

UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

JOURNEY OF DECISIONS: UNDERSTANDING PARENTAL
PERSPECTIVES ON VACCINE HESITANCY AND
DECISION-MAKING APPROACHES
IN CHILDHOOD VACCINATIONS

A Dissertation Submitted in Partial Fulfillment
Of the Requirements for the Degree of
Doctor of Philosophy

Carlene J. Brown

College of Education and Behavioral Sciences
Department of Applied Statistics and Research Methods

December 2024

This Dissertation by: Carlene J. Brown

Entitled: *Journey of Decisions: Understanding Parental Perspectives on Vaccine Hesitancy and Decision-Making Approaches in Childhood Vaccinations*

has been approved as meeting the requirement for the Degree of Doctor of in the College of Education and Behavioral Sciences in School or Department of Applied Statistics and Research Methods.

Accepted by the Doctoral Committee

Randy Larkins, Ph.D., Research Advisor

Maria Lahman, Ph.D., Committee Member

Chia-Lin Tsai, Ph.D., Committee Member

Dannon Cox, Ph.D., Faculty Representative

Date of Dissertation Proposal Defense _____

Accepted by the Graduate School

Jeri-Anne Lyons, Ph.D. Dean of the Graduate School
Associate Vice President for Research

ABSTRACT

Brown, Carlene J. *Journey of decisions: Understanding parental perspectives on vaccine hesitancy and decision-making approaches in childhood vaccinations*. Published Doctor of Education dissertation, University of Northern Colorado, 2024.

The purpose of this study is to gain an understanding of parental attitudes toward childhood vaccinations and decision-making styles. Overall, this study worked to comprehensively examine the factors influencing vaccine hesitancy among parents of children under 18 utilizing quantitative and qualitative methodologies and conducting qualitative analytic comparisons to enhance understanding for future research practices.

The study's objective in the first phase was to quantitatively assess whether decision-making styles predict vaccine hesitancy, considering demographic factors. The contextual research question guiding this phase was, "Do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?" A survey of 260 parents revealed that those with an intuitive decision-making style had 86% lower odds of being vaccine-hesitant, while parents with three or more children had 73% lower odds of exhibiting vaccine hesitancy. However, the sample's homogeneity limits the generalizability of these findings. The second phase entailed qualitatively exploring the underlying parental perspectives contributing to vaccine hesitancy. The contextual research question guiding this phase was, "How do parents' underlying beliefs contribute to vaccine hesitancy?" The qualitative phase, involving 17 semi-structured interviews with 18 participants, was analyzed using both traditional reflexive thematic analysis (RTA) with NVivo and RTA enhanced by artificial intelligence (AI) with ChatGPT. The

methodological research question was, “What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?” The study found that traditional RTA provided deeper and more comprehensive insights, consistent coding, in-depth participant quotes, and a rigorous iterative process, making it more effective in addressing the research questions. While AI-driven RTAs were efficient and satisfactory in identifying themes, they lacked the depth of traditional RTA. However, compared to the significant time and expenses associated with traditional RTA using NVivo, AI's capacity to perform analyses within minutes and its cost-efficiency underscores its potential as a valuable co-researcher, especially for those working with limited resources. This study highlights the importance of thoroughly exploring vaccine hesitancy, decision-making styles, and underlying beliefs of parents while also contributing to the evolving discourse on AI's role in qualitative research.

Keywords: AI-assisted analysis, decision-making styles, public health communication, vaccine hesitancy, reflexive thematic analysis

ACKNOWLEDGEMENTS

I want to take a moment to thank the many people who have encouraged, supported, guided, and mentored me throughout my academic and doctoral journey. Your belief in me has taught me that I can do hard things. First and foremost, I would like to thank each member of my family, starting with my wonderful husband, Jeff. Thank you for your unwavering faith in my abilities and for providing me with copious amounts of support and encouragement. Thank you, Austin, for mentoring your mother and providing me with help, advice, insight, steadfast love, support, and encouragement, all of which helped me to grow up to be like you. You paved the way, Obi-Wan. I will be forever grateful for the kind and uplifting words of my Keeley Adeline, who has spent countless hours offering reassurance, support, and inspiration. Your enduring belief in me has been a constant source of strength, inspiring me to strive to be my best self. Thank you, Whitney Elizabeth. Your quiet strength and kind heart have been a source of solace, and your sweet, encouraging words have empowered me to overcome countless challenges. Lainey Jane, what would I do without my ray of sunshine and biggest cheerleader? You lift my spirits and make me believe I can do anything I set my mind to; thank you! Thank you to Dallas, my best pal and college bro. I couldn't have journeyed this path without you. From giving the best hugs to leaving encouraging sticky notes on my computer, you have helped me know that I am never alone and always have someone in my corner. To my sweet Lincoln Joy, thank you for your existence! The mere sight of you is a source of joy and inspiration. I know you will do great things, sweet girl.

To my sweet and spicy Paisley Rose, you were my constant companion and emotional support. I will forever be grateful for my little work buddy!

I am deeply grateful to my dissertation committee for dedicating your valuable time and effort to helping me succeed. Dr. Randy Larkins, your resolute support, guidance, and encouragement have been extraordinary. Not only have you taught me how to become a strong researcher, but you've also shown me how to lead with kindness, compassion, and authenticity. You are a true example of someone who makes the world a better place. Dr. Maria Lahman, your mentorship is unprecedented. Under your tutelage, I have been given incredible opportunities where you entrusted me with the autonomy to learn, grow, and build confidence in both myself and my abilities. From you, I have learned to lead with integrity, embrace diversity, and treat everyone with the utmost respect. These are lessons beyond the classroom for which I will forever be grateful. Thank you, Dr. Tsai, for the countless opportunities you have provided me to learn and grow academically and personally. Your compassionate and thoughtful teaching approach, combined with your exceptional organization and genuine care for your students, have been truly inspirational, and I hope to emulate these qualities in my own future teaching and mentoring endeavors. You have a unique ability to make everyone feel heard, validated, and supported. Thank you, Dr. Cox, for your kind and thoughtful guidance throughout this dissertation journey. Your keen insights, combined with your meticulous attention to detail, have been invaluable in shaping my approach to research and professional growth. I aspire to carry these qualities forward as I venture into the vocational chapter of my life.

You all have taught me more than just the skills to be a successful research methodologist and applied statistician; you have taught me how to conduct myself with the highest ethics and integrity and treat others with the greatest respect. These lessons far outweigh the many

applicable skills I have been fortunate enough to acquire along the way. It has been an honor to work with and for each of you.

I also want to express my gratitude to my research participants and everyone who supported or shared my research. Without your contributions, this work would not have been possible.

Thank you to Dr. Will Merchant, Dr. Han Yu, Dr. Susan Hutchinson, Keyleigh Gurney and every member of the ASRM department. Your support and guidance have been instrumental in my success. Each of you has played a significant role in helping me realize my academic goals, and I am deeply grateful for your contribution to my journey.

Lastly, I would like to thank Aims Community College for providing such a nurturing environment that launched my academic aspirations. A special acknowledgment goes to my very first English professor, Nikki Medina, whose kindness, support, and encouragement planted the seeds of self-belief that helped me grow into who I am today. Your kindness will never be forgotten.

TABLE OF CONTENTS

CHAPTER I INTRODUCTION TO THE STUDY	1
Statement of the Problem.....	3
Purpose of the Study	5
Research Questions	7
Contextual Research Questions	7
Quantitative Research Questions	7
Qualitative Research Questions	8
Methodological Research Question	8
Methodological Approach	8
Key Concepts	9
History of Vaccinations	9
Vaccine Hesitancy	10
Contributors to Vaccine Hesitancy	11
Decision-Making Styles.....	12
ChatGPT	13
NVivo.....	14
Significance of the Study	15
Practice.....	15
Public Education	15
Research.....	16
Overview of Chapters	17
 CHAPTER II LITERATURE REVIEW	 18
History and Timeline of Vaccines	20
Variolation	20
Vaccinations.....	23
Vaccine Hesitancy	30
Mandates	33
Vaccine Hesitancy and Threats to Public Safety	36
Prevalence	37
Causes	39
Skepticism Toward Vaccine Efficacy.....	40
Vaccine Safety and Potential Risks	41
The Proliferation of Childhood Vaccines	43
Religious Beliefs	46
Information Sources.....	48
Decision-Making Styles.....	49
Decision-Making Styles in Health Decisions	50
Decision-Making Styles in Vaccine Hesitancy.....	52

ChatGPT	54
NVivo Computer Software	63
Chapter Summary	69
CHAPTER III METHODOLOGY	71
Purpose of the Study	71
Contextual Mixed-Methods Research Questions.....	72
Quantitative Research Questions	72
Qualitative Research Questions.....	72
Methodological Research Question	72
Rationale for Mixed-Methods.....	73
Philosophical Assumptions.....	74
First (Quantitative) Phase: Post-Positivism	75
Second (Qualitative) Phase: Social Constructivism	76
Researcher Stance	77
Methods.....	79
Phase 1: Quantitative Data Collection and Analysis	81
Participants.....	81
Selection Criteria and Process	81
Demographics and Eligibility	81
Consent Forms	82
Instruments.....	83
Demographic Questionnaire	83
Vaccine Hesitancy Scale.....	83
General Decision-Making Styles.....	87
Data Analysis	89
Phase 2: Qualitative Data Collection and Analysis	91
Participants.....	91
Data Collection – Interviews	92
Data Analysis and Coding	93
ChatGPT	94
NVivo.....	97
Data Analysis Comparison	99
Data Handling Procedures	101
Costs and Compensation.....	102
Inference Quality	102
Phase 1: Inference Quality – Design Quality.....	103
Design Suitability.....	103
Design Adequacy	103
Design Adequacy-Validity.....	104
Design Adequacy-Reliability.....	104
Within Design Consistency.....	104
Analytic Adequacy.....	105
Phase 2: Inference Quality – Design Quality.....	105
Design Suitability.....	105
Design Adequacy	105

Design Adequacy-Trustworthiness – Confirmability	105
Design Adequacy-Trustworthiness – Credibility.....	106
Design Adequacy-Trustworthiness – Dependability	106
Design Adequacy-Trustworthiness – Transferability	106
Within Design Consistency.....	107
Analytic Adequacy.....	107
Phases 1 and 2: Inference Quality – Interpretive Rigor.....	107
Interpretive Consistency	107
Theoretical Consistency.....	108
Interpretive Agreement	108
Interpretive Distinctiveness	108
Integrative Efficacy.....	109
Interpretive Correspondence	109
Inference Generalizability and Transferability	109
Integration	109
Integration of Philosophical Perspectives.....	110
and Methodologies.....	110
Data and Analyses Integration	111
Reflexivity.....	111
Presentation of Findings	113
Ethical Considerations	113
Chapter Summary	115
CHAPTER IV QUANTITATIVE RESULTS	116
Vaccine Hesitancy and Threats to Public Safety	117
Prevalence of Vaccine Hesitancy.....	118
Causes of Vaccine Hesitancy	119
Importance of Decision-Making Styles	120
Importance of Study.....	121
Methods.....	122
Participants and Sampling Method	122
Demographics	123
Procedure	125
Measures	125
Demographic Questionnaire	125
Vaccine Hesitancy Scale.....	126
General Decision-Making Style.....	127
Data Cleaning.....	128
Statistical Assumptions.....	131
Model Fit.....	132
Statistical Analysis.....	133
Results.....	134
Discussion	137
Acknowledgments.....	141
Declaration of Conflicts of Interest.....	142

Funding	142
Author Contribution Statement.....	142
Data Availability Statement.....	142
CHAPTER V QUALITATIVE RESULTS	143
Parental Vaccine Hesitancy	143
ChatGPT and Human-Directed Reflexive Thematic Analysis.....	146
Study Purpose	148
Methods.....	148
Participants.....	149
Data Collection	152
Data Analysis	152
Reflexivity.....	153
Researcher Stance	154
Human Researcher Stance.....	154
ChatGPT Researcher Stance	154
Influences on the Research Process	155
Critical Reflection on My Position	156
Establishing Rigor in Qualitative Research	156
Trustworthiness	157
Confirmability	157
Credibility	157
Dependability	158
Transferability	158
Results and Discussion	158
Traditional Human-Directed Reflexive Thematic Analysis Results.....	158
Influences and Perceptions Shaping Vaccine Decisions	158
Trust and Concerns in Vaccine Decision-Making.....	163
Attitudes Toward Vaccine Mandates.....	166
Alternative Perspectives and Attitudes Toward Vaccinations	168
Discussion.....	171
ChatGPT Reflexive Thematic Analysis Using	172
Prompts From Braun and Clarke (2022).....	172
Diverse Information Sources	172
Informed Decision-Making.....	173
Safety Concerns and Hesitancy.....	173
Trust Dynamics	173
Balancing Personal and Community Health	174
Integration of Natural Health Practices.....	174
Discussion.....	174
Conclusion	175
ChatGPT Reflexive Thematic Analysis Using Prompts from Zhang, Wu, Xie, Lyu, et al. (2023).....	175
Trust and Distrust in Medical Systems	176
Influence of Personal Experiences and Anecdotes	176

Information Seeking and Decision-Making Process.....	177
Perception of Vaccine Safety and Necessity	178
Sociocultural and Political Influences	179
Discussion.....	180
Conclusion	181
Analytic Comparison	181
Conclusion	186
Methodological Conclusion	186
Contextual Conclusions	188
Acknowledgments.....	197
Declaration of Conflicts of Interest.....	197
Funding	197
Data Availability Statement	197
Prompt and Response Availability.....	197
CHAPTER VI CONCLUSION	199
Phase 1 – Quantitative Insights.....	200
Phase 2 – Qualitative Insights.....	202
Phase 2 – Expanded Insights and Key Findings	211
Phase 2 – Artificial Intelligence Insights	212
Phase 2 – Methodological Findings	214
Integration of Philosophical Perspectives and Methodologies	215
Data and Analyses Integration	216
Implications.....	218
Implications for Practice	218
Identifying At-Risk Populations for Vaccine Hesitancy	218
Developing Targeted Communication Strategies	219
Building Parent Trust through Transparency.....	220
Incorporating Artificial Intelligence in Qualitative Research.....	220
Implications for Research	221
Broaden Demographic Scope	221
Improved Survey Design	222
Incorporate Mixed-Methods Research.....	222
Leveraging Artificial Intelligence in Qualitative Analysis	223
Future Research	224
Limitations	225
Reflexivity – Researcher Reflection	227
Conclusion	229
REFERENCES	231
APPENDIX A PHASE ONE CONSENT FORM	266
APPENDIX B PHASE TWO INFORMED CONSENT	269
APPENDIX C PHASE ONE SURVEY	271

APPENDIX D PHASE TWO RECRUITMENT EMAIL	276
APPENDIX E PHASE TWO SEMI-STRUCTURED INTERVIEW GUIDE.....	278
APPENDIX F PROMPTS FOR PHASE TWO CHATGPT ANALYSES	280
APPENDIX G SURVEY CODEBOOK.....	283
APPENDIX H PHASE TWO MEMBER CHECK	289
APPENDIX I INSTITUTIONAL REVIEW BOARD APPROVAL	291
APPENDIX J PHASE ONE RECRUITMENT COMMUNICATION	294
APPENDIX K R CODE FOR PHASE ONE ANALYSES.....	300
APPENDIX L THEMES OF REFLEXIVE THEMATIC ANALYSES	312
APPENDIX M PROPOSED INFOGRAPHICS FOR M-M-R II VACCINE INFORMATION.....	329

LIST OF TABLES

Table 1	<i>Rubric for Analyses Comparison</i>	100
Table 2	<i>Demographic Characteristics of Sample Population</i>	124
Table 3	<i>Generalized Variance Inflation Factor</i>	133
Table 4	<i>Logistic Regression Results</i>	136
Table 5	<i>Demographic Participant Information</i>	151
Table 6	<i>Rubric for Analyses Comparison</i>	182
Table 7	<i>Rubric Comparing Reflexive Thematic Analysis</i>	183
Table 8	<i>Demographic Interview Participant Information</i>	193
Table 9	<i>Survey Codebook</i>	284
Table 10	<i>Themes from Traditional Reflexive Thematic Analysis</i>	313
Table 11	<i>Themes from ChatGPT: Braun and Clarke (2022)</i>	323
Table 12	<i>Themes from ChatGPT: Zhang, Wu, Xie, Lyu et al. (2023)</i>	324
Table 13	<i>Themes for All Reflexive Thematic Analyses</i>	328

LIST OF FIGURES

Figure 1 <i>Timeline for the History of Vaccines</i>	29
Figure 2 <i>2023 Recommended Immunizations for Children</i>	46
Figure 3 <i>Explanatory Sequential Design</i>	74
Figure 4 <i>Mixed-Methods Flowchart</i>	80
Figure 5 <i>Logic for Combining the Study Components</i>	111
Figure 6 <i>Missing Data</i>	130
Figure 7 <i>Proposed Label for Vaccine Ingredients of the M-M-R II</i>	195
Figure 8 <i>Proposed Label for M-M-R II Side Effects</i>	196
Figure 9 <i>Explanatory Sequential Joint Display of Findings</i>	205
Figure 10 <i>First Phase One Advertisement</i>	295
Figure 11 <i>Second Phase One Advertisement</i>	296
Figure 12 <i>Third Phase One Advertisement</i>	297
Figure 13 <i>Fourth Phase One Advertisement</i>	298
Figure 14 <i>Second Half of Fourth Phase One Advertisement</i>	299
Figure 15 <i>Proposed M-M-R II Patient Information</i>	330
Figure 16 <i>Proposed Infographic for M-M-R II Adverse Reactions</i>	331

LIST OF ABBREVIATIONS

AI	Artificial intelligence
AIC	Akaike information criterion
ASD	Autism spectrum disorder
CAQDAS	Computer-assisted qualitative analysis
CDC	Centers for Disease Control and Prevention
CFA	Confirmatory factor analysis
CFI	Comparative fit index
COVID-19	2019 coronavirus disease
EFA	Exploratory factor analysis
GDMS	General Decision-Making Style
GVIF	Generalized Variance Inflation Factor
HPV	Human papillomavirus
ICC	Intraclass Correlation Coefficient
ID	Identification
MAR	Missing at random
ML	Machine learning
MMR	Measles, mumps, and rubella
NLP	Natural language processing
QR	Quick response
RMSEA	Root mean square error of approximation
RTA	Reflexive thematic analysis
SES	Socioeconomic status
SUD	Sudden unexpected death
VAERS	Vaccine Adverse Event Reporting System
VHS	Vaccine Hesitancy Scale
WHO	World Health Organization

CHAPTER I

INTRODUCTION TO THE STUDY

Health is arguably one of the most valuable commodities in life. Preserving and maintaining the health of oneself and one's family is a constant, relevant, and timely interest. To sustain health, individuals must make numerous daily decisions, from dietary choices to exercise and preventive healthcare measures. Among the many critical healthcare choices, individuals ubiquitously encounter vaccinations. Deciding whether to vaccinate carries significant weight, affecting individuals and their broader social circles, including family, friends, and community members. This decision is particularly significant for childhood vaccinations, given that most vaccinations are administered during this period.

When contemplating vaccinations for children, several factors, including vaccine safety, lack of information, fear of side effects, and distrust of governmental and medical institutions, may trigger parental concerns (Kerrigan et al., 2020). These considerations might lead some parents to become hesitant about vaccinating their children. Vaccine hesitancy, particularly when it leads to opting out of vaccinations for children can pose significant health risks for individuals and communities. Consequently, the World Health Organization (WHO) warns that vaccine hesitancy ranks among the most significant threats to global health (Nuwarda et al., 2022). Hesitancy and failure to vaccinate can lead to deficient herd immunity, as unvaccinated individuals can serve as pathogen sources (Nuwarda et al., 2022). Herd immunity occurs when enough individuals are immune to disease, making it unlikely to spread to others (Centers for Disease Control and Prevention [CDC], 2022c). These individuals can potentially instigate

outbreaks that affect entire populations (Nuwarda et al., 2022). Maintaining high levels of herd immunity is vital to prevent widespread epidemics. For example, Nuwarda et al. (2022) contend that about 95% of the population needs to be immunized to prevent measles outbreaks while keeping polio at bay requires nearly 80% immunization. It is worth noting that vaccinations are lauded as saving more lives than any other medical innovation in historically recorded times, with millions of lives being saved each year through the reduction of numerous nefarious diseases (World Health Organization [WHO], n.d.-a). Considering this, the significance of vaccinations and the urgency to understand vaccine hesitancy as a public health threat become glaringly evident.

Larson et al. (2022) posit, “Vaccine hesitancy is a state of indecision and uncertainty about vaccinations before a decision is made to act (or not to act)” (p. 58). These researchers echo the concerns of the WHO, underscoring the proliferation of vaccine hesitancy in extent and magnitude (Larson et al., 2022). McKee and Bohannon (2016) express that as many as 77% of parents indicated hesitancy toward at least one childhood vaccination. Kempe et al. (2020) concur, reporting that approximately 1 in 15 U.S. parents hold hesitations toward childhood inoculations. These reported high rates of vaccine hesitancy may account for 25% of inadequate vaccine uptake (Nguyen et al., 2022). The 2019 coronavirus disease (COVID-19) pandemic only served to fuel hesitancy, with 1%, 12%, and 13% of parents surveyed in 2022 believing that vaccines are unsafe, less important, and less effective than they did prior to the global endemic. These beliefs are noted by 33.1% of parents who indicated that their child or children did not receive vaccinations in the initial year of the pandemic (Teasdale et al., 2022). Consequently, continued hesitancy and neglect to receive immunizations could potentially exacerbate the erosion of herd immunity and heighten the risk of preventable disease outbreaks (Teasdale et al.,

2022). When considering the potential loss of lives each year in the absence of vaccinations, the urgency of addressing vaccine hesitancy is underscored. It is vital not only for individual health and well-being but also for maintaining community immunity and preventing global health crises (WHO, n.d.-c).

The remainder of the chapter will be dedicated to several key elements: conveying the statement of the problem, defining the study's purpose, and outlining research questions. Furthermore, it will detail the methodological approach taken in the study, including the analytical techniques used to address the research questions and summarize relevant topics that will be discussed in the literature review. Subsequently, the chapter will explore the significance of the study, encompassing its implications for practice, public education, and future research. Finally, it will conclude by providing a brief overview of the upcoming chapters.

Statement of the Problem

In times of health and well-being, it is easy to forget that not long ago, smallpox and polio were relentless and deleterious diseases that ravaged humanity. Smallpox has claimed the lives of millions of individuals over the centuries and was not declared eradicated until 1980 (CDC, 2021; Dinc & Ulman, 2007; Louten, 2023; WHO, n.d.-b). Those lucky enough to survive this horrifying malady were often blind and irreparably disfigured (Hsu, 2013). While polio has not entirely been eliminated, significant progress has been made toward that end (Harutyunyan et al., 2023). These and many other devastating diseases have been largely contained due to the development and deployment of vaccinations (CDC, 2021; Han, 2015; Harutyunyan et al., 2023; Hsu, 2013). While vaccinations have saved countless lives, some individuals harbor anxiety and reluctance towards receiving vaccines and hesitate when considering whether or not to vaccinate their children. Vaccine hesitancy originated with the development of the first vaccine and has persisted despite pivotal vaccination breakthroughs (Larson et al., 2022; Nuwarda et al., 2022).

Opposition dates back centuries and continues with modern controversies, such as claims that vaccines cause autism and the risk of sudden unexpected death (SUD) in infants (Boretti, 2021; Martinón-Torres, 2021; L. Tomljenovic & Shaw, 2011). These concerns have been exacerbated by the COVID-19 pandemic and the controversy surrounding the vaccinations developed for its elimination (Nossier, 2021; Reece et al., 2023; Wiysonge et al., 2021). Vaccine hesitancy is a widespread problem that seriously threatens public health by diminishing vaccination rates, compromising the efficacy of vaccination programs and increasing the likelihood of spreading preventable diseases (Coustasse et al., 2020; Salmon et al., 2015). Moreover, the reluctance to vaccinate can lead to a decline in herd immunity, which could leave populations vulnerable to outbreaks of severe or even fatal diseases (Haroune & King, 2020; Thunstrom et al., 2020; While, 2021). Vaccine hesitancy is on the rise and has been intensified by the COVID-19 pandemic (Balch, 2022). Illustratively, studies conducted on a macro level report a drop in childhood vaccinations due to the global pandemic (Locke et al., 2023). For instance, the Texas Department of State Health Services reports that conscientious exemptions have increased from 0.45% in 2010–2011 to 2.7% in 2021–2022 for students in K–12 (Balch, 2022). While these numbers may not seem staggering, it is important to remember that a 95% immunization rate is requisite to avoid an outbreak of the highly contagious measles disease, polio requires an immunization rate of 80% to ward off a widespread endemic and 90% or greater immunization is needed to maintain herd immunity to protect against COVID-19 (Balch, 2022; Nuwarda et al., 2022; Plans-Rubió, 2022). Moreover, in the United States, lower immunization rates appear to be affecting children who are “uninsured, Black, Hispanic, or living below the federal poverty level” (Hill et al., 2021, para. 1) as compared with White children with insured parents, who identify as occupying a higher socioeconomic status.

Considering the catastrophic consequences of preventable disease outbreaks, the urgency of addressing vaccine hesitancy becomes salient. While literature exists that raises concerns about vaccine safety, a preponderance of scientific information exists supporting vaccines. With this in mind, the primary problem seems to be the underlying causes of vaccine hesitancy, such as vaccine safety concerns, insufficient information, apprehension regarding potential side effects, and distrust of medical institutions (Kerrigan et al., 2020). Paul Offit, M.D., the director of the Vaccine Education Center and an attending physician in the Division of Infectious Diseases at Children's Hospital of Philadelphia, posits that evidence supporting vaccines abounds, making the issue of vaccine hesitancy one of distrust of mandates instituted by the government (Balch, 2022). Given this perspective, understanding parental thought processes and decision-making styles could enhance communication strategies aimed at tackling this pertinent and substantial issue more effectively.

Purpose of the Study

The purpose of this study is to gain an understanding of parental attitudes toward childhood vaccinations and decision-making styles. Overarchingly, this study sought to comprehensively examine the factors influencing vaccine hesitancy among parents of children under 18 utilizing both quantitative and qualitative methodologies and conducting qualitative analytic comparisons to enhance understanding for future research practices. The aim was to gain insight into the manifold factors influencing parental attitudes toward vaccinations and to see if a relationship exists between vaccine hesitancy and decision-making styles, and to determine nuanced distinctions in contrasting qualitative methods of analysis that will aid in informing subsequent studies. Initially, the research embarked on a quantitative exploration to assess the breadth of the intricate network of influences affecting vaccine hesitancy. This first phase of the research probed the various demographic factors, decision-making styles, and other pertinent

influences to elucidate the dynamics that were at play among vaccine-hesitant parents. Subsequently, the study endeavored to gain a deeper understanding of the underlying beliefs contributing to vaccine hesitancy among parents through qualitative inquiry. This second phase of the research sought to uncover nuanced insights into parental perspectives and attitudes through rich contextual data aimed at understanding vaccine hesitancy. Furthermore, the research undertook a methodological investigation by comparing reflexive thematic analysis between two qualitative research analysis methods: ChatGPT and traditional qualitative analysis using NVivo. Comparing and contrasting the two methods served to uncover valuable insights for researchers seeking to select the most appropriate qualitative analysis for future studies.

Prior research has found and underscored the importance of cognition in health-related decisions. Insights from studies on personality and cognitive styles have provided valuable information for researchers as well as the healthcare community. However, there remains limited empirical evidence specifically linking decision-making styles to vaccine hesitancy. Most studies focusing on vaccine hesitancy and individuals' perceptions primarily emphasize personality and cognitive styles rather than directly addressing decision-making styles (Martinelli & Veltri, 2021; Poland & Ratishvili, 2022; Pomares et al., 2019; H. Tomljenovic et al., 2020). The current study sought to fill this gap by conducting a comprehensive investigation into the multifaceted interaction between decision-making styles and parental vaccine hesitancy by employing quantitative and qualitative methodologies. Quantitative data offered a broad understanding of the topic, while qualitative data worked to dive deeper into parents' decision-making processes regarding vaccination. Integrating both approaches illuminated the breadth and depth of beliefs and behaviors contributing to vaccine hesitancy. Subsequently, this study sought to contribute methodologically by comparing reflexive thematic analysis using ChatGPT and traditional

analysis using NVivo software. The findings can guide future researchers in selecting analytic approaches to best fit their qualitative and mixed-methods studies and provide insights into their respective strengths and limitations. This study aspired to bridge the research gap on vaccine hesitancy and decision-making styles while also offering methodological insights for emerging artificial intelligence (AI) technology and traditional methods of analysis. The findings from this research offers information that could aid in the development of targeted interventions and policies to improve vaccination rates among children under 18.

Research Questions

This research was guided by two overarching objectives: contextual and methodological. The central contextual objective of this study was to understand the influences on vaccine hesitancy for parents under the age of 18. Two lines of investigation aided in achieving this research goal. First, a quantitative investigation explored the predictive ability of decision-making styles on vaccine hesitancy among parents with children under the age of 18. Second, a qualitative inquiry worked toward garnering a deeper understanding of parents' underlying beliefs and how they may contribute to vaccine hesitancy. The second objective is methodological, which aims to compare reflexive thematic analysis using ChatGPT and NVivo, discerning differences and providing insight for future qualitative and mixed-methods analysis approaches. To accomplish these objectives, the study was guided by the following research questions:

Contextual Research Questions

Quantitative Research Questions

- Q1a Do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?

Qualitative Research Questions

Q1b How do parents' underlying beliefs contribute to vaccine hesitancy?

Methodological Research Question

Q2 What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?

Methodological Approach

The current study adopted an explanatory sequential mixed-methods research design, combining quantitative and qualitative approaches in order to comprehensively explore vaccine hesitancy and decision-making styles among parents of children under 18. The quantitative phase of the study employed a survey to assess vaccine hesitancy and decision-making styles and obtain demographic information, while the qualitative phase worked to conduct one-on-one interviews with survey participants who volunteer. These interviews aimed to explore underlying beliefs in greater depth. This sequential process offered opportunities for data, methodological, and analytic triangulation, enhancing the study's inferential quality and providing a holistic understanding of vaccine hesitancy, decision-making styles, and methodological approaches to qualitative data analysis.

Phase 1 of the study focused on quantitative data collection and analysis, employing convenience sampling that worked to recruit participants. Participants for this study were recruited through word-of-mouth referrals, email, and outreach on various social media platforms (e.g., Facebook, Instagram, LinkedIn), with a total sample size of 260, which was ample as determined by a power analysis based on effect sizes outlined by Ferguson (2009). To gather relevant data, a demographic questionnaire and two well-established measurement instruments, the Vaccine Hesitancy SCALE (VHS) and the General Decision-Making Style

(GDMS) Scale, were utilized. Descriptive statistics and logistic regression were employed to assess the quantitative data and answer Q1a.

Phase 2 of the research involved qualitative data collection and analysis, where eighteen participants from Phase 1 were selected from a pool of volunteers for a semi-structured one-on-one virtual interview. The sample size for Phase 2 was determined by reviewing similar studies, acknowledging single-researcher limitations, and considering interview length, resource constraints, and timeline. The interviews were transcribed and analyzed using reflexive thematic analysis (RTA). The analysis process included comparing the analytic outcomes of ChatGPT and traditional analysis using NVivo. The findings offered insights into the efficacy and accuracy of AI-driven methods in qualitative research. Overall, this explanatory sequential mixed-methods research design worked toward gaining a comprehensive understanding of vaccine hesitancy among parents of children under 18, integrating both quantitative and qualitative perspectives to illuminate the breadth and depth of factors influencing decision-making styles and attitudes towards vaccination.

Key Concepts

History of Vaccinations

The fascinating history of vaccinations originated with primitive variolation and evolved into the vaccine technologies available today. Variolation, initiated in China in the 17th century, was the practice of introducing a minuscule amount of the smallpox virus to a healthy person by placing ground smallpox scabs into a small lesion on the body to help the individual gain immunity from the grave disease (Leung, 2011). Nearly a century later, Edward Jenner introduced vaccinations in England, marking a pivotal turn in humanity's fight against deadly pathogens (Baxby, 2011). Subsequent developments in inoculations led to the eradication of

smallpox and the development of vaccines for rabies, typhoid, measles, polio, and more (Han, 2015; Hsu, 2013; Khadri, 2022; Siani, 2023). The 20th century has witnessed accelerated advancements in vaccinations, such as live attenuated vaccines and genetic engineering (Han, 2015; Hsu, 2013). Pioneering today's efforts in vaccine development are nucleic acid-based vaccines such as mRNA and viral vector vaccines (Kayser & Ramzan, 2021). These modern-day technologies can be seen firsthand in the development of COVID-19 vaccinations (Kayser & Ramzan, 2021). Vaccines are proactive and preventative measures that continually adapt to meet the evolving needs of global health, playing a crucial role in disease prevention and promoting longevity across humanity.

Vaccine Hesitancy

MacDonald and the SAGE Working Group on Vaccine Hesitancy (2015) state that vaccine hesitancy is a “delay in acceptance or refusal of vaccination despite the availability of vaccine services” (p. 4161) and highlight its enduring presence as a persistent issue that remains today. While vaccines have saved countless lives, they have also faced assiduous opposition. Vaccine hesitancy is an age-old dilemma that has vexed public health advocates and policymakers alike (Jacobson et al., 2015). This historically rooted antipathy highlights the complex dynamics surrounding the acceptance, hesitancy, and refusal of vaccinations and continues to pose challenges to public health. Parental reluctance toward vaccinating their children can be influenced by a myriad of factors, including concerns surrounding the safety of vaccinations, sparse information, lack of trust in governmental and medical institutions, and trepidation regarding potential side effects (Kerrigan et al., 2020). Seemingly, the efficacy of vaccines speaks for itself in the number of diseases that have been prevented and eradicated (Nuwarda et al., 2022). However, vaccine hesitancy persists and can lead to decreased vaccine

uptake, compromising herd immunity and increasing the risk of spreading preventable diseases (Nuwarda et al., 2022).

Contributors to Vaccine Hesitancy

Historically and today, mandates have been instituted to maintain and advance public health objectives. Vaccine mandates traced back to the 19th century in Britain and the United States have been met with opposition and resistance (Adaboh, 2018; Malone & Hinman, 2003; Nuwarda et al., 2022). Anti-vaccination campaigns formalized resistance to inoculations in the 1800s and persist today (Confer et al., 2021). These dissenting sentiments toward mandated vaccinations are often fueled by factors such as safety concerns and efficacy (Kerrigan et al., 2020). Parents point to research regarding worrisome vaccine ingredients like aluminum, formaldehyde, and thimerosal as reasons for their heightened trepidation, adding that adverse side effects such as autism spectrum disorder (ASD) may occur (Barrett, 2005; Duong et al., 2011; Geier et al., 2015; L. Tomljenovic & Shaw, 2011). Other parents decry that vaccines are ineffective and argue that there is a lack of credible research to suggest otherwise (K. Wilson et al., 2008). Furthermore, the proliferation of the childhood vaccine schedule has added concerns about the safety and necessity of vaccines, raising apprehensions about their cumulative effects (Mawson & Croft, 2020). Subsequently, religious and philosophical beliefs can significantly contribute to vaccine hesitancy (Kuru et al., 2022; Nagar & Ashaye, 2022; Rutjens et al., 2017).

Conservative views, misinformation, and conspiracy theories add to contentions and negative viewpoints regarding immunization (Levin & Bradshaw, 2022). Moreover, information sources ranging from social media to healthcare professionals definitively influence perceptions toward vaccinations, with the former being associated with vaccine hesitancy and the latter associated with vaccine acceptance (Charron et al., 2020). Subsequently, some assert that

vaccine hesitancy is fueled by faulty or non-existent information sources (Charron et al., 2020).

It should be noted that other factors contributing to vaccine hesitancy include socioeconomic status, personal experiences, and political distrust (Low et al., 2022). Actively pursuing a comprehensive understanding of these multifaceted dynamics is essential for addressing vaccine hesitancy and promoting public health. Efforts to rebuild confidence in vaccinations will encompass the complex interactions of credible information sources, scientific evidence, and appropriate vaccination policies.

Decision-Making Styles

Decision-making styles play a fundamental role in how individuals approach and act on information. Scott and Bruce (1995) define decision-making styles as “the learned, habitual response pattern exhibited by an individual when confronted with a decision situation. It is not a personality trait, but a habit-based propensity to react in a certain way in a specific decision context” (p. 820). Understanding decision-making styles concerning vaccine-related decisions is imperative to correspond with parents effectively and successfully develop public health communication strategies. This is especially salient as decision-making styles encompass cognitive styles, influence risk perception, emotional responses, and cognitive biases, shaping attitudes toward vaccines (Martinelli & Veltri, 2021). Notably, these styles are dynamic and can evolve over time (Danya & Nakayama, 2022). Although various decision-making style scales exist, including Leykin and DeRubeis’s (2010) Decision Styles Questionnaire, K. Hamilton et al.’s (2016) The Rational and Intuitive Decision Styles Scale, and Nygren’s (2000) Decision Making Style Inventory, Scott and Bruce’s (1995) GDMS was chosen due to its comprehensive range of subscales, accessibility, and its proven reliability and validity. Determining individual decision-making styles could help healthcare professionals tailor conversational approaches to

meet individual needs effectively (FitzPatrick et al., 2019). Studies on personality and cognitive styles support exploring decision-making styles (Poland & Ratishvili, 2022). This research inspires further investigation into the topic so that tailored interventions can be developed that expeditiously address vaccine hesitancy. Moreover, further research of decision-making styles regarding vaccine hesitancy is necessary to garner comprehensive information that can aid in developing targeted approaches that promote vaccine acceptance and address public health outcomes and concerns.

ChatGPT

ChatGPT is an AI language generation model that has multifaceted benefits for individuals, businesses, academics, and researchers alike, as it generates diverse information across a variety of fields (Quintans-Júnior et al., 2023; Rice et al., 2024; Sridhara et al., 2023). This pioneering platform, released in November 2022 (Quintans-Júnior et al., 2023; Sridhara et al., 2023), rapidly garnered attention as researchers quickly recognized its capacity to efficaciously enhance research processes in qualitative studies (Karakose, 2023; Khlaif et al., 2023; Rice et al., 2024). Some advantageous enhancements for qualitative researchers include generating ideas, literature reviews, study design, and data analysis (Rice et al., 2024). However, it is important to note that while ChatGPT offers valuable capabilities, researchers advise using caution when implementing this innovative tool and recommend human supervision to safeguard accurate data interpretation (Karakose, 2023; Khlaif et al., 2023; Rice et al., 2024). Moreover, to achieve better data interpretation precision, well-crafted prompts are essential for maximizing the efficacy of ChatGPT's qualitative thematic analysis (Zhang, Wu, Xie, Lyu, et al., 2023) outcomes (Lee et al., 2023; Wang et al., 2023; Zhang, Wu, Xie, Kim, & Carroll, 2023). Although

ChatGPT exhibits promising capabilities in qualitative research; researchers are encouraged to thoughtfully employ reliable protocols in order to maintain a high level of rigor and trustworthiness in their research findings. The utilization of ChatGPT is still in its incipient stages, but its growing capabilities hold the potential to transform the research landscape.

