
I am confident that I can express my views about vaccines to my obstetrician/pediatrician

[a]A higher score represents greater parental confidence regarding the benefits of vaccination.
[b]Responses for this survey item were reverse-coded, so that a higher score had the same meaning across all survey items within the same construct.
[c]A higher score represents greater parental concern about the risks of vaccination.
[d]A higher score represents higher perceived self-efficacy regarding vaccination decision making.

Note : Items are rated on a 5-point Likert scale, with response options corresponding to a scale of "strongly disagree" to "strongly agree" or "not at all confident" to "absolutely confident." For each respondent, scores on individual items within each construct are added, then divided by the number of contributing items, so that each individual has a mean score for each construct on a 5-point Likert-type scale ranging from 1 to 5.

Appendix C

Information Seeking in Facebook Scale

PsycTESTS

Information Seeking in Facebook Scale

PsycTESTS Citation:
Asghar, H. M. (2015). Information Seeking in Facebook Scale [Database record]. Retrieved from PsycTESTS. doi: https://dx.doi.org/10.1037/t45206-000

Instrument Type:
Rating Scale

Test Format:
The measure has 21 items and used a Likert-type response scale to indicate level of agreement or disagreement with each item's statement using anchors ranging from 1 (Strongly disagree) to 5 (Strongly agree).

Source:
Asghar, Hanan M. (2015). Measuring Information Seeking through Facebook: Scale development and initial evidence of Information Seeking in Facebook Scale ((ISFS). Computers in Human Behavior, Vol 52, 259-270. doi: https://dx.doi.org/10.1016/j.chb.2015.06.005, © 2015 by Elsevier. Reproduced by Permission of Elsevier.

PsycTESTS

doi: http://dx.doi.org/10.1037/t45206-000

Information Seeking in Facebook Scale
ISFS

1. Facebook makes me learn about a topic I am not familiar with
2. I use Facebook to post questions because Facebook users [e.g., friends, group members or others] provide me with better information than an Internet search
3. *I do not read quotes shared through Facebook's photos or statuses**
4. I use Facebook to follow new trends
5. I feel that in order to know more about a brand or store, I have to like its page
6. I do not use Facebook to follow a trend*
7. In general, I read news, scientific facts or inspirational quotes shared on Facebook because I find them informative
8. I have a good time reading posts shared through Facebook
9. I do not like the brand's or store's pages for offers, sales, or new products*
10. I use Facebook to see new/cool photos/photo albums/videos
11. I believe that Facebook provides me with information on many subjects
12. Facebook keeps me informed about the lives of my friends and/or family members
13. I think reading Facebook feed is informative
14. Facebook helps me find answers to personal problems
15. *For me, reading Facebook posts is a waste of time*
16. I do not find informative posts on Facebook*
17. Reading Facebook Newsfeed is entertaining
18. It is fun to go over Facebook posts.
19. Facebook groups/pages keep me informed about products, services and trends
20. The advice offered by friends/members allows interaction with people
21. News, quotes and scientific facts shared through Facebook are informative.
22. I do not use Facebook as a source of information*
23. The exchange of information offered through Facebook allows me to answer personal issues effectively.

Note. *An asterisk in bold indicates that the item is reverse scored. The items in italics were not retained nor used for running any analysis. All items are scored on the following scale: 1: Strongly disagree, 2: Disagree, 3: Neither agree nor disagree, 4: agree, 5: Strongly agree with higher scores reflecting higher information seeking in Facebook.*

Appendix D

Dear Recipient:

As a graduate student in the School of Health Science at Liberty University, I am conducting research as part of the requirements for my doctoral degree. My research aims to explore influences on maternal vaccination decisions. I am writing to invite eligible participants to join my study.

Participants must be at least 18 years of age, current or expectant mothers, reside in the same home as their child at least half of the year and currently reside in the United States. Participants, if willing, will be asked to complete an anonymous survey. No personal identifying information will be collected.

The linked survey will require approximately 15 minutes to complete.

There is no compensation for responding. The data collected will provide helpful information regarding factors contributing to vaccine hesitancy among mothers. Thank you for your consideration.

To participate, please click on this link or copy and paste this into your browser: <insert survey monkey link>

Sincerely,

Natalie Flynn

Appendix E

Survey Participation Information

The attached survey is for research conducted by the College of Health Sciences at Liberty University. This research aims to provide a deeper understanding of the factors contributing to vaccine hesitancy amongst mothers to encourage public health officials to address any noted gaps and assist healthcare providers in identifying opportunities to lessen vaccine hesitancy. Your participation is voluntary and will only involve completing the questionnaire. Completing this questionnaire should require approximately 15 minutes of your time. Please do not use any outside assistance while answering these questions. Please answer each question honestly and to the best of your ability. You are not required to identify yourself on the questionnaire. The researchers will not place any codes on the questionnaire that could directly identify you. The results of this research might be published. Any research reports or publications from this research will not reveal your name or identity. Your research record will remain confidential. There are no direct benefits to you for completing this questionnaire.