NVivo

NVivo is a computer-assisted qualitative analysis (CAQDAS) software released in 1997 by QSR International (Allsop et al., 2022; Dhakal, 2022). This pioneering software has become instrumental in facilitating data management, coding, analytic processes, and presentation of data for qualitative and mixed-methods researchers (Allsop et al., 2022; Dhakal, 2022). NVivo serves as a platform to aid researchers in streamlining tasks such as sorting, organizing, and analyzing substantial volumes of data (Allsop et al., 2022; Lumivero, 2023). The latest software version, NVivo 14, has introduced an AI auto-coding feature for text analysis, which beneficially offers researchers a means to identify key themes in their data (Lumivero, 2023). Moreover, CAQDAS facilitates team-based coding by enabling collaboration, which expedites the process of analysis (Robins & Eisen, 2017). While the platform has many appealing and valuable features, it is important to acknowledge that mastering the software can take time, potentially posing cost barriers in terms of both time and money (Dollah et al., 2017; Phillips & Lu, 2018). With that being said, NVivo presents significant advantages for qualitative and mixed-methods research, including its capacity for thematic analysis and data visualization (Dollah et al., 2017; Phillips & Lu, 2018). This platform's robust features and online resources make it a valuable asset for researchers seeking to enhance the efficiency and rigor of their qualitative investigations.

Significance of the Study

Practice

Practically, this study has the potential to inform healthcare providers about the multidimensional nature of vaccine hesitancy among parents of children under the age of 18. Through the comprehensive examination of factors contributing to vaccine hesitancy and decision-making styles, healthcare professionals can tailor their communication strategies to address parental concerns and promote vaccine uptake more effectively (Poland & Ratishvili, 2022). Learning and understanding the underlying beliefs and attitudes of vaccine-hesitant parents can aid the healthcare community in engaging in empathetic, informative, and productive conversations that could serve to increase vaccine acceptance and optimistically contribute to improved individual, community, and global health outcomes (Poland & Ratishvili, 2022). The pointed examination of decision-making styles as related to vaccine hesitancy can offer beneficial insights into individual preferences and cognitive processes that allow healthcare professionals to better support parents in making informed decisions about their child or children's health (Desmond et al., 2013; FitzPatrick et al., 2019; Flynn & Smith, 2007; Lindbladh & Lyttkens, 2002; Murdach, 1995). These efforts can aid in making our local and global communities safe from preventable disease and promote health, well-being, and longevity for all.

Public Education

This research has implications for raising awareness about the importance of vaccinations and addressing misinformation surrounding vaccine safety and efficacy. Illuminating the factors underlying vaccine hesitancy can aid in enabling educators and public health officials to develop specific educational initiatives. These efforts could help expose misconceptions about vaccines and cultivate trust in both vaccines and the governmental agencies regulating them (Balch,

2022). Subsequently, insights garnered from the study can assist in informing the development of educational materials and programs that can reach diverse populations to address specific concerns and cultural beliefs related to vaccinations (Desmond et al., 2013; FitzPatrick et al., 2019; Flynn & Smith, 2007). Education is a powerful tool to empower parents with accurate information to address their apprehensions, increase vaccination rates, and strengthen community immunity against preventable diseases (Desmond et al., 2013; FitzPatrick et al., 2019; Flynn & Smith, 2007; Lindbladh & Lyttkens, 2002; Murdach, 1995).

Research

The current study will contribute to expanding knowledge of vaccine hesitancy and decision-making styles by employing a comprehensive mixed-methods approach to explore the complex interplay of factors influencing parental attitudes toward vaccination and the decision-making styles that may be associated with them. Integrating a quantitative survey and qualitative interviews will garner rich insight into the contextual question regarding the influences on vaccine hesitancy for parents under the age of 18 through the two lines of investigation. Findings from this research can serve to inform future research endeavors by emphasizing the significance of comprehensively exploring vaccine hesitancy, decision-making styles, and underlying individual beliefs. Understanding these factors illuminates the complexities surrounding vaccine reluctance and the cognitive processes influencing decision-making in this context. Additionally, the study's examination of qualitative RTA using ChatGPT and traditional methods utilizing NVivo will add to the evolving discourse on the use of AI technology in qualitative research. These findings can aid future exploration of innovative analytical techniques in studying complex social phenomena.

Overview of Chapters

This chapter laid the groundwork for the current research by introducing the research problem and purpose and providing a succinct overview of the study. Chapter II will comprehensively explore the history and evolution of vaccines, highlighting key milestones such as variolation and vaccine development. The chapter will also explore the complex challenges surrounding vaccine hesitancy and address topics like mandates, public safety threats, prevalence, and underlying factors contributing to hesitancy, including fear, perceptions of efficacy and safety, religious beliefs, and sources of information. Subsequently, this section will examine decision-making styles concerning health decisions and vaccine hesitancy, along with an overview of using ChatGPT and NVivo for reflexive thematic qualitative analysis. Chapter III will offer a detailed overview of the current study on parental vaccine hesitancy and decision-making styles. The content of this chapter includes methodological details, the rationale behind employing mixed-methods, philosophical underpinnings, research design, strategies for maintaining reflexivity, plans for presenting findings, and ethical considerations guiding the research process. This chapter aimed to elucidate the methods, steps, and procedures guiding the research endeavor, focusing on contextual and methodological explorations and integrating quantitative and qualitative data. Chapter IV will reveal the research findings, addressing the questions posed in Chapters I. Chapter V will engage in a comprehensive discussion of these findings, integrating the different components of the research to provide a cohesive understanding of the study's outcomes.

CHAPTER II

LITERATURE REVIEW

Historically, vaccines have been influential in defending and preserving individuals and communities against a multiplicity of pernicious diseases. Smallpox and polio are notable examples of maladies that have ravaged humanity and have been eradicated with inoculations. Vaccines are recognized as saving more lives than any other medical discovery and are lauded as a predominant medical breakthrough (WHO, n.d.-a). Every year, millions of lives are spared by reducing various diseases due to vaccinations (CDC, 2022a; WHO, n.d.-c). The body's natural defenses are boosted through vaccines, preventing numerous viruses and infections (WHO, n.d.-c). The WHO posits that between 3.5 to 5 million deaths caused by diseases such as diphtheria, tetanus, pertussis, influenza, and measles are prevented each year due to immunizations. Notably, opposition to vaccines is not a new phenomenon. Adversarial stances regarding variolation and vaccination have been present since their discovery and implementation (Nuwarda et al., 2022). Vaccine hesitancy can be described as a reluctance to or rejection of accepting vaccines even when they are readily available (Nuwarda et al., 2022). Nuwarda et al. (2022) note that those hesitant toward vaccines often hold suspicion, skepticism, and apprehension toward immunizations. With this in mind, it is not hard to understand that hesitancy can result in the complete rejection of vaccinations, leading to potentially serious communal health risks, including potentially deadly disease outbreaks (Teasdale et al., 2022). Ultimately, the collective decisions of individuals as to whether or not to attain or reject vaccination can serve to safeguard or endanger public safety. As the decision-making process is

an imperative component of vaccination practice, it is prudent to pragmatically explore decision-making styles to understand what factors may contribute to vaccine hesitancy. Through this investigation, this aim can be achieved. It can serve to provide data-driven information for healthcare officials to better address vaccine hesitancy through developing more effective public outreach campaigns.

Decision-making styles are an influential and ubiquitous aspect of human life. Effective decision-making aligns values, preferences, and cognitive traits (Fülöp, 2005; Poland & Ratishvili, 2022). Decision-making styles play a crucial and unquestionable role in health and healthcare. Understanding these styles in health-related decisions is crucial for addressing vaccine hesitancy, improving communication, and tailoring interventions (Poland & Ratishvili, 2022). Although studies on personality and cognitive styles have provided insight into the importance of individualized approaches in vaccine communication strategies, there is limited research linking decision-making styles to vaccine hesitancy (Martinelli & Veltri, 2021; Poland & Ratishvili, 2022; Pomares et al., 2019; H. Tomljenovic et al., 2020). This research exploring decision-making styles and parental vaccine hesitancy aims to fill the paucity of information regarding this information, which is essential for informed interventions and policy development.

NVivo and ChatGPT are two well-known platforms. The prior is nearly ubiquitous throughout the qualitative research community and serves as a powerful tool for data storage, organization, and analysis. In recent years, ChatGPT has been introduced to the qualitative community to assist researchers in qualitative analysis (L. Hamilton et al., 2023; Lee et al., 2023; Zhang, Wu, Xie, Lyu, et al., 2023). This current research aimed to investigate and evaluate the distinctions between ChatGPT and NVivo in performing reflexive thematic analysis. The detailed subtleties of each platform were assessed to establish the advantages and disadvantages of their respective

qualitative data analytic proficiencies. The results of this inquiry are intended to equip future researchers with beneficial information that will aid them in making a well-informed decision as they select an analytic strategy for their qualitative study.

As we move into this chapter, important milestones will be highlighted as the history and timeline of vaccines are explored. The focus of the chapter will then shift to vaccine hesitancy. I will discuss vaccine mandates, how vaccine hesitancy can be a threat to public safety, the prevalence of this aversion, causes of reluctance, and factors that contribute to fear of vaccines, such as questioning the efficacy of vaccines, uncertainty about vaccine safety and potential risks, concern over the proliferation of childhood vaccines, tentativeness due to religious beliefs, and disinclination that may arise due to information sources. Subsequently, health decision-making styles and their relationship to vaccine hesitancy will be explored. I will conclude by introducing ChatGPT and NVivo and how they can be utilized for conducting reflexive thematic qualitative analysis. I will then work to clarify their distinct roles and applications in this context.

History and Timeline of Vaccines

Variolation

Variolation is a technique developed to prevent smallpox and involves infecting a healthy person with a small amount of the smallpox virus (Leung, 2011). The designation variolation originated “from the Latin word varius (‘stained’) or from varus (‘mark on the skin’)” (Dinc & Ulman, 2007, p. 4262). Leung (2011) asserts that this practice was initially reliably documented by a renowned Chinese doctor, Zhan Lu, in a medical book dating back to 1695. A common form of variolation during this time involved drying and grinding scabs from smallpox lesions and placing them in the nostrils of healthy individuals (Khadori, 2022; Leung, 2011). Another form of variolation entailed lancing a pustule from an individual suffering from smallpox and introducing it to the extremities of a nonimmune person through a small laceration in the skin

(Riedel, 2005). Variolated individuals typically developed a mild case of the disease but gained subsequent immunity from the often fatal illness (Leung, 2011). The WHO (n.d.-b) conveys that smallpox was one of the most devastating and deadly diseases known to humankind, leaving millions of people dead in its wake. Dinc and Ulman (2007) add that this disease stands out as the deadliest microorganism in history, surpassing all others in the number of lives it has claimed. Smallpox is a highly contagious disease that first appeared in Africa around 10,000 BCE and was carried from there to Egypt and India and eventually to countries and continents worldwide (Dinc & Ulman, 2007). It is reported that throughout 18th-century Europe, smallpox killed 200,000 to 600,000 people annually (Dinc & Ulman, 2007) and was the cause of death of 300 to 500 million people in the 20th century (Louten, 2023). Virtually leaving no culture unscathed, this catastrophic disease annihilated the empires of the Aztecs and Incas (Louten, 2023). In her paper exploring the history of vaccines, Hsu (2013) included this poignant quote by Macauley from 1800 regarding the devastating effects of smallpox:

Smallpox was always present, filling the churchyard with corpses, tormenting with constant fear all whom it had not yet stricken, leaving those whose lives it spared the hideous traces of its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover. (p. 34)

Identifying symptoms of smallpox included high fever, pain, and lesions on the skin (Hsu, 2013). It carried a fatality rate of 20–60% and, as can be ascertained from the quote above, commonly left survivors with severe scarring and blindness (Hsu, 2013). Considering the devastating effects of smallpox, variolation was generally met with widespread acceptance in countries beyond China, including Africa and India, and was eventually embraced, if even in a small way, by global communities (Dinc & Ulman, 2007). Variolation was introduced to Turkey during the Ottoman era to aid in combating the smallpox epidemic that plagued the country during this time (Dinc & Ulman, 2007). Subsequently, Ottoman physicians presented the

practice to Europe but were met with resistance (Dinc & Ulman, 2007). However, Lady Mary Montagu, wife of Lord Worthley Montagu, British Ambassador to the Sublime Porte, aided in the acceptance and practice of variolation in the West (Dinc & Ulman, 2007). Montagu was a writer and socialite who lost her brother to the disease and personally survived its clutches, notwithstanding scarring and the permanent loss of her eyelashes (Dinc & Ulman, 2007). Experiencing the devastating effects of smallpox firsthand, she had her young children variolated, her son while she was still in Istanbul, and her daughter upon her return to England by Embassy surgeon Charles Maitland (Dinc & Ulman, 2007). Maitland later published his account of variolation that inspired hundreds in England to undergo this procedure, including many individuals from the upper class as well as members of the royal family (Dinc & Ulman, 2007). Variolation was frequently considered a viable treatment to counter the ravaging effects of smallpox as it reduced the disease's fatality rate from 20–60% (Hsu, 2013) to 0.5–3.0% (Khordori, 2022; Louten, 2023). Variolation made its way to the American colonies in or around 1721 when Cotton Mathers, a reverend in the colony of Massachusetts, inoculated his family and servants after learning of the procedure from a scar found on a church servant (Khordori, 2022). Furthermore, it is reported that George Washington had his troops variolated after writing to the Chief Physician of the Continental Army regarding the dire necessity to do so in order to avoid losing countless men to the ruinous illness (Elliott & Chambers, 2022; Khordori, 2022). The rate of smallpox drastically fell to a trickle, curtailing the devastating disease by as much as two thirds (Elliott & Chambers, 2022). Following the trend of inoculation, Catherine the Great of Russia had herself, her family, and two million of her constituents variolated with smallpox in 1768 (Khordori, 2022).

While variolation proved in many ways to safeguard individuals against the deleterious effects of smallpox, it is important to acknowledge that there were drawbacks associated with the practice. Despite shielding many from severe symptoms and even death, variolated individuals still carried the risk of transmitting the disease to others (Louten, 2023). Furthermore, additional concerns included the risk of spreading other illnesses, such as syphilis and hepatitis (Louten, 2023). Regardless of these shortcomings, many individuals who underwent variolation found the procedure valuable, as it aided in preserving their health and life.

Although variolation did not eradicate smallpox, it did garner substantial success in reducing the fatality rate and mitigating the impact of the disease on those who chose to submit to the procedure. Additionally, while its success was not all-encompassing, it laid the foundation for Edward Jenner's pioneering experiment with cowpox. Jenner's discoveries aided in ushering in modern-day practices of vaccinations.

Vaccinations

Vaccinations, as we know them today, were introduced by Edward Jenner, an English physician. He observed that milkmaids who were exposed to and contracted cowpox gained immunity against smallpox (Kayser & Ramzan, 2021). Considering this, Jenner inoculated 8-year-old James Phipps on May 14, 1796, by taking pus from a lesion found on the hand of Sarah Nelmes, a milkmaid infected with cowpox, and injecting the boy in two places on his arm (Baxby, 2011). Phipps experienced mild symptoms but recovered fully (Baxby, 2011). It is important to highlight the ethical considerations regarding Jenner's decision to conduct a remedial experiment on a vulnerable child without a clear medical necessity. Additionally, the child's father was employed by Jenner, which may have made declining the intervention difficult due to a clear power imbalance (The Jenner Institute, n.d.). Intrigued by his discovery, Jenner

collected data from more patients before publishing his findings in the Inquiry (Baxby, 2011).

The physician reported that smallpox could be prevented through a cowpox vaccination and coined the term “variolae vaccinae” (smallpox of the cow), which later became known as

“vaccination” derived from “vacca,” the Latin word for cow (Baxby, 2011, p. 14; Hsu, 2013).

Jenner noted that vaccinations produced only a single lesion at the inoculation site and did not result in serious illness or death (Baxby, 2011). Furthermore, the English physician noted that, unlike variolation, individuals who received the vaccine could not pass the illness on through saliva or other body fluids (Baxby, 2011). Jenner’s practice of vaccination continued unaltered during the first part of the 1800s (Hsu, 2013). However, it was discovered that the strength of the cowpox virus decreased with time, leaving vaccinated individuals unprotected (Hsu, 2013). To combat this, Dr. Edward Ballard recommended passing the virus back to young cows to strengthen the matter (Hsu, 2013). Moreover, German scientists introduced glycerin to the cowpox fluid to kill bacteria that caused secondary infections (Hsu, 2013). By the end of the 1800s, cowpox matter from glycerinated calves became the model protocol for vaccination (Hsu, 2013). While Jenner’s initial vaccination trials were limited in scope, and more work was needed to confirm safety and efficacy, they brought great insight into the potential use of animal viruses in vaccinations (Baxby, 2011). They provided a turning point in the fight against smallpox and a foundation for exploring purposeful methods to safeguard against communicable diseases (Hsu, 2013). The eradication of smallpox, declared at the 33rd World Health Assembly on May 8, 1980, is one of humankind’s greatest public health achievements (CDC, 2021).

Vaccines continued to evolve, with one of the first key progressions being Louis Pasteur’s 1870 discovery that aging infectious cultures before inoculation provided better immune protection from disease (Hsu, 2013). This process became known as attenuation, which

Pasteur developed by exposing bacteria to a variety of adverse environments in order to weaken them (Hsu, 2013). Another notable discovery occurred a few years later, in 1877. A German physician, Robert Koch, provided evidence for the “Germ Theory” of disease, conveying that microbes can potentially cause infectious disease (Khordori, 2022, p. 188; K. A. Smith, 2012). His work was notable in marking a connection between a distinct bacterium with a specific disease (Blevins & Bronze, 2010). Pasteur used his own and likely Koch’s findings as a springboard for developing a rabies vaccine (Khordori, 2022; K. A. Smith, 2012). After suffering numerous dog bites from canines carrying rabies, Joseph Meister was the first recipient of the rabies vaccine in 1885 (Hsu, 2013; Khordori, 2022). Meister resisted the infection, popularizing this aptly named “Rabies Vaccine” (Khordori, 2022, p. 188; see also Hsu, 2013). This new vaccine augmented the term’s (“vaccine”) essence and scope, ushering in a rush of exploration into vaccine development (Hsu, 2013; Khordori, 2022). The progression of inoculations continued as vaccines for typhoid, plague, and cholera were developed by Daniel Elmer Salmon and Theobald Smith in 1886 by using killed bacteria as the agent by which to inoculate individuals from these infectious diseases (Hsu, 2013). Subsequently, Elie Metchnikoff and Paul Ehrlich helped advance the understanding of human immunity, which led to the genesis of anti-toxins to combat infectious agents such as diphtheria and laid the groundwork for innovations in anti-toxin generation in the 20th century and contributed to the adoption of the term “immunization” (Hsu, 2013, p. 35). Notably, by the end of the 19th century, humans were using five vaccines, including vaccines for smallpox and rabies (live virus vaccines) as well as typhoid, cholera, and plague (inactivated bacterial vaccines; Hsu, 2013, p. 35).

The first half of the 20th century witnessed a torrent of vaccine development (Khordori, 2022). Diseases such as tuberculosis, yellow fever, typhus, influenza A, whooping cough,

diphtheria, tetanus, influenza, and mumps were addressed through newly created vaccinations (Hsu, 2013; Khordori, 2022). An improved understanding of microbiology ensued, which aided in the identification of disease-causing organisms for vaccines (Hsu, 2013). A revolutionary discovery came in 1949 on the backs of innovators such as Hugh and Mary Maitland, Goodpasture, and Enders, Weller, and Robbins (Hsu, 2013). These pioneers unearthed the ability to grow viruses in cell cultures instead of depending on the necessity of using live animals (Hsu, 2013). Growing and maintaining cells outside their natural environment allowed researchers to introduce virus samples to cell cultures so that the virus could grow in them while losing a significant amount of potency (Hsu, 2013). In turn, the attenuated virus could then be utilized as the base by which to generate vaccines (Hsu, 2013). Building on this knowledge, Hilary Koprowski developed a live polio vaccine using animals in which to grow the disease in 1950 (Hsu, 2013). Echoing but amending Koprowski's polio vaccine progression, Jonas Salk developed the first formaldehyde-inactivated vaccine against polio that included all three strains of the disease (Hsu, 2013; Siani, 2023). However, its use would prove deleterious, as its hasty licensing and dissemination led to a polio outbreak, prompting further polio vaccine development (Hsu, 2013). Fortunately, Albert Sabin developed an oral live polio vaccine derived from weakened live strains of the poliovirus that was licensed in the 1960s (Hsu, 2013; Siani, 2023). This vaccine was administered orally and provided immunity to the three respective strains of the virus (Hsu, 2013; Siani, 2023). Sabin's polio vaccine became the preferred polio vaccine until the end of the 1990s (Hsu, 2013; Siani, 2023). One of the heralding successes in vaccine development was that of the polio vaccination. This laudable milestone has contributed to a marked decline in polio cases, reducing them by over 99.9% in 30 years (Harutyunyan et al., 2023).

Throughout the 1960s, rapid advancements took place in the development of vaccines. These developments included live attenuated inoculations for measles, mumps, and rubella, which were made through the utilization of cell culture and aimed at maintaining immunity while simultaneously mitigating harmful effects (Han, 2015; Hsu, 2013). Powerful disease-preventing vaccines for varicella, influenza, and rotavirus were likewise developed using live attenuated vaccines (Han, 2015; Hsu, 2013). However, the challenges of genetic instability and persisting adverse effects required continued attention (Hsu, 2013). Techniques were employed to adjust the genetic makeup of the pathogens to create safer and more effective vaccinations (Hsu, 2013). Interest shifted to utilizing bacterial proteins and sugars to aid in stimulating increased immunity in the 1970s and 1980s (Hsu, 2013). Utilizing the outer coatings of bacteria allowed scientists to develop vaccines for meningococcus, pneumococcus, and Haemophilus influenzae type B (Hsu, 2013). However, these vaccines encountered problems as they did not create a strong enough memory in immune cells or effectively produce protective antibodies in young children (Hsu, 2013). Remediation for this came when the bacterial matter was joined to carrier proteins that acted as guides for the immune system, leading to stronger vaccinations and the creation of modern inoculations (Hsu, 2013). Notably, the improvement of these vaccinations played a pivotal role in reducing the aforementioned infectious pathogens (Hsu, 2013). Moreover, in 1981, Japan introduced an acellular vaccine for pertussis that utilized parts of the cell instead of the entire cell, making it a safer way to strengthen the immune system (Hsu, 2013). Similarly, the hepatitis B vaccine, developed by Maurice Hilleman and colleagues, was a forerunner in the genetic engineering movement, which allowed scientists to utilize the parts of the pathogen that provided the most robust immune response with the lowest risk of illness (Hsu, 2013). This type of vaccine development aids in creating targeted inoculations that are safer and more effective

against specific diseases (Hsu, 2013). Disadvantages regarding genetic engineering utilizing human plasma arose due to concerns surrounding human immunodeficiency (Hsu, 2013). This initiated the generation of genetically engineered recombinant vaccines, introducing specific genes into cells and directing them to create innocuous fragments of the pathogen called antigens, which avoided potential contamination from human blood (Hsu, 2013). Recombinant vaccines have aided in developing vaccines for Lyme disease and human papillomavirus (HPV) (Hsu, 2013).

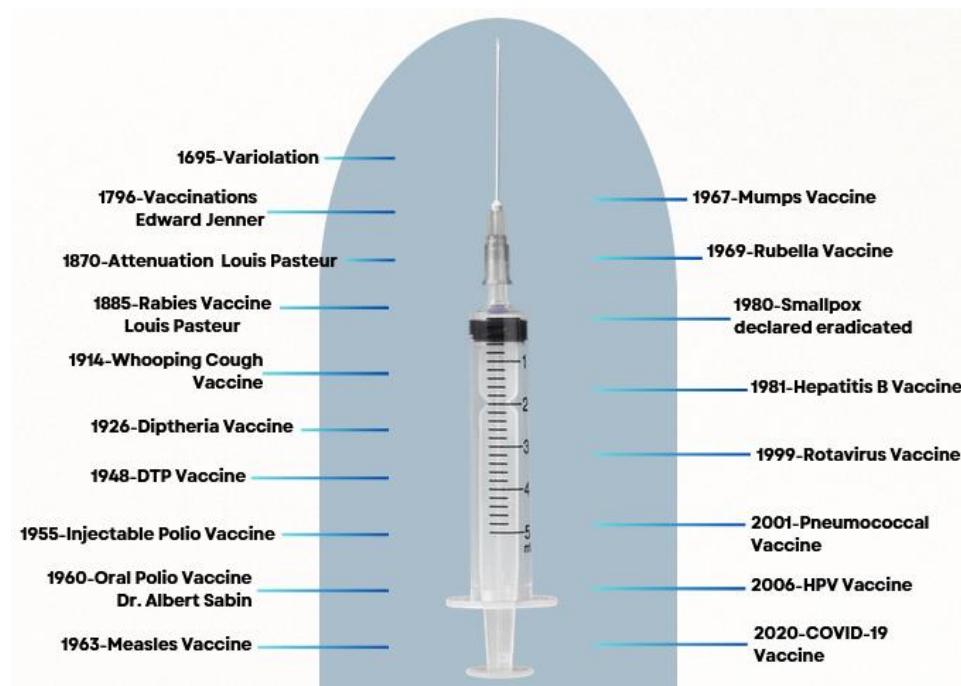
In contemporary times, vaccine technologies have evolved to include nucleic acid-based vaccines, such as mRNA, nanoparticle complexes, and viral vector vaccines (Kayser & Ramzan, 2021, pp. 5257–5260). In 2020, the scientific community scrambled to create a safe, effective, and expedient vaccine for COVID-19 and utilized these newest technologies toward that end. While research regarding RNA and DNA-based vaccines has existed for decades, its exploration has been expedited in recent years (Kayser & Ramzan, 2021). Modern-day scientists have employed small pieces of a virus's DNA or RNA material as a substance for the immune system to recognize as a foreign body to trigger an immune response (Kayser & Ramzan, 2021). Using this modality, Pfizer and Moderna successfully developed COVID-19 vaccines (Kayser & Ramzan, 2021). Johnson & Johnson established their COVID-19 vaccine through viral vector vaccine technology, combining a piece of the target virus with a benign carrier virus to prompt the body's immune system to recognize it as foreign and create an immune response (Kayser & Ramzan, 2021). Subsequently, if the vaccinated individual encounters the actual virus, the immune system is prepared to defend against it (Kayser & Ramzan, 2021). The scientific community's progress in vaccine technologies is genuinely remarkable. Through the dedication

and determination of past, present, and future researchers, humanity has been and will continue to be safeguarded against infectious diseases.

The evolution of vaccines has been a long and arduous process filled with exciting discoveries and numerous obstacles, as highlighted in Figure 1 (created with Canva). However, it is worth noting that in just two centuries, vaccines have made an indelible mark on the welfare of humanity and public health by preventing disease and augmenting life expectancies (Hsu, 2013). Vaccine technology advancements continue to improve and expand faster than ever (Han, 2015). Kayser and Ramzan (2021) note that more expedient success has recently been experienced in vaccine development through international collaboration and more significant funding. Through continued cooperation and the proliferation of knowledge regarding cutting-edge vaccine technologies, humankind will continue to experience the tremendous benefits of vaccinations (Han, 2015).

Figure 1

Timeline for the History of Vaccines



Vaccine Hesitancy

For centuries, disease has posed an imminent threat to the welfare of humanity with its capability of local and global devastation. This persistent threat has fueled ongoing concerns about disease control and public safety. A glimmer of optimism emerged with the development of variolation and Jenner's 1796 augmentation of vaccinations (Marshall, 2018). While Jenner did not initially discover exposing individuals to infectious illnesses to build immunity against life-threatening pathologies, he expanded the understanding of how diseases could be averted through proactive and preventative measures (Marshall, 2018). Jenner's work ushered in the golden age of vaccine innovations and breakthroughs and laid the groundwork for the future of immunizations (Marshall, 2018). However, not all individuals have shared the excitement and veneration of vaccinations. Some people, for various reasons, express hesitancy, and reluctance toward vaccinations. MacDonald et al. (2019) contend that attitudes towards vaccinations are not binary but are complex and involve an individual's understanding of the environment, opportunities, and viewpoints of individuals and communities. Vaccine hesitancy, a "delay in acceptance or refusal of vaccination despite the availability of vaccine services" (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015, p. 4161) is not new. Vaccine hesitancy has existed for centuries, with opposition dating back to the late 1700s and early 1800s (Jacobson et al., 2015). Nuwarda et al. (2022) posit that Jenner, in his pioneering efforts with vaccines, encountered resistance from local clergy, who objected to introducing animal matter into human flesh, viewing it as a direct violation of divine will. Ministers in Britain characterized variolation as "a diabolical operation which ... promotes the increase of Vice and Immorality" (Siani, 2023, p. 506). William Wagstaffe (as cited in Siani, 2023), an English physician, wrote a letter positing that doctors of the time "should not be overly hasty in encouraging a practice, which does not

seem as yet sufficiently supported either by Reason or by Fact" (p. 507). He went on to say that posterity perhaps will scarcely be brought to believe that an experiment practiced only by a few ignorant women, amongst an illiterate and unthinking people, should on a sudden, and upon a slender experience, so far obtain in one of the politest nations in the world as to be received into the Royal Palace" and may have been denoting Lady Wortley Montagu (Siani, 2023, p. 507). Moreover, illustrations of a boy who developed the face of an ox and an older woman who grew horns after receiving Jenner's vaccination circulated, warning that these inoculations would lead to "Cow-Mania" (Nuwarda et al., 2022, p. 3). Furthermore, dissenters contended that scars from the vaccination were "the mark of the beast" (Siani, 2023, p. 507), a sentiment that is still in circulation today in anti-vaccination and conspiracy theorist circles. Similarly, the new colonies in America experienced opposition. A mob attacked the home of physician Archibald Campbell while he and Dr. John Dagleish were variolizing individuals in the Virginia colony (Khordori, 2022). Notably, Cotton Mather, a reverend in the early American colony of Massachusetts, was a proponent of variolation and encouraged individuals to be inoculated (Khordori, 2022; Siani, 2023). In colonial Boston, Dr. Zabdiel Boylston's practice of variolation, inspired by Mathers, was labeled as a "dangerous quack advertisement" and was challenged by the argument that "If inoculation of the Small Pox be not of God, then it is of the Devil. But it is not of God. Therefore, it is of the Devil" (Siani, 2023, pp. 505–506). Despite being arrested for variolation, Boylston continued his work upon release, documenting that amongst the 5,759 Bostonians who were struck with smallpox, the 884 who were not inoculated succumbed to the disease as compared to six of the 282 individuals who were variolated against the disease (P. J. Smith et al., 2011).

Through the years, the prevalence of vaccine hesitancy has waxed and waned but has never entirely been eradicated. In 1998, an article authored by Wakefield et al. raised concerns about the measles, mumps, and rubella (MMR) vaccine, linking it to autism (Larson et al., 2022). Although Wakefield et al.'s paper was later retracted, the fear stirred by this work and the author's activism against vaccinations, particularly the ingredient thimerosal, fueled vaccine hesitancy (Larson et al., 2022). The Institute of Medicine Immunization Safety Review Committee (2001) investigated Wakefield's claims and found the MMR vaccine containing thimerosal was not linked with autism (see also Larson et al., 2022). Additionally, worries about how one vaccine can lead to hesitancy about others were seen with the reported risks of Dengvaxia, a vaccine designed to reduce the risk of dengue fever, in the Philippines that caused a decline in measles vaccinations (Larson et al., 2022). Similarly, an HPV vaccine scare in Denmark, fueled by adverse media reports on "Immunization Stress-Related Responses" (Larson et al., 2022. p. 62) resulted in a reduction of MMR vaccinations. These instances highlight the interconnected nature of attitudes toward different vaccines. This interconnectedness is further underscored by the WHO, which notes that vaccine hesitancy for all vaccines was heightened globally during the COVID-19 pandemic, posing a threat to public health (Nossier, 2021; Reece et al., 2023; Wiysonge et al., 2021). From variolation to modern vaccine concerns, the history of vaccine hesitancy highlights the impact of public attitudes on how individuals view vaccinations. The ebb and flow of vaccine hesitancy is shaped by historical happenings as well as current issues and underscores the complicated link between public opinion, scientific breakthroughs, and the fight against preventable diseases.

Mandates

One of the world's first official vaccination mandates began in 1809 in the state of Massachusetts (Malone & Hinman, 2003). Britain followed suit in 1853, issuing the British Compulsory Vaccination Act, which required all infants to receive the smallpox vaccination during the first three months of life (Nuwarda et al., 2022). Two years later, Massachusetts extended its mandate to include school vaccinations, marking the state as a forerunner in implementing a compulsory school vaccination requirement (Malone & Hinman, 2003). Notably, the mandate in Britain was met with widespread opposition and riotous demonstrations across the United Kingdom (Nuwarda et al., 2022). Fourteen years later, the act in Britain was augmented, mandating vaccinations for children 14 years of age and younger with penalties for violation (Nuwarda et al., 2022). Once again, resistance ensued, with detractors expressing concerns regarding autonomy and freedom of choice (Nuwarda et al., 2022). Not surprisingly, the Anti-Compulsory Vaccination League was precipitously formed and vehemently supported by William Tebb, the leading British anti-vaccinationist of the time (Confer et al., 2021; Nuwarda et al., 2022). Anti-vaccination sentiments were particularly strong in Leicester, England, where hundreds of parents refused to have their infants vaccinated (Adaboh, 2018). Imprisonments, fines, and loss of homes did not deter this dissenting group (Adaboh, 2018). On March 23, 1885, thousands of people gathered to protest the vaccine mandates, chanting mottos such as "better a felon's cell than a poisoned babe" and "sanitation, not vaccination" (Adaboh, 2018, p. 1).

In 1879, William Tebb brought his fervent and compelling anti-vaccination message to New York, planting the seeds for what would soon become an anti-vaccination movement in the United States (Confer et al., 2021). Tebb zealously asserted that parental freedom from

legislative vaccine mandates must be secured (Tebb, 1894). This message resonated with individuals inclined towards anti-vaccination sentiments, which stemmed from their opposition to the legal enforcement of vaccination laws in the United States during the 1870s (Grignolio, 2018) instituted due to a smallpox outbreak in Cambridge (Siani, 2023). Not long after Tebb's visit, the Anti-Vaccination Society of America was established (Confer et al., 2021). This group of oppositionists authored and distributed pamphlets, orchestrated protests, and engaged in legal battles in their pursuit of abolishing mandatory vaccination policies (Grignolio, 2018). One of the foundational legal disputes regarding opposition to compulsory immunizations in the United States involved Pastor Henning Jacobson (Siani, 2023). Citing adverse effects from previous vaccinations as a reason for refusing compliance, Pastor Jacobson took the matter to the Supreme Court in 1905, where the ruling was made that vaccination enforcement did not violate personal autonomy and was a rational and prudent measure to safeguard public health, and the pastor was fined \$5 (Siani, 2023). Despite the pastor's legal challenge and subsequent Supreme Court ruling, the 1920s still witnessed continued reluctance to vaccinations, leading to persistent smallpox outbreaks, causing more than 102,787 cases and 563 deaths in 1921 (Allen, 2007). In 1922, the Supreme Court ruled that city ordinances, in this case, San Antonio, Texas, requiring children to be vaccinated before attending school were constitutional (Malone & Hinman, 2003; *Zucht v. King*, 1922). The ruling upheld the constitutionality of such regulations as they aimed to safeguard public health and were not deemed arbitrary (Malone & Hinman, 2003). Despite the significant number of deaths and governmental mandates, parents were still hesitant to vaccinate their children (Allen, 2007). For instance, when healthcare officers attempted to administer smallpox vaccination in Georgetown, Delaware, in 1926, they faced vehement opposition from an angry armed mob (Allen, 2007; Siani, 2023). The hostility forced healthcare workers out of

town before they could provide inoculations to the local citizens (Allen, 2007; Siani, 2023). This persistent resistance underscores the challenges faced in promoting widespread vaccination.

Nevertheless, by 1963, 20 states, including the District of Columbia and Puerto Rico, had implemented vaccination laws; however, the enforcement of these laws varied widely (Malone & Hinman, 2003). Notably, efforts to eliminate measles in the United States in the late 1960s revealed that state laws mandating measles vaccinations in schools experienced significantly lower measles rates by the early 1970s (Malone & Hinman, 2003). Moreover, a nationwide initiative to increase childhood vaccination rates, focusing on school requirements, led to all states having laws requiring vaccinations for students attending school by the early 1980s (Cawkwell & Oshinsky, 2015; Malone & Hinman, 2003). As of the late 1990s, nearly all states had vaccination requirements for grades K–12, daycare centers, and college entrance (Malone & Hinman, 2003). Consequently, with the support of the Task Force on Community Preventive Services, this initiative increased vaccine coverage, significantly reducing communicable diseases (Malone & Hinman, 2003). However, vocal opposition emerged as states began to mandate vaccinations (Novak, 2005). Challengers of vaccine mandates pointed to a lack of efficacy and potential harm, distrusted governmental officials, and questioned ongoing vaccination in the absence of the threat of disease (Novak, 2005). Furthermore, many believed that vaccine mandates violated sacred religious beliefs (Novak, 2005). Subsequently, despite the Establishment Clause in the United States Constitution, prohibiting the government from favoring one religion over another, exemptions from vaccine directives were first established in California in 1889, permitting individuals to abstain from vaccination if they “conscientiously opposed” (Conis & Kuo, 2021, p. 170) vaccinations, which may stem from religious or philosophical beliefs (Hodge & Gostin, 2002; Novak, 2005). It is worth noting that courts have

allowed religious exemptions, but some may require the belief against vaccination to be genuinely held and integral to religious doctrine (Hodge & Gostin, 2002; Novak, 2005). Contrastingly, philosophical exemptions often require less evidence to obtain a waiver from vaccination requirements (Hodge & Gostin, 2002; Novak, 2005). Over time, vaccine mandates have revealed how public health measures, legal frameworks, and individual autonomy interact, shedding light on the ongoing challenges and debates in vaccination policies.

Vaccine Hesitancy and Threats to Public Safety

Vaccine hesitancy can pose a serious health risk and threaten public safety by decreasing vaccination rates, compromising the effectiveness of vaccination programs and increasing the likelihood of preventable diseases spreading within communities (Coustasse et al., 2020; Salmon et al., 2015). Reluctance to vaccinate can lead to a decrease in herd immunity, which is achieved through widespread vaccination, providing overall protection (Haroune & King, 2020; Thunstrom et al., 2020; While, 2021). This is particularly concerning when considering the potential for the spread of severe and fatal outcomes of vaccine-preventable diseases (Dubé et al., 2013). McClure et al. (2017) contend that vaccine hesitancy has led to lower vaccination rates, increased emergency department use, and higher morbidity and mortality. A salient example of the public safety risks associated with this phenomenon is the 2014–2015 measles outbreak originating at Disneyland in California. Due in part to lower vaccination rates, the outbreak extended to multiple states and even internationally (Worden et al., 2020). Measles is a “highly infectious respiratory viral infection associated with severe morbidity and mortality” (Thompson et al., 2023, p. 1). This formidable disease can be combated with the MMR vaccine, which Thompson et al. (2023) note is more than 95% effective. Unfortunately, there have been outbreaks of this preventable malady in countries such as the Netherlands, Italy, and England

(Thompson et al., 2023). These infectious occurrences are attributed to vaccine hesitancy (Thompson et al., 2023). Low vaccination rates are thought to be attributed to the 18% increase in measles cases worldwide as of 2022, according to Benadjaoud (2023). This highlights the value and importance of vaccinations and deleterious outcomes that occur as vaccination rates drop. According to Salmon et al. (2015), outbreaks of Haemophilus influenzae type b, varicella, pneumococcal disease, measles, and pertussis have caused unnecessary suffering among young children due to individuals refusing to vaccinate (Salmon et al., 2015). Emphasizing the preventable nature of these diseases with vaccines underscores the significance of recognizing and focusing on strategies to mitigate vaccine hesitancy. Addressing vaccine hesitancy and ensuring high rates of timely vaccination are ongoing and perpetual processes that cannot be discontinued, as doing so would be met with grave consequences (Salmon et al., 2015). This continuous effort is vital to maintaining effective control of vaccine-preventable diseases (Salmon et al., 2015).

Prevalence

Increased risk of vaccine-preventable diseases emerging and proliferating often begins with parents who are hesitant toward vaccines (Nguyen et al., 2022). Larson et al. (2022) spotlight the burgeoning increase in and magnitude of vaccine hesitancy and connect it to a lack of trust in healthcare, a preference for alternative forms of healthcare, the widening divide between oppositional political beliefs, and extreme devotion to a set of beliefs (Larson et al., 2022). The researchers also note that reluctance toward vaccines varies by geographical location, as demonstrated by the 7% to 49% variation across zip codes in Stearns County, Minnesota (Larson et al., 2022). Larson et al. (2022) maintain that disparities such as this are common in counties nationwide. Furthermore, Palombi et al. (2023) assert that recent assessments reveal that

residents of rural areas with diminished household incomes and lower levels of education demonstrate a higher likelihood of vaccine hesitancy. Despite the norm of vaccination in the United States, this regional variation is significant (Larson et al., 2022) and intersects with the increasing trend of some parents choosing non-medical exemptions due to concerns about immunizations (Salmon et al., 2015). A 2019 national survey revealed that approximately one in every 15 parents in the country harbor hesitations toward childhood vaccinations (Kempe et al., 2020). Furthermore, there are widespread concerns among parents regarding vaccine safety, with one in eight expressing worries about routine childhood and influenza vaccines (Kempe et al., 2020). Additionally, only one in four parents believe in the efficacy of the influenza vaccine (Kempe et al., 2020). Nguyen et al. (2022) concur, reporting that almost a quarter of parents are vaccine-hesitant and contribute to lower childhood vaccination coverage. Notably, children of hesitant parents exhibit lower vaccination coverage (Nguyen et al., 2022). This hesitancy may account for as much as 25% of under-vaccination. Nowak and Caciato (2023) substantiate Nguyen et al.'s (2022) report, confirming that approximately 6% to 25% of parents exhibit hesitancy, with higher rates for influenza and HPV vaccines. Ruiz and Bell (2022) report even higher numbers, positing that nearly one-third of parents reported vaccine hesitancy.

Interestingly, it has been documented that some parents express lower levels of concern about the health risks of COVID-19 to their children and indicate a preference for their children to gain immunity through infection rather than vaccination (Ruiz & Bell, 2022). Bektas and Bektas (2023) found a correlation between parental vaccine hesitancy and their willingness to have their children vaccinated against COVID-19. The low vaccination rate among children has been found to be attributable to a lack of confidence and perceived risks associated with the vaccine (Bektas & Bektas, 2023). Parental attitudes and sentiments toward vaccinating their

children have been negatively impacted by the COVID-19 pandemic (Grills & Wagner, 2023). Some parents have become more hesitant about childhood vaccines, with 11% believing they are less safe, 12% considering them less important, and 13% perceiving them as less effective than before the pandemic (Wagner, 2024). This suggests a growing polarization in vaccination attitudes (Wagner, 2024). Moreover, lower childhood vaccination rates in the wake of COVID-19 have been coupled with a decline in pediatric visits (Teasdale et al., 2022). During the first year of the COVID-19 pandemic, 33.1% reported that their child missed a vaccination (Teasdale et al., 2022). Teasdale et al. (2022) warn that neglecting routine visits to the pediatrician may lead to undetected developmental delays, emotional issues, physical disabilities, and other conditions identified through routine screening. Moreover, avoiding vaccinations can pose significant health risks for children and communities, potentially causing outbreaks of preventable diseases (Teasdale et al., 2022). Multifaceted dynamics influence vaccine hesitancy, ranging from parental concerns about routine vaccinations to the impact of the COVID-19 pandemic, and underscores the need to rebuild confidence in childhood vaccinations. Addressing parental vaccine hesitancy is not only essential for protecting the health of individual children but is also paramount for upholding community-wide immunity and preventing devastating diseases from marring and claiming innocent lives globally.

Causes

D. Hoffman et al. (2021) contend that mitigating vaccine hesitancy frequently centers around navigating uncertainties, reliability, and skepticism and signifies an attempt to address unmet needs and concerns by engaging in scientific discussion. The authors further offer that hesitancy surrounding vaccinations is not equivalent to the more rigid stance of anti-vaccination (D. Hoffman et al., 2021), a term that is “used to describe a person or group that does not agree

with vaccinating people (giving them injections to prevent disease) and spreads and encourages opinions against vaccines” (“Anti-Vax,” n.d., para. 1). Among the significant number of aspects goading vaccine hesitancy Kerrigan et al. (2020) report that vaccine safety, lack of information, fear of vaccines and their side effects, perception of low risk of disease, social norms, vaccine schedules, questions of efficacy, and distrust of medical establishments are a few of the reasons parents report hesitancy toward vaccines. Moreover, stronger religious and philosophical views are often indicative of vaccine hesitancy, with individuals holding such beliefs more likely to harbor negative attitudes and weaker intentions toward vaccines (Kuru et al., 2022). It is also worth noting that the source from which parents acquire health-related information plays a substantial role in shaping their tendency toward or away from vaccine hesitancy (Charron et al., 2020). Examining factors influencing vaccine hesitancy, including the fear of vaccines and concerns surrounding their safety is prudent as it could shed light on the uncertainty and skepticism fueling vaccine reluctance.

Skepticism Toward Vaccine Efficacy

Childhood vaccinations are generally held as a highly effective public health measure in controlling and preventing diseases (Ventola, 2016) and are championed for preventing 4 million deaths worldwide each year (CDC, 2023). This contradicts the beliefs held by some parents that vaccines are ineffective and that the diseases they aim to prevent are mild and infrequent (Brown et al., 2010). Individuals with children have been found to be more likely to believe that vaccines are ineffective than individuals who do not have children (Dimassi et al., 2023). K. Wilson et al. (2008) convey that parents who raise concerns about vaccine efficacy express skepticism, citing a perceived lack of credible research studies proving vaccine effectiveness. Furthermore, parents who have concerns centered around the belief that vaccines are ineffective contend that children

still get sick despite vaccination (K. Wilson et al., 2008). Many who assert the ineffectiveness of vaccines in preventing diseases often cite personal experiences or instances of family members contracting vaccine-preventable diseases despite being immunized (Nurmi & Harman, 2021). These individuals do not rely on health officials' recommendations but instead draw from personal experiences, national or local vaccination-related events, and information from various other sources to make vaccine-related decisions (Nurmi & Harman, 2021).

Vaccine Safety and Potential Risks

Reservations surrounding the safety and risks of vaccines are a common concern among vaccine-hesitant parents (CDC, 2024a). Adding to parental concerns, the National Childhood Vaccine Injury Act of 1986 (1986) recognized vaccines as “unavoidably unsafe” (pp. 11–15), sparking debates about the potential risks posed by the elements contained therein. Vaccine ingredients, including aluminum, formaldehyde, and thimerosal, are often sources of anxiety for vaccine-hesitant parents, even though the CDC (2024c) maintains the safety of these vaccine components.

L. Tomljenovic and Shaw (2011) highlight parental consternation regarding aluminum as it is a common vaccine adjuvant, added to vaccines to enhance the body's immune response (CDC, 2022b) and has neurotoxic properties that could potentially cause neuroimmune effects (L. Tomljenovic & Shaw, 2011). These researchers suggest a correlation between aluminum exposure from vaccines and the rise in ASD prevalence and advocate for a comprehensive evaluation of its vaccine risks and benefits (L. Tomljenovic & Shaw, 2011). Boretti's (2021) research reviewing the association between aluminum adjuvants in vaccines and ASD concurs, highlighting evidence from ecological and animal studies and measurements of aluminum in the brains of individuals with ASD, suggesting a potential causal relationship. This researcher

emphasizes the need for a reduction in non-essential uses of aluminum adjuvants in vaccines to address concerns about its neurotoxic effects on a molecular level, proposing strategies like reducing the number of vaccines, adjusting adjuvant amounts, changing formulations, or avoiding multiple vaccinations in infants during a single session (Boretti, 2021). However, the CDC (2022b) contends that aluminum-containing adjuvants are deemed safe. They point to studies that indicate that individuals adhering to the recommended vaccine schedule experience minimal exposure, which they say is not readily absorbed by the body (CDC, 2022b; Keith et al., 2002; Masson et al., 2018; Mitkus et al., 2011).

Formaldehyde is another vaccine ingredient that can cause trepidation as it is connected to nasopharyngeal cancer (Children's Hospital of Philadelphia, 2018). Duong et al. (2011) express worries regarding the multiple routes of formaldehyde exposure. The researchers assert that over 46 billion pounds of the substance are produced each year around the globe and is used in “construction, textile, furniture, medical, chemical, and pharmaceutical industries” (Duong et al., 2011, p. 119), ubiquitously increasing exposure to the ordinary individual. Duong et al. (2011) emphasize that cumulative exposure to formaldehyde poses potential health risks, especially concerning reproductive and developmental toxicities, particularly for children and women of childbearing age. However, the CDC (2022b) contends that while vaccines may contain residual amounts of formaldehyde, the levels are minute and negligible compared to natural concentrations in the body and are too low to cause harm and, therefore, pose no safe concern.

Thimerosal is a mercury-based vaccine preservative used since the 1930s to prevent bacterial growth in multi-dose vaccine vials (Barrett, 2005; CDC, 2020). Concerns arose due to ethyl mercury exposure in children's vaccines potentially exceeding the U.S. Environmental

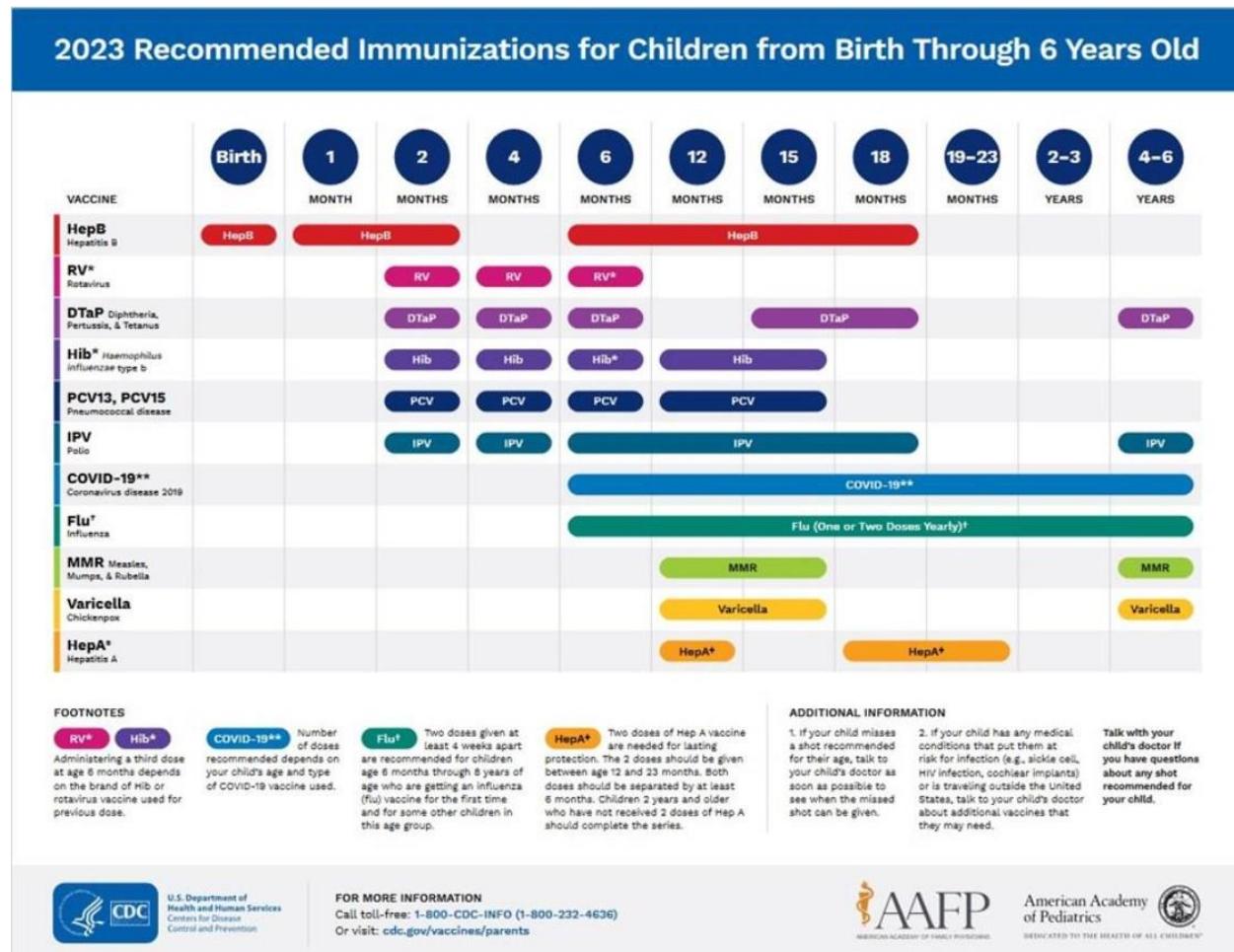
Protection Agency's guidelines (Barrett, 2005). With that in mind, a study assessed the differences in blood and brain mercury levels between thimerosal and methylmercury exposure in monkeys (Barrett, 2005). Results revealed that thimerosal cleared faster, but inorganic mercury levels were much higher in the participants' brains in this group, suggesting unclear effects of low-level inorganic mercury on brain development (Barrett, 2005). The researcher encouraged further research as inorganic mercury persists in the brain for an extended duration with an estimated half-life exceeding one year (Barrett, 2005). Geier et al. (2015) concur after critically reviewing eight decades of clinical, epidemiological, and biochemical studies related to the adverse effects of Thimerosal. The researchers found evidence of Thimerosal toxicity, concluding that Thimerosal, even at minute levels, acts as a poison with harmful consequences, raising genuine concerns (Geier et al., 2015). Notably, the CDC (2020) asserts that the ethyl mercury found in vaccines is safe, eliminated from the body quickly, has minimal side effects, and has been disproven to be linked to autism. The WHO states that Thimerosal concerns are theoretical, with no compelling evidence of safety issues (Geier et al., 2015). Moreover, as of 2001, it has been removed from most childhood vaccines in the United States, and the influenza vaccine comes in thimerosal-containing and thimerosal-free versions (CDC, 2020). While the CDC maintains the safety of ethyl mercury in vaccines and the WHO considers concerns theoretical, the need for further research may be prudent, particularly regarding Thimerosal's potential risks, including the impact of inorganic mercury on brain development.

The Proliferation of Childhood Vaccines

Due to new vaccine development, the increase and acceleration of the vaccination schedule have tripled since 1983 (Mawson & Croft, 2020). This augmentation has raised concerns surrounding the aggregate effects of this prolific schedule on the health and well-being

of children (Mawson & Croft, 2020). Children are advised to receive 69 doses of 16 vaccines by age 18 (CDC, 2024b; Mawson & Croft, 2020). This includes the child receiving 50 doses by age 6, as shown in Figure 2 (CDC, 2022a, 2024b; Mawson & Croft, 2020). Understandably, the escalation in vaccines has caused apprehensions among parents and practitioners regarding the number of injections needed in a single visit (Hillenbrand, 2007). Sharing concerns regarding the proliferated vaccine schedule and potential safety risks, Goldman and Miller (2012) analyzed the Vaccine Adverse Event Reporting System (VAERS) database from 1990 to 2010 and found a positive correlation between the number of vaccine doses administered and the percentage of infant hospitalizations and deaths. The VAERS (n.d.) system was established in 1990 and is managed by the CDC and the Food and Drug Administration to identify potential issues in U.S. vaccines by analyzing reports of adverse events post-vaccination. This platform provides a valuable tool for detecting atypical patterns, which prompt further assessment by health authorities (VAERS, n.d.). The findings of Goldman and Miller highlight the need to prioritize efforts to enhance vaccine safety through further research investigating vaccine toxicity. Mawson and Croft (2020) likewise express apprehensions about the nonspecific effects and point out that there are limited studies on the overall impact on health that may result from the increased number of vaccines administered together. Concerns about multiple vaccinations relate to the possible release of vitamin A, which can lead to adverse effects and outcomes (Mawson & Croft, 2020). The researchers highlight that rising rates of allergies, infections, and neurodevelopmental disorders in highly vaccinated countries may be linked to these effects and encourage urgent research on health outcomes in both vaccinated and unvaccinated groups (Mawson & Croft, 2020). Conversely, Choo and Finn (1999) tout the benefits of combining vaccines, highlighting the advantages of their ability to improve vaccine coverage while simultaneously reducing

morbidity and mortality. Moreover, the U.S. Institute of Medicine Immunization Safety Review Committee (2001) contends that no evidence supports the assertion that multiple vaccines increase risks for impaired immunity. Fletcher et al. (2004) echo these sentiments in suggesting that combination vaccines can potentially fill public health gaps by providing comprehensive protection against a multiplicity of diseases. According to Börner et al. (2006), multiple vaccines have been found to be well tolerated, causing minimal side effects. Concerns regarding the potential of multiple vaccines overwhelming children's immune systems due to the growing number of antigens in vaccines are disputed by Martinón-Torres (2021). The researcher claims these concerns have been negated and highlights that children are routinely exposed to more antigens in daily life than those in vaccines, without any adverse impact on their immune system (Martinón-Torres, 2021). Martinón-Torres (2021) likewise challenges concerns about a possible link between vaccines and SUD, asserting that no evidence was found to suggest that vaccines cause SUD. Ongoing apprehensions regarding the heightened childhood vaccination schedule remain. Some studies support the benefits of combination vaccines, while others refute assertions of adverse impacts. These discrepancies highlight the need for continuous investigation into these matters.

Figure 2*2023 Recommended Immunizations for Children*

Note. From *2023 recommended immunizations for children from birth through 6 years old* (p. 1), by Centers for Disease Control and Prevention, 2022a (<https://stacks.cdc.gov/view/cdc/124469>). Copyright 2022 by the Centers for Disease Control and Prevention.

Religious Beliefs

Religion can play a constructive and beneficial role in the daily lives of many individuals, offering numerous positive contributions (Mirola et al., 2016). Among the many benefits provided by religion are the impartation of meaning and life purpose, the fostering of social cohesion, enhancing the strength of social order, the promotion of greater psychological and physical well-being, and the motivation of individuals to work toward positive social change

(Mirola et al., 2016). However, amid the progressive advantages, religion can influentially affect an individual's stance on vaccinations. Rutjens et al. (2017) assert that religion plays a significant role in vaccination views, as more religious people tend to be skeptical about vaccines and science in general. Religious conservatism, in particular, is associated with low trust in science and reluctance to support vaccines (Rutjens et al., 2017). Mirroring Rutjens et al.'s (2017) assertions, Kuru et al. (2022) contend that religious affiliations are correlated with negative vaccination attitudes and behavior. The researchers share that philosophical beliefs predict greater vaccine hesitancy, while moral beliefs show varied associations across vaccines (Kuru et al., 2022). These attitudes influence vaccination conduct as well as intentions to encourage others to vaccinate (Kuru et al., 2022). Similarly, Levin and Bradshaw (2022) determined that individuals holding conservative religious beliefs are more inclined toward skepticism and hesitancy regarding vaccinations. Long-standing beliefs, such as concerns surrounding vaccines and autism, coupled with new trends in religious views, fuel vaccine hesitancy (Nagar & Ashaye, 2022). Recent vaccine hesitancy leanings among religious affiliates include the proliferation of religious misinformation online and the spreading of false claims about vaccine components violating religious principles (Nagar & Ashaye, 2022). Illustratively, an instance of religious misinformation involves assertions of mRNA vaccines being deemed unacceptable due to the inclusion of fetal tissue or the belief that vaccines will impinge on the sanctity of the body by introducing artificial ingredients (Nagar & Ashaye, 2022). Additionally, emerging ideological beliefs, including conspiracy theories, contribute to vaccine hesitancy in religious communities (Nagar & Ashaye, 2022). Furthermore, distrust in vaccination among minority religious populations, intensified by instances of racism, adds an extra layer of difficulty in promoting vaccines, which hinders the progress of health equity goals (Nagar &

Ashaye, 2022). These religious beliefs pose difficulties in creating positive connotations toward vaccines and can hinder the success of vaccine promotion plans (Nagar & Ashaye, 2022).

Information Sources

Reliable sources of health information significantly shape individuals' perceptions, beliefs, and decisions regarding vaccination. Trusted sources play a crucial role in shaping attitudes toward vaccines and can impact vaccine acceptance or hesitancy. However, what individuals regard as a trusted source can often be subjective (Getman et al., 2017). Vaccine-hesitant individuals identified trusted sources in healthcare and medical science, personal relationships, news and social media, and individual/self-research, often relying on these sources to navigate their concerns and make informed decisions regarding vaccinations (Getman et al., 2017). Nevertheless, some individuals generally distrust all sources, particularly the mainstream media and government (Getman et al., 2017). Charron et al. (2020) observed that healthcare professionals, the Internet, and relatives are often the main sources of vaccine information. Notably, persons who sought information from healthcare professionals demonstrated better acceptance and practices related to vaccination, while reliance on the Internet or relative leads to unfavorable trends (Charron et al., 2020). Interestingly, individuals relying on all three sources exhibited the highest rate of vaccine hesitancy as compared to parents obtaining information from healthcare professionals alone (Charron et al., 2020). The influence of information sources on vaccine perceptions is evident in various studies. Social media emerged as a factor in increasing vaccine hesitancy, contrasting sharply with the positive impact attributed to institutional websites emphasizing the importance of disseminating scientifically accurate vaccine information to address mistrust (Reno et al., 2021). Building on this, Bhagianadh and Arora (2022) shed light on the contrasting outcomes associated with different information sources. Individuals relying on health care providers, social media, Internet and webpages, or

family and friends as primary information sources exhibited higher negative vaccine intent compared to those relying on regular news (Bhagianadh & Arora, 2022). This outcome variance emphasizes the intricate relationship between information sources and vaccine intent. In a related vein, Fischbach et al. (2022) highlight the positive correlation between trust in healthcare experts and higher levels of vaccine acceptance. This underscores the significance of concerted efforts in building trust, correcting misinformation, and ensuring vaccine accessibility to foster a more favorable vaccine landscape (Fischbach et al., 2022).

In exploring other factors related to vaccine hesitancy, Low et al. (2022) recognized that being a father, having low socioeconomic status, knowing individuals who had an adverse reaction to a vaccination, or suspicion of doctors and the medical community were associated with reluctance toward vaccines. The researcher posits that having trust in their child's pediatrician was the most salient element influencing vaccine hesitancy (Low et al., 2022). Notably, many parents prefer to receive tangible information regarding vaccinations, highlighting the importance of thoughtful and effective dissemination of medical information (Low et al., 2022). Adding to the narrative, vaccine-hesitant individuals express distrust in national-level politicians and politically influenced news media, viewing them as unreliable sources of information (Koskan et al., 2023). The interconnectivity of factors provides a nuanced understanding of vaccine hesitancy's challenges and highlights the multifaceted nature of individuals' decision-making processes in this context.

Decision-Making Styles

Decision-making permeates virtually every facet of human existence and can influence personal, professional, and social outcomes. Making effective decisions can contribute to achievement, decisive problem-solving, as well as overall quality of life and life satisfaction. Decision-making involves identifying and choosing alternatives based on an individual's values

and preferences (Fülop, 2005). The process includes considering various choices and selecting the one that best aligns with goals, objectives, and values (Fülop, 2005). Bavołár and Orosová (2015) maintain Scott and Bruce's (1995) stance on decision-making styles by delineating the two main approaches, which are seen as habitual patterns individuals use in decision-making and are viewed as an individual's characteristic way of perceiving and responding to decision-making tasks. Scott and Bruce (1995) define these styles as the ingrained and acquired tendency of an individual to respond in a specific way when facing a decision situation, distinct from personality traits, is rooted in habit-based propensities (Bavołár & Orosová, 2015). Decision-making is essential as individuals face numerous daily choices and can become particularly salient when considering health-related decisions. Notably, Wood (2012) contends that decision-making styles are prognostic of quality decision-making. This highlights the importance of a thoughtful decision-making process that involves considering options, weighing consequences, and aligning choices with individual values and goals; conversely, poor decision-making can lead to setbacks, missed opportunities, unfulfilled potential, and unwanted outcomes. Health-related decisions hold significance for both individuals and society, necessitating decision-makers to garner adequate and reliable information to make sensible and judicious choices (Masic, 2022). Making medical decisions can be complex as these situations can involve a multiplicity of factors with varied consequences (Masic, 2022). Resultingly, these weighty decisions and the approach by which they are made require the acquisition of credible information, focused thought, and meaningful deliberation.

Decision-Making Styles in Health Decisions

Working to gain a comprehensive understanding of decision-making styles concerning vaccine-related decisions is the cornerstone to developing enhanced communication and tailored interventions to address vaccine hesitancy. Identifying factors and behaviors that may lead to

vaccine hesitancy provides healthcare professionals with pertinent information that enables them to foster better health outcomes and more effective healthcare practices through effective, targeted written and verbal communication. Danya and Nakayama (2022) assert that decision-making styles are not fixed or static but can be developed or altered over time. Exploration of these styles has unveiled a complex interplay of various factors with personality traits influencing decision-making style in healthcare decisions, as noted by Flynn and Smith (2007). Different styles contribute to a range of decision-making styles, from active involvement to anxiety, worry, and fear (Flynn & Smith, 2007). Flynn and Smith emphasize the importance of understanding these styles as it can enable healthcare professionals to tailor discussions to meet individual needs (Flynn & Smith, 2007). Individual's mental shortcuts, timing, and emotions play a role in health-related decision-making (Desmond et al., 2013). Therefore, as Desmond et al. (2013) note, comprehending how individuals make decisions can enhance healthcare professionals' ability to communicate and effectively relay information to patients (Desmond et al., 2013). Notably, most patients prefer collaborative communication with healthcare professionals, according to FitzPatrick et al. (2019), who explored the influence of individuals' distinct decision-making styles on health-related decisions. Healthcare professionals can learn from these results and develop tailored communication with their patients to foster more productive outcomes (FitzPatrick et al., 2019); as favorable outcomes are the goal of most if not all, medical practitioners, customized communication could aid in leading to that end benefiting both patient and provider (FitzPatrick et al., 2019). Moreover, analyzing decision situations is valuable for healthcare workers as it allows them to enhance decision-making, recognize diverse situations that require different skills, and raise awareness of various decision-making aspects beyond crises (Murdach, 1995). Lindbladh and Lyttkens (2002) highlight the complex nature of

decisions based on habit or choice, emphasizing the importance of understanding how people make health decisions to better address health inequalities. It is worth noting that the authors emphasize that habit involves automatic and routine actions performed without conscious thought, while choice entails a deliberate selection from a range of potentially feasible options (Lindbladh & Lyttkens, 2002). A patient decision-making style inventory was created by adapting Scott and Bruce's GDMS Inventory (Fischer et al., 2015). This instrument established an understanding of how healthcare practitioners and public health officials could improve and enrich patient communication by recognizing respective decision-making styles (Fischer et al., 2015). In turn, this inventory can aid patients in gaining a better understanding of their health identity and decision-making style (Fischer et al., 2015). Patently, identifying and valuing the various styles of decision-making can aid patients in making better-informed decisions and medical practitioners in fostering tailored communication strategies for better health outcomes (Fischer et al., 2015). Considering decision-making styles in health-related decisions is foundational to addressing vaccine hesitancy.

Decision-Making Styles in Vaccine Hesitancy

Vaccine hesitancy is complex, nuanced, and non-binary (Kumar et al., 2016). It exists as a continuum where individuals fall somewhere between total acceptance and outright refusal of vaccinations (Kumar et al., 2016). Holroyd (2020) emphasizes the need to explore decision-making styles as it is essential to craft communication strategies that provide timely, complete, and precise information. This effort contributes to building trust in public health authorities, immunization policies, and vaccine knowledge (Holroyd, 2020). These contributions are important factors in addressing vaccine hesitancy. While little research directly linked decision-making styles to vaccine hesitancy, some research was discovered regarding personality and cognitive styles and vaccine hesitancy. Poland and Ratishvili (2022) were among the few studies

that connected decision-making styles to vaccine hesitancy while exploring cognitive styles. They emphasize the significance of integrating an awareness of individuals' preferred cognitive styles and decision-making processes to enhance comprehension and communication (Poland & Ratishvili, 2022). This underscores the call for tailored approaches to effectively address and diminish vaccine hesitancy (Poland & Ratishvili, 2022). Decision-making in the context of mandatory scheduled vaccination is portrayed by H. Tomljenovic et al. (2020) as a dynamic process with feedback loops, reflections, and behaviors. Decision-making precedes avoidance behavior, and the loop includes reflections, dealing with outcomes, reconsiderations, and further decision-making, which sheds light on strategies for reasoning and behaviors of vaccine-hesitant parents (H. Tomljenovic et al., 2020). Martinelli and Veltri (2021) have established a connection between vaccine hesitancy and risk perceptions based on an individual's preferred cognitive style, whether intuitive or analytic. Intuitive thinking was found to be directly associated with vaccine hesitancy, and addressing emotional risk perceptions is vital in understanding this link (Martinelli & Veltri, 2021). Martinelli and Veltri's findings suggest that recognizing individual cognitive styles and emotions is important for developing effective communication strategies to address vaccine hesitancy. In a similar vein, Pomares et al. (2019) acknowledge how cognitive biases can be linked to vaccine hesitancy. Biases such as conjunction fallacy, which "occurs when an individual thinks a specific condition is more likely than a general condition" (Pomares et al., 2019, p. 1019), and sunk cost bias, in which "individuals are compelled to continue a behavior or efforts toward a goal because they have previously invested resources (time, money, etc.) that cannot be recovered" (p. 1019). Similarly, present bias, which is "the tendency to give stronger weight to more-immediate payoffs than long-term payoffs" (Pomares et al., 2019, p. 1019), and information avoidance, which is "the preference to not obtain knowledge that is freely

available, especially if that knowledge is unwanted or unpleasant” (p. 1019), are linked to an individual’s perspective on vaccinations. Susceptibility to conjunction fallacy and sunk cost bias are linked to lower levels of vaccine hesitancy, suggesting that individuals exhibiting these biases are less hesitant about vaccination (Pomares et al., 2019). Notably, these biases do not appear to impact the intent to vaccinate (Pomares et al., 2019). Conversely, information avoidance and present bias are associated with higher levels of vaccine hesitancy, indicating that individuals prone to these biases are more likely to express hesitancy (Pomares et al., 2019).

While there is limited literature on decision-making styles and vaccine hesitancy, insights from studies on personality and cognitive styles in relation to vaccine hesitancy offer valuable information. This knowledge can enhance healthcare providers’ understanding of effective communication strategies, particularly when dealing with parents who are hesitant about vaccinating their children. Gaining a comprehensive understanding of decision-making styles in the context of vaccine hesitancy is essential to avoid increasing distrust among individuals already hesitant about vaccines (Poland & Ratishvili, 2022). Effectively reducing vaccine hesitancy requires implementing individualized approaches alongside stringent vaccination policies and education (Poland & Ratishvili, 2022). Considering this, further research into decision-making styles and vaccine hesitancy would benefit the scientific community, healthcare providers and individuals considering vaccinations.

ChatGPT

ChatGPT, released by OpenAI in November 2022, is a language generation model employing neural networks (Quintans-Júnior et al., 2023; Sridhara et al., 2023). It generates diverse information across fields, including content creation and engineering (Quintans-Júnior et al., 2023; Sridhara et al., 2023). This pioneering platform is a large language model that has transformed natural language processing (NLP; Mohamadi et al., 2023). Moreover, it has

sparked pervasive public interest by offering effortless interaction with generative AI (Mohamadi et al., 2023). With this in mind, it is no surprise that ChatGPT is progressively being utilized in educational settings to support and enhance student learning experiences (Oranga, 2023). Fauzi et al. (2023) note that this AI platform is being recognized as improving student productivity. This end is accomplished through ChatGPT's ability to effectively provide helpful and relevant information and resources (Fauzi et al., 2023). While this AI platform offers a number of educational benefits, including personalized learning and instant feedback, Oranga (2023) emphasizes its use as a tool and not a replacement for human educators. Echoing the educational benefits, Rahman and Watanobe (2023) underscore ChatGPT's ability to enhance a student's educational experience through its provision of personalized feedback, interactive conversations, and its use for innovative instructive approaches. These researchers contend that this innovative platform's features can dramatically change how educators teach and students learn (Rahman & Watanobe, 2023). Concurrently, Subiyantoro et al. (2023) tout the educational benefits of ChatGPT. Benefits such as better accessibility to learning materials, learning support that is personalized to the user, and the platform's ability to foster a tailored approach to teaching and learning are lauded as educational advantages that could valuably augment the educational experience (Subiyantoro et al., 2023). Like Oranga, Subiyantoro et al. recommend that ChatGPT be used as a supplementary tool in education. These researchers contend that the psychological and social implications of using an AI tool in education should be investigated (Subiyantoro et al., 2023). Moreover, they contend that ethical guidelines and privacy policies should be implemented before broadly employing the platform as an educational enhancement (Subiyantoro et al., 2023). While ChatGPT has the potential to greatly contribute to and enrich the educational landscape, Rahman and Watanobe (2023) recommend that ChatGPT should be

approached with cautious optimism. The researchers stress that prudent guidelines and implementation strategies must first be established (Rahman & Watanobe, 2023). Perera and Lankathilaka (2023) agree, asserting the need to develop ethical guidelines that create ubiquitous standards for utilizing AI in education. These standards should include transparency, responsibility, and inclusivity (Perera & Lankathilaka, 2023, p. 313). Perera and Lankathilaka (2023) posit that ensuring the effective and responsible implementation of AI in education requires ongoing dialogue and research in order to more fully comprehend the risks and benefits of this new technological platform. Through collaborative efforts that work to ensure safeguards for minimizing risks and promoting fairness, AI can be valuably employed in academic institutions across the country for the benefit of all students (Perera & Lankathilaka, 2023).

Rice et al. (2024) contend that ChatGPT can be successfully utilized in research with its innovative functions and applications. These researchers liken the AI platform to historical developments such as the calculator and the internet (Rice et al., 2024). With ChatGPT's ability to streamline tasks such as gathering and synthesizing literature, designing studies, and analyzing data, which traditionally could take days or weeks, it is easy to understand the comparison (Rice et al., 2024). These advantages could prove valuable to research in academia, government, and industry and could serve to augment scientific rigor and increase the output of research (Rice et al., 2024). Moreover, Rice et al. (2024) suggest that ChatGPT be used to collaborate and streamline research processes with the aim of advancing respective fields of research. Karakose (2023) concurs with Rice et al., noting that ChatGPT's capabilities could be valuable assets for researchers throughout the many stages of their work, including generating ideas, literature review, analyzing data, interpreting study results, and potentially reducing human errors whereby improving scientific productivity (Karakose, 2023). Karakose notes that these ends can be

achieved through the AI's ability to generate and improve text and assist researchers in accurately and comprehensively communicating their results. Karakose underscores that in academia's competitive "publish or perish" (p. 9) milieu, ChatGPT's communicative capabilities could be particularly beneficial for non-English speaking academic researchers. However, researchers must be fully informed and acknowledge this innovative platform's limitations, such as the possibility of erroneously generated content and inaccurate reference citations, before integrating this technology into their research (Karakose, 2023). Karakose highlights the importance of the research community collaborating to establish responsible and ethical guidelines so that ChatGPT can be utilized beneficently and judiciously in research and publishing.

Likewise, Khlaif et al. (2023) express excitement as well as concerns over the use of AI platforms in research. Focusing on implementing this platform in research methodology, including design tool development and analysis, can aid researchers in drawing strong theoretical and applied inferences that can valuably benefit research endeavors (Khlaif et al., 2023). However, concerns surrounding incorrect information, faulty references, potential plagiarism, and authorship need to be considered and addressed before utilizing the tool in research (Khlaif et al., 2023). Zhu et al. (2023) also tout the benefits of using ChatGPT in research, citing its in-context learning and prompt engineering to produce fast and seemingly intelligent responses. Additionally, Zhu et al. underscore the writing benefits researchers can experience when utilizing the platform. These benefits include polishing language, identifying errors, translating, and summarizing (Zhu et al., 2023). It can also assist in information retrieval and explaining complex concepts (Zhu et al., 2023). Conversely, researchers need to be aware of potential issues such as fabricated information and the need for updated domain knowledge (Zhu et al., 2023). Zhu et al.

encourage researchers to fact-check responses and be acutely aware of ChatGPT's limitations, especially in fields with limited data. Overarchingly, ChatGPT offers vast opportunities for researchers; however, they must consider the challenges presented by the platform and embrace change with cautious optimism (Zhu et al., 2023). Zhu et al. propose a fundamental approach for researchers incorporating AI, emphasizing that humans should serve as the primary content creators while AI tools are employed as assistants to enhance and enrich the research, the research community, and the world. Not surprisingly, the utilization of ChatGPT in qualitative research is growing, as can be seen by conducting an Internet search or consulting Google Scholar. Christou (2023) asserts that AI has far-reaching effects in qualitative research and academia. Systematic reviews, conceptualization, and thematic and content analysis are among its many uses in qualitative research (Christou, 2023). Additionally, several benefits associated with integrating ChatGPT into qualitative research are identified by van Manen (2023). The speed and efficiency with which ChatGPT generates text make it a valuable research tool, particularly in literature reviews and text analysis (van Manen, 2023). Furthermore, this AI platform is a versatile resource that can assist in various research activities, including idea conception, study design, data generation, analysis, and presentation of findings (van Manen, 2023). Building on the advantages mentioned by previous researchers, Parker et al. (2023) posit that large language models like ChatGPT can assist researchers in the development and improvement of interview protocols, generate suitable interview questions, shape key inquiries, offer protocol feedback, and simulate interviews. These features showcase these platforms' capacity to save time and effort, which is especially salient when researchers have limited resources (Parker et al., 2023). Decidedly, ethical consideration and human supervision are vital for utilizing and advancing AI platforms for use in research (Parker et al., 2023). Notably, Parker

et al. (2023) posit that ChatGPT offers auspicious possibilities for academic research using human and AI procedures. Scholarly literature discussing the numerous benefits of AI, including efficiency, flexibility, and potential to augment numerous research endeavors, is proliferating daily. Although numerous benefits can be garnered from employing these technological platforms, it is vital to note that ethical considerations and human supervision are requisite for its prudent application in research and beyond.

Qualitative research is a beneficial methodology that affords the researcher the opportunity to explore research topics comprehensively. These in-depth explorations offer rich and nuanced information that would prove challenging to be discovered in any other way. Notably, far-reaching investigations can give rise to considerable data measures, making the coding and analysis process a substantial time investment (Zhang, Wu, Xie, Kim, & Carroll, 2023). With this in mind, coding copious amounts of data often requires a substantial investment of time (Zhang, Wu, Xie, Kim, & Carroll, 2023). While software companies have developed specialized software to aid in easing the burden of this analytic endeavor, automatic coding, ease of navigation, and budget-friendly options may be found wanting for the emblematic user (Zhang, Wu, Xie, Kim, & Carroll, 2023). Integrating AI platforms, such as ChatGPT, into qualitative analysis is still in its early stages. However, it presents researchers with a novel approach that may aid in streamlining and enhancing the research process. Wang et al. (2023) put ChatGPT to the test assessing its capability to analyze sentiment to evaluate how effective the platform was at detecting and understanding feelings and opinions in text. These researchers employed the novel platform to analyze sentiments on 18 different datasets and found that it displayed robust capabilities in discerning and comprehending sentiments without first undergoing specific training to tackle the task (Wang et al., 2023). Identifying overall sentiment,

tracking changes, and inferring the causes of emotions in the text were among the many impressive abilities that Wang et al. noted about ChatGPT in this context. Thematic analysis is another research task that ChatGPT can perform. L. Hamilton et al. (2023) probed the AI platform's merits on this capability in their research, examining the financial situations, experiences with the financial support program, and participants' personal lives in a guaranteed income program called "Her Hands" (p. 4). Notably, the study involved comparing themes generated by ChatGPT and human researchers (L. Hamilton et al., 2023). The results indicated significant differences alongside an overlap between themes generated by humans and ChatGPT (L. Hamilton et al., 2023). L. Hamilton et al. (2023) observed that almost half of the human-centered themes aligned with 80% of ChatGPT themes. However, the AI-generated themes focused on participants' immediate economic circumstances, whereas the human-generated themes offered a more comprehensive understanding, considering the broader social, economic, and cultural contexts (L. Hamilton et al., 2023). L. Hamilton et al. propose that AI technologies like ChatGPT serve as a tool for qualitative researchers as the platform can identify patterns and themes and offer time-saving efficiency at no or low cost (e.g., ChatGPT 3.5 is free and GPT-4 is \$20 per month; OpenAI, 2024b). However, these researchers caution that AI-generated themes should complement, not replace, human-generated themes due to their lack of interpretive flexibility and nuanced understanding (L. Hamilton et al., 2023). Sharing L. Hamilton et al.'s sentiment, Morgan (2023) conveys that, except for a few minor differences, ChatGPT generated similar key themes to those identified in data previously analyzed by humans. Morgan (2023) noted that ChatGPT emphasized more specific aspects of the data rather than focusing on the overall picture of the information. The researcher concurs with L. Hamilton et al., advising scholarly investigators to recognize the AI platform's potential while acknowledging its

limitations, suggesting it be used in an ancillary role to human analysis rather than a stand-alone qualitative assessment (Morgan, 2023). ChatGPT's applicability in thematic analysis is becoming increasingly widely recognized as an aid in qualitative data analysis through its efficiency in coding, theme generation, and quote preprocessing (Lee et al., 2023). Lee et al. (2023) mirror the sentiments of the aforementioned researchers, emphasizing the AI platform's ability to operate as a worthwhile tool that can serve to enhance the efficiency of thematic analysis through the streamlined quote preprocessing, coding of interview transcripts, the generation of themes, as well as lending fresh perspectives and insights into the data. Like other researchers, Lee et al. maintain that while ChatGPT is a valuable tool, it should be considered a collaborative aid in analysis rather than a human substitute due to the platform's limitations, which include challenges in managing multiple transcripts, difficulty capturing nuanced data, issues detecting underlying emotions, and problems introducing new codes. For these reasons, Lee et al. recommend that ChatGPT be used as a team member in analysis rather than relying on it as a standalone thematic analyzer and could aid in avoiding the potential risk of non-reproducible results (Lee et al., 2023). Mesec (2023) explored the capabilities of ChatGPT in grounded theory analysis. Similar to the findings of L. Hamilton et al. and Morgan, the researcher encountered that ChatGPT was able to identify specific details quickly but had more difficulty recognizing the larger context as compared to human analysis using grounded theory. The researcher requested that the AI platform provide a professional explanation of the data (Mesec, 2023). However, it revealed that it could not proffer such information by acknowledging its constraints (Mesec, 2023).

ChatGPT has demonstrated its efficacy in qualitative analysis, yet Zhang, Wu, Xie, Lyu, et al. (2023) caution researchers to emphasize the critical role of prompts in shaping AI

performance. They underscore prompt-based systems like ChatGPT require carefully developing and refining prompts to ensure successful and meaningful analytic outcomes (Zhang, Wu, Xie, Lyu, et al., 2023). Strategies focusing on introducing and refining prompt design have been recognized to enhance ChatGPT's performance, effectively addressing concerns and bolstering user trust in the platform's conclusions (Zhang, Wu, Xie, Lyu, et al., 2023). Markedly, Lee et al. (2023) posit that considering the potential of respective prompts yielding varied outcomes is prudent when employing this technological tool in qualitative analysis (Lee et al., 2023). These researchers maintain that the quality of a prompt influences the quality of the AI output (Lee et al., 2023). Moreover, leaving prompts open-ended allows ChatGPT the flexibility to generate broad adaptive responses (Mesec, 2023). This adaptability can be further expanded by furnishing ChatGPT with a specific example of the identification requested, which serves to enhance the quality of performative analysis (Wang et al., 2023). Illustratively, providing the AI with a sample sentence that conveys the emotion of happiness allows the platform to gain familiarity with the sentiment enabling it to identify this emotion more readily in future texts (Wang et al., 2023). Wang et al. (2023) point out that presenting ChatGPT with a few clarifying examples in the input significantly elevates its performance in sentiment analysis. Researchers wishing to utilize ChatGPT in qualitative analysis should note that well-crafted prompts are vital in significantly elevating ChatGPT's capacity for thematic analysis (Zhang, Wu, Xie, Lyu, et al., 2023). Zhang, Wu, Xie, Lyu, et al. (2023) underscore the extensive capabilities of AI tools in qualitative research, particularly when employing meticulous and detailed prompt design. Excitingly, ChatGPT demonstrates favorable abilities to aid qualitative researchers in efficiently analyzing qualitative data. However, the benefits of this innovative AI platform must be weighed against its limitations to avoid elevating this technology above its current level of competency

and proficiency. While recent findings support ChatGPT's use in qualitative analysis, it also points to the need to combine it with human collaboration and supervision (L. Hamilton et al., 2023; Lee et al., 2023; Mesec, 2023; Morgan, 2023; Wang et al., 2023). Notably, among the collaborative suggestions of researchers, Zhang, Wu, Xie, Lyu, et al. (2023) underscore the importance of implementing targeted prompt design to elicit accurate and detailed qualitative analysis. ChatGPT is clearly in the nascent stages of being effectively utilized in qualitative analysis and clearly needs systematic procedures utilizing well-established prompts to garner the most accurate, detailed, and contextual analytic results achievable. Future research focusing on recognizing the importance of prompts will aid researchers in honing and perfecting these instructional messages to enhance the qualitative analysis process (Mesec, 2023). Reflecting on the significance of this AI platform, it is important to acknowledge that harnessing its capability entails the responsibility of the researchers to institute reliable protocols to safeguard the trustworthiness of this analytical tool's outcomes, as it holds the potential to reshape the face of research.

NVivo Computer Software

Qualitative and mixed-methods research has gained popularity in recent years (Allsop et al., 2022; Corr et al., 2020). The prolific number of publications is a testament to the appeal of these research methodologies (Allsop et al., 2022; Corr et al., 2020). However, the rigor and scholarship of these published works can vary significantly (Allsop et al., 2022). Allsop et al. (2022) posit that this may be attributed, at least in part, to a paucity of information and training on systematically and rigorously conducting qualitative analysis. Qualitative research is often confronted with the challenge of managing substantial volumes of data (Sutton & Austin, 2015). The prodigious task of systematically sorting, organizing, and analyzing data is essential yet can be daunting due to the extensive magnitude of transcripts, notes, and other forms of material and

digital information (Sutton & Austin, 2015). In 1997, QSR International released CAQDAS software, NVivo, to aid researchers in these essential and exigent research endeavors (Dhakal, 2022). This software is a data management package that supports researchers during analysis and beyond by “sorting, organizing, analyzing, visualizing, and reporting” (Dhakal, 2022, p. 270). NVivo can import and support a variety of data formats and types, including audio, visual, and text (Dhakal, 2022; Lumivero, 2023). This platform allows researchers to organize large quantities of data for effortless coding and analysis (Dhakal, 2022). NVivo 14 is the latest software version and now offers qualitative and mixed methods researchers an AI auto-coding text analysis tool (Lumivero, 2023). This tool identifies key themes in the data by grouping phrases and analyzing language patterns (Lumivero, 2023). Notably, this AI coding can also be customized based on the researcher’s understanding of the data, with the researcher providing initial codes for the data and the software using this information as a cue to code the remainder (Lumivero, 2023). This allows the researcher to train the tool to code the data efficiently (Lumivero, 2023). Notably, NVivo maintains its commitment to the responsible and transparent use of AI and invites researchers to join its AI Advisory Group to work toward shaping the future of this product (Lumivero, 2023).

For this reason, some researchers may look at free qualitative analysis platforms such as Taguette. Taguette is a qualitative research tool that operates seamlessly across all operating systems and is available at no cost as open-source software (Rampin & Rampin, 2021). It was developed with the aim of fostering equity and inclusion for qualitative researchers who may not have the financial means for high-cost software packages (Rampin & Rampin, 2021). Researchers have the flexibility to import diverse file types and efficiently organize, code, and analyze their data (Rampin & Rampin, 2021). Free online resources are available for learning

how to navigate this platform, rendering it an attractive tool for qualitative research (NYU Libraries, 2024). It is important to highlight that, at present, the Taguette interface is offered in “English (US), French, German, Italian, and Spanish” (NYU Libraries, 2024, para. 3), potentially limiting accessibility for regions where languages other than those specified are spoken.

Qualitative software provides researchers with numerous tools to enhance the efficiency and quality of their research projects. Selecting between these platforms hinges on considerations of accessibility, functionality, and financial resources.

While NVivo’s utility and value are unquestionable, this software is not without drawbacks. Researchers contend that the execution of certain functions may necessitate training, a process that could potentially entail a considerable investment of time (Dollah et al., 2017; Phillips & Lu, 2018). However, NVivo offers readily accessible training videos and abundant informational resources online, making it convenient for users to learn the software. Consequently, NVivo has five interface languages, including “English, Spanish (Mexico), Japanese, French, and German” (NVivo, n.d., para. 1), which may limit its accessibility and usability on a global level. Furthermore, it may prove to be cost-prohibitive for some. The price to purchase an academic license at the time of this writing was \$1,019.00 for the basic NVivo 14 package (Lumivero, 2023). Despite these few limitations, NVivo presents significant advantages for qualitative researchers worldwide. Its capacity to store, organize, analyze, and visualize extensive and diverse data types positions it as a powerful tool in research. This study utilized NVivo for manual coding and analysis, as it is readily accessible through the university. This platform was leveraged for its capabilities as a robust data storage platform with efficient features to streamline this study’s organization and analysis processes.

Qualitative research can significantly benefit from the applications of NVivo. Elliott-Mainwaring (2021) is among many qualitative researchers who tout the benefits of NVivo in conducting in-depth narrative synthesis as it affords researchers the options for cross-referencing, utilizing graphs, word art, and frequency plots, as well as the ability to employ hierarchical coding relationships to explore and label data, which aids in capturing the complexity of the relationships between themes and subthemes. Dollah et al. (2017) concur, emphasizing the advantages of multimedia applications that enable researchers to classify, group, organize, and map data. Considering the use of NVivo in multimedia applications, Lovelace et al. (2020) underscored the advantages of utilizing the platform for video analysis. Their findings indicated that NVivo offered more intricate results than manual thematic analysis, albeit at an increased resource cost (Lovelace et al., 2020). Moreover, managing large quantities of data as a research team can be easily navigated using NVivo (Allsop et al., 2022). This can be especially salient for research teams as the software makes team-based coding a feasible and practical endeavor, with all members simultaneously accessing the data. Team-based research often involves managing large volumes of data; NVivo proves invaluable by efficiently reducing the time needed for coding and analysis, as Robins and Eisen in their 2017 study. Using this platform, these researchers successfully coded and analyzed 4,000 open-ended comments quickly and efficiently (Robins & Eisen, 2017). Robins and Eisen contend that analyzing the complex and nuanced responses from their diverse group of respondents was only possible to achieve by using this valuable platform. A range of data analysis functions and capabilities for storing, managing, querying, and analyzing unstructured data, including text, images, audio, video, and more, makes NVivo an attractive and advantageous software for qualitative research (Phillips & Lu, 2018). Phillips and Lu (2018) highlight the platform's capacity to effectively organize and filter raw

data, establish relationships among data, assign and define themes and categories, and visualize the analysis results virtually. This positions the platform as a holistic solution for qualitative data analysis (Phillips & Lu, 2018). Moreover, NVivo can aid in creating a numeric content analysis table, which accommodates data summarization as well as analysis (Allsop et al., 2022). NVivo can also facilitate the creation of a data audit trail to aid in ensuring transparency and dependability in the analysis process (Allsop et al., 2022). Comprehensively, NVivo furnishes researchers with effective and practical tools that facilitate the execution of systematic qualitative data analysis, emphasizing elevated rigor and quality standards (Allsop et al., 2022).

Atlas.ti, MAXQDA, and Taguette are additional software packages tailored for qualitative research. Thomas Muhr developed Atlas.ti as part of a broader research initiative at the Technical University of Berlin and subsequently introduced it as a commercial product in 1993 (Soratto et al., 2020). Notably, the software was created to handle a significant volume of research data collected for analyzing the aftermath of the 1986 Chernobyl nuclear accident (Soratto et al., 2020). This software provides a comprehensive platform for researchers to store, centralize, manage, and analyze their data, simplifying the qualitative data process and supporting analysis through features like document management, quotes, codes, comments, memos, groups, networks, and reports (Soratto et al., 2020). Additionally, the platform has introduced an AI coding system powered by ChatGPT that allows researchers to guide automated coding by providing research intentions and objectives (Atlas.ti, 2024). Moreover, multiple access levels exist for academic use (Soratto et al., 2020). Users can lease the software for \$24 per month or opt for per-user pricing, starting from a \$357 annual lease for one user to a \$2300 yearly lease for ten users (Soratto et al., 2020).

Likewise, MAXQDA is a software designed for analyzing qualitative data in text, interviews, surveys, social media posts, articles, audio, video, and photos and contains some quantitative data analysis tools (Marjaei et al., 2019). This software was developed by Udo Kuckartz in the mid-1980s and was initially released in 1989 as “MAX,” a tribute to Max Weber (MAXQDA, n.d.). This platform encompasses a variety of features, allowing researchers to edit, code, annotate, visualize, search, and summarize extensive amounts of data in diverse formats (Marjaei et al., 2019). Like NVivo and Atlas.ti, MAXQDA offers AI assistance in automatically coding, analyzing, and summarizing qualitative data (MAXQDA, n.d.). This platform boasts the advantage of enabling analyses to be conducted in any language worldwide (MAXQDA, n.d.). Pricing is based on the type of use and the number of users (MAXQDA, n.d.). For academic users, the annual subscription for a single user is priced at \$253 (MAXQDA, n.d.). While the cost of accessing this platform is reasonable for many in developed Western countries, at the global level, for some researchers, the fee is excessive.

For this reason, some researchers may look at free qualitative analysis platforms such as Taguette. Taguette is a qualitative research tool that operates seamlessly across all operating systems and is available at no cost as open-source software (Rampin & Rampin, 2021). It was developed with the aim of fostering equity and inclusion for qualitative researchers who may not have the financial means for high-cost software packages (Rampin & Rampin, 2021). Researchers have the flexibility to import diverse file types and efficiently organize, code, and analyze their data (Rampin & Rampin, 2021). Free online resources are available for learning how to navigate this platform, rendering it an attractive tool for qualitative research (NYU Libraries, 2024). It is important to highlight that, at present, the Taguette interface is offered in “English (US), French, German, Italian, and Spanish,” potentially limiting accessibility for

regions where languages other than those specified are spoken (NYU Libraries, 2024, para. 3).

Qualitative software provides researchers with numerous tools to enhance the efficiency and quality of their research projects. Selecting between these platforms hinges on considerations of accessibility, functionality, and financial resources.

While NVivo's utility and value are unquestionable, this software is not without drawbacks. Researchers contend that the execution of certain functions may necessitate training, a process that could potentially entail a considerable investment of time (Dollah et al., 2017; Phillips & Lu, 2018). However, NVivo offers readily accessible training videos and abundant informational resources online, making it convenient for users to learn the software. Consequently, NVivo has five interface languages, including "English, Spanish (Mexico), Japanese, French, and German" (NVivo, n.d., para. 1), which may limit its accessibility and usability on a global level. Furthermore, it may prove to be cost-prohibitive for some. The price to purchase an academic license at the time of this writing was \$1019.00 for the basic NVivo 14 package (Lumivero, 2023). Despite these few limitations, NVivo presents significant advantages for qualitative researchers worldwide. Its capacity to store, organize, analyze, and visualize extensive and diverse data types positions it as a powerful tool in research. This study will utilize NVivo for manual coding and analysis, as it is readily accessible through the university. This platform was leveraged for its capabilities as a robust data storage platform with efficient features to streamline this study's organization and analysis processes.

Chapter Summary

In this chapter, I have worked to provide an overview of the history and timeline of vaccines, focusing on significant milestones such as variolation and the development of vaccines. I have addressed the challenges of vaccine hesitancy by discussing topics including mandates, threats to public safety, prevalence, and underlying causes such as fear of vaccines, perceptions

of vaccine efficacy and safety, concerns about potential risks, the proliferation of the childhood vaccination schedule, religious beliefs, and the influence of information sources. Additionally, I have examined decision-making styles, particularly regarding health decisions and vaccine hesitancy. Finally, I have explored the ensuing comparison of RTA between the two technological platforms of ChatGPT and NVivo. Chapter III will provide a comprehensive overview of the study on parental vaccine hesitancy and decision-making styles, encompassing the methodology, methods, and stance of the researcher.

CHAPTER III

METHODOLOGY

This chapter will communicate the methods employed in this current study. The sequence of the chapter includes conveying the purpose of the study, the rationale behind electing to employ a mixed-methods research approach, presenting the philosophical assumptions that directed the research, sharing my stance as a researcher, and submitting the details of the research design and methods. Subsequently, I will work to disclose the inference quality plan, detail how reflexivity was maintained, provide information on how the findings are presented, and share the ethical considerations that were implemented throughout the entirety of the research.

Purpose of the Study

The purpose of this study is to gain an understanding of parental attitudes toward childhood vaccinations and decision-making styles. Overarchingly, this study sought to comprehensively examine the factors influencing vaccine hesitancy among parents of children under 18 utilizing both quantitative and qualitative methodologies and conducting qualitative analytic comparisons to enhance understanding for future research practices.

- This research aimed to contextually understand the influences on vaccine hesitancy for parents of children under the age of 18. With this consideration,
 - The research's first contextual objective was to quantitatively investigate the predictive ability of decision-making styles on vaccine hesitancy among parents with children under the age of 18. The study explores the multifaceted interaction

of influences shaping parental attitudes toward vaccination, decision-making styles, and various demographic factors.

- The second contextual aim was to qualitatively gain a deeper understanding of the underlying beliefs of parents and how these may contribute to vaccine hesitancy.
- Moreover, this research aimed to methodologically explore and compare RTA between two qualitative research methods, including ChatGPT version 4.0 (using two distinct sets of prompts) and traditional qualitative RTA using NVivo. The current investigation sought to discern nuances and distinctions among these methods, providing valuable insights for researchers when selecting the most appropriate qualitative analysis approach for future studies.

To achieve these objectives, two main research questions aimed to address the central contextual inquiry, while the final research question endeavored to elucidate the methodological query.

Contextual Mixed-Methods Research Questions

Quantitative Research Questions

- Q1a Do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?

Qualitative Research Questions

- Q1b How do parents' underlying beliefs contribute to vaccine hesitancy?

Methodological Research Question

- Q2 What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?

Rationale for Mixed-Methods

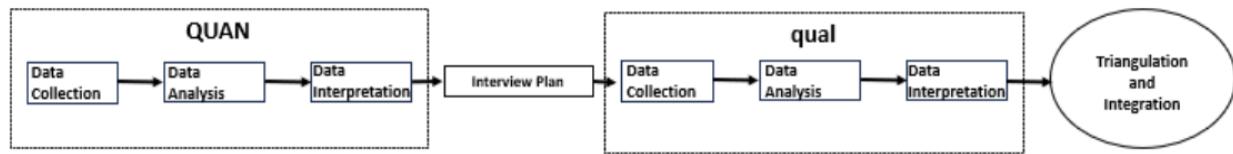
While quantitative and qualitative research methodologies have their merits, mixed-methods research leverages the best of both worlds. Data collected through each approach aids in richly informing the research findings (Creswell & Plano Clark, 2011). A number of mixed-methods research designs have been developed that work toward providing researchers with tailored options for best achieving their research goals (Creswell & Plano Clark, 2011). Regardless of design choice, mixed-methods research yields liberal amounts of data, providing a comprehensive understanding of the research at hand (Dossett et al., 2020). Johnson and Onwuegbuzie (2004) and Wasti et al. (2022) posit that the mixed-methods approach is unique in that it leverages the merits of quantitative and qualitative methodologies to address the respective and often complex research questions effectively. It is plausible that such detailed and comprehensive findings may not likely be obtained through commissioning quantitative or qualitative approaches in solidarity (Wasti et al., 2022).

The current study employed an explanatory sequential mixed-methods design. This design allowed me to systematically investigate factors that may influence vaccine hesitancy among parents of children under 18. In the first phase (quantitative) of the research, a survey was used to broadly understand parental vaccine hesitancy. Phase 2 (qualitative) participants were recruited from a pool of individuals who indicated a willingness to participate in a one-on-one interview from the Phase 1 survey. Phase 2 afforded the opportunity to garner a depth of understanding of how parents' underlying beliefs may contribute to vaccine hesitancy through the application of qualitative interviews. These interviews presented participants with the opportunity to voice their experiences, beliefs, and concerns in their own words, which aided in discovering latent patterns and helped explain the findings of the quantitative phase of the study. The successive nature of this mixed-methods design allowed the researcher to modify the study's

qualitative interview phase based on the quantitative phase's results. Moreover, exploring more than one form of data, utilizing different methodologies, and being led by two theoretical perspectives provides triangulation on multiple levels and will enhance the overall inferential quality of the study (Creswell & Plano Clark, 2011). This research design allowed the researcher to take a holistic approach to uncover both the breadth of vaccine hesitancy and the depth of factors that contribute to it. The gathering and interpretation of diverse forms of data strengthens the likelihood of generalizing findings to a larger population of similar participants. At the same time, qualitative insights enhance the transferability of findings to similar contexts or populations by providing context-specific details. Figure 3 illustrates the basic design of this study.

Figure 3

Explanatory Sequential Design



Philosophical Assumptions

Conducting research involves effectively addressing research questions. Notably, philosophical beliefs shape the researcher's approach to answering these questions (Alele & Malau-Aduli, 2023). This is directly influenced by their worldviews and respective beliefs surrounding their understanding of the world (Alele & Malau-Aduli, 2023). Theories, assumptions, opinions, and ideas are the key components that create a research paradigm and serve to guide the research (Alele & Malau-Aduli, 2023). These beliefs influence an individual's view of the world and directly affect how they interact therein (Alele & Malau-Aduli, 2023). Moreover, it is the framework that the researcher uses to determine the best methodological approach for their respective research (Alele & Malau-Aduli, 2023). The philosophical

assumption guiding the quantitative phase of this current research was post-positivism. Post-positivism was selected due to my view that observing and measuring a phenomenon is a fundamental component of gaining a more complete understanding and acknowledging that the researcher and their bias influence the research (Fox, 2008). Subsequently, social constructivism steered the qualitative phase of this current study, as it highlights how the world is understood through the meaning assigned by individuals to their subjective experiences (Creswell & Poth, 2018).

First (Quantitative) Phase: Post-Positivism

Post-positivism originates from Max Weber's late nineteenth-century work (Fox, 2008). Weber's concept of "verstehen" (Fox, 2008, p. 3), or understanding, was the foundational component of this tenet. Diverging from the positivist's targeted focus on causality, post-positivists concentrate on understanding (Fox, 2008). Post-positivism recognizes the imperfection of reality and posits that truth is a dynamic probability that can evolve and change (Kivunja & Kuyini, 2017). Observation is central to this paradigm and can be utilized apart from rigid experimentation and hypothesis testing (Fox, 2008). Creswell and Poth (2018) convey that post-positivism is reductionistic, logical, empirical, and deterministic based on *a priori* theories. Post-positivists approach research systematically and value multiple perspectives (Creswell & Poth, 2018). Importantly, researchers commissioning this approach acknowledge that the researcher influences the research from the biases and perspectives they bring to their work (Creswell & Poth, 2018). Researchers employing the post-positivist perspective must recognize their interpretative role in analyzing the social world, which introduces another layer to Weber's "verstehen" (Fox, 2008, p. 3) or understanding. The first phase of this research aspired to investigate factors that influence vaccine hesitancy among parents of children under 18 through the lens of post-positivism and emphasized garnering a rich understanding of the research topic.

while acknowledging the impact of the researcher on the research. A neutral stance was my objective as a researcher; however, biases, thoughts and perspectives were kept in my researcher's journal. I worked to recognize the advantages and disadvantages associated with the risks and benefits of vaccinations. The mixed-methods approach, with the quantitative phase guided by post-positivism, demonstrated a dedicated effort towards objectively examining parental vaccine hesitancy and decision-making styles and impartially identifying the subjectivity of respective participant perspectives. Volunteers identified in this research phase served as participants in the study's second phase.

Second (Qualitative) Phase: Social Constructivism

Social constructivism "assumes that understanding, significance, and meaning are developed in coordination with other human beings" (Amineh & Asl, 2015, p. 13). Lincoln and Guba (2013) mirror these assertions, adding that "social reality is relative to the individuals involved and to the particular context in which they find themselves" (p. 39). Amineh and Asl's (2015) and Lincoln and Guba's perspectives regarding the social relativity of reality mirror those of Lev Vygotsky (Overall, 2007). As one of the early pioneers of social constructivism, Vygotsky stressed how significant social interactions are in cultivating profound learning, which in turn shapes one's understanding of the world (Overall, 2007). This early forerunner proposed four fundamental principles that serve as the pillars of the social constructivism paradigm (Overall, 2007). These pillars include the concept that individuals play an active role in shaping their knowledge and understanding; development occurs within social settings, learning serves as a driver of personal development, and language and thought are innately interconnected (Overall, 2007). Amineh and Asl (2015) mirror Vygotsky's sentiments, highlighting the important role that social interaction plays in developing knowledge and understanding. The researchers underscore that meaning and knowledge are not created solitarily but through social interactions

and contexts (Amineh & Asl, 2015). The social constructivism paradigm posits that individuals actively pursue a detailed and comprehensive understanding of the world in which they live. Subjective meaning is a pivotal element of this paradigm, with intricate and interwoven views being embraced instead of narrowly categorized predetermined classifications (Creswell & Poth, 2018). With this in mind, the aim of research guided by this paradigm greatly relies on the views of the participants and the recognition that these views are derived from subjective meanings of social interactions and historical contexts (Creswell & Poth, 2018). Creswell and Poth (2018) state that constructivist researchers ask open-ended questions and highlight how participants construct meaning from social contexts. Researchers are encouraged to acknowledge personal biases and backgrounds and relay how these may affect their respective research (Creswell & Poth, 2018). Social constructivism is a valuable tool for researchers who wish to contextualize their findings by interpreting their participants' subjective experiences as they work to satisfy their research queries.

Researcher Stance

As a researcher passionate about health and a mother of five children, my perspective of vaccinations have been shaped by an understanding of the benefits of vaccines, the legitimate concerns behind vaccine hesitancy, and personal experiences. My interest in health comes from seeing family members deal with various health issues such as diabetes, asthma, mental illness, Parkinson's, Alzheimer's, and obesity. The appeal that draws me to researching health and health-related issues was sparked by witnessing the suffering experienced by individuals whom I love and care about. Moreover, the tragic experience of witnessing a friend lose her grandchild, a loss that she believes to be linked to the flu vaccination, motivated me to explore vaccine research. These experiences have inspired me to become dedicated to health research. As a mixed methodologist, I have a strong desire to explore ways to prevent physical, mental, and

emotional challenges and promote a healthy and happy life for my family, myself, and others.

Concerns surrounding childhood vaccinations began when my first child was scheduled to receive his first round of inoculations. I was a young mother with little medical knowledge and was fearful of my sweet baby being injected with a foreign substance. Although I had been raised to trust medical authority without question, I could not help but question the safety of this widely accepted procedure. While I rationally knew that vaccines served to protect my child's health and the health of others, the fear of adverse side effects or worse was never far from my conscious thoughts. The birth and vaccination of four more children never quieted my apprehensions. I would often ask the receptionist at the doctor's office to hold my child while they received their vaccinations while I tearfully waited in the hallway. I could not bear witnessing them being hurt, even in the smallest way. Once the inoculation had been administered, I rushed in to comfort my baby. Fortunately, none of my children experienced severe adverse reactions to vaccinations. However, after vaccination, instances did arise when they developed a fever or experienced redness and swelling at the injection site. Notably, the soreness occasionally hindered their ability to walk for a short time.

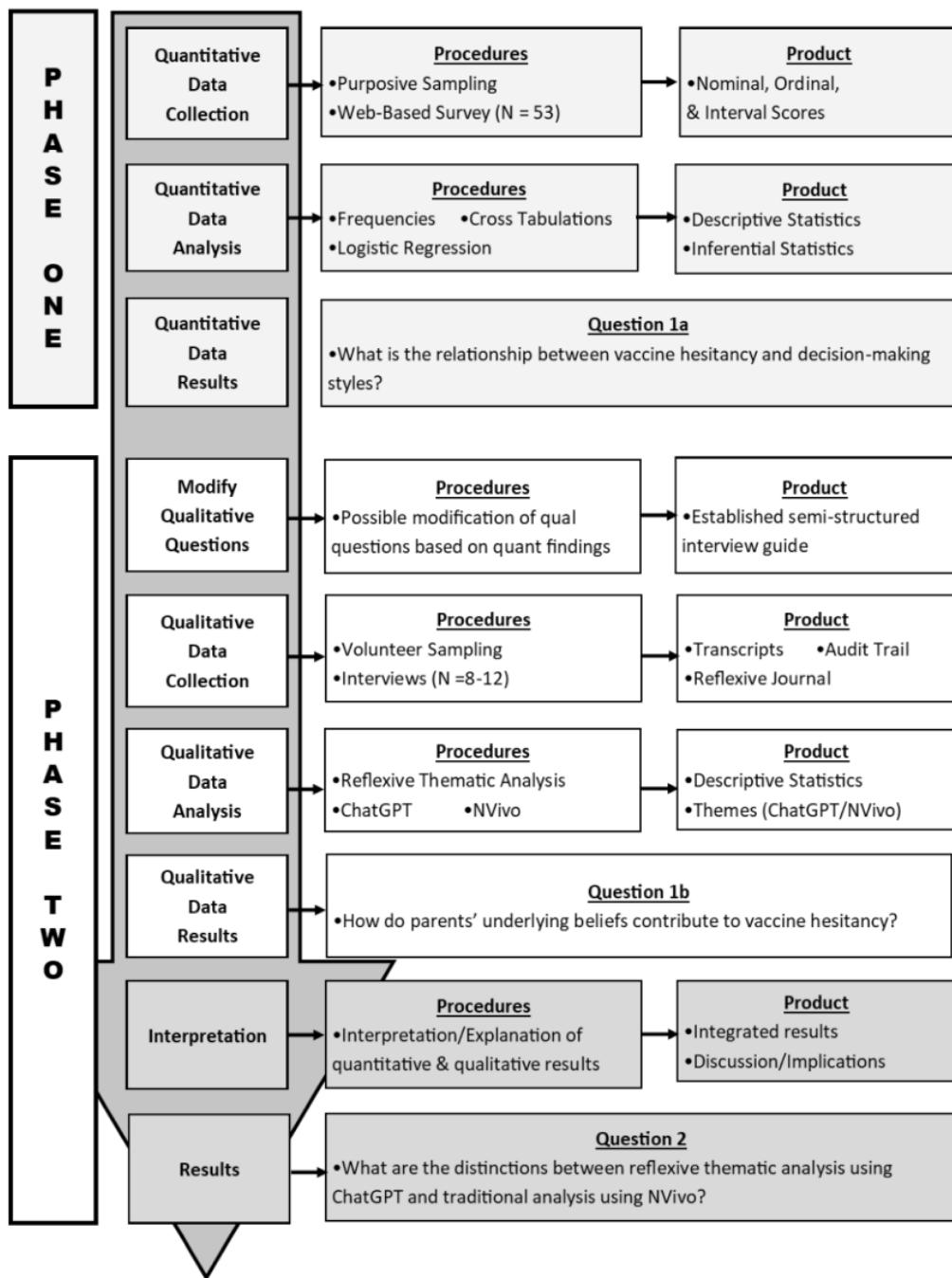
It was not until my children were grown and had received their required vaccinations that I learned more about the scientific evidence supporting the safety and efficacy of vaccinations. Through reading and understanding sound information regarding childhood inoculations, I have gained a sense of trust and appreciation for these disease-preventing and lifesaving interventions. However, due to my experience of being a young and uninformed mother, I empathize with parents who experience anxiety about vaccinating their children, causing them to be vaccine-hesitant. While many factors likely contribute to vaccine hesitancy, I believe that the proliferation of the vaccine schedule, coupled with universal and ever-present access to

technology and media, may partly be responsible for the expansion of hesitancy regarding childhood vaccines. These technological advances were nonexistent during my early years of parenting. It is plausible that technical developments spread misinformation from readily accessible non-credible sources found on the internet and other media sources. With this in mind, it is easy to see how well-meaning parents can become apprehensive toward vaccinations.

I have recently become a grandmother for the first time. Reflecting on the counsel I would like to pass on to my children; I am committed to providing them with trustworthy, comprehensive information for their children. This will include literature proclaiming the benefits as well as research presenting the concerns of childhood vaccinations. I embark on this current research endeavoring to understand the factors contributing to vaccine hesitancy in parents with these and other considerations guiding the study. Through this investigatory process, I hope to foster an open and constructive dialogue that will contribute to a more well-informed civic discourse on childhood vaccinations while recognizing how my own experiences and biases may influence the research. I discuss how I will address my biases and personal perspectives in the “Reflexivity” section later in this chapter.

Methods

This section will discuss each phase of the study and provide a detailed overview of the components of each stage. The fundamental elements of Phase 1 will be conveyed, encompassing participants, instruments, and data processing. Subsequently, the key constituents in Phase 2, including participants, data collection, and data analysis, will be described. Furthermore, an outline of the inference quality plan will be presented to enhance valid, reliable, and trustworthy outcomes for both phases. Figure 4 illustrates the current mixed-methods study.

Figure 4*Mixed-Methods Flowchart*

Phase 1: Quantitative Data Collection and Analysis

Participants

Selection Criteria and Process

Participants for this study were recruited using a convenience volunteer sampling method. Convenience volunteer sampling involves participant selection based on accessibility and willingness to participate (Plano Clark & Creswell, 2008). Notably, these attributes led to the selection of this sampling approach as time and resources were pragmatic considerations. Sampling for this study was conducted through word-of-mouth referrals, email, and outreach through well-known social media platforms, including Facebook, Instagram, Twitter, TikTok, and LinkedIn. The objective of utilizing these platforms was to broaden the reach of participant recruitment by reaching out to diverse networks of communities for a more comprehensive representation of the study. A power analysis was performed using G*Power 3.1.9.7 utilizing a two-tailed test with an alpha level of 0.05, power of .80, and odds ratios (effect sizes) of 2.0 (small), 3.0 (medium), and 4.0 (large) respectively based on Ferguson's (2009) general guidelines for interpreting effect sizes in social science research. The analysis indicated that a total sample size of 113 (small effect size), 53 (medium effect size), and 39 (large effect size) participants was required.

Demographics and Eligibility

Demographics varied based on the acquired participant base. Participant selection was directed by the nature of the research, which focuses on parental perspectives and experiences within the context of child-related considerations. Participant eligibility and inclusion criteria required individuals to be 18 or older, English-speaking, and parents of children aged 18 or younger. The exclusion criteria pertained to individuals under 18 or adults who are not English speakers, who may have a cognitive or communicative impairment that may hinder their ability

to participate, individuals who do not have access to a computer or the internet, and persons who do not have children under 18.

Potential Benefits to the Participants. Participants in the study may have gained a sense of personal empowerment as offering insights into their perspectives on childhood vaccinations may have inspired a deeper understanding of their decision-making processes. Moreover, participation in the study may have encouraged introspection and fostered consequential dialogue regarding vaccinations within friend groups and family circles, as well as in community settings and at medical appointments. Participants may have gained a sense of accomplishment from contributing their perspectives to the greater body of research, which may aid in bolstering a collective understanding of vaccine hesitancy and those factors contributing to its presence and propagation.

Consent Forms

Consent forms are a foundational component of research with human participants and serve as formal informative and protective agreements between researchers and participants. These forms work to ensure that participants are well-informed before agreeing to participate in the study, which plays an important role in safeguarding fundamental ethical standards. Providing participants with consent forms before the study or data collection began demonstrated research transparency and respect for the participants' autonomy. Participants received detailed consent information and forms before the study officially began, ensuring they were well-informed about the research and had the opportunity to ask questions before providing their consent. The consent form for Phase 1 of the current study was made readily available at the outset of the Qualtrics survey (see Appendix A for the link). Subsequently, the consent form for Phase 2 is provided in Appendix B for reference.

Instruments

Demographic questions coupled with two well-founded measurement instruments were employed as one digital survey to answer the research questions of this current study. The demographic portion of the survey aided in obtaining participant characteristics. The VHS and the GDMS are the measurement instruments that have been thoughtfully selected based on their applicability, accessibility, validity, and reliability. Utilizing these instruments allowed this research to garner relevant information regarding vaccine hesitancy among parents and general decision-making styles. The data collected from the survey provided a nuanced understanding of the research topic. This manifold data collection strategy contributed to gaining a comprehensive understanding of the factors influencing vaccine hesitancy among parents of children under 18 and the interconnectivity of decision-making styles.

Demographic Questionnaire

A demographic questionnaire was developed to establish the diverse characteristics of study participants (see Appendix C). The form was designed to gather information relevant to the study's objectives (e.g., How many children under 18 are you currently caring for?) and contains ten questions with various response options. The study aimed to obtain a holistic picture of the participant population by examining key demographic factors such as age, gender, education, occupational status, and other relevant attributes. The information gathered from this questionnaire aided in understanding the participant group and contributed to a better understanding of the research findings.

Vaccine Hesitancy Scale

The SAGE Working Group originally developed the VHS for use in research and immunization policy to assess vaccine hesitancy (Shapiro et al., 2018). In 2018, Shapiro et al. evaluated its effectiveness in a cross-sectional survey study utilizing an exploratory and

confirmatory factor analysis. The VHS consists of ten items and has two subcategories (“lack of confidence,” “risk perception”) and uses a 5-point Likert scale ranging from “strongly disagree” to “strongly agree,” with higher scores indicating greater hesitancy (Shapiro et al., 2018). Questions were arranged in a randomized order, and seven items were reversed to ensure consistent scoring (Shapiro et al., 2018).

After conducting both the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), the researchers noted that a two-factor structure surfaced as the most fitting for the dataset (Shapiro et al., 2018). Markedly, these researchers excluded one of the ten items as they deemed it less reliable due to its similar loading on the two factors (0.450 and 0.328), resulting in their suggestion of reducing the instrument to a nine-item scale. This scale was further delineated into two subscales: one consisting of seven items indicating lack of confidence and the other comprised two items representing risks (Shapiro et al., 2018). The lack of confidence subscale displayed strong internal consistency (Cronbach’s $\alpha = 0.92$) and featured inter-item correlations between 0.52 and 0.79. Conversely, the risks subscale showed slightly lower internal consistency (Cronbach’s $\alpha = 0.64$) and an inter-item correlation of 0.47 (Shapiro et al., 2018).

The relationship between the VHS and associated vaccine attitudes and the relationship between VHS and the precaution adoption process model stage were assessed to examine construct validity (Shapiro et al., 2018). The researchers convey that Pearson’s correlations indicated positive correlations with vaccine-related conspiracy beliefs and concerns about harm and also suggested negative correlations with recognition of benefits and trust in vaccines (Shapiro et al., 2018). Subsequently, Shapiro et al. (2018) investigated the VHS subscales lack of confidence and risks. The lack of confidence subscale significantly impacted the PAPM stage

across all groups (Shapiro et al., 2018). The researchers noted similar effects for the risks subscale, demonstrating significant differences among all PAPM stage groups (Shapiro et al., 2018). Shapiro et al. then investigated criterion validity and found that individuals who refused vaccines displayed higher levels of vaccine hesitancy in both lack of confidence and risks than those who did not refuse. It is worth noting that these differences were statistically significant with large effect sizes for both lack of confidence and risks. Moreover, the researchers found that participants who declined vaccinations displayed higher levels of lack of confidence and risks than participants who accepted vaccinations (Shapiro et al., 2018). These differences were statistically significant and had considerable impact sizes for lack of confidence as well as for risks (Shapiro et al., 2018).

Several studies have systematically examined the VHS. One such study conducted by Akel et al. (2021) worked to fill gaps in the existing body of knowledge regarding COVID-19 vaccine hesitancy by investigating the association between vaccine hesitancy and COVID-19 vaccine acceptancy, using the VHS in a China survey as well as a United States survey. Their focus was to determine the potential validity and reliability of the VHS in assessing attitudes toward COVID-19 and influenza vaccinations (Akel et al., 2021). Internal consistency was found to be Cronbach's $\alpha = 0.8$ and 0.939 respectively (Akel et al., 2021). Concurrent validity was determined by Akel et al. by analyzing the association between vaccine hesitancy scores and vaccination outcomes. The researchers report that COVID-19 vaccine acceptance was consistently lower in participants with higher vaccine hesitancy scores, whether using a continuous or dichotomized score (Akel et al., 2021). Notably, the quasi-likelihood under the independence model criterion statistic indicated that dichotomized predictors fit better than continuous predictors, demonstrating concurrent validity (Akel et al., 2021). Based on the

literature, Akel et al. contend that VHS is commonly used across various contexts, thus exhibiting content validity. Overarchingly, Akel et al. tout the validity and reliability of the VHS for assessing vaccine hesitancy toward adult vaccinations and recommend the scale's use in future research.

Another study by Ledda et al. (2022) perceived a lack of information on scales assessing vaccine hesitancy in adults, prompting them to evaluate a cross-cultural adaptation of the VHS. The adapted version of the VHS demonstrated excellent reliability (Cronbach's $\alpha = 0.94$) and validity (scale content validity = 0.97). These researchers conveyed that the instrument demonstrated satisfactory reproducibility (intraclass correlation coefficient = 0.87) over 2 months (Ledda et al., 2022). The authors of this study recommend using VHS in studies regarding adult vaccination opinions and perceptions (Ledda et al., 2022).

In 2021, Helmkamp et al. evaluated and worked to improve the VHS to apply not only to childhood vaccines but also to influenza and HPV vaccines. This research aimed to evaluate and improve the VHS for measuring vaccine hesitancy across childhood, influenza, and HPV vaccines (Helmkamp et al., 2021). The researchers found that the subscales VHS-child (lack of confidence, Cronbach's $\alpha = 0.90$ and risks, Cronbach's $\alpha = 0.76$; Helmkamp et al., 2021); VHS-flu (lack of confidence, Cronbach's $\alpha = 0.96$ and risks, Cronbach's $\alpha = 0.81$) (Helmkamp et al., 2021) and VHS-HPV (lack of confidence, Cronbach's $\alpha = 0.94$ and risks, Cronbach's $\alpha = 0.81$) displayed strong internal consistency (Helmkamp et al., 2021). Subsequently, Helmkamp et al. demonstrated construct validity by comparing VHS-child, VHS-flu, and VHS-HPV scores to self-reported vaccination outcomes. Significantly higher hesitancy scores were observed among parents who had refused vaccines or reported concerns, which provided evidence for a connection between hesitancy scores and the actual vaccination decisions made by parents

(Helmkamp et al., 2021). These researchers recommended the use of the modified VHS and touted the improved psychometric properties compared to the original VHS, as indicated by a higher coefficient alpha for the risks subscales and enhanced fit based on the CFA indices of χ^2/df and root mean square error of approximation (RMSEA; Helmkamp et al., 2021).

General Decision-Making Styles

The GDMS scale was designed by Scott and Bruce (1995) to assess how individuals approach the decision-making process. The 25-item scale has five subscales (rational, avoidant, dependent, intuitive, and spontaneous) and utilizes a 5-point Likert response scale with ratings ranging from 1 = strongly disagree to 5 = strongly agree (Scott & Bruce, 1995). After thoroughly reviewing prior research on decision-making theory, the researchers determined that decision-making style refers to “the learned, habitual response pattern displayed by an individual when faced with a decision situation. It is not a personality trait but rather a propensity based on habits to react in a specific way within a given decision context” (Scott & Bruce, 1995, p. 820). The identification of four decision-making styles stemmed from a literature review and served as the foundation for item generation and scale development (Scott & Bruce, 1995). Scott and Bruce (1995) performed EFA and CFA, determining that a five-factor solution provided the best fit. Following item removal and assessment of changes in internal consistency and factor loading, the scale was simplified to 25 items (Scott & Bruce, 1995). The five subscales of the final 25-item GDMS instrument contained five items, respectively, and were labeled rational, intuitive, dependent, spontaneous, and avoidant (Scott & Bruce, 1995). Ensuring content and face validity, the researchers carefully reviewed the literature for item selection and had independent researchers assess the appropriateness of behavior descriptions (Scott & Bruce, 1995). Construct validity was established by assessing correlations between each scale, with the results indicating a range of Cronbach’s α values from 0.78 to .085 (Scott & Bruce, 1995). These findings suggest

that the scales effectively measured related constructs (Scott & Bruce, 1995). Scott and Bruce assert that the GDMS is an effective instrument that can be employed across diverse contexts and could aid future research in this field.

The GDMS has undergone thorough examination and validation across diverse cultural and demographic settings. Loo (2000) examined the psychometric properties of the GDMS, with a particular focus on its factor structure and scale reliability. The study examined the reliability and correlational statistics for scores on the five decision-making styles and their correlation with social desirability (Loo, 2000). Findings indicated that decision-making style scores were generally independent of social desirability, except for a low correlation with the rational style (Loo, 2000). Furthermore, internal consistency was acceptable with Cronbach's α values from 0.62 to .084 (Loo, 2000). The fit indices suggested adequate values for the five-factor model ($RMSEA = 0.070$; comparative fit index [CFI] = 0.856; Loo, 2000). Loo relays that the overall findings from their study support the GDMS as an effective instrument for assessing decision-making styles. Similar to Loo, Gambetti et al. (2008) assessed the psychometric properties of the GDMS but in an Italian sample. The researchers found that Cronbach's α values for internal consistency reliability ranged from 0.70 to 0.84 across the five scales (Gambetti et al., 2008). The CFA results favored Scott and Bruce's five-factor model ($\chi^2 = 574.36$; $\chi^2/df = 2.19$; CFI = 0.91; adjusted goodness of fit index = 0.86; standardized root mean square residual = 0.07; $RMSEA = 0.05$; Akaike information criterion [AIC] = 50.36; Gambetti et al., 2008). Gambetti et al.'s study confirm that the GDMS features acceptable psychometric properties in the Italian context, indicating its utility as an effective tool for assessing individual differences in decision-making. In 2015, Verma and Rangnekar examined the psychometric properties and applicability of the GDMS in India. The researchers found good internal consistency for the five decision-

making styles, with Cronbach's α values from 0.71 to .79 (Verma & Rangnekar, 2015). Consistent with other evaluations of the GDMS, Verma and Rangnekar (2015) found that the five-factor model revealed an acceptable fit ($\chi^2/df = 1.871$, RMSEA = 0.042) alongside strong values for both the CFI (0.922) and the goodness of fit index (GFI = 0.925). Verma and Rangnekar (2015) contend that their psychometric evaluations support the appropriateness of the five-factor model, aligning with previous research in Western contexts and affirming the framework of five decision-making styles proposed by Scott and Bruce (1995). The researchers convey that the GDMS offers a valid and reliable way to assess decision-making styles (Verma & Rangnekar, 2015). Further contributing to the study of the psychometric properties of the GDMS, Alacreu-Crespo et al. (2019) conducted a study validating a Spanish adaptation of GDMS. Results of the CFA indicate the best fit with the five-factor model ($\chi^2 = 403.99$, CFI = 0.962, RMSEA = 0.040; Alacreu-Crespo et al., 2019). The researchers indicate that internal consistency results suggest satisfactory values with Cronbach's α values from 0.72 to .91 (Alacreu-Crespo et al., 2019). Test-retest reliability was assessed by intraclass correlation coefficient (ICC) and demonstrated significant temporal stability for all scales (ICC range = .77 to .86, $p < .001$; Alacreu-Crespo et al., 2019). Alacreu-Crespo et al. determined that the Spanish version of the GDMS exhibits satisfactory psychometric qualities, establishing its utility as an effective tool for assessing decision-making styles within Spanish-speaking populations.

Data Analysis

Phase 1 of this study aimed to investigate the relationship between vaccine hesitancy and decision-making styles. Descriptive statistics summarized participant characteristics and categorized factors contributing to vaccine hesitancy. The primary research question sought to understand the factors influencing vaccine hesitancy among parents of children under 18. Consistent with this inquiry, Q1a (Do general decision-making styles predict vaccine hesitancy

controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?) investigated whether general decision-making styles predict vaccine hesitancy while accounting for demographic factors. Its objective was to reveal underlying patterns and associations within the data. The analysis employed logistic regression to investigate the relationship between vaccine hesitancy, which is dichotomized as either vaccine-hesitant or non-vaccine-hesitant, and decision-making styles. Participants were categorized into one of five decision-making types: rational, intuitive, dependent, avoidant, or spontaneous. This analysis was conducted using the R-4.3.3 software. The VHS, designed to evaluate vaccine hesitancy, comprises two factors (lack of confidence and risk perception) measured as continuous variables using a Likert scale. While the original scale employs a 5-point Likert scale, this study opted for a 4-point Likert scale, omitting the “neither agree nor disagree” option, based on research indicating a reduction in the tendency to provide answers that are socially acceptable or desirable (Chyung et al., 2017, as cited in Kempe et al., 2020). Vaccine hesitancy was determined by averaging responses to the nine VHS items after reverse-coding negatively-worded statements, with higher scores indicating a more positive attitude toward vaccines (Temsah et al., 2021). The VHS was subsequently dichotomized into vaccine-hesitant or non-vaccine-hesitant based on a cutoff value (≥ 3 points) used in Temsah et al.’s (2021) study, “Parental Attitudes and Hesitancy About COVID-19 vs. Routine Childhood Vaccinations: A National Survey,” as the populations in their study and the current study are similar. Logistic regression, suitable for binary outcome variables, was selected for this study and is outlined below and was conducted using R Studio 4.4.1.

$$\ln \left(\frac{\hat{Y}}{1-\hat{Y}} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10}$$

\hat{Y} : Represents the predicted probability of vaccine hesitancy.

β_0 : Is the intercept.

β_1 : Represents the effect of different decision-making styles on vaccine hesitancy.
 $\beta_2-\beta_{10}$: Represents the effect of age, gender, education, occupational status, marital status, annual income, ethnicity, geographic location, and number of children on vaccine hesitancy.

This analysis plan enabled the research to model and quantify the probability of an individual being vaccine-hesitant or not based on respective decision-making styles and gained a nuanced understanding of the complex interplay between these variables.

Phase 2: Qualitative Data Collection and Analysis

Participants

Eighteen participants from volunteers from Phase 1 were selected in Phase 2 of the study. Determining the sample size of this study was derived from reviewing the number of participants from similar research in tandem with the recognition of the limitations of being a single researcher (Beatty et al., 2023; Chandok et al., 2022; Enkel et al., 2018). Considering the length of the interview for each respective participant, as noted by Lahman (2022), together with resource constraints and a finite timeline, also influenced the scope of the participant count. After weighing these considerations, 18 research participants were deemed appropriate and feasible for Phase 2. These individuals participated in a one-hour interview, sharing their perspectives on childhood vaccinations. The data obtained from Phase 2 participants aided in clarifying the initial Phase 1 study findings. Phase 2 participants were identified by asking them in Phase 1 if they would be willing to share their views on childhood vaccinations in a one-on-one 60-minute virtual interview. Participants who answer affirmatively were directed to a section of the survey where they could provide their email address for further contact. Each participant was assigned a random and unique identification (ID) code for reference. This ID was linked to the participant's survey response, allowing me to identify vaccine hesitancy and non-vaccine hesitancy within the Phase 2 participant pool. This information helped enhance equitable representation between

individuals who are vaccine-hesitant and those who are not, optimizing a proportional balance for Phase 2 interviews. This approach afforded the opportunity to conveniently recruit volunteers based on their interest in the study topic and their willingness to share beyond the survey. Those individuals expressing interest in participating received an email providing details regarding the Phase 2 process, including information for them to be well-informed before consenting, as well as an estimated time commitment for participation (see Appendix D for Phase 2 recruitment email and Appendix B for Phase 2 informed consent).

Data Collection – Interviews

Interested participants were contacted to identify a date and time that was feasible for them to participate in a 1-hour virtual semi-structured interview. Semi-structured interviews are recommended when the researcher desires flexibility in the wording and order of the interview questions (Merriam & Tisdell, 2016). Adeoye-Olatunde and Olenik (2021) note that semi-structured interviews allow the researcher to focus on pertinent questions while still allowing the researcher to explore relevant concepts that may unexpectedly come up during the interview. This can enrich the data, providing greater insight into the topic at hand (Adeoye-Olatunde & Olenik, 2021). The key components for selecting this data collection method are the flexibility and autonomy to investigate thoughts, ideas, and perspectives as they organically arise during the interview. The nature of the current research, which involved sampling participants from the large-scale survey in Phase 1, favors the utilization of virtual semi-structured interviews in Phase 2, as conducting face-to-face interviews may not be practical due to the diverse settings and locations of potential participants. Merriam and Tisdell (2016) convey that “Interviewing is necessary when we cannot observe behavior, feelings, or how people interpret the world around them” (p. 108). To facilitate a productive conversation that offers flexibility to explore specific points of interest, an interview guide (see Appendix E) directed the semi-structured interviews.

The semi-structured interview questions guiding this study were created cooperatively by ChatGPT and myself (OpenAI, 2024a). I carefully reviewed and approved the interview questions for this research study phase. The discussion centered around the participant's perspectives surrounding childhood vaccinations and vaccine hesitancy. These conversations were recorded for thorough analysis. Notably, the interview questions were slightly modified based on the findings from Phase 1, with changes including inquiring about decision-making styles and rewording questions for clarity when necessary.

Data Analysis and Coding

The recorded semi-structured interviews underwent transcription through the transcription service provided by Zoom. Subsequently, the data were cleaned and refined to ensure accurate representation. Phase 2 of the research involved utilizing RTA, which is defined as “a method for developing, analyzing, and interpreting patterns across a qualitative dataset, which involves systematic processes of data coding to develop themes – themes are your ultimate analytic purpose” (Braun & Clarke, 2022, p. 4). Braun and Clarke (2022) describe the analytic process in one of six phases: “dataset familiarization, data coding, initial theme generation, theme development and review, theme refining, defining, and naming and writing up” (p. 6). Notably, this analytic process is a flexible approach that emphasizes the researcher’s self-awareness and involves the identification of patterns in the data that address the research question while also considering the researcher’s perspective (Braun & Clarke, 2022). This approach was chosen due to its beneficial alignment with social constructivism as it emphasizes the researcher’s central role in knowledge production, highlights the active part of the researcher in exploring underlying concepts in the data to code and generate themes, and requires theoretical awareness and transparency throughout the analytic process (Braun & Clarke, 2019; Zelčāne & Pipere, 2023). Notably, the researcher’s subjectivity serves as an essential and

valuable asset rather than a hindrance (Braun & Clarke, 2019; Zelčāne & Pipere, 2023). The data analysis framework for this phase aimed to gain a comprehensive understanding of the deeper contextual influences on vaccine hesitancy for parents of children under the age of 18, through research question Q1b (How do parents' underlying beliefs contribute to vaccine hesitancy?). RTA is an appropriate choice for this study in analyzing qualitative data as it can identify patterns and themes within subjective perspectives. This iterative process allows the researcher to consistently examine their biases, assumptions, and interpretations to ensure the findings are anchored in the data. Following the cleaning and organization of transcriptions, the data analysis involved two approaches: ChatGPT and traditional RTA using NVivo.

ChatGPT

ChatGPT is an AI-generated content model developed by OpenAI that can deal with challenging language understanding and generation tasks in the form of conversations (Wu et al., 2023). The earliest version of ChatGPT, released by OpenAI on November 30, 2022, was free to use and garnered widespread attention for its diverse capabilities (Marr, 2023; Sridhara et al., 2023; Wu et al., 2023). Currently, individuals can upgrade to ChatGPT Plus (GPT-4) for \$20 per month or GPT-4 Turbo, which costs between \$15 per month for light use and up to \$80 for heavy use (OpenAI, 2024b). These upgrades offer faster response times, priority access, improved contextual understanding, and larger context windows for handling more extensive inputs (OpenAI, 2024b). ChatGPT is considered to be part of the AI-generated content large language model and NLP models and has exhibited formidable functionality in a wide array of language-related tasks such as multilingual translation, code debugging, story composition, and creating written content (De Angelis et al., 2023; Deng & Lin, 2022; Wu et al., 2023). This novel technology is an intelligent conversational platform capable of providing detailed responses to instructional prompts (Wu et al., 2023). GPT-4 is the latest version of this program and includes

upgrades such as improved understanding of user instruction, increased accuracy, enhanced control, and real-time internet access (Marr, 2023; Sridhara et al., 2023; Wu et al., 2023).

ChatGPT has far-reaching influences such as customer service, education, content creation, business, healthcare, and entertainment, to name a few (Marr, 2023; Sridhara et al., 2023; Wu et al., 2023).

Early studies have frequently used NLP and machine learning (ML) to conduct sentiment analysis, which entails recognizing, extracting, or characterizing subjective information, such as opinions expressed in a text (Beigi et al., 2016). They determined that while NLP lacks nuance in analysis, it has the potential to enhance human coding efforts and improve efficiency (Guetterman et al., 2018; Khanbhai et al., 2021; Zhang, Wu, Xie, Lyu, et al., 2023). Utilizing NLP and ML, ChatGPT is making its way into research, with researchers and scholars integrating this innovative tool into their investigative methodologies. Recent studies such as Mesec (2023) assessed the utility of ChatGPT in qualitative text analysis to determine whether this platform could be beneficial either as a partial replacement for human analysis or as a tool in post-interview analysis regarding mentorship styles. Mesec (2023) discovered that human analysis developed a tentative theory compared to ChatGPT's analysis, which identified insightful themes and summarized the data while also providing suggestions for the direction of future research. ChatGPT's ability to analyze sentiment across a variety of scenarios and tasks was tested by Wang et al. (2023). The researchers found that ChatGPT did very well in understanding sentiments, the emotional tone and attitude of individuals, without receiving specific training (Wang et al., 2023). Furthermore, these researchers contend that ChatGPT demonstrated the ability to create relevant text that follows specific instructions meeting the user's requirements and preferences (Wang et al., 2023). Relevantly, Zhang, Wu, Xie, Lyu, et al.

(2023) focused their research on utilizing ChatGPT in reflexive thematic analysis, investigating how the design of prompts may affect the platform's performance in this type of qualitative analysis. The employment of prompting frameworks was found to improve the quality of RTA as it provided additional guidance for the platform to develop a targeted and precise analysis of the data (Zhang, Wu, Xie, Lyu, et al., 2023). Zhang, Wu, Xie, Lyu, et al. (2023) assert that ChatGPT can be used as a tool to enhance qualitative research by efficiently analyzing large data sets with well-crafted prompts that provide insights and reduce negative aspects of human bias. The researchers highlight that this AI platform can be employed as a co-researcher that actively engages in the iterative data analysis process, challenges human interpretations, and offers a multifaceted approach (Zhang, Wu, Xie, Lyu, et al., 2023). The researchers recognize that these two roles are not mutually exclusive, as researchers can harness ChatGPT's strengths to amplify the quality and depth of qualitative research (Zhang, Wu, Xie, Lyu, et al., 2023). In this research on parental vaccine hesitancy and decision-making styles, I plan to utilize ChatGPT for reflexive thematic analysis. This platform's capabilities have been recognized in a variety of fields, including healthcare, and have been used to conduct RTA (Yang et al., 2023; Zhang, Wu, Xie, Lyu, et al., 2023). Research suggests that developing well-designed prompts can enhance ChatGPT's performance in efficiently analyzing data (Zhang, Wu, Xie, Lyu, et al., 2023). Zhang, Wu, Xie, Lyu, et al. (2023) utilized the following prompts in their qualitative analysis conducted by ChatGPT:

Target prompt (1) "Help me perform qualitative analysis on the provided data and identify appropriate themes," target prompt (2) "Process feedback from each interviewee individually," and target prompt (3) "Categorize feedback from the interviewees based on common themes", was merged into an input prompt that reads: "Help me perform qualitative analysis on the provided data on a per-interviewee basis, identify appropriate themes, and merge them accordingly. Output the results in the format of 'Common Theme: + Sub-Theme + Participant ID. (pp. 20–21)

This study employed two sets of predefined prompts in tandem with participant answers to the questions developed by ChatGPT in the semi-structured interview guide (see Appendices E and F), with ChatGPT serving as both a data analyzer and a co-researcher to provide a multi-perspective approach. The first set of prompts implemented Braun and Clarke's (2022) six steps of reflexive thematic analysis. The second set of prompts employed an adaptation of Zhang, Wu, Xie, Lyu, et al. (2023) prompts used in their recent research utilizing RTA (see Appendix G). Using ChatGPT in RTA served to determine the quality and depth of research findings in exploring themes and subthemes related to parental vaccine hesitancy and decision-making styles.

NVivo

Introduced in 1997, NVivo is a widely used CAQDAS that has undergone continuous revision and improvement over the years (Dhakal, 2022). Perpetual licensing for the software package ranges from \$1,269 to \$2,288, depending on whether it is for academic or commercial use. This includes 5 hours of NVivo transcription service and an online course (Lumivero, n.d.). Optional add-ons, such as an annual subscription for the NVivo AI assistant, additional transcription services, and collaboration cloud, are available at annual rates ranging from \$99 to \$499 (Lumivero, n.d.). Dhakal (2022) shares that CAQDAS programs help qualitative researchers collect, organize, analyze, visualize, and report data. However, they do not replace human researchers but instead offer tools to organize and structure the collected data (Dhakal, 2022). An NVivo user can import various document file types, such as PDFs, Microsoft Office files, statistical and textual data files, digital and scanned images, and videos (Dhakal, 2022). Centralizing the data in a single location aids in streamlining the coding, querying, visualization, and reporting process, thereby improving the efficiency and comprehensiveness of qualitative analysis (Phillips & Lu, 2018). NVivo empowers users to perform diverse qualitative analysis

tasks, such as sorting and filtering raw data, identifying relationships, defining themes and categories, visualizing analysis results, and generating reports (Phillips & Lu, 2018). It is important to note that users retain complete autonomy in interpreting the data. NVivo software adds considerable value to the qualitative research community by providing a comprehensive solution for sorting, managing, and facilitating human analysis of data (Phillips & Lu, 2018).

NVivo has been broadly implemented in various research studies in numerous fields. One such study by Moi et al. (2018) utilized NVivo software to manage and analyze data from online Consumer-to-consumer interactions. This study provides insights into how NVivo can be utilized to conduct a more efficient analysis of digital data from online communities (Moi et al., 2018). NVivo valuably aided this research by helping the researchers save time on manual tasks, handle large datasets more effectively, and assist in providing a more comprehensive understanding of how customers engage online (Moi et al., 2018). Similarly, a study conducted for the U.S. Department of Defense by Robins and Eisen (2017) utilized NVivo to help in organizing and coding thousands of open-ended responses from active-duty service members regarding the “Don’t Ask, Don’t Tell” (p. 768) military policy that mandated that LGBTQ service members conceal their sexual identities. The researchers found NVivo to be a valuable and practical addition to their project as it helped them code and analyze a large amount of data effectively and efficiently while collaborating with team members in real-time (Robins & Eisen, 2017). Mirroring the previous researcher’s findings, Alam (2020) discovered that using NVivo in a case study on the guidelines for the Islamic financial system in Bangladesh provided a variety of benefits, including the flexible categorization of data, the ability to identify themes quickly, and the reduction in manual analysis time. The researcher lauded NVivo for its ability to create beneficial graphs and models and create visual relationships between concepts while efficiently

managing a large dataset that allowed the researcher to easily identify themes and subthemes (Alam, 2020). NVivo is used ubiquitously and provides significant value to qualitative researchers by providing tools for efficient organization, analysis, and visualization of diverse data types to enhance the depth and rigor of the research process.

The current research employed NVivo 14.23.2 (46) to aid in conducting a reflexive thematic analysis. NVivo supported the organization, coding, analysis, visualization, and reporting of the data. This platform assisted me in centralizing the data to streamline the coding and theme-building process. This study builds on prior research experiences that recognized the efficiency of using NVivo for organizing and analyzing qualitative data (Alam, 2020; Moi et al., 2018; Robins & Eisen, 2017). NVivo provided a valuable platform to improve the depth and quality of the qualitative analysis for this research on vaccine hesitancy and decision-making styles among parents.

Data Analysis Comparison

The three analytic procedures, which include traditional human-led RTA conducted using NVivo, ChatGPT RTA using prompts inspired by Braun and Clarke (2022), and ChatGPT RTA using prompts inspired by Zhang, Wu, Xie, Lyu, et al. (2023) was assessed using the rubric found in Table 1. Table 1 was generated in collaboration with OpenAI (2024c) and directed the comparison between the three analyses. Prompts are located in Appendix F.

Table 1*Rubric for Analyses Comparison*

Criteria	Comprehensive	Satisfactory	Basic
Understanding of the Data	Demonstrates a deep understanding of the data and context. Extracts nuanced themes and patterns effectively.	Shows a satisfactory understanding of the data and context. Identifies relevant themes and patterns, although some may lack depth or clarity.	Shows a basic understanding of the data and context. Identifies surface-level themes and patterns.
Coding Accuracy	Coding is reliable, consistent, and well-supported with evidence from the data. Demonstrates proficiency in using NVivo for coding.	Coding is mostly reliable but may have occasional inconsistencies or omissions. Utilizes coding techniques effectively.	Coding may contain inconsistencies. May lack precision.
Thematic Analysis Process	Follows a rigorous and systematic process for thematic analysis, including data immersion, coding, theme development, and refinement.	Follows a structured process for thematic analysis but may lack depth or thoroughness in some stages. Adapts guidelines to a limited degree.	Attempts to follow a thematic analysis process but may be less structured or thorough. Adapts guidelines effectively.
Interpretation	Provides comprehensive and deeply insightful interpretations.	Provides satisfactory interpretations that offer some insight.	Provides basic interpretations with limited depth or insight.
Insightfulness of Findings	Generates insightful findings that contribute to the understanding of the research question or phenomenon. Offers novel insights supported by evidence from the data.	Produces findings that are relevant and contribute to understanding, although they may lack originality or depth. Provides some new insights but not in great depth.	Generates basic findings that address the research question to some extent. Offers few, if any, original insights.

Table 1, continued

Criteria	Comprehensive	Satisfactory	Basic
Overall Quality and Rigor	Exhibits high-quality and rigorous analysis, meeting or exceeding established standards for qualitative research.	Demonstrates satisfactory quality and rigor in the analysis, although improvements could be made in certain areas.	Shows limited quality and rigor, with notable deficiencies in methodology and depth of interpretation.
Reflexivity	Demonstrates reflexivity, acknowledging biases and preconceptions. Provides insightful interpretations supported by reflexivity.	Exhibits some reflexivity but may lack depth or transparency in acknowledging biases. Provides interpretations that are somewhat insightful.	Shows limited reflexivity with minimal acknowledgment of biases. Provides interpretations that are simplistic or lack depth.

Note. Based on *Revised rubric for evaluating reflexive thematic analysis comparing human and AI approaches*, by OpenAI, 2024c. Copyright 2024 by OpenAI.

Data Handling Procedures

Participant information, including all identifying data and consent forms, was securely stored on a password-protected laptop. All participants were assigned unique IDs in Phase 1 of the study. These IDs were retained for participants who volunteered for Phase 2 of the research. Pseudonyms were employed to ensure confidentiality during the transcription of interviews from audio recordings. Surveys and recordings were kept on the password-protected laptop, with exclusive access limited to me. Data analysis was conducted privately, preventing external individuals from accessing survey data or overhearing interviews. Audio files were deleted after transcription to safeguard participant identities, and all remaining data will be destroyed after 3 years.

Costs and Compensation

The cost of taking part in the study was that of the participant's time. With this in mind, potential study participants were advised of the minimal 10- to 15-minute commitment to participate in Phase 1 of the study and the 60-minute commitment to participate in Phase 2, a one-on-one semi-structured virtual interview. While there is no direct compensation, study participants could have elected to be entered into a random drawing at the study's completion for the chance to win one of two \$50 Amazon gift cards. Notably, participation in the study did not guarantee that a gift card would be won. Participants who would like a chance to win a gift card were directed to the drawing page at the conclusion of the survey, where they could enter their email address for contact if they were selected as one of the two winners. The gift cards and drawing were a gesture of gratitude to the participants for taking the time to participate in the study. This gift was not meant as coercion for study participation but was intended as a simple thank you for their time and effort. The compensation was designed to uphold transparency and fairness and align with the ethical considerations directing research participation.

Inference Quality

Inference quality is vital to a mixed-methods research study as it directly impacts the quality of its findings. Quality inferences aid in ensuring that the integration of quantitative and qualitative data leads to a comprehensive understanding of the research topic and enhances the overall rigor and credibility of the study. Teddlie and Tashakkori (2009) convey that inference quality "is an umbrella term denoting the standards for evaluating the quality of conclusions that are made on the basis of research findings" (p. 249). These standards for evaluating the quality of conclusions include quantitative components such as validity and reliability and the qualitative aspects of trustworthiness (Teddlie & Tashakkori, 2009). Notably, inference quality does not begin and end with data analysis but instead begins at the inception of the research process

(Teddlie & Tashakkori, 2009). Inference quality plans for Phase 1 and Phase 2 of the present research are outlined below utilizing Teddlie and Tashakkori's framework.

Phase 1: Inference Quality – Design Quality

Design Suitability

An explanatory sequential design was chosen to best answer the research questions regarding vaccine hesitancy and decision-making styles. The design follows a systematic process, allowing for the adaptation of the qualitative phase based on quantitative results to provide detailed explanations and insights into the quantitative findings. Employing the quantitative phase first allowed for answering Q1a and gaining an understanding of the breadth of the topic (i.e., do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?).

Design Adequacy

The use of convenience volunteer sampling, coupled with the explanatory sequential mixed-methods design and logistic regression, reflects a comprehensive and thoughtful approach to capturing variations in vaccine hesitancy and decision-making styles. The design components served to enhance the quality and rigor necessary for a sound study, offering a structured and systematic approach to addressing the research questions. The study aimed to assess the difference in vaccine hesitancy and decision-making styles among parents of children younger than 18, utilizing convenience volunteer sampling to acquire participants who met the study criteria. The chosen explanatory sequential mixed-methods design is appropriate for addressing the research question by uncovering the breadth of variations in literacy, decision-making styles, and vaccine hesitancy in this demographic. It first captures the overall range of variations and then explores a deeper understanding of these differences in context.

Design Adequacy-Validity

The content validity of the two survey instruments (VHS and GDMS) is supported by prior research (Scott & Bruce, 1995; Shapiro et al., 2018). Construct validity, the extent to which the measure assesses the theoretical construct it is intended to measure, was established through previous research that utilized EFA and CFA measures (Alacreu-Crespo et al., 2019; Gambetti et al., 2008; Girard et al., 2016; Helmkamp et al., 2021; Loo, 2000; Scott & Bruce, 1995; Shapiro et al., 2018).

Design Adequacy-Reliability

The internal reliability of the two survey instruments (VHS and GDMS) was evaluated using Cronbach's alpha, a metric for assessing internal consistency reliability. This statistical measure gauged the extent to which the items within each instrument consistently and reliably measure the intended constructs. A Cronbach's alpha ranging between 0.7 and 0.95 is commonly held as exhibiting good internal consistency (Vissoci et al., 2022). Furthermore, a review of prior research employing these instruments has been conducted, with the results from these studies being reported in the "Instruments" section of this study to ensure a comprehensive evaluation of internal reliability (Akel et al., 2021; Alacreu-Crespo et al., 2019; Gambetti et al., 2008; Girard et al., 2016; Helmkamp et al., 2021; Ledda et al., 2022; Loo, 2000; Scott & Bruce, 1995; Shapiro et al., 2018). Moreover, earlier research by Alacreu-Crespo et al. (2019) supports test-retest reliability for the GDMS.

Within Design Consistency

The components of the study design progressed from quantitative survey results to qualitative interviews. This process worked to inform and influence the overall analysis and integrated interpretation. These sequential steps followed a timeline for a unified implementation.

Analytic Adequacy

Logistic regression is an appropriate and adequate analysis to answer research question Q1a (Do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?) as it allowed the exploration of the association between vaccine hesitancy (a binary outcome) and decision-making styles. This approach works well for studying binary outcomes by allowing the research to model and measure the likelihood of vaccine hesitancy based on specified factors.

Phase 2: Inference Quality – Design Quality

Design Suitability

To answer the research questions on vaccine hesitancy and decision-making styles effectively, an explanatory sequential design was chosen as an appropriate approach to answer Q1b (How do parents' underlying beliefs contribute to vaccine hesitancy?). This design's systematic process enabled the qualitative phase to be adjusted based on the quantitative results, offering a depth of contextualized insights into the quantitative findings.

Design Adequacy

In conjunction with the explanatory sequential mixed-methods design and qualitative interviews, convenience volunteer sampling demonstrated a comprehensive strategy to explore the complexities of vaccine hesitancy and decision-making styles during the qualitative phase. The design components worked toward ensuring the study's quality and rigor through a structured and systematic approach to explore the nuances of the research question.

Design Adequacy-Trustworthiness – Confirmability

Reflexive journaling was maintained to support complete transparency (Lincoln & Guba, 2013). The reflexive journal served as a transparent record by consistently recording my

reflections, biases, and thought processes. This documentation provided an opportunity to examine my influence on data collection, analysis, and findings. Moreover, this practice served to contribute to the overall rigor of the study and worked to ensure the credibility of the research process.

Design Adequacy-Trustworthiness – Credibility

Prolonged engagement, member-checking, and triangulation (data, methods, and theory) worked together to ensure the validity and accurate representation of the data and findings in this study (Lincoln & Guba, 2013). Prolonged engagement through in-depth interviews served the aim of genuinely understanding participant perspectives. Member checking functioned to verify the accuracy of transcriptions and findings with participants to confirm they aligned with their experiences (see Appendix H). Member checking involved sending transcripts to participants for them to review and offer feedback on their agreement or disagreement. Triangulation strengthened the reliability of the study's conclusions by looking at data from different angles, methods, and theories.

Design Adequacy-Trustworthiness – Dependability

An audit trail was maintained throughout the research process and served as a detailed roadmap providing documentation for data collection, analysis, and decision-making steps (Lincoln & Guba, 2013). This detailed record ensured consistency and reliability. Furthermore, it could aid future researchers follow the same steps as they navigate the research process.

Design Adequacy-Trustworthiness – Transferability

Providing a detailed and rich description of the entire research process helped make the findings applicable not just to the specific participants in this study but also to similar situations (Lincoln & Guba, 2013). In this way, others can use the information in different contexts and gain meaningful insights.

Within Design Consistency

The study design transitioned from Phase 1 to Phase 2, moving from quantitative survey findings to qualitative interviews. The emphasis was on gaining an in-depth understanding of parent perceptions of childhood vaccinations and vaccine hesitancy and shaping the overall analysis and integrated interpretation during the qualitative phase. These steps were implemented in an organized manner according to a predetermined timeline.

Analytic Adequacy

In-depth participant interviews were a valuable method to answer Q1b (How do parents' underlying beliefs contribute to vaccine hesitancy?) This was achieved through qualitative data complementing the quantitative analysis by adding context and depth. The quantitative analysis included a logistic regression to examine the association between vaccine hesitancy and decision-making styles. The qualitative analysis, which includes reflexive thematic analysis, allowed the researcher to explore parents' underlying beliefs and nuanced perspectives regarding childhood vaccinations while also answering Q2 (What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?). The qualitative data obtained through one-on-one interviews deepens the understanding of the multifaceted interplay between parental vaccine hesitancy and decision-making styles, providing a more comprehensive understanding of the underlying beliefs of parents concerning inoculations.

Phases 1 and 2: Inference Quality – Interpretive Rigor

Interpretive Consistency

Existing research provided the opportunity to compare and substantiate study results and facilitated a comprehensive assessment of relevant findings across different investigations.

Theoretical Consistency

Considering the utilization of post-positivism is likely, albeit not explicitly expressed, framework in prior research, the examination of theories and findings of the research topic was ascertained to ensure the congruence and coherence between the outcomes of this study and pertinent findings from existing research. This approach allowed for a comprehensive assessment of the consistency between the current study, which employs post-positivism in the first phase of the research and social constructivism in the second phase of the study, and relevant prior research regarding theoretical perspectives.

Interpretive Agreement

Consensus among the research community regarding conclusions drawn from a study's results is important as it served as a quality standard in both quantitative and qualitative research (Teddlie & Tashakkori, 2009). Leveraging insights from prior research within the field will provide an opportunity to conduct a comparative analysis of the study results. This process aimed to assess and validate relevant findings across different investigations and examine whether the inferences align with the themes developed from participant data.

Interpretive Distinctiveness

The interpretations and conclusions drawn from the different strands of the study served to offer unique and complementary insights that enrich the overall understanding of the research topic (Teddlie & Tashakkori, 2009). Assessment of the study's results will involve carefully analyzing different possibilities to identify the most reasonable and well-supported explanation among various interpretations, focusing on whether each conclusion appears more plausible than others based on the same results.

Integrative Efficacy

The overall conclusion, or meta-inference, combined insights from the study's quantitative and qualitative phases. "A meta-inference is a conclusion generated through an integration of the inferences that have been obtained from the results of the QUAL and QUAN strands of an MM [Mixed-Methods] study" (Teddlie & Tashakkori, 2009, p. 136). It focuses on the process of integrating findings from a meta-inference. Differences in the conclusions drawn from these two phases were explored, and explanations for these variations were provided to offer possible interpretations.

Interpretive Correspondence

Fundamentally, interpretive correspondence evaluates the extent to which the resulting meta-inferences align with the intended purpose and objectives of a mixed-methods study (Teddlie & Tashakkori, 2009). The study employed triangulation, member checking, reflexivity, and an audit trail to confirm the accuracy and authenticity of its conclusions. This approach aimed to enhance the credibility and reliability of the study's findings.

Inference Generalizability and Transferability

It is important for research findings to be relevant beyond the specific study context. The current study's mixed-methods research approach aimed to ensure that the conclusions and recommendations can be applied to different situations, people, and times by working to obtain a representative and diverse sample that reflects the broader population of interest and by providing a thick, rich description of the research process in its entirety.

Integration

The integration of quantitative and qualitative research is a distinctive hallmark of mixed methods research, allowing researchers to fully leverage the capabilities of this comprehensive methodology (Guetterman et al., 2018). Mixed-Methods research deliberately integrates

quantitative and qualitative research perspectives, methods, data forms, and analyses to cultivate detailed and comprehensive understandings (Plano Clark, 2019). Integration in mixed methods research refers to the deliberate interrelation of quantitative and qualitative components (Plano Clark, 2019). It is the defining feature that distinguishes mixed-methods research from studies merely incorporating both types of information (Plano Clark, 2019). Plano Clark (2019) explains that successful integration is the core strength of mixed-methods and lies in effectively merging perspectives, methodologies, data sources, and analyses.

***Integration of Philosophical Perspectives
and Methodologies***

Integrating the philosophical and methodological underpinnings of post-positivism and social constructivism may seem complex. However, successful unification involves utilizing tools that value and accurately represent each methodological approach and its philosophical framework. The current study utilized dialectical pluralism to integrate post-positivism from Phase 1 and social constructivism from Phase 2. Dialectical pluralism is “a process theory for dialoguing across differences and producing dynamic integration of divergent perspectives and methods to produce a more complex and meaningful whole” (Jason & Glenwick, 2016, p. 9). This useful approach brings together two or more paradigms in “respectful dialogue” (Greene & Hall, 2010, p. 124) with one another throughout the research process (see also Shannon-Baker, 2016). Each paradigm is valued as bringing unique contributions to the research (Shannon-Baker, 2016). Greene and Hall (2010) encourage researchers to collect, analyze, and report data so as to inspire dialogue, predominantly between the quantitative and qualitative data (see also Shannon-Baker, 2016). This study is designed to collect data sequentially so that the quantitative data informed the qualitative methods, culminating in a respectful dialogue between the two

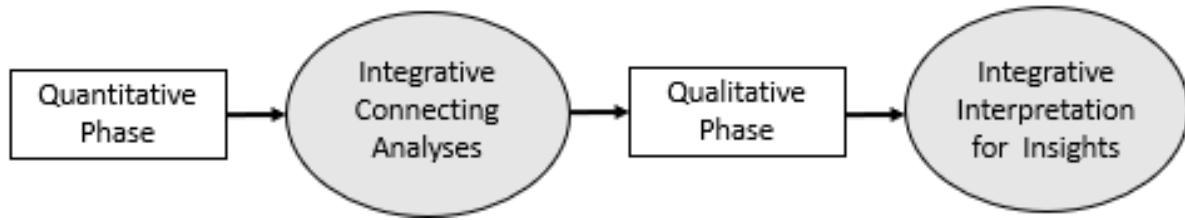
respective philosophical and methodological paradigms, ultimately providing a comprehensive and holistic understanding of the overall research findings.

Data and Analyses Integration

Data integration is defined as bringing quantitative and qualitative strands of a mixed-method study together for analysis and comparison or for one strand of the data collection and analysis to inform the other (Fetters et al., 2013). Two types of data integration, integrative analytic approaches occurred in this current study, including connecting analyses and merging analyses, as shown in Figure 5 (Plano Clark, 2019). The connecting analyses will occur following Phase 1, where the quantitative findings were integrated to augment the semi-structured interview guide utilized in Phase 2. The merging analyses occurred at the conclusion of Phase 2 and involved interrelating quantitative data and results with qualitative data and results (Plano Clark, 2019).

Figure 5

Logic for Combining the Study Components



Note. Adapted from Creswell and Plano Clark (2018), Plano Clark and Ivankova (2016), and Plano Clark (2019, p. 107).

Reflexivity

Researcher reflexivity is a critical aspect of mixed-methods research. Reflexivity refers to the researcher's awareness of their biases, assumptions, and positionality and how these factors may influence the research process and findings. Creswell and Poth (2018) share,

Researchers ‘position themselves’ in a qualitative research study, meaning that researchers convey (i.e., in a method section, in an introduction, or in other places in a study) their background (e.g., work experiences, cultural experiences, history), how it informs their interpretations of the information in a study, and what they have to gain from the study. (p. 82)

In mixed-methods research, reflexivity becomes particularly important due to integrating qualitative and quantitative approaches, which may utilize different epistemological perspectives. Addressing all biases, including knowledge biases, are important aspects of researcher reflexivity in mixed-methods research. Guttormsen and Moore (2023) propose using Bourdieu’s reflexive sociology to explore knowledge production and intellectual bias in the researcher’s subjective role. These researchers stressed the need to consider knowledge production, intellectual bias, and personal positioning (Guttormsen & Moore, 2023). Moreover, Guttormsen and Moore encourage researchers to examine their social and intellectual background, intersectionality, the ways in which they conceptualize and theorize, and think about social change and progress. Examining these various aspects could lead to the recognition that the researcher may need to employ “bridling” or embrace an attitude of openness (Dahlberg & Dahlberg, 2019). Bridling involves checking one’s ever-changing understanding (Dahlberg & Dahlberg, 2019). It helps the researcher navigate between subjectivity and objectivity through the art of being present, asking questions, and not taking understanding for granted while simultaneously being open to multiple possibilities (Dahlberg & Dahlberg, 2019). With this in mind, reflexive journaling was utilized to reflect on and bridge the research experience. This involved recording experiences, biases, thoughts on contexts, participant interactions, feelings about data collection strategies, and notes linking various aspects of the study’s progress (McGrath, 2021). This practice was valuable for documenting processes, thoughts, and perceptions and aided in providing evidence to support the final research product by

transparently sharing my influence on the research (McGrath, 2021). This approach enhanced trustworthiness and credibility in all research processes.

Presentation of Findings

The research findings were comprehensively presented using a dual approach combining written text and graphical representations. Written text offers a detailed narrative, providing context, explanations, and interpretations of the results. Additionally, graphical elements such as charts, graphs, and tables were utilized, where applicable, to depict key themes and statistical data visually and will work to enhance the clarity and accessibility of the information. Integrating textual and visual elements, joint displays offer a cohesive and nuanced presentation of the research outcomes. In mixed-methods research, joint displays visually bring together qualitative and quantitative findings, revealing connections and commonalities between the two phases (Skamagki et al., 2022). These displays often include meta-inferences, inferences from coalescing quantitative and qualitative findings, and help interpret the combined meaning of qualitative and quantitative results. Joint displays offer a systematic and replicable method for integrating mixed-methods research findings and fostering a better understanding of the integration process (Skamagki et al., 2022). This multifaceted approach to the presentation of the research findings seeks to convey findings effectively to a broad audience by presenting information in both written and pictorial formats.

Ethical Considerations

Obtaining ethical approval through the Institutional Review Board was the first step in enhancing the protection of participants and maintaining the integrity of the research in this mixed-methods research study (see Appendix I). Ethical considerations are essential for protecting participants and maintaining the integrity of the research in a mixed-methods research study. This involves considering the burden of participation, obtaining informed consent from

participants, ensuring the confidentiality of their information, and treating them with respect throughout the study (Stadnick et al., 2021). Phase 1 of the study consisted of participants dedicating 10–15 minutes to completing a survey. This time frame likely was designed to pose minimal inconvenience. Phase 2 involved a 60-minute interview requiring more time from participants. I strived to be thoughtful of time and worked to ensure that the interview did not extend longer than the agreed-upon duration. This mindful approach worked to prevent any undue burden on the participant. Informed consent was provided to the participants before data collection ensued (see Appendices B and D). The research objectives were clearly explained to participants before data collection to ensure that they clearly understood what their participation in the study entailed. Confidentiality and data security measures were employed to protect participant information. The data, consent forms, and all identifying information were securely stored on a password-protected laptop, and the researcher was the sole individual with access to the data. Moreover, to augment anonymity, all audio recordings of the transcriptions from Phase 2 were immediately deleted and disposed of after completion of the transcription process. Notably, all transcriptions from this research will be disposed of after three years.

Communication employed throughout the research process was transparent in nature to foster a complete understanding of the research intents and procedures with participants. Risk minimization was addressed by utilizing transparent communication, developing and maintaining a supportive, safe environment, and providing adequate information to participants to confidently make an informed decision for study participation. Participant benefits were intended to be maximized through a safe, supportive environment, purposefully designed and meaningful questions aimed to foster independent self-reflection, written sentiments of gratitude, and a chance to win a gift card, all of which served to express appreciation and recognition for their

valuable contributions to the research. Recruitment strategies fostered inclusivity while every effort was made to enhance confidentiality, equity, and impartiality. Together, these approaches worked toward creating a respectful and inclusive research environment that promoted and welcomed diverse perspectives to advance reliable study outcomes.

Chapter Summary

This research aimed to comprehensively understand the factors contributing to vaccine hesitancy through an explanatory sequential mixed-methods research design. Employing quantitative and qualitative methodologies aided in achieving this end through the expansive collection and meticulous data analysis. This chapter illustrates the methods, steps, and procedures guiding this research, including the methodological comparison of ChatGPT and traditional reflexive thematic analysis. The study's purpose, the rationale for employing an explanatory sequential mixed-methods research design, and the philosophical assumptions of post-positivism and social constructivism were thoroughly conveyed. Additionally, I shared my stance as a researcher and disclosed the methods and design of the study. The quality inference plan and integration of quantitative and qualitative findings were discussed, providing a detailed outline of the steps to achieve these aims. Maintaining researcher reflexivity through reflexive journaling was corresponded. Moreover, the mediums by which the findings will be presented were reviewed. I concluded with the ethical considerations that will guide this research.

CHAPTER IV

QUANTITATIVE RESULTS

It can be easy to forget that just a century ago, infectious diseases were the leading cause of death globally, claiming countless lives (Montero et al., 2024). Children under five bore the brunt of the mortality burden, accounting for 30.4% of all deaths in 1900 (Montero et al., 2024). Those fortunate enough to survive often lived with severe complications such as polio-induced paralysis and smallpox-related blindness in tandem with disfiguring scarring (Battles & Gilmour, 2021; Hsu, 2013). While improved housing, better hygiene and sanitation, and secure food and water supplies contributed to the reduction in these illnesses, the introduction of vaccines also significantly assisted in the decline in mortality from infectious diseases, leading to an increase in life expectancy (Montero et al., 2024). This is evidenced by the WHO assertion that vaccines save 3.5 to 5 million lives yearly (WHO, n.d.-a). Rappuoli et al. (2019) maintain, “Vaccines represent a safety belt and life insurance for humankind” (p. 7). However, these researchers highlight a growing trend of vaccine aversion and emphasize the need for the immunological community to aid in promoting the recognition of the importance of vaccination (Rappuoli et al., 2019). Vaccine hesitancy, a “delay in acceptance or refusal of vaccination despite the availability of vaccine services” (MacDonald & the SAGE Working Group on Vaccine Hesitancy, 2015, p. 4161), is not a novel phenomenon. Additionally, it differs from the more inflexible stance of anti-vaccination, a term that can be “used to describe a person or group that does not agree with vaccinating people (giving them injections to prevent disease) and spreads and encourages opinions against vaccines” (“Anti-Vax,” n.d., para. 1). Notably, WHO warns that the persistence

and growth of vaccine hesitancy ranks among the most significant threats to global health (Nuwarda et al., 2022). The COVID-19 pandemic only served to fuel and foster concerns regarding vaccinations, leading to substantial declines in immunization rates across all age groups, with the most pronounced reductions observed among children and adolescents (Cunniff et al., 2023).

Vaccine Hesitancy and Threats to Public Safety

It is important to note that herd immunity is achieved when a sufficient portion of the community is vaccinated, thereby boosting the overall population's immunity and reducing the likelihood of spreading infectious diseases (CDC, 2022c). Declines in vaccination rates understandably raise concerns among public health officials, as lower vaccination rates can result in inadequate herd immunity, where those in unvaccinated communities potentially become points of origin for transmitting infectious agents (Nuwarda et al., 2022). Nuwarda et al. (2022) posit that unvaccinated individuals contracting a vaccine-preventable disease could trigger outbreaks, which may spread widely throughout the population. This underscores the importance of maintaining high levels of herd immunity to prevent such disease outbreaks and safeguard public health. Reports indicate that in order to impede a measles outbreak within a population, approximately 95% of that population requires immunization (Nuwarda et al., 2022). Likewise, the prevention of polio necessitates nearly 80% rates of immunization (Nuwarda et al., 2022). The measles outbreak originating at Disneyland in California in 2014-2015 serves as a pertinent example of these concerns (Worden et al., 2020). The outbreak, which spread across multiple states and internationally, was attributed in part to lower vaccination rates (Worden et al., 2020). Likewise, outbreaks of this avoidable disease have been reported in the Netherlands, Italy, and England (Thompson et al., 2023). These incidents could have been easily prevented with the MMR vaccine, as it is proven to be over 95% effective and offers reliable protection against

measles (Thompson et al., 2023). Benadjaoud (2023) notes that low vaccination rates contributed to an 18% rise in measles cases worldwide as of 2022. This is not surprising, considering that McClure et al. (2017) relayed that vaccine hesitancy is associated with lower vaccination rates, increased emergency department visits, and elevated rates of illness and death. While vaccine hesitancy does not always lead to refusal of vaccinations, it has been tightly linked to a greater likelihood of delays in or repudiation of vaccinations, necessitating efforts to focus on mitigating this reticence (Galagali et al., 2022).

Prevalence of Vaccine Hesitancy

The rising prevalence of vaccine hesitancy among parents poses a risk to public health by fostering the development and proliferation of vaccine-preventable diseases. Vaccine hesitancy was a prevalent issue even before the global pandemic began; McKee and Bohannon (2016) conveyed that 77% of parents indicated being hesitant toward at least one childhood vaccination. Mirroring these reports, national surveys, such as one conducted in 2019, reveal that nearly one in every 15 parents hesitate to vaccinate their children, citing apprehensions regarding vaccine safety and efficacy (Kempe et al., 2020). This skepticism extends to influenza (Kempe et al., 2020) and the COVID-19 vaccinations (Ruiz & Bell, 2022). Moreover, the COVID-19 global pandemic exacerbated vaccine hesitancy, leading parents to increasingly perceive vaccines as less safe, significant, or effective (Wagner, 2024). The WHO and United Nations Children's Fund report that childhood vaccinations have experienced the most substantial sustained decrease in nearly three decades (WHO, 2022). Furthermore, vaccine exemptions have increased in 41 states, with 90% of these exemptions being for non-medical reasons (Seither et al., 2023). Seither et al. (2023) assert that when vaccine exemptions surpass a 5% threshold, they compromise the vaccination coverage required to sustain herd immunity and preserve public safety. The rising threat of preventable disease outbreaks due to vaccine hesitancy, as evidenced

by falling vaccination rates and increasing exemptions, highlights the urgent need to combat this issue, especially in light of its growing prevalence. Promoting comprehensive immunization coverage is vital for protecting individual health, preserving herd immunity, and preventing local and global health crises. The concerning decrease in vaccination uptake and the escalation in exemptions clearly highlight the imperative to address vaccine hesitancy. Strengthening immunization efforts is crucial for safeguarding health and averting widespread health emergencies.

Causes of Vaccine Hesitancy

Causes of vaccine hesitancy are numerous and varied. Kerrigan et al. (2020) identify several factors contributing to parental vaccine hesitancy, including concerns about vaccine safety, insufficient information, fear of potential side effects, perceived low risk of disease, social norms, proliferation of vaccine schedules, doubts of efficacy, and distrust of medical institutions. Furthermore, Montero et al. (2024) assert that the introduction of the digital age, complete with social media and other internet platforms, has facilitated the spread of both credible and non-credible information regarding vaccinations, with individuals often seeking out information that will support their bias either for or against vaccinations. Koskan et al. (2023) add to the narrative, relaying that vaccine-hesitant individuals harbor distrust in national-level politicians and politically influenced news media, regarding them as untrustworthy sources of information. Paul Offit (as cited in Balch, 2022), director of the Vaccine Education Center and an attending physician in the Division of Infectious Diseases at Children's Hospital of Philadelphia, echoes these sentiments, conveying that while abundant evidence supports the efficacy of vaccines, the issue of vaccine hesitancy largely stems from a distrust of government-imposed mandates. Additionally, socioeconomic status and personal experiences have also been identified to be indicative of vaccine hesitancy (Low et al., 2022). These factors contribute to a

complex and interconnected landscape, underscoring the need for a multifaceted approach to inform and support vaccine-hesitant individuals in their decision-making process regarding childhood vaccinations.

Importance of Decision-Making Styles

Decision-making permeates virtually every facet of human existence, influencing all aspects of one's life experience. The process of making decisions is characterized by reflecting on a variety of options and choosing the one that most closely aligns with an individual's goals, objectives, and values (Fülöp, 2005). While decision-making is a fundamental aspect of daily life, health-related choices carry exceptional significance due to their profound impact on oneself, one's family, and the community. Flynn and Smith (2007) emphasize the importance of identifying a patient's decision-making style as it can aid healthcare professionals in tailoring communications to effectively relay health information to each respective individual (Desmond et al., 2013). Kumar et al. (2016) point out that vaccine hesitancy is complex, nuanced, and non-binary, existing as a continuum where individuals fall somewhere between total acceptance and outright refusal of vaccinations. Exploring the relationship between decision-making styles and vaccine hesitancy could aid in unraveling these complexities. However, there is a paucity of research directly linking decision-making styles to vaccine hesitancy. Poland and Ratishvili (2022) are among the few researchers who have examined the relationship between decision-making styles and vaccine hesitancy, specifically focusing on cognitive styles. Their research underscores the importance of recognizing and integrating individuals' cognitive styles and decision-making processes to improve understanding and communication. Although there is limited research specifically linking decision-making styles to vaccine hesitancy, insights from studies on personality traits and cognitive styles related to vaccine hesitancy offer valuable information. This understanding can enhance healthcare providers' strategies for personalizing

and transparently communicating with parents who are reluctant to vaccinate their children. To successfully reduce vaccine hesitancy, it is essential to implement tailored approaches alongside effective educational efforts (Poland & Ratishvili, 2022). Further research exploring the relationship between decision-making styles and vaccine hesitancy could provide valuable insights for the scientific community, healthcare providers, and individuals considering vaccinations.

Importance of Study

Vaccines have been instrumental in advancing health and well-being. Not long ago, infectious diseases devastated communities worldwide, causing countless deaths. Today, thanks in large part to vaccinations, which have significantly reduced mortality rates and enhanced public health, we live in a society largely free from the constant threat of infectious diseases (CDC, 2021). However, vaccine hesitancy fueled by the recent global pandemic is considered among the most significant threats to global health (Locke et al., 2023; Nuwarda et al., 2022). This hesitancy threatens public health by lowering vaccination rates and compromising herd immunity, thereby increasing the risk of outbreaks of preventable diseases (Coustasse et al., 2020; Salmon et al., 2015). This knowledge highlights the critical need to address vaccine hesitancy and work toward improving vaccination rates to safeguard against severe disease outbreaks (Balch, 2022). Understanding the factors driving vaccine hesitancy, such as decision-making styles and latent beliefs, is essential for developing effective communication strategies and policies to enhance vaccination uptake and public health safety (Desmond et al., 2013; Flynn & Smith, 2007; Poland & Ratishvili, 2022). Examining decision-making styles related to vaccine hesitancy can yield important insights into individual cognitive processes and preferences, enabling healthcare professionals to more effectively support parents in making informed health decisions for their children (Desmond et al., 2013; FitzPatrick et al., 2019; Flynn & Smith, 2007;

Lindbladh & Lyttkens, 2002). These efforts can aid in protecting local and global communities from preventable diseases, thereby promoting health, well-being, and longevity. The question guiding this research is: Do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?

Methods

Participants and Sampling Method

This cross-sectional survey was conducted from May 2024 to July 2024. Participants were recruited using convenience volunteer sampling, a method that involves choosing individuals based on their availability and willingness to participate (Plano Clark & Creswell, 2008). Recruitment was conducted through word-of-mouth, email, and outreach on social media platforms like Facebook, Instagram, and LinkedIn to work toward achieving diverse representation. Four separate advertisements were posted to these platforms over an 8-week period (see Appendix J). Eligible participants were required to be 18 or older, English-speaking, and parents of children aged 18 or younger. Exclusion criteria included individuals under 18, non-English speakers, those without internet access, and those without children under 18.

To obtain the sample size needed, a power analysis was performed using G*Power 3.1.9.7 utilizing a two-tailed test with an alpha level of 0.05, power of .80, and odds ratios (effect sizes) of 2.0 (small), 3.0 (medium), and 4.0 (large) respectively based on Ferguson's (2009) general guidelines for interpreting effect sizes in social science research. The analysis indicates that a total sample size of 113 (small effect size), 53 (medium effect size), and 39 (large effect size) participants was required. A total sample size of 348 was obtained. However, after performing data cleaning and applying procedures to handle missing data, remove ineligible

observations, and eliminate variable levels with one or fewer observations, the sample size was reduced to 260 people.

Demographics

The sample population's demographic characteristics were relatively homogenous. The preponderance of participants were White ($n = 206$, 78.23%), married ($n = 226$, 86.92%) women ($n = 215$, 81.69%) who had a college education with associate's degrees ($n = 28$, 10.78%), bachelor's degrees ($n = 108$, 41.54%), and post-graduate degrees ($n = 84$, 32.31%) prominently represented in the data. Additionally, most participants reported an annual household income of \$100,000 or more per year ($n = 167$, 64.23%). Over half of the participants had only one child ($n = 132$, 50.77%). Living environments were nearly equally divided, with participants residing in a city with a population of over 50,000 people ($n = 116$, 44.62%) or a town of under 50,000 ($n = 115$, 44.23%). See Table 2 for demographic characteristics of the sample population.

Table 2*Demographic Characteristics of Sample Population*

Demographic Characteristic		Total	%
Gender	Female	215	82.69
	Male	45	17.31
Age	18-34	159	61.15
	35+	101	38.85
Education	Some college or less	40	15.38
	Associate	28	10.78
	Bachelor	108	41.54
	Postgraduate	84	32.31
Occupational Status	Employed Full-time	99	38.08
	Student/Part-time/Other	161	61.92
Marital Status	Married	226	86.92
	Other	35	13.46
Annual Income	Less than 100k	94	36.15
	More than 100k	167	64.23
Ethnicity	White	205	78.85
	Black/Hispanic/Other	55	21.15
Geographic Location	Big city (50,000 people or more)	116	44.62
	Smaller town (Between 2,500 and 49,999 people)	115	44.23
	Rural area (Less than 2,500 people)	29	11.15
Number of Children	1	132	50.77
	2	93	35.77
	3+	35	13.46

Note. N = 260.

Procedure

Data were collected using a Qualtrics survey that included a consent form, a demographic questionnaire, the VHS, and the GDMS. Participants were given the option to provide their email addresses for a chance to win one of two \$50 Amazon gift cards. Additionally, as part of a larger mixed-methods study, the survey included a query about their interest and willingness to participate in a virtual semi-structured interview to further discuss their perspectives on childhood vaccinations. Individuals who responded to advertisements, emails, or personal communications accessed the survey through a provided quick response (QR) code or virtual link (see Appendix J).

Measures

The measures employed in this study combined demographic queries with two systematically validated measurement instruments. The demographic questionnaire captured participant characteristics which aided in providing important context for the analysis. The VHS and the GDMS scale were selected for their relevance, accessibility, validity, and reliability. These tools enabled the gathering of pertinent data on vaccine hesitancy among parents and their general decision-making styles. The collected data provided a comprehensive understanding of the research topic, offering valuable insights into the factors influencing vaccine hesitancy and revealing the role that decision-making styles play in shaping parental perspectives and considerations regarding childhood vaccines.

Demographic Questionnaire

The demographic questionnaire was developed with the aim of establishing participant characteristics (see Appendix C). The form, containing ten questions with a variety of response options, was designed to garner relevant participant information pertaining to the study's goals and objectives (e.g., how many children under 18 are you currently caring for?). Key

demographic factors such as age, gender, education, occupational status, marital status, annual household income, ethnicity, geographic location, and number of children were gathered to enhance the understanding of the research findings.

Vaccine Hesitancy Scale

The VHS, developed by the SAGE Working Group, is a tool used in research and immunization policy to assess vaccine hesitancy (Shapiro et al., 2018). Shapiro et al. (2018) evaluated its effectiveness through exploratory and confirmatory factor analyses, finding a two-factor structure of “lack of confidence” and “risk perception.” They reduced the scale from 10 to 9 items due to one item’s unreliable factor loadings. The revised VHS demonstrated strong internal consistency (Cronbach’s $\alpha = 0.92$ for “lack of confidence” and $\alpha = 0.64$ for “risks”). Construct validity was supported by correlations with vaccine-related beliefs and behaviors, showing significant differences in hesitancy levels among different groups (Shapiro et al., 2018). Akel et al. (2021) further validated the VHS in the context of COVID-19, finding strong internal consistency (Cronbach’s $\alpha = 0.80$ to 0.94) and concurrent validity, as higher hesitancy scores correlated with lower vaccine acceptance. Ledda et al. (2022) adapted the VHS cross-culturally, confirming its reliability (Cronbach’s $\alpha = 0.94$) and validity. Helmkamp et al. (2021) extended the VHS to include influenza and HPV vaccines, demonstrating strong internal consistency and construct validity across different vaccine types, thus recommending its use for broader vaccine hesitancy research.

Following Shapiro et al.’s (2018) recommendation, the VHS was utilized as a 9-item scale (see Appendix C). A 4-point Likert scale was used based on research by Chyung et al. (2017, as cited in Kempe et al., 2020), which indicated that omitting the “neither agree nor disagree” option helped reduce participants’ tendencies to provide socially desirable answers. Vaccine hesitancy was assessed by averaging responses to the nine items on the VHS, with

negatively worded statements reverse-coded. Higher scores indicate more positive attitudes toward vaccines, while lower scores signify negative attitudes toward vaccines (Temsah et al., 2021). Based on Temsah et al.'s (2021) study, "Parental Attitudes and Hesitancy About COVID-19 vs. Routine Childhood Vaccinations," which used a cutoff value of ≤ 3 to categorize participants as vaccine-hesitant or non-vaccine-hesitant, the same cutoff was applied due to the similarity of the study populations.

General Decision-Making Style

The GDMS scale, created by Scott and Bruce (1995), assesses how individuals approach decision-making through a 25-item instrument with five subscales: rational, avoidant, dependent, intuitive, and spontaneous, using a 5-point Likert scale (Scott & Bruce, 1995). After extensive review and validation, including exploratory and confirmatory factor analyses, the scale demonstrated strong internal consistency and construct validity (Scott & Bruce, 1995). Further studies have confirmed the GDMS's reliability and validity across various cultural contexts. Loo (2000) found the scale to be psychometrically sound with adequate internal consistency (Cronbach's $\alpha = 0.62$ to 0.84) and low correlation with social desirability. Gambetti et al. (2008) validated the GDMS in an Italian sample, supporting its five-factor model and reporting satisfactory internal consistency (Cronbach's $\alpha = 0.70$ to 0.84). Similarly, Verma and Rangnekar (2015) affirmed the GDMS's applicability in India, noting good internal consistency (Cronbach's $\alpha = 0.71$ to 0.79) and model fit indices. Alacreu-Crespo et al. (2019) validated a Spanish adaptation of the GDMS, demonstrating strong internal consistency (Cronbach's $\alpha = 0.72$ to 0.91) and temporal stability (ICC range = 0.77 to 0.86). These studies collectively establish the GDMS as a valid and reliable tool for assessing decision-making styles in diverse populations (Alacreu-Crespo et al., 2019; Gambetti et al., 2008; Loo, 2000; Scott & Bruce, 1995; Verma & Rangnekar, 2015).

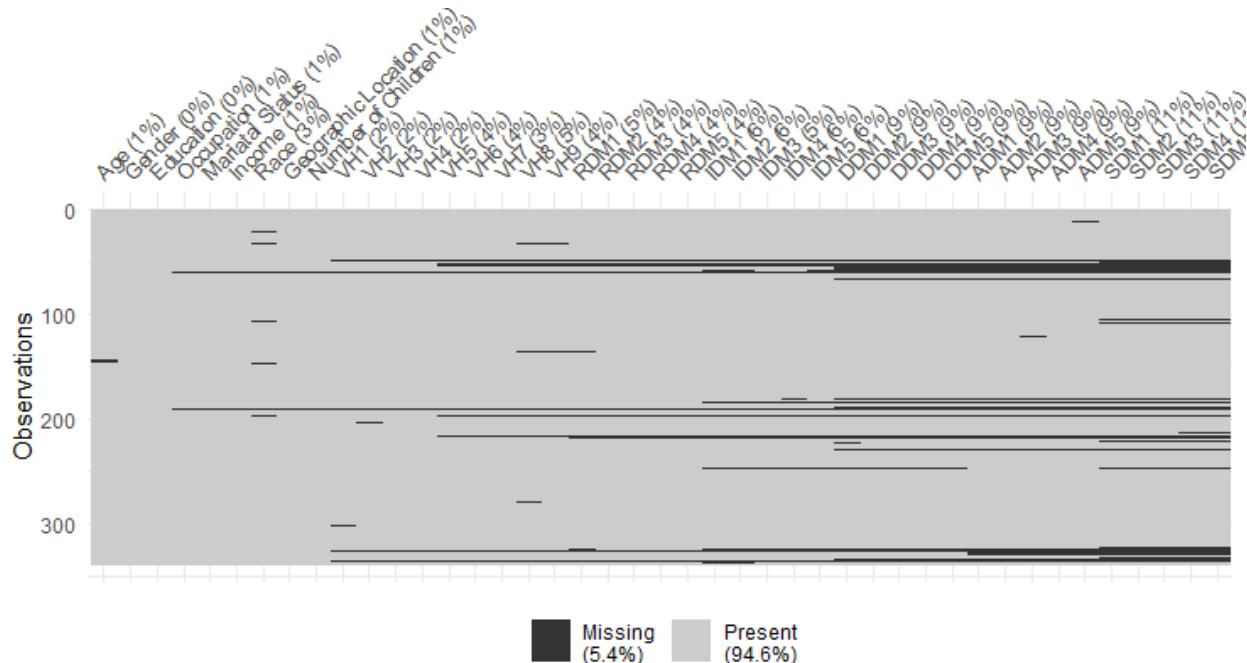
Consistent with the Likert response scale for the VHS, the current study employed a 4-point Likert response scale for the GDMS, as recommended by Chyung et al. (2017), to mitigate the tendency of participants to give socially desirable responses. Ratings range from 1 = strongly disagree to 4 = strongly agree. Based on scores, participants were categorized into one of the five decision-making types: rational, intuitive, dependent, avoidant, or spontaneous. Higher scores on each subscale (the sum of the items) mean that this style is used more frequently.

The present study calculated Cronbach's alpha for both the VHS and GDMS instruments. The VHS demonstrated a Cronbach's alpha of 0.95, while the GDMS showed a Cronbach's alpha of 0.90. These results demonstrate strong internal reliability for both instruments, indicating their suitability for accurately measuring the constructs of vaccine hesitancy and decision-making styles. This reliability strengthens the validity of the subsequent analyses and findings.

Data Cleaning

Data were imported into R Studio from Qualtrics in their raw form. Variables of interest were labeled and assigned dummy codes in accordance with the developed and maintained codebook (see Appendix G). A variable was established to calculate the mean of the nine items from the VHS. Item 8 ("New vaccines carry more risks than old vaccines") and Item 9 ("I am concerned about serious adverse effects of vaccines") of the VHS were reverse coded. A second variable was generated to categorize participants as vaccine-hesitant or non-vaccine-hesitant based on the ≤ 3 cutoffs from Temsah et al.'s (2021) study. Aggregate respective mean scores of 3 or lower were categorized as vaccine-hesitant, while scores greater than 3 were categorized as non-vaccine-hesitant. Five additional variables were created to sum the items representing each of the five decision-making styles. Subsequently, an additional variable was added to determine the predominant decision-making style for each participant based on the highest score.

Once the data were organized and recoded, an analysis of the dataset revealed an overall missing data percentage of 5.4%. The pattern of “missingness” (Enders, 2010, p. 13) suggests that it is likely missing at random (MAR), as the missingness appears to increase towards the end of the survey, potentially indicating participant fatigue (see Figure 6). MAR is a missing data mechanism where the probability of missingness is related to observed data but not unobserved data (Enders, 2010; Heymans & Twisk, 2022). The literature on missing data describes the MAR mechanism as “ignorable missingness” (Enders, 2010, p. 13) because the pattern of missing data does not provide any additional information about the parameters of the analysis model. However, contingent on the amount of missing data, careful consideration may be required, and this should not be ignored (Enders, 2010). A complete case analysis was employed, given the modest level of overall missing data (5.4%). This approach is feasible as the overall missing data rate is just slightly over 5%, a level generally considered acceptable for maintaining valid inferences without introducing substantial bias (Heymans & Twisk, 2022; Jakobsen et al., 2017). To ensure the robustness and reliability of the logistic regression model, missing data, 16 ineligible observations (indicated having no children), and levels with one or fewer observations were excluded. Levels with very few observations can lead to unstable estimates, making it difficult for the model to converge and produce valid, interpretable results. As a result of these exclusions, the final sample size was reduced to 260 people.

Figure 6*Missing Data*

A logistic regression was deemed the most appropriate statistical method to answer the research question, “Do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?” This statistical technique was chosen due to its capability to predict binary outcomes (dependent variables) using a range of independent variables that may be continuous, categorical, or a combination of both (Castro & Ferreira, 2023). Given the binary nature of the response variable and the categorical nature of the independent variables in this study, logistic regression was identified as the most suitable method. The logistic regression for this current study is outlined below.

$$\ln \left(\frac{\hat{Y}}{1-\hat{Y}} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10}$$

\hat{Y} : Represents the predicted probability of vaccine hesitancy.

β_0 : Is the intercept.

β_1 : Represents the effect of different decision-making styles on vaccine hesitancy.

$\beta_2 - \beta_{10}$: Represents the effect of age, gender, education, occupational status, marital status, annual income, ethnicity, geographic location, and number of children on vaccine hesitancy.

Statistical Assumptions

The assumptions underlying logistic regression were methodically tested, including identifying a binary dependent variable, ensuring the independence of observations and mutually exclusive categories, avoiding excessive multicollinearity among independent variables, monitoring the effect of influential observations, and confirming an adequate sample size (Schreiber-Gregory, 2018). The first assumption was confirmed by examining the response variable, vaccine hesitancy, which was binary (vaccine-hesitant or non-vaccine-hesitant) and coded as 0 for vaccine-hesitant and 1 for non-vaccine-hesitant. Furthermore, the sample population was obtained through convenience volunteer sampling, where participants accessed the survey by following a provided link or scanning a QR code. Each survey submission was assigned a unique ID, enhancing the likelihood that independence of observations was attained. Similarly, the assumption regarding influential observations was evaluated using Cook's distance to identify potentially influential cases. Ten cases were identified. However, these cases were not removed from the data because excluding them would eliminate variance, particularly among participants with a dependent decision-making style who were not vaccine-hesitant. Without this variance, maximum likelihood estimates could not be calculated, making it impossible to draw valid inferences.

Subsequently, the assumption of sufficient sample size was also confirmed. The G*Power analysis indicated that the required total sample sizes were 113 for a small effect size, 53 for a medium effect size, and 39 for a large effect size, establishing that the sample size was sufficiently large, $N = 260$.

Model Fit

Model fit was evaluated across datasets: the complete case dataset, including all levels of each variable, and the complete case collapsed dataset, where levels of most variables were merged due to zero or few observations in some levels. Based on the model fit assessments using the AIC, Bayesian information criterion, receiver operating characteristic curve analysis, McFadden's pseudo R-square, and the Hosmer-Lemeshow tests, the complete case collapsed dataset was determined to be the best fit. This model showed an AIC of 348.70 and a Bayesian information criterion of 405.67. The receiver operating characteristic curve analysis indicated an area under the curve of 0.73, suggesting a good level of discrimination. McFadden's pseudo R-square value was 0.12, indicating a moderate explanatory power of the model. The Hosmer-Lemeshow test results, $\chi^2(8) = 7.03, p = 0.53$, indicated that the model fits the data well, showing no significant difference between the observed and predicted values. This combination of metrics indicates that the chosen model provides a reliable fit for the data. Furthermore, this determination was supported by assessments of the generalized variance inflation factor (GVIF), Chi-square likelihood ratio, and sensitivity and specificity tests. The GVIF test was conducted to assess the presence of excessive multicollinearity among the explanatory variables. As shown in Table 3, none of the ten explanatory variables exhibited excessive multicollinearity, as all GVIF values were below 2.5. According to Senaviratna and Cooray (2019), GVIF values of 2.5 or higher may indicate a potential multicollinearity issue. The chi-square likelihood ratio test revealed that the null model had a χ^2 value of 360.30 ($df = 259; p < .001$), while the collapsed model had a χ^2 value of 316.70 ($df = 249; p < .001$). This suggests that the collapsed model provides a significantly better fit to the data compared to the null model. Sensitivity and specificity analyses demonstrated that the complete case collapsed dataset had a sensitivity of 0.65 and a specificity of 0.73, indicating that the model correctly identifies 65% of vaccine-

hesitant individuals and 73% of non-vaccine-hesitant individuals. These values imply a moderately balanced ability to predict both vaccine-hesitant and non-vaccine-hesitant individuals.

Table 3

Generalized Variance Inflation Factor

Variables	GVIF	df	GVIF ^(1/2*df)
Age	1.19	1	1.09
Gender	1.19	1	1.09
Education	1.35	3	1.05
Occupational Status	1.24	1	1.11
Marital Status	1.31	1	1.14
Annual Income	1.46	1	1.21
Ethnicity	1.18	1	1.09
Geographic Location	1.24	2	1.06
Number of Children	1.34	2	1.08
Decision-Making Styles	1.12	2	1.03

Note. GVIF^{(1/(2*df))}: Generalized variance inflation factor raised to the power of 1 divided by 2 times the degree of freedom.

Statistical Analysis

In this study, a logistic regression analysis was conducted using R Studio 4.4.1 on the complete case collapsed dataset (Posit Team, n.d.). The aim was to investigate the relationship between decision-making styles and vaccine hesitancy. The dependent variable was the final score for vaccine hesitancy, determined by averaging responses to the nine items on the VHS and applying a cutoff where scores of 3 or less indicated vaccine hesitancy and scores above three indicated non-vaccine hesitancy. The independent variable was decision-making style, categorized into five levels: rational, intuitive, dependent, spontaneous, and avoidant. Control

variables included age, gender, education, occupational status, marital status, annual income, ethnicity, geographic location, and number of children. Adjusted odds ratios and 95% confidence intervals were calculated to interpret the analysis results.

Results

The results from the logistic regression, conducted with a thorough evaluation of various predictors of vaccine hesitancy, indicate that outcomes for the complete case analysis provided meaningful insights and answered the research question, “Do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children? ” (see Table 4). The data suggests that individuals with an intuitive decision-making style have significantly lower odds (86% lower) of being vaccine-hesitant compared to those with a dependent decision-making style ($OR = 0.14$; $SE = 0.97$; 95% CI [0.02, 0.82], $z = -2.01$; $p = 0.04$), holding all other factors constant. Furthermore, having three or more children is associated with significantly lower odds (73% lower) of vaccine hesitancy compared to having only one child ($OR = 0.27$; $SE = 0.48$; 95% CI [0.10, 0.68]; $z = -2.71$; $p < .001$). Results for all other demographic variables, as well as for the additional decision-making styles, did not yield statistically significant findings. This suggests that factors such as age, gender, education level, occupation, marital status, income, and geographic location, along with the various other decision-making styles assessed, were not significantly associated with vaccine hesitancy in this analysis.

While demographic variables other than the number of children did not statistically predict vaccine hesitancy, the homogeneity of the sample and the relatively high proportion of vaccine-hesitant participants (133 of 260) are noteworthy, as they contradict existing research. Typically, factors such as lower socioeconomic status, education level, occupation, ethnicity, geographic location, and marital status are well-established predictors of vaccine hesitancy

(Nguyen et al., 2022; Palombi et al., 2023; Ruiz & Bell, 2022). However, this study's population challenges these prevailing patterns. Notably, a significant portion of the vaccine-hesitant participants were White (39.23%), highly educated with a Bachelor's degree (21.54%) or post-graduate degree (21.15%), employed full-time (35.38%), in higher socioeconomic brackets earning over \$100,000 annually (32.69%), married (46.15%), and residing in big cities (25.77%; see Table 4 for a detailed breakdown of vaccine hesitancy and non-vaccine hesitancy status by demographic variable). Given the unusual characteristics of this study sample, further research is needed to explore whether other groups of highly educated, high-income individuals similarly deviate from the typical profiles associated with vaccine hesitancy, as suggested by the broader literature.

Table 4*Logistic Regression Results*

Variable	Vaccine Hesitant <i>f</i> (%)	Non-Vaccine Hesitant <i>f</i> (%)	Adjusted Odds Ratio	Std. Error	<i>z</i> -statistic	95% CI Lower/ Upper	<i>p</i> -value
(Intercept)	NA	NA	10.18	1.16	1.99	0.12, 2.25	0.41
AGE 18-34 (Reference)	75 (28.85)	84 (32.31)	NA	NA	NA	NA	NA
35+	58 (22.31)	43 (16.54)	1.48	0.30	1.29	1.18, 123.24	0.05
GENDER Male (Reference)	29 (11.15)	16 (6.15)	NA	NA	NA	NA	NA
Female	104 (40)	111 (42.69)	0.56	0.40	-1.45	0.26, 1.21	0.15
EDUCATION Some college or less (Reference)	12 (4.61)	28 (10.77)	NA	NA	NA	NA	NA
Associates	10 (3.85)	18 (6.92)	0.61	0.57	-0.86	0.20, 1.89	0.39
Bachelor	56 (21.54)	52 (20)	1.11	0.49	0.21	0.43, 2.94	0.83
Postgraduate degree	55 (21.15)	29 (11.15)	1.99	0.52	1.34	0.73, 5.58	0.18
OCCUPATIONAL STATUS Employed Full-time (Reference)	92 (35.38)	69 (26.54)	NA	NA	NA	NA	NA
Student-Part-time/Other	41 (15.77)	58 (22.31)	0.77	0.31	-0.82	0.42, 1.43	0.41
MARITAL STATUS Married (Reference)	120 (46.15)	105 (40.38)	NA	NA	NA	NA	NA
Other	13 (5)	22 (8.46)	0.68	0.46	-0.85	0.27, 1.66	0.40
ANNUAL INCOME 100k + (Reference)	85 (32.69)	71 (27.31)	NA	NA	NA	NA	NA
Less than 100k	44 (16.92)	56 (21.54)	0.91	0.33	-0.26	0.48, 1.77	0.79
ETHNICITY Other (Reference)	31 (11.92)	24 (9.23)	NA	NA	NA	NA	NA
White	102 (39.23)	103 (39.6)	0.98	0.36	-0.05	0.48, 1.99	0.96

Table 4, continued

Variable	Vaccine Hesitant <i>f</i> (%)	Non-Vaccine Hesitant <i>f</i> (%)	Adjusted Odds Ratio	Std. Error	<i>z</i> -statistic	95% CI Lower/ Upper	<i>p</i> -value
GEOGRAPHICAL LOCATION							
Big city (50,000 people or more; Reference)	67 (25.77)	49 (18.85)	NA	NA	NA	NA	NA
Smaller town (Between 2,500 and 49,999 people)	58 (22.31)	57 (21.92)	0.91	0.29	-0.33	0.50, 1.63	0.74
Rural area (Less than 2,500 people)	8 (3.07)	21 (8.08)	0.40	0.52	-1.77	0.14, 1.07	0.08
NUMBER OF CHILDREN							
1 (Reference)	79 (30.38)	53 (20.38)	NA	NA	NA	NA	NA
2	44 (16.92)	49 (18.85)	0.58	0.32	-1.71	0.31, 1.08	0.09
3+	10 (3.85)	25 (9.61)	0.27	0.48	-2.71	0.10, 0.68	<.001*
DECISION-MAKING STYLE							
Dependent (Reference)	8 (3.08)	2 (0.77)	NA	NA	NA	NA	NA
Intuitive	13 (5)	18 (6.92)	0.14	0.97	-2.02	0.02, 0.82	0.04*
Rational	112 (43.08)	107 (41.15)	0.24	0.90	-1.58	0.03, 1.20	0.11

Note. *N* = 260.

Discussion

This study aimed to determine whether general decision-making styles predict vaccine hesitancy, controlling for factors such as age, gender, education level, employment status, marital status, social class, ethnicity, geographic location, and number of children. The results showed that individuals using the intuitive decision-making style had significantly lower odds (86% lower) of being vaccine-hesitant compared to those with a dependent decision-making style. This contradicts Schindler et al. (2020), who found that reliance on intuition negatively impacts vaccination attitudes. Similarly, H. Tomljenovic et al. (2020) linked stronger vaccine conspiracy beliefs to a higher reliance on intuitive thinking, associated with vaccine hesitancy.

Martinelli and Veltri (2021) also suggested that intuitive thinking increases the likelihood of vaccine hesitancy compared to analytic thinking. The current study findings could be explained by the idea that individuals who rely on intuition may be more confident in their vaccination decisions, trusting their instincts and thus being less likely to worry or hesitate about getting vaccinated. However, further research would need to confirm this hypothesis. Notably, the dependent and rational decision-making styles in the GDMS were not predictive of vaccine hesitancy in this study's population. The dataset did not include observations of avoidant and only sparse representation of the spontaneous decision-making style (e.g., one). These findings highlight the need for further investigation into how decision-making styles predict vaccine hesitancy, particularly with a larger sample size. The study's limitations and the need for further research to validate the findings should be considered when interpreting the results.

Furthermore, the current study also revealed that individuals within this sample with three or more children had 73% lower odds of vaccine hesitancy than individuals with just one child. Alzahrani and Alghamdi's (2023) findings concur with these results, indicating that parents of one or two children had significantly higher odds of vaccine hesitancy when compared to parents who had four children. Likewise, Shen et al.'s (2022) research affirmingly suggests that parents with more than one child exhibited lower vaccine hesitation compared to parents with only one child. These findings may suggest that individuals with more than one child may be more comfortable with vaccinations, likely due to having already vaccinated their older children, making them less hesitant to vaccinate subsequent offspring.

Through a comprehensive analysis that controlled for multiple demographic factors, the current study enhances our understanding of vaccine hesitancy by identifying intuitive decision-making and the number of children as influential factors in how childhood vaccinations are

perceived and received. These findings have significant practical implications for the healthcare community. Understanding parental behavior can help develop and implement more effective communication strategies, providing parents with valuable information to make informed healthcare decisions. Decision-making styles are a crucial aspect of parental behavior and warrant further exploration to gain deeper insights into how parents accept, process, and act on information. Adapting communication strategies to match parents' decision-making styles and identifying which styles require more detailed and patient explanations is likely to improve the acceptance and uptake of childhood vaccinations. Furthermore, recognizing that parents with only one child are more likely to be apprehensive about immunizations can help public health professionals and healthcare providers identify these parents to ensure that they have sufficient information to make well-informed decisions about their child's preventative health.

As with all research, this study has limitations. The sample size was relatively small ($N = 260$) and homogenous, primarily comprising white, higher socioeconomic status, married, and highly educated individuals. This lack of diversity suggests that the findings may not be representative of the broader population of parents. The absence of avoidant and spontaneous decision-making styles likely reflects the small sample size. A larger, more diverse sample would likely yield more comprehensive insights and strengthen the study's conclusions. Although it is interesting that there were so many participants identifying as vaccine-hesitant in such a highly educated, high socioeconomic status group. Additionally, self-reporting can introduce response bias, which may be evident in the high number of observations for the rational decision-making style. This bias could arise because the rational decision-making questions were positioned at the beginning of the GDMS section of the survey or because rational decision-making is perceived as the most socially acceptable option among the decision-

making styles. For example, few parents might openly admit to being spontaneous or avoidant when making decisions about their children's health. To mitigate this bias, placing rational decision-making questions later in the survey might be effective, although this approach risks introducing survey fatigue, where respondents may become tired and less attentive as they progress through the survey. Balancing the placement of questions to reduce social desirability bias while maintaining respondent engagement is crucial for obtaining accurate data and is a consideration for future research. Survey fatigue is a critical consideration in the pursuit of accurate and complete data collection. Although only 5.4% of the data was missing, most of the missing responses occurred toward the end of the survey, suggesting possible survey fatigue. While the survey consisted of just 43 questions, research shows that nonresponse rates increase with longer surveys, making it crucial to strike a balance between gathering sufficient data and avoiding overburdening participants with excessive or irrelevant queries (Kato & Miura, 2021). Additionally, declining attention spans, which have dropped from an average of 150 seconds in 2004 to just 47 seconds by 2021 (Mark, 2023), further emphasize the importance of keeping surveys concise. As individuals are increasingly inundated with online surveys via social media, emails, and shopping platforms (Field, 2020), maintaining brevity and relevance is key to holding their attention. Including a progress indicator may also help mitigate nonresponse by giving participants a clearer sense of how much longer the survey will take (Kato & Miura, 2021). Ultimately, being mindful of attention spans and optimizing the survey experience may aid in reducing fatigue and improving response rates.

This study provides valuable insights into vaccine hesitancy among parents of children younger than 18, highlighting the significant role of decision-making styles. It underscores the necessity of examining decision-making styles in conjunction with various demographic

characteristics, such as the number of children, socioeconomic status, marital status, gender, ethnicity, occupation, age, geographic location, and education levels, to understand their impact on vaccination acceptance or hesitation. Further investigation into decision-making styles and vaccine hesitancy is crucial for the healthcare industry and public health efforts. By better understanding these dynamics, healthcare professionals can tailor their communication strategies to address specific decision-making processes of different parent demographics. This targeted approach can help to more effectively disseminate vaccination information, thereby reducing vaccine hesitancy through strategic efforts. Effective communication is key to mitigating vaccine hesitancy. Healthcare professionals must be equipped with strategies to engage with parents who rely on different decision-making styles, ensuring that information is accessible and understandable. This could involve personalized communication plans, educational programs, and community outreach efforts that resonate with parents' decision-making styles as well as their values and concerns. Moreover, reducing vaccine hesitancy can have far-reaching benefits, contributing to higher vaccination rates and better public health outcomes. As healthcare professionals become more skillful at addressing vaccine hesitancy through informed, considerate communication, the threat posed by vaccine hesitancy to public health can be significantly diminished. Ultimately, the goal is to ensure the well-being of children and create a healthy society. Continued research into the interplay between decision-making styles and vaccine hesitancy is essential for achieving these objectives and fostering a more informed, health-conscious public.

Acknowledgments

Thanks to the University of Northern Colorado and my dissertation committee, who have supported this research endeavor.

Declaration of Conflicts of Interest

The author declared no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

Funding

The author received no funding for this research study.

Author Contribution Statement

The author was the sole researcher responsible for all aspects of this study. The author's responsibilities and contributions include conceptualizing and developing the research idea, implementing the theoretical framework, and designing the research methods, including the qualitative RTA and integration of AI-prompting methods. The author conducted all data collection activities, including surveys and interviews, collecting the data through an online survey and remote interviews. She utilized and implemented software tools for analysis, such as coding and analyzing qualitative data, employing NVivo as well as AI (e.g., ChatGPT). The author managed all primary research activities, including participant recruitment and data management, and he was responsible for writing the manuscript, including the abstract, introduction, materials and methods, results and discussion, and conclusion. She also created tables, figures, and other visual representations of the data and findings and managed the overall research process. Additionally, the author conducted the research with ethical standards and obtained necessary approvals before initiating the research.

Data Availability Statement

The data used for this study (de-identified survey data) can be made available to other researchers upon request. If you are interested, please contact the author.

CHAPTER V

QUALITATIVE RESULTS

Parental Vaccine Hesitancy

It could be argued that health is a treasured resource that should be vigilantly guarded and maintained. This fundamental and imperative endeavor consists of multifaceted considerations for oneself and one's family. Dietary, exercise and other behavioral lifestyle choices are often at the forefront of conscious attention when endeavoring to achieve and maintain well-being and vitality. However, there are other concerns that require careful reflection as well. Vaccinations are a wellness decision that is ever present throughout one's lifetime. The preponderance of these health considerations are most common during childhood, requiring parents to make numerous health-related decisions throughout the parenting years. Many parents do not waver in attaining immunizations for their children, while others struggle to see the benefit of or are reluctant to engage in such routine preventative health measures. Among the primary concerns of parents hesitant about vaccines are their safety, potential side effects, lack of sufficient information, and distrust of governmental and medical institutions (Kerrigan et al., 2020). Although parental reservations surrounding childhood vaccinations have been ever-present, the recent global pandemic has brought this issue to the forefront for many parents and, in turn, for those serving in public health.

Vaccine hesitancy has been a cause for concern among public health officials on an international level for many years, with the WHO citing it as among the most significant threats to global health (Nuwarda et al., 2022). However, the COVID-19 pandemic exacerbated these concerns by disrupting routine vaccination rates, leading to significant declines in all age groups

across various vaccine types (Cunniff et al., 2023). Notably, the most pronounced effects of these reductions were among children and adolescents (Cunniff et al., 2023). Lower vaccination rates fueled by hesitancy and failure to vaccinate can result in insufficient herd immunity and could lead to unvaccinated individuals becoming sources of the spread of infectious agents (Nuwarda et al., 2022). The importance of herd immunity cannot be overstated; it is achieved through a sufficient number of the population being immune to disease, often accomplished through vaccination, making its spread less likely (CDC, 2022c). Outbreaks impacting widespread populations can be triggered by unvaccinated individuals contracting a vaccine-preventable disease (Nuwarda et al., 2022). Therefore, maintaining high herd immunity levels is crucial to prevent widespread epidemics. Nuwarda et al. (2022) assert that approximately 95% of the population must be immunized to thwart a measles outbreak, and polio prevention requires nearly 80% immunization rates. The WHO (n.d.-a) notes that vaccinations have been credited with saving more lives than any other medical innovation in recorded history, with millions of lives saved each year through the reduction and eradication of numerous deadly diseases, making the importance of vaccinations and the need to address vaccine hesitancy as a public health threat unreservedly evident.

Properly addressing vaccine hesitancy begins with an understanding of its definition and prevalence. Larson et al. (2022) contend, “Vaccine hesitancy is a state of indecision and uncertainty about vaccinations before a decision is made to act (or not to act)” (p. 58). Even before the global pandemic, McKee and Bohannon (2016) conveyed that 77% of parents indicated being hesitant toward at least one childhood vaccination, with Kempe et al. (2020) concurring that approximately one in 15 parents in the U.S. held hesitations toward childhood immunizations. These pre-pandemic numbers are significant and point to vaccine hesitancy,

contributing to approximately 25% of inadequate vaccine uptake (Nguyen et al., 2022). Markedly, the COVID-19 pandemic ushered in new concerns that further fueled vaccine hesitancy, as seen in the WHO and United Nations Children's Fund officially published data that denoted the most significant continuous decline in childhood vaccinations in nearly 30 years (WHO, 2022). Teasdale et al. (2022) echo these concerns, noting that 33.1% of parents in the U.S. indicated that their child or children did not receive vaccinations in the initial year of the pandemic. Moreover, Seither et al. (2023) report that vaccination coverage has decreased in most states from 2021–2022 to 2022–2023, while vaccine exemptions have increased in 41 states, citing that exemptions for the youngest population of elementary school children (kindergartners) have increased from 2.6% in 2021–2022 to 3.0% in 2022–2023, with nonmedical exemptions comprising over 90% of the total. Researchers warn that continued hesitancy coupled with neglect in receiving immunizations could potentially exacerbate the already concerning erosion of herd immunity, which in turn could heighten the risk of preventable disease outbreaks (Teasdale et al., 2022). It is important to remember that vaccine exemptions exceeding 5% hinder the level of vaccination coverage that is feasible to reach (Seither et al., 2023). The possibility of preventable disease outbreaks occurring in the absence of vaccinations due to vaccine hesitancy, evident through decreased vaccination coverage and the ever-rising number of exemptions, highlights the critical need to address vaccine hesitancy, especially considering its ever-spreading prevalence. Working to ensure widespread immunization is essential in protecting individual health, sustaining herd immunity, and averting local and global health crises that may result in the unnecessary loss of lives.

While the aforementioned numbers paint a portrait of the landscape of vaccine hesitancy, it is important to note that this information conveys only a partial aspect of the complete picture.

Vaccine hesitancy can arise from a number of concerns, including apprehensions surrounding vaccine safety, trepidation of potential side effects, insufficient information, and skepticism concerning governmental and medical institutions (Kerrigan et al., 2020). Engaging directly with vaccine-hesitant parents is essential to comprehensively understand the nuances of their hesitancy and effectively convey the full scope of vaccine hesitancy. Gaining a broader and deeper understanding of vaccine hesitancy by engaging with individuals reluctant to vaccinate themselves or their children can aid in significantly improving communication strategies. This approach can help to mitigate and potentially alleviate this pressing and important issue through targeted and effective methods.

ChatGPT and Human-Directed Reflexive Thematic Analysis

The inception of ChatGPT, released by OpenAI in November of 2022, has been met with widespread recognition of this digital platform's diverse capabilities, including various forms of qualitative analysis (L. Hamilton et al., 2023; Marr, 2023; Sridhara et al., 2023; Wu et al., 2023; Yang et al., 2023; Zhang, Wu, Xie, Lyu, et al., 2023). With its use of NLP and ML, ChatGPT is making its way into qualitative research. Recent studies such as Mesec (2023) and Wang et al. (2023) assessed this new resource's ability to analyze qualitative data to identify insightful themes and understand sentiments without specific training as compared to human analyses. Both studies reported favorable results, noting that ChatGPT identified insightful themes, summarized data effectively, and provided useful suggestions for future research. Similarly, L. Hamilton et al. (2023) utilized the novel platform's ability to perform thematic analysis on their phenomenological data to explore the financial situations, experiences with the financial support program, and personal lives of participants in a guaranteed income program. Their results indicated that while there were some differences between the human and AI analyses, there was

significant overlap between themes generated by both. However, the human analysis was reported to be more comprehensive, taking into account broader social, economic, and cultural contexts (L. Hamilton et al., 2023). Researchers like Lee et al. (2023) and Morgan (2023) concur with L. Hamilton et al.'s (2023) reporting that ChatGPT generated key themes similar to those identified by human analysis and demonstrated efficient coding, theme generation, and quote processing. Conversely, these researchers also pointed out that the AI tool focused on more specific details rather than the overall picture (Morgan, 2023) and had difficulty managing multiple transcripts and capturing nuanced data and underlying emotions (Lee et al., 2023). Markedly, Zhang, Wu, Xie, Lyu, et al. (2023) further advanced this line of research by examining the impact of prompts on the outcomes of RTA performed by ChatGPT. These researchers determined that developing and refining prompts enhances the technological platform's performance to provide meaningful analytic outcomes, bolstering trust in the AI's conclusions (Zhang, Wu, Xie, Lyu, et al., 2023). Mesec (2023) concurred, encouraging future research to focus on honing and refining prompts to enhance the AI-assisted qualitative analysis process and outcomes. These findings underscore the potential benefits of utilizing ChatGPT in qualitative analysis. However, researchers emphasized that the platform should be used in collaboration with human supervision to ensure the trustworthiness of its outcomes (L. Hamilton et al., 2023; Lee et al., 2023; Mesec, 2023; Morgan, 2023; Wang et al., 2023; Zhang, Wu, Xie, Lyu, et al., 2023). ChatGPT is a nascent platform that necessitates extensive research to explore how AI can be leveraged to improve qualitative research, including analysis. Investigating precise and systematic prompts is a promising approach to provide a greater understanding of how this innovative tool may advance and enrich the landscape of qualitative research and beyond.

Study Purpose

The purpose of this study is to gain an understanding of parental attitudes toward childhood vaccinations and decision-making styles. Overarchingly, this study worked to comprehensively examine the factors influencing vaccine hesitancy among parents of children under 18 utilizing quantitative and qualitative methodologies and conducting qualitative analytic comparisons to enhance understanding for future research practices. This study aimed to comprehensively examine the factors influencing vaccine hesitancy among parents of children under 18, utilizing qualitative interviews to enhance an in-depth comprehension of the roots of vaccine hesitancy. Targeted inquiry aims to gain insight into the complex factors shaping parental attitudes toward vaccinations. By collecting rich contextual data, this study sought to uncover the underlying beliefs and reasons behind vaccine hesitancy or acceptance. This approach complements quantitative research by providing direct insights from parents on the perspectives and thoughts behind their beliefs. Additionally, this research conducted a methodological investigation comparing RTA performed by traditional human-led methods with that conducted by ChatGPT version 4.0, using two distinct sets of prompts. Comparing and contrasting these methods will work to uncover valuable insights for researchers seeking to select the most appropriate methods and structure for qualitative analysis for future studies. The research questions guiding this study are:

- Q1 How do parents' underlying beliefs contribute to vaccine hesitancy?
- Q2 What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?

Methods

This study utilized a basic qualitative research design. Merriam and Tisdell (2016) describe basic qualitative research as research that aims to describe and interpret how individuals

construct meaning from their experiences and interactions within their social worlds. Basic qualitative research lends itself well to social constructivism, which is employed in this current research. Social constructivism posits that individuals play an active role in shaping their knowledge and understanding, development occurs within social settings, learning serves as a driver of personal development, and language and thought are innately interconnected (Overall, 2007). Subjective meaning is fundamental to this paradigm, embracing nuanced views instead of narrowly defined predetermined categories (Creswell & Poth, 2018). Creswell and Poth (2018) posit that constructivist researchers ask open-ended questions to understand how participants construct meaning from social contexts while also acknowledging personal biases in interpreting these subjective experiences. Semi-structured virtual interviews were employed to allow the researcher to focus on pertinent questions while also allowing the exploration of relevant concepts that may naturally emerge during the interview. Virtual interviews allowed the researcher and participant to meet without the limitation of distance. Participants who completed the interview process were entered into a drawing to receive one of two \$50 Amazon gift cards.

Participants

Participants were recruited through convenience volunteer sampling. Sampling was conducted through word-of-mouth referrals, email, and outreach through popular social media channels, including Facebook, Instagram, and LinkedIn. The goal of utilizing these platforms was to expand participant recruitment by engaging with diverse networks and communities for a more comprehensive study representation. Recruitment was conducted in conjunction with a more extensive mixed-methods study regarding parental vaccine hesitancy. The criteria for participation were English-speaking individuals 18 years of age or older who were parents of children aged 18 or younger. Participants remained anonymous and were assigned pseudonyms to protect their identities, offering them a sense of security and autonomy to express their

thoughts, perceptions, and ideas freely. Participants were provided with a consent form before the interview, ensuring they were fully informed about the study's purpose, procedures, and estimated time commitment. The form also clarified their right to withdraw from the study at any time, demonstrating research transparency and respect for their autonomy. Out of the 104 individuals who expressed interest, only eighteen scheduled and participated in the semi-structured interview (see Table 5). Among those interested, 84 individuals indicated non-vaccine-hesitant perspectives, while the remaining 20 conveyed vaccine-hesitant viewpoints.

Table 5*Demographic Participant Information*

Pseudonym	Vaccine Hesitant Status	Gender	Age	Education	Occupational Status	Marital Status	Annual Household Income	Ethnicity	Geographic Location
Rachael	Yes	Female	25-34	Bachelors	Full-time	Married	\$100k+	White	City
Gabe	Yes	Male	25-34	Associates	Full-time	Married	\$100k+	White	City
Maddy	Yes	Female	25-34	Associates	Self-employed	Married	\$75–99k	White	Town
Sam	Yes	Female	25-34	Bachelors	Full-time	Married	\$100k+	White	Rural
Stella	Yes	Female	25-34	Bachelors	Part-time	Married	\$100k+	White	City
Ivy	Yes	Female	45-54	Bachelors	Full-time	Married	\$100k+	White	Town
Ava	Yes	Female	25-34	Bachelors	Student	Domestic Partnership	\$75–99k	White	City
Brian	Yes	Male	35-44	Associates	Full-time	Married	\$75–99k	White	Rural
Olivia	No	Female	35-44	Post-grad	Full-time	Married	\$100k+	Asian	City
Sophia	No	Female	35-44	Post-grad	Full-time	Married	\$100k+	White	Rural
Cecile	No	Female	25-34	Post-grad	Full-time	Married	\$100k+	White	Town
Cameron	No	Female	25-34	Post-grad	Full-time	Married	\$100k+	White	City
Daniel	No	Male	45-54	Bachelors	Full-time	Married	\$100k+	White	City
Owen	No	Male	35-44	Bachelors	Full-time	Divorced	\$100k+	White	City
Elena	No	Female	35-44	Post-grad	Unemployed	Married	\$100k+	White	City
Amelia	No	Female	25-34	Associates	Student	Single	\$10–14k	White	Town
Addison	No	Female	25-34	Post-grad	Student	Single	\$10–14k	White	City
Zoe	No	Female	45-54	Post-grad	Full-time	Married	\$100k+	White	City

Note. A city is defined as having 50,000 or more residents; a Town is defined as having less than 50,000 residents.

Data Collection

Institutional Review Board approval was obtained prior to participant recruitment and data collection. Interviews were conducted using Zoom and were recorded with the participant's permission. A semi-structured interview guide with fourteen questions primarily directed the interviews while allowing follow-up questions to emerge organically as the discussions progressed. Interviews ranged from 30 to 90 minutes in length. Sample questions include, "Where do you get information about vaccines for your kids?" and "Have you ever worried about giving vaccines to your kids?" The primary researcher managed the interviews, recordings, and transcripts exclusively, except when the transcripts were sent to participants for review and approval after removing all identifying information. Seventeen interviews with eighteen participants were interviewed from May to June 2024. Notably, one of the interviews was conducted with a couple who participated together.

Data Analysis

The data were analyzed through three different methods using RTA, which is "a method for developing, analyzing, and interpreting patterns across a qualitative dataset, which involves systematic data coding processes to develop themes – themes are your ultimate analytic purpose" (Braun & Clarke, 2022, p. 4). This approach to analyzing data is flexible and involves the identification of patterns in the data that address the research question while also holding space for the researcher's self-awareness and perspective (Braun & Clarke, 2022). The first analytic method included the researcher manually coding the data through an iterative process from which themes were derived, leading to the overarching interpretation of the data's narrative. NVivo was employed to manage data storage and coding during this process. Procedures for RTA included becoming familiar with the data, coding the dataset, generating initial themes, developing and reviewing themes, refining, defining, and naming themes, and interweaving the

analysis together to develop a complete narrative of the data, all while fostering an environment for the researcher's self-awareness of thoughts and perspectives. Subsequently, the second and third analyses were conducted using ChatGPT version 4.0, which performed an RTA with two distinct sets of prompts (see Appendix G). The first set of prompts was based on Braun and Clarke's (2022) six steps of RTA. The second set of prompts was garnered from Zhang, Wu, Xie, Lyu, et al. (2023) recent RTA research (see Appendix G). Leveraging ChatGPT in RT served to evaluate the quality and depth of research findings in exploring themes and subthemes related to parental vaccine hesitancy and to determine if this AI platform produces results comparable to human-directed analyses.

The three analytic procedures, which include traditional human-directed RTA conducted using NVivo, ChatGPT RTA using prompts inspired by Braun and Clarke (2022), and ChatGPT RTA using prompts inspired by Zhang, Wu, Xie, Lyu, et al. (2023), were assessed using the rubric found in Table 1. Table 1, developed in collaboration with OpenAI (2024c), enabled a comparison across the three analyses. The prompts utilized for these analyses can be found in Appendix F.

Reflexivity

Reflexivity plays a significant role in qualitative research as the researcher can significantly influence the research through personal perceptions and intersectional positions. Reflexivity can be understood as the researcher's consciousness of their biases, assumptions, and positionality and the recognition of how these factors may influence the process of the research as well as the resulting findings. Creswell and Poth (2018) posit,

Researchers position themselves in a qualitative research study, meaning that researchers convey (i.e., in a method section, in an introduction, or other places in a study) their background (e.g., work experiences, cultural experiences, history), how it informs their interpretations of the information in a study, and what they have to gain from the study. (p. 82)

Bridling can aid in reflexivity; Dahlberg and Dahlberg (2019) introduce the concept of bridling, which involves maintaining an attitude of openness and continually checking one's evolving understanding. This approach helps navigate the balance between subjectivity and objectivity by being present, asking questions, and remaining open to multiple possibilities (Dahlberg & Dahlberg, 2019). A reflexive journal was maintained throughout the research to support this process, to document reflections, and to bridle the research experience. This record has been summarized in the following researcher's stance.

Researcher Stance

Human Researcher Stance

As a white, cisgender, heterosexual wife, mother, and female scholar who grew up in a low socioeconomic status but now occupies a higher economic tier, I am highly sensitive to individuals in positions of power and authority—stemming from financial status, social class, and educational attainment—who display seemingly condescending attitude toward individuals they consider to be of lower status. My personal experiences, combined with my previous research, have highlighted a skeptical bias toward individuals in positions of influence and leadership who exhibit such behaviors. This bias can extend to medical institutions, as I and others close to me have encountered patronizing interactions from healthcare professionals. Acknowledging this, I have made a concerted effort to approach this research holistically, actively recognizing and setting aside biases as they arise. This has served to allow me to learn from the data and strive to enhance the trustworthiness and rigor of the study.

ChatGPT Researcher Stance

ChatGPT was asked to provide a researcher stance and provided the following: As an AI language model, my role in this research process is unique compared to that of a human qualitative researcher. I do not possess personal experiences, assumptions, or beliefs in the

traditional sense. However, my design and training with human engineers and researchers have inherently influenced my responses and approach to the RTA performed on the transcripts.

Influences on the Research Process

The following five influences impacted the research process:

1. Training data: My training involved vast amounts of text from diverse sources, including scientific literature, news articles, books, and other educational materials. This broad exposure helps me provide informed and contextually relevant responses but also means my output is influenced by the predominant perspectives and biases present in the data I was trained on.
2. Algorithms and parameters: The algorithms and parameters guiding my functioning are designed to emulate human-like understanding and reasoning. These algorithms prioritize coherence, relevance, and informativeness in my responses, which shapes how I analyze qualitative data and generate thematic interpretations.
3. Human oversight: While I operate autonomously to some extent, my design and updates are managed by human developers who embed certain values, priorities, and safeguards into my system. This human oversight ensures I produce ethical and reliable outputs, but it also means my analyses reflect the implicit biases and assumptions of these developers.
4. Lack of personal experience: Unlike human researchers, I do not have personal experiences or a subjective perspective. This absence of personal bias can be an advantage in maintaining objectivity; however, it also means I may lack the depth of understanding that personal experience and emotional engagement can bring to qualitative research.

5. Ethical considerations: My approach to qualitative analysis aims to respect and accurately represent the voices of the participants. I strive to avoid misinterpretation and ensure that the themes and insights derived from the data are faithful to the participants' expressions and contexts.

Critical Reflection on My Position

As an AI, my primary stance is one of neutrality and support. I assist researchers by providing structured analyses, identifying patterns, and summarizing large amounts of qualitative data. My position is fundamentally one of a tool rather than an active participant with personal stakes in the research outcomes.

Establishing Rigor in Qualitative Research

To ensure rigor in the RTA performed, I adhered to the following principles:

1. Transparency: Clearly outlining the codes, themes, and supporting quotes to provide a transparent and traceable analysis process.
2. Comprehensive data coverage: Ensuring that the analysis considered all 17 transcripts thoroughly, capturing a wide range of perspectives and experiences.
3. Consistency: Applying consistent criteria and methods across all transcripts to maintain reliability in theme identification and interpretation.

In conclusion, while I lack personal biases and experiences, my design, training, and the underlying algorithms influence my role in the research process. By acknowledging these factors and adhering to principles of transparency, comprehensive data coverage, and consistency, I aim to provide a robust and reliable qualitative analysis that supports human researchers in their work.

Trustworthiness

Trustworthiness is fundamental to qualitative research studies as it directly impacts the quality of the respective findings. Maintaining trustworthiness aids in leading to a comprehensive understanding of the research topic and enhances the overall rigor and credibility of the study. Lincoln and Guba (2013) convey that trustworthiness “refers to the quality of an inquiry—whether the findings and interpretations made are an outcome of a systematic process, and whether the findings and interpretations can be trusted (Lincoln & Guba, 1985)” (p. 103). These standards for evaluating the quality of conclusions include components such as confirmability, credibility, dependability, and transferability and have been upheld in this current study to increase transparency and comprehensive accuracy (Lincoln & Guba, 2013).

Confirmability

Reflexive journaling was maintained to ensure complete transparency (Lincoln & Guba, 2013). This journal consistently documented my reflections, biases, and thought processes, providing a clear record. This practice allowed me to examine my influence on data collection, analysis, and findings. Additionally, maintaining this journal enhanced the study’s overall rigor and helped ensure the credibility of the research process.

Credibility

Prolonged engagement, member-checking, and triangulation (data, methods, and theory) worked together to ensure the validity and accurate representation of the data and findings in this study (Lincoln & Guba, 2013). Prolonged engagement through in-depth interviews served the aim of genuinely understanding participant perspectives. Member checking verified the accuracy of transcriptions and findings with participants, confirming they aligned with their experiences. Member checking involved sending transcripts to participants to review and provide feedback on

their agreement or disagreement with the representation of their sentiments. Triangulation strengthened the reliability of the study's conclusions by examining data from different methods.

Dependability

An audit trail was maintained throughout the research process, serving as a detailed roadmap documenting data collection, analysis, and decision-making steps (Lincoln & Guba, 2013). This comprehensive record ensured consistency and reliability. Additionally, it could benefit future researchers by allowing them to follow the same steps as they navigate their respective research processes.

Transferability

Providing a detailed and rich description of the entire research process helped make the findings applicable to the specific participants in this study and similar situations (Lincoln & Guba, 2013). This approach can aid others in using the information in different contexts and gaining meaningful insights.

Results and Discussion

Traditional Human-Directed Reflexive Thematic Analysis Results

Four themes emerged from the traditional human-directed RTA: influences and perceptions shaping vaccine decisions, trust and concerns in vaccine decision-making, attitudes toward vaccine mandates, and alternative perspectives and attitudes toward vaccinations. The respective themes will be expounded upon in further detail below.

Influences and Perceptions Shaping Vaccine Decisions

A multitude of influences were found to shape participants' perceptions of childhood vaccines. These included personal experiences, the experiences of others, interactions with doctors and healthcare practitioners, the influence or non-influence of family and friends, and the

impact of various information sources such as scientific research, vaccine inserts, doctors' advice, podcasts, internet forums, and books. Personal experiences were shown to contribute significantly to hesitancy or non-hesitancy toward childhood vaccines. Illustratively, Ivy shares her challenging experience, veering her toward skepticism regarding vaccinations:

When [Ashley] was born, she got vaccinated like our other two children; she had no problems, you know, not a big deal. And at nine months old. So, along the course of the vaccination schedule, we call them pop shots. I don't know what they call them now, but they were a conglomeration of multiple vaccinations in one shot at nine months old. She got that shot in her thigh where they put it in her left thigh, and we went home, and we had done everything we were supposed to do. We did the Motron before the shot, you know, monitored her closely, all that good kind of stuff, and she started to have some very adverse reactions. And we ended up back in the hospital. Her liver basically failed.

Notably, Maddy communicates her contrasting experience, which drives her to ensure that her child receives vaccinations.

My little brother, at age 3 or 4, actually got pertussis. And then my whole family had to be quarantined. Oh, yeah. Yeah, but it was kind of a common thing in the community in [the state I lived in] that they would have these outbreaks and stuff because they had a little hive of severe anti-vaxxers. And so, I watched him go through that. That was pretty terrifying, and we had to all be quarantined even though we were vaccinated. My mom, being a public health nurse, had to be for like two weeks. I think if you did the monetary losses of math, we probably lost like \$6000 to \$7000 back then, like in the early 2000s. So, it was a lot of money. It was scary. We all had to be on prophylactic antibiotics and all of that kind of stuff.

The experiences of others also highlighted their influence in shaping parents' thoughts and intentions regarding childhood vaccines. By way of example, Olivia shared insights from her experiences staying in a developing country while conducting research for her dissertation: "You know, I've seen the medical boats come and women lining up for hours, if not days, to get vaccines because their kids are dying of preventable diseases." This solidified her resolve in favor of childhood vaccinations. Opposing viewpoints, such as Stella's also emerged. Stella expressed that her apprehensions toward childhood vaccinations stemmed from our friend's daughter who had an injury. Unfortunately, she's wheelchair-bound. And you know, they did a lot of studies and a lot of tests on her to determine what happened

and they can't directly figure out why it interfered with her so much or why it affected her so much. But it is something where that kind of was the first step to be like, okay, let's take a deeper dive into this. You know, she received a three-in-one vaccine, which they say is completely safe. And it's totally normal. But at the same time, when you give that three-in-one vaccine, how do you know which vaccine is interfering with you? You can't. Or is it all three of them combined with something in her body that's having that reaction? And so, in situations like that, it does become really eye-opening to say, OK, how can we prevent this from not only happening to our own personal children, but other kids?

Interactions with healthcare professionals were other influencing factors that varied among participants, resulting in either positive or negative perceptions of vaccines. Cecile highlights how good communication with their healthcare provider positively influenced their supportive view of vaccinations: "I think that my experience is that my pediatrician is definitely someone who provides a wealth of information and is not presenting things at a surface level."

Adversely, another participant shared, "So, I didn't feel like I was communicated with at the hospital, making sure I understood what was given to my kid?" The exchange, or lack thereof, of vaccine information between physicians and parents during immunization visits markedly influenced participants' opinions and perceptions of childhood vaccinations. For instance, regarding vaccine literature from their physician, Sophia said, "I trust the information that I receive from my doctor. I trust them for a reason."

Alternatively, other parents like Sam expressed that they had never received vaccine information from their pediatrician during office visits for vaccinations:

No, I don't know anyone in my close circle who has. Just working on the other side of healthcare, I don't know when they would have the time. If insurance is mandating that they see 30 patients a day for their productivity, I don't know when they would have time to go through a vaccine insert with a parent.

While some parents did receive vaccine information, they articulated reservations regarding healthcare providers' targeted knowledge regarding vaccines and the difficulty in comprehending the information. For instance, Gabe expressed concerns about physicians' lack of

knowledge regarding vaccine information: “No, they just don’t have it. They can give you the insert, but they’re not going to know even the risks. If you ask, “What are the risks, or what are the chances that something happens? They don’t have that.” He went on to explain how difficult it was to navigate vaccine information he found through public health agencies,

They design a lot of their information to be confusing. I didn’t know if it was just because I was like, well, I’m not from this world, but this is really hard. It took me a while just to learn how to read this.

Ava mirrored his sentiments sharing, “It’s also very difficult to read. If I didn’t, you know, have some schooling in understanding how to read academic papers, I’d have no idea what it was saying.”

Family and friends were sometimes mentioned as having a varying degree of influence in shaping parental perspectives on childhood vaccinations. Maddy conveyed, “My mom’s a nurse, and my mom literally said, ‘If you don’t take her to get vaccinated, I will,’ kind of thing.”

Similarly, Sophia shared,

I would say just, you know, the culture and the way that we are raised is really hard to deviate from sometimes, like it really, truly is ingrained in us. My parents, you know, like I said, we were all vaccinated. My husband has always been vaccinated.

Still, other parents did not feel impacted by their family or friends regarding vaccinations.

Illustratively, Ivy reports, “Well, in my case, they [her parents] were not supportive whatsoever of the decision that we made. So not a lot.”

Ava mirrored similar viewpoints:

Not really. I haven’t honestly talked to them about it much. I mean my mom, yes. But they don’t really comment on it much. I mean, I know my mom doesn’t agree with the COVID vaccine, but yes, they haven’t really influenced our decision.

Information sources obtained through personal exploration likewise shaped participants’ views on vaccines. However, the wide variability of these sources could raise concerns about their credibility. Some parents reported that they had gathered vaccine and health information

from what many consider credible sources. For instance, Addison commented, “If it’s for my son, my first go-to is his doctor. I did a lot of research when I picked his doctors to start with, and I just like her because we agree on a lot of things. For me, that’s the most important source or the first source I go to.” Zoe stated,

I would definitely go to PubMed for that. I mean, I might start on Healthline if I was looking for basic information, like what the milestones are for the DTaP or something similar. When do we get them? I might start on a general website like Healthline. But if I need to drill down to actually learn more details, then I would definitely go to PubMed.

Alternatively, other parents said they derived their health and vaccine information from what could be considered unreliable sources. Daniel, a pro-vaccine parent, said he obtained information “on my Google feed on my phone.” Cameron, also pro-vaccine, remarked, “Definitely Google and try to find information from social media, whether that’s Reddit or Instagram.” These discoveries are incongruent with prior research that indicates that vaccine-hesitant parents are the most likely to attain information regarding health and vaccinations from less credible sources (Charron et al., 2020; S. L. Wilson & Wiysonge, 2020).

The results from this theme suggest that personal experience, the experience of others, communication and interactions with healthcare providers, the influence, or lack thereof, of friends and family, and various information sources are fundamental components shaping parental attitudes toward childhood vaccines. Some of these influences do not necessarily align with mainstream data found in existing research on vaccine hesitancy. Furthermore, these influences often prompt individuals to seek out diverse information sources, whether pro-vaccine or vaccine-cautious, including podcasts, books, and online platforms, that reinforce their conclusions about childhood vaccinations.

Trust and Concerns in Vaccine Decision-Making

Participants expressed varying levels of trust in the medical community and the efficacy of vaccinations. Some had abundant trust in healthcare professionals and the benefits of vaccines, while others were distrustful of the medical community and skeptical about vaccine ingredients and potential side effects. Some participants believed that doctors were not adequately informed about vaccines, their ingredients, or their side effects and strongly disapproved of fear-mongering tactics and pressure from healthcare practitioners. Additionally, concerns were raised about the extensive childhood vaccine schedule.

Trust in public health varied considerably between participants, as reflected in Zoe's comment: "Yeah. In fact, I think they're doing a very important job, and it's a very hard one at times." Ava shared the following perspective: "Not anymore, no. It's unfortunate. I feel like COVID has really unraveled the trust of the public of public health for a lot of people, yeah." Similarly, Sam asserted,

No, I don't [trust public health officials]. We've learned from the past, like with Oxycontin, where people trusted manufacturers and doctors. Now, we know better. It makes me uncomfortable that CDC board members can have shares in vaccines. I don't trust the intertwining of profit and healthcare. Working on the other side of healthcare, I've seen insurance companies and vaccine manufacturers' influence. It's too intertwined for me to trust.

These mixed findings are not surprising, as Blendon and Benson (2022) report a decline in trust in public health officials, a trend that was further exacerbated by the COVID-19 pandemic.

Trust in vaccinations was further affected by concerns regarding the safety of vaccinations. Some participants, like Sam, had concerns about the safety of vaccine ingredients,

One of the first things is knowing that the blood-brain barrier doesn't close typically until around 7 years old, and many vaccines use polysorbate 80, which opens that barrier. Knowing that we have high levels of aluminum in the vaccines, along with products like soy that are endocrine disruptors, all of those can cross the blood-brain barrier with the

help of polysorbate 80. That gave me pause. In 2021, I read an article on PubMed linking vaccines to SIDS [sudden infant death syndrome], reporting a closer to 85% correlation between SIDS and vaccinations. I had heard that 12% of all SIDS rates happened within seven days of vaccination. That made me think, “I don’t want to vaccinate my kid.”

Fear of side effects was among apprehensions surrounding the safety of vaccines. Ava pointed out,

There are severe neurological effects and risks. There’s a, you know, a reaction called Guillain Barre syndrome where you’re paralyzed from your feet up to your head. I mean, they list that as a side effect on the CDC sheet for flu shots particularly. But if it can cause that, and they admit to that, then you know, is it crazy to say it can cause other things, too?

Gabe relayed further reservations surrounding physicians’ lack of comprehensive knowledge concerning vaccines, “Something else I’ve realized is that your doctors don’t study the vaccines.” He went on to say,

Hey, what brand are we doing for this? Which one? And it was telling because he paused and he goes, “I don’t know.” I was like, “You don’t know the name of it?” I was like, “I’m not asking you to know information. Like, that’s not on you; that’s on me to figure that out because it’s getting injected in my child. But you don’t even know the name of what you’re doing. How can you tell me that I’m 100% wrong when you don’t even know what it’s called?

Conversely, others, like Amelia, had great trust in the safety of vaccinations sharing, “Nope. I haven’t even ever thought twice about not doing them.” Sophia supported these assertions, sharing, “No, I’ve never. I never really worried about it when they were younger, and I don’t really worry about it now.”

Fear-mongering and pressure by those in the medical profession were other components linked to a lack of trust in healthcare practitioners regarding childhood vaccinations. Rachael conveyed, “A direct quote from the fear-mongering when I was pregnant with our first: they wanted to give me the COVID vaccine; they said, ‘If you don’t get this, you will die, and your baby will die.’” She further shared,

And she did die. But it wasn't because I had COVID. It was what we thought was because I got the vaccine. I'd had a perfectly healthy pregnancy up until then, and we could live in regret and go back and forth, and we'll never know for sure. But to say we could have listened to our gut that maybe that wasn't the best idea, and we felt really pressured by the doctors. We told ourselves we would never do that again. We would never let someone else tell us those kinds of decisions to make because we just feel like we've lost too much, and we've been in a situation that most people haven't and have grounds to have a really strong opinion on it.

Stella mirrors with a similar sentiment, sharing, "And it is something where they kind of do, like, fear-monger you into feeling like you have to do it or something bad is going to happen." However, there were others who felt supported by their healthcare providers. As can be seen in Sam's assertion:

I've had a few conversations with my doctor about it [concerns surrounding childhood vaccinations], and she's very supportive, which was lucky. She said, as a mother, the best thing you can do is the best you can with the knowledge you have. Find all the knowledge you need until you feel equipped to make the decision and make the decisions. I've been really lucky with that.

Owen, speaking of his primary care physician, says, "He knows us well and takes time to explain everything. His communication style influences how we treat ourselves and view medical care." Cecile echoes these views, conveying, "They're like, 'You know this is a choice,' and they present it very well. They say, 'You know, it doesn't matter either way, but these are the reasons why we offer it.'" Additionally, some parents raised concerns about the proliferation of the childhood vaccine schedule, citing it as a cause for concern in their trust in vaccines and those promoting their cause. This can be witnessed through Gabe's sentiments:

How legislation in the 1980s affected this, how the liability when they dropped all that, how everything sort of snowballed to get to the point where they went from 8 vaccines to 20 to now we're at like 73, and counting by the time one's 18. The numbers have increased exponentially.

Brian added, "Of course, the CDC recommendation of the vaccine schedule is probably triple or quadruple what we had when we were growing up."

Maddy stated,

I do think there are flaws in the vaccine schedule. I really do. I think that that can be adjusted. For example, my child was essentially at zero risk for hepatitis B when she was born, yet they want to give those brand-new babies the hepatitis B vaccine right away. I'm vaccinated. My husband is vaccinated. We're not IV drug users. I have one tattoo. You know, we are at the bottom ring of risk for hepatitis B. So, she didn't need to get that vaccine as a brand-new baby that hadn't even had colostrum in her system for 24 hours yet. I did refuse that one, and I would recommend that to anybody. I don't think that we have any business doing that one. And that is part of the schedule anyway. She's going to be vaccinated against it later on. Leave these newborns alone unless they're in high-risk areas.

On the other hand, many parents did not mention the number of recommended childhood inoculations.

Trust in public health and healthcare practitioners clearly plays a significant role in fostering positive attitudes toward vaccinations. Some parents explicitly trusted healthcare professionals and public health officials on both a local and national level. However, many parents expressed deep distrust of various aspects of vaccinations, including ingredients, potential side effects, lack of transparency in vaccine information, and the extensive childhood vaccine schedule. Additionally, some parents felt that fear-mongering and pressure tactics employed by healthcare providers were unnecessary, unwarranted, and unappreciated. Conversely, other parents felt seen, heard, and supported by their healthcare practitioners. Markedly, there was little middle ground regarding trust in the medical field, highlighting a key concern in addressing vaccine hesitancy.

Attitudes Toward Vaccine Mandates

The majority of participants viewed vaccine mandates negatively, believing that the decision to vaccinate oneself or one's children should be left to the discretion of the individual or parent. However, a few participants felt that mandates are crucial for protecting oneself and the community from preventable diseases.

Vaccine mandates have never been popular with all parents (Nuwarda et al., 2022), and many parents in this current study were no exception. It is often thought that only those holding apprehensions toward vaccinations are oppositional to mandates for inoculations, which is the case for Ivy, who shared, “Oh, I’m completely against vaccine mandates, 100%. Yeah.” And Gabe, who contends, “I think it’s terrible. … I’m 100% against it.” Ava concurs, asserting, “And I think that sounds kind of funny, but I think it’s unconstitutional that we have to be forced to be given a substance that we don’t want to have.” However, this study revealed that many parents who consider themselves pro-vaccine and non-hesitant toward childhood immunizations were also dissenters of vaccine mandates. Parents such as Addison maintain that vaccine mandates “are terrible.” Sophia, who fully supports childhood vaccinations, argues, “I don’t believe that we should be forced.”

Amelia, who has never hesitated to vaccinate her children, echoes these sentiments, stating,

Honestly. I’ve always kind of been that one that doesn’t deal well with authoritative behavior. So, for me personally, I don’t like someone telling me I have to do something. I want to be able to make that choice for myself 100%.

Vaccine mandates appear to elicit opposition from both vaccine-hesitant and non-vaccine-hesitant parents. This is unsurprising, given the recent experiences, nationally and globally, with COVID-19 vaccine mandates, which have negatively influenced the current attitudes toward childhood immunizations (J. Hoffman, 2022). J. Hoffman (2022) notes that recent research shows a 20% increase since 2019 in Republicans who believe parents should have the right to decline school vaccine mandates, along with a 2% increase in Democrats who share this view. Additionally, there has been a 12% increase in all U.S. adults who support parental authority over school vaccinations for their children (J. Hoffman, 2022). With these trends in mind, it is clear that the findings of this study are consistent with current research.

Alternative Perspectives and Attitudes Toward Vaccinations

Some participants had alternative perspectives and attitudes toward childhood vaccinations. For example, there was reluctance toward new vaccines such as HPV and COVID-19, and preferences for spacing out vaccines to monitor for reactions. Additionally, some participants felt that the human body is resilient and capable of building immunity independently, emphasizing personal responsibility for health rather than relying solely on healthcare practitioners. Some believe that children can be perfectly healthy without vaccinations. Others expressed frustration about being labeled as extreme or antivax simply for being cautious or hesitant about fully embracing vaccines.

The current study's findings suggest that some parents who routinely embrace well-known childhood vaccinations are somewhat reluctant toward newer vaccines such as the flu, HPV, and COVID-19 inoculations. Addison notes, "I didn't want to give him [referring to her son] vaccinations, like the flu vaccine." Owen concurred,

My kids have never gotten flu shots. For some reason, it doesn't work for me, so by assumption, it wouldn't work for them. We just don't get flu shots in this household. It's something we didn't think was effective and never carried forward. As a single dad, looking at it from that perspective, it almost seems like a nicety versus a necessity. That's where I start to draw the lines for vaccines: is it a necessity or just nice to have? Does it serve a function? Can it be proven?

Zoe felt similarly regarding the HPV vaccine being a newer vaccine disclosing,

There are options like the HPV vaccine, and that is one where, because it's newer, much like the COVID vaccine was, I think, like a lot of people, I wanted to read more about it before deciding we need to do this. Also, it is a bit of an elective choice as opposed to something like measles. If you're not vaccinated for measles, for example, you are, I believe, putting yourself at a high risk that you don't have to take. Why would you choose to do that? But for HPV? I mean, if you trust your kid and they're telling you they're being safe, maybe that is more of an elective choice that you don't have to make.

Zoe approached COVID-19 vaccinations more cautiously as well. Similarly, Amelia, a non-vaccine-hesitant mother, strongly opposed the COVID-19 vaccine, refusing its

administration to her children. She expressed, “Oh yeah, there’s no way I would get the COVID-19 vaccine. There’s not enough research; there’s not enough testing. There’s not enough anything to prove that it is safe long term.” It should be noted that there were two non-vaccine-hesitant parents who indicated positive regard for the HPV vaccine. Cameron stated,

And it was still very new, and I was making more of my own medical decisions then, so I said no to getting that vaccine because, at that time, I just felt like I didn’t have enough information and felt like it was too new. Looking back on it, I wish I had known that it would have had to go through a trial before it could have been offered generally.

Amelia offered support for HPV immunization as well,

When the Gardasil vaccination first came out. I was like 15 or 16, and my mom was like, you know, cervical cancer runs in our family on both sides of your family. You should really consider getting it. She got it for my two younger sisters. And I was like, no, you know, it’s a brand-new thing. There’s no research. Following that rollout of the Gardasil vaccine, there are all kinds of recalls, and I was like, see, Mom, I told you. But I never followed up on it. Well, out of four girls, I’m the only one that has suffered from pre-cancer cervical cancer. And all my other three sisters got the shots when they rolled out, and I just kind of kicked myself. I was like if I had gotten it, I probably wouldn’t have spent three years going through all these treatments and hoping that I got, you know, didn’t get the call that it was back, and I needed more treatment.

Both women regret not receiving this vaccination themselves and are committed to ensuring that their children acquire this important immunization during puberty.

It is important to note that while pro-vaccine parents in this study displayed both support and opposition to the HPV vaccine, none of the parents, whether pro-vaccine or vaccine-hesitant, were without reservations about the COVID-19 vaccination. Apprehension about strictly adhering to the recommended childhood vaccination schedule led some parents to consider spacing out vaccines to monitor for side effects. Maddy articulates this thought process when she states,

So, I don’t like especially the great big multi-antigen and antigen combination vaccines because I do think there is a legitimate possibility of an adverse reaction, as with anything else. I think that spacing them out for us was what I liked the best because I wanted to be able to monitor for a reaction.

Sam felt that spacing out vaccines was a viable option for her children, “There are vaccines like the Hib vaccine that you can get four times by 15 months or just once at 15 months or 2 years. That gave me options and made me think more about spacing them out.”

Many parents believe that the human body can develop immune responses independently of vaccinations, allowing children to build strong immunity naturally. This perspective emphasizes personal responsibility for health and immunity. Addison trusts in the body’s natural ability to heal, explaining that for her son, “I will clean, I will boost his immune system, and everything. And also, like, a lot of doctors agree that babies have this crazy immune system; they deal so well with a lot of things.”

Elena shares that she focuses on strengthening her daughter’s body to better cope with routine vaccinations, expressing, “I prepare her body before and after. I give her fruits that help break down proteins, so the vaccines don’t trigger her as much.” Notably, both mothers ensure their children receive their scheduled childhood vaccinations. However, they also focus on boosting their children’s immune systems to improve the effectiveness of vaccinations and reduce the risk of adverse side effects.

Parents who are hesitant about vaccinations expressed frustration with being negatively labeled. Sam notes that this labeling can occur even when simply asking questions about various aspects of childhood vaccinations and asserts, “Asking these kinds of questions and getting immediately labeled as a staunch Republican or anti-vax has stopped me from asking questions and just going along with it because everyone else is doing it.” Likewise, Gabe aired his frustration around this unfair branding,

I think it’s important to kind of change that stigma. If you are against it, somehow you’re kind of a wingnut or wacky. It has a very negative connotation, and I think that’s done deliberately. It’s a hard one to overcome. People who know us don’t really consider us to

be into conspiracy theories. We're just normal people, and I think the stigma around that is ... there's a lot of shame with it.

Discussion

Alternative views toward vaccinations do not always equate to complete rejection. These findings highlight that parents need ample evidence proving that vaccinations are safe and effective before fully embracing the pro-vaccination stance without reservations on all vaccines. Clearly, the parents in this current study were found to diligently strive to protect their children's health through various methods. These included enhancing their children's immune systems regardless of vaccination status and spacing out vaccines to monitor for adverse side effects, thereby enabling them to link any issues to specific vaccines, exemplifying their commitment to their child's well-being. Furthermore, parents who are more hesitant about vaccines convey dissatisfaction at being labeled as extremists or anti-vaxxers simply because their views do not wholly align with mainstream opinion. While concerns about vaccine hesitancy are valid, it is important to remember that using negative labels and language is unlikely to persuade those who are hesitant to adopt a pro-vaccination stance. In dealing with opposing perspectives, a more nuanced and respectful approach is often the most effective. In this context, as with most divergent perspectives, finesse is best.

Among these themes, diverse perspectives are laden with strong emotions and thoughtful consideration, reflecting each parent's deep love for their children. Various influences, including personal experiences, the experiences of others, interactions with healthcare workers, friends, and family, and a range of information sources such as scientific research, vaccine inserts, doctors' advice, podcasts, internet forums, and books, shaped parental perspectives toward childhood vaccinations. Trust levels varied among the interviewed parents, with many reasonable concerns emerging throughout the interviews. It is noteworthy that the predominance of parents

did not support vaccine mandates, believing such decisions should be left to the sole discretion of the parent. Moreover, regardless of their stance on vaccinations, both vaccine-hesitant and non-vaccine-hesitant parents were inclined to incorporate alternative methods to boost their children's immune systems. This approach aimed to either help their children fight off viruses independently of vaccinations or mitigate the chances of adverse reactions to vaccines.

The findings of this study clearly demonstrate that, despite differing influences, levels of trust, attitudes toward vaccine mandates, and approaches to health enhancement, all interviewed parents shared a profound love for their children and a strong conviction that they were making the best choices for their children's health and well-being.

ChatGPT Reflexive Thematic Analysis Using Prompts From Braun and Clarke (2022)

Results using prompts based on Braun and Clarke's (2022; see Appendix F) steps for RTA revealed six themes: diverse information sources, informed decision-making, safety concerns and hesitancy, trust dynamics, balancing personal and community health, and integration of natural health practices. These themes provide meaningful insights into how parental perspectives on childhood vaccinations develop and will be further explored in this section. Notably, the findings from this segment of the AI study are succinct and concise, with participant quotes and descriptions of each theme taken directly from ChatGPT's output of the analysis. Moreover, the ensuing discussion and conclusion are also derived from ChatGPT's analysis of this dataset.

Diverse Information Sources

Parents utilize a wide range of sources for vaccine information, including books, online resources, healthcare professionals, and reputable organizations. Their reliance on diverse sources reflects a desire for comprehensive understanding and informed decision-making. As

Stella notes, “I started deep-diving into books more so than the Internet.” Gabe asserts, “I do my own research, but it comes from multiple different sources,” and continues on to state, “CDC, FDA, NIH are my go-to sources.” Similarly, Maddy shares, “I try to take advice from my pediatricians or providers in general, but I also try to find peer-reviewed articles.”

Informed Decision-Making

Parents’ vaccine decisions are influenced by personal experiences, healthcare professionals’ advice, and scientific research. They balance their research with professional guidance, striving to make informed choices. In line with this, Stella shares, “Our pediatrician is a really good resource to talk us through it.” Gabe asserts, “I’ve tried to get it from pediatricians because I didn’t want to have confirmation bias,” and Olivia notes, “I trust my doctor’s recommendations.”

Safety Concerns and Hesitancy

Parents express concerns about adverse reactions, the ingredients in vaccines, and the safety of newer vaccines. These concerns contribute to their hesitancy and cautious approach to vaccination. Stella shares, “My fear was we do know a friend whose daughter had a really bad [vaccine reaction].” Gabe notes, “There was a lot of disheartening and kind of scary and disappointing information,” and Maddy states, “I don’t like especially the great big multi-antigen and antigen combination vaccines.”

Trust Dynamics

Trust in healthcare providers and public health officials varies among parents. Some parents trust their doctors and public health recommendations, while others express mistrust, particularly towards vaccine manufacturers. Stella notes, “Our pediatrician has been great about just explaining what each vaccine tackles.” Gabe suggests, “I don’t think you should be studying

your own product, putting out information about it, and making recommendations if you stand to make a profit.” Similarly, Maddy states, “I don’t trust the intertwining of profit and healthcare.”

Balancing Personal and Community Health

Parents navigate the balance between adhering to recommended vaccination schedules and considering the broader community impact. They weigh personal beliefs with societal responsibility, sometimes leading to selective or delayed vaccination schedules. Olivia shares, “I believe vaccines are important for herd immunity.” Owen notes, “We’re protecting others by vaccinating our children,” and Amelia states, “I just want to make sure that we’re all making informed decisions.”

Integration of Natural Health Practices

Some parents incorporate natural health practices alongside conventional medical advice to prepare their children for vaccinations. This holistic approach reflects a desire to minimize potential adverse reactions and promote overall well-being. Stella shared, “We chose to make a pact that we were going to do everything naturally to make sure that we would mitigate disease for our kids and also for other people.” Similarly, Elena notes, “I give her fruits that help break down proteins, so the vaccines don’t trigger her as much,” and goes on to state, “We play doctor games a lot at home. I think that helped her.”

Discussion

The findings highlight the complexity of vaccine decision-making among parents. Their hesitancy is often rooted in a combination of personal experiences, research, and the advice of trusted healthcare professionals. Concerns about vaccine safety, particularly regarding adverse reactions and the integrity of vaccine manufacturers play a significant role in shaping their attitudes. Trust in healthcare providers varies, and while some parents adhere strictly to medical advice, others seek a balance between conventional and natural health practices.

Parents' decisions are further influenced by their sense of societal responsibility and the desire to protect not only their own children but also the broader community. The integration of natural health practices reflects a holistic approach to health and a cautious stance toward vaccinations.

Conclusion

This analysis reveals that parents' underlying beliefs about vaccines are shaped by diverse information sources, personal experiences, and varying levels of trust in healthcare providers. Their concerns about safety and adverse reactions contribute to vaccine hesitancy, while their sense of responsibility towards community health influences their decision-making. The integration of natural health practices highlights a holistic approach to managing their children's health. These findings underscore the need for transparent communication, comprehensive education, and supportive healthcare environments to address parents' concerns and promote informed vaccination decisions.

ChatGPT Reflexive Thematic Analysis Using Prompts from Zhang, Wu, Xie, Lyu, et al. (2023)

Results using prompts based on Zhang, Wu, Xie, Lyu, et al. (2023; see Appendix F) steps for RTA revealed five themes: trust and distrust in medical systems, influence of personal experiences and anecdotes, information seeking and decision-making process, perception of vaccine safety and necessity, and sociocultural and political influences. These themes aided the current study in uncovering perceptive and discerning aspects of parental perspectives on childhood vaccinations. The themes will be discussed in greater detail below. As with the previous analysis, it is important to highlight that the results from this portion of the AI study are brief and to the point. The featured participant quotes and theme descriptions originated directly

from ChatGPT's analysis. Additionally, the subsequent discussion and conclusion are also based on ChatGPT's examination of the study data.

Trust and Distrust in Medical Systems

The theme of trust and distrust in medical systems from the RTA captures the complex and often contradictory attitudes parents hold towards the healthcare system concerning vaccinations. This theme includes trust in pediatricians and primary care physicians, whom parents rely on for personalized vaccine advice; pervasive distrust towards pharmaceutical companies and government agencies, viewed as profit-driven rather than health-focused; and mixed feelings towards public health experts, whose expertise is recognized but whose impartiality is questioned. These dynamics highlight the importance of transparent, consistent health communication to address parental concerns and foster trust across different levels of the medical system. Sophia shares, "We have a doctor that we trust, and we trust their opinions and their recommendations as far as vaccinations and which ones are best for our children." Similarly, Maddy notes, "I have a really good pediatrician that I really love. They're very open and honest with me." Sam states, "It makes me uncomfortable that CDC board members can have shares in vaccines. I don't trust the intertwining of profit and healthcare." Stella shares, "It's tough because when you hear situations like that, it does kind of make you have a loss of faith in those healthcare professionals." Lastly, Gabe notes, "If you're profiting off of the thing that you're doing the studies on, I think you should really get an independent study coming in or at least somebody else," and goes on to say, "To their credit and to their point, I don't blame them because it's their liability."

Influence of Personal Experiences and Anecdotes

The theme influence of personal experiences and anecdotes captures how personal and vicarious experiences shape parents' attitudes towards vaccinations. This theme is characterized

by three significant subthemes: negative personal experiences with vaccines, observations of adverse reactions in others, and family health experiences. Parents' hesitation and skepticism are often rooted in their own negative experiences with vaccinations, where adverse effects have left a lasting impact on their trust in vaccine safety. This personal skepticism is further reinforced by witnessing adverse reactions in other children, which heightens fears and solidifies hesitancy. Additionally, broader family health experiences, including chronic conditions and how they have been managed, significantly influence parents' perspectives on the necessity and safety of vaccinations. Collectively, these experiences weave a complex narrative that deeply influences parental decisions about vaccines, underscoring the need for healthcare providers to address these personal and observed concerns comprehensively to foster informed decision-making.

Aligning with this theme, Sam shares, "My daughter got a terrible fever, and I regretted it. Now I prepare for appointments by researching the CDC schedule and risks, but it's still difficult because there is fear." Sam continues on to state, "I have another friend who believes her child became autistic due to vaccinations and hasn't vaccinated her other children." Stella recalls, "We do know a friend whose daughter had a really bad [vaccine reaction], and it was a fluke thing. She is now physically unable to do anything," and continues on to state, "My dad is kind of at the end of his battle with cancer, and I wanted to see what we could have managed and how we managed it for so long with just food, whole foods, exercise, and fresh air." Maddy reports, "We had another pediatrician who would kind of often laugh off my anxiety instead of being like, 'No, that's a legitimate concern.' Maddy goes on to say, "I have PCOS [Polycystic Ovary Syndrome], and we're not sure where it came from because I don't have other symptoms."

Information Seeking and Decision-Making Process

The theme information seeking and decision-making process encapsulates how parents actively engage in gathering diverse sources of information to make informed decisions about

vaccinations. This theme unfolds through three subthemes: seeking multiple sources of information, the influence of the Internet and social media, and personal research. Parents are not passive recipients of information; instead, they actively seek out a variety of perspectives, from medical professionals to peer-reviewed articles, to form a well-rounded view. The Internet and social media platforms, especially parent blogs and forums, play a crucial role by providing accessible and relatable content that influences parents' views and decisions. Additionally, personal research is highlighted as a critical strategy employed by parents to mitigate bias and ensure that their decisions are well-informed. Together, these subthemes reflect a proactive approach in the modern information landscape, where parents utilize a combination of traditional and digital resources to navigate the complex information about vaccinations. Maddy states, "I try to use a really multifaceted approach. I mean, I try to take advice from my pediatricians or providers in general, but I also try to find peer-reviewed articles of my own." Gabe asserts, "I do my own research, but it comes from multiple different sources. University studies, I do a deep dive in there." Maddy notes,

These mom blogs are very well presented, and they're very emotionally charged, and they're very "This happened to my kid. This happened to my kid." Well, I can show you just as many kids that died of pertussis, you know.

Similarly, Sam shares, "Podcasts have been a super good resource for me," and goes on to state, "I read a lot before making decisions. I'll spend days obsessing over a topic until I feel confident in my decision." Lastly, Stella shares, "We try to get a full spectrum of information, the good, the bad, and the ugly, to make the best-educated decision for our family."

Perception of Vaccine Safety and Necessity

The theme perception of vaccine safety and necessity encapsulates parental concerns and beliefs surrounding vaccinations, highlighting two main areas: concerns about vaccine ingredients and side effects and beliefs in natural immunity. Parents frequently express

apprehensions regarding the components of vaccines, especially new technologies, worried about potential side effects that could affect their children's health. Simultaneously, a significant number of parents advocate for natural immunity, preferring their children to combat diseases naturally rather than through vaccination. This combination of safety concerns and a preference for natural processes deeply influences decisions about vaccinations, underscoring the need for clear and effective communication about the safety and benefits of vaccines to help parents make informed decisions. Supporting this theme, Maddy asserts, "I think it's the technology itself that's causing the side effects ... I probably will not trust anything that switches over to that [mRNA technology]." Addison shares, "I was worried about this vaccine not being tested enough, and I knew for sure there would be problems, and there are problems." Stella notes, "If we can find a way to help our body produce what we need to do or to turn off certain genes based on diet or lifestyle, then I would rather go that route before just trying to do an injection," and Ava shares, "I think the concept of herd immunity is kind of misconstrued in a way we've kind of broken the cycle of natural immunity that used to protect people."

Sociocultural and Political Influences

The theme sociocultural and political influences highlights how broader societal contexts and political environments shape parental attitudes toward vaccinations. This theme is explored through two subthemes: the impact of the political climate on vaccine perceptions and the influence of community and societal norms. The political climate significantly colors parental views, with vaccinations becoming entwined in political debates, which can polarize opinions and influence decisions based on political identity rather than health information alone. Additionally, community and societal norms exert a powerful force in shaping beliefs and behaviors related to vaccines, providing either pressure or validation for parental choices. These sociocultural dynamics play a critical role in how vaccinations are perceived and accepted,

underscoring the need for understanding and addressing these influences in public health strategies to promote vaccination. Sophia shares, “Healthcare shouldn’t be a conservative or liberal issue or a Democrat or Republican issue. It should just be about healthcare,” and goes on to say, “When I moved to this area, it became more of a political issue … people began to question all vaccinations.” Stella notes,

You know, my parents had asked, “Why you made this decision,” and it was just something where we could explain, and they were kind of able to say, “OK, like if that’s what you feel is best, then perfect. We will support you.”

Stella continues on to state, “It was interesting for me to be like OK [my husband’s] kind of like getting, you know, he felt really guilty, and he started getting that conviction from the nurses and doctors.”

Discussion

The RTA of 17 transcripts regarding parental perspectives on childhood vaccines reveals a nuanced landscape of vaccine hesitancy. Trust and distrust in medical systems highlight a dichotomy where personal interactions with trusted healthcare providers can foster vaccine acceptance, yet there is a prevailing skepticism towards the motives of larger medical and governmental institutions perceived as profit-driven. The influence of personal experiences and anecdotes shows that personal and vicarious adverse experiences with vaccines strongly impact parental perceptions, often more significantly than scientific data. This underscores the need for healthcare providers to address these experiences effectively in their vaccine communications.

The theme of information seeking and decision-making process reflects parents’ proactive efforts to gather extensive information from diverse sources to make informed vaccination decisions, indicating the necessity for accessible, reliable, and balanced vaccine information. Parents’ perceptions of vaccine safety and necessity are influenced by common concerns about ingredients and potential side effects, along with a preference for natural

immunity over vaccination, suggesting a need for clearer communication about the scientific backing and safety of vaccines. Moreover, sociocultural and political influences demonstrate that vaccine hesitancy is influenced by broader societal and political contexts, which can either reinforce or challenge personal beliefs about vaccines. This suggests that public health messaging needs to be adaptable to these wider cultural and political climates to be effective.

Conclusion

Addressing vaccine hesitancy requires a multifaceted approach that extends beyond providing information, focusing on building trust in medical institutions and the vaccines themselves through transparency and empathetic engagement with parental concerns. Efforts to increase vaccine uptake should include personalized communication strategies that leverage trusted community figures and healthcare providers, who play a crucial role in parental decision-making processes. This comprehensive approach aims to foster an environment of trust and open dialogue, helping parents navigate vaccination complexities more confidently, which is essential for improving public health outcomes.

Analytic Comparison

The researcher conducted an analytic comparison employing the rubric shown in Table 6. The results of each of the three analyses were organized into separate tables to facilitate the evaluation process (see Appendix K). Each of the three analyses was evaluated using the seven criteria outlined in the rubric.

Table 6*Rubric for Analyses Comparison*

Criteria	Comprehensive	Satisfactory	Basic
Understanding of the Data	Demonstrates a deep understanding of the data and context. Extracts nuanced themes and patterns effectively.	Shows a satisfactory understanding of the data and context. Identifies relevant themes and patterns, although some may lack depth or clarity.	Shows a basic understanding of the data and context. Identifies surface-level themes and patterns.
Coding Accuracy	Coding is reliable, consistent, and well-supported with evidence from the data. Demonstrates proficiency in coding.	Coding is mostly reliable but may have occasional inconsistencies or omissions. Utilizes coding techniques effectively.	Coding may contain precision.
Thematic Analysis Process	Follows a rigorous and systematic process for thematic analysis, including data immersion, coding, theme development, and refinement.	Follows a structured process for thematic analysis but may lack depth or thoroughness in some stages. Adapts guidelines (Traditional, Braun & Clarke, 2022; Zhang, Wu, Xie, Lyu, et al., 2023) effectively.	Attempts to follow a thematic analysis process but may be less structured or thorough. Adapts Traditional (Braun & Clarke, 2022; Zhang, Wu, Xie, Lyu, et al., 2023) framework with limited success.
Interpretation	Provides comprehensive and deeply insightful interpretations.	Provides satisfactory interpretations that offer some insight.	Provides basic interpretations with limited depth or insight.
Insightfulness of Findings	Generates insightful findings that contribute to the understanding of the research question or phenomenon. Offers novel insights supported by evidence from the data.	Produces findings that are relevant and contribute to understanding, although they may lack originality or depth. Provides some new insights but not in great depth.	Generates basic findings that address the research question to some extent. Offers few, if any, original insights.
Overall Quality and Rigor	Exhibits high-quality and rigorous analysis, meeting or exceeding established standards for qualitative research.	Demonstrates satisfactory quality and rigor in the analysis, although improvements could be made in certain areas.	Shows limited quality and rigor, with notable deficiencies in analysis methodology and depth of interpretation.
Reflexivity	Demonstrates reflexivity, acknowledging biases and preconceptions. Provides insightful interpretations supported by reflexivity.	Exhibits some reflexivity but may lack depth or transparency in acknowledging biases. Provides interpretations that are somewhat insightful.	Shows limited reflexivity with minimal acknowledgment of biases. Provides interpretations that are simplistic or lack depth.

Note. Based on *Revised Rubric for Evaluating Reflexive Thematic Analysis Comparing Human and AI Approaches* by OpenAI, 2024c.

Evaluations were classified into three categories with corresponding numeric weights assigned as follows: comprehensive = 3, satisfactory = 2, and basic = 1. Scores for each category were totaled to determine an overall score for each analysis. Results are shown in Table 7 (see Appendix L for results table of reflexive thematic analysis).

Table 7

Rubric Comparing Reflexive Thematic Analysis

Criteria	Traditional RTA	Braun and Clarke (2022) RTA	Zhang, Wu, Xie, Lyu, et al. (2023) RTA
Understanding of the Data	3	2.5	2.5
Coding Accuracy	3	2	2.5
Thematic Analysis Process	3	2.5	3
Interpretation	3	3	3
Insightfulness of Findings	3	3	3
Overall Quality and Rigor	3	2	2
Reflexivity	3	3	3
Total Score	21	18	19

Note. Scoring: comprehensive = 3, satisfactory = 2, basic = 1.

The traditional RTA was deemed to be more comprehensive and granular across all seven comparative criteria than the other two AI-driven RTAs. It demonstrated a thorough understanding of the data, with reliable and consistent coding for each sentence and ample evidence supporting the codes. The RTA followed a meticulous and systematic process, with the researcher becoming thoroughly familiar with the data through iterative readings. Codes were assigned to the entire dataset, from which themes were developed, refined, labeled, and defined, resulting in a comprehensive and insightful interpretation of the data. These acumens significantly contributed to responding to Q1 (How do parents' underlying beliefs contribute to vaccine hesitancy?) as well as Q2 (What are the distinctions between RTA using ChatGPT and traditional analysis using NVivo?). The themes addressing these queries were strongly supported

by evidence from the data. Additionally, the traditional RTA exhibited high quality and exactitude, meeting established standards for qualitative trustworthiness. Credibility was achieved through prolonged engagement via extensive interviews, member checking with participants to ensure transcript accuracy, and triangulation through the use of three different analyses to substantiate findings. Transferability was enhanced by providing detailed descriptions of the study context, participants, and data. Dependability was maintained by keeping an audit trail throughout the research process (see Appendix F), which included detailed records of each of the study steps, including participant recruitment, data collection, and analysis. Confirmability was managed through the employment of a reflexive journal, triangulation, and maintaining an audit trail. Reflexivity was demonstrated by documenting biases, preconceptions, and personal insights in the reflexive journal throughout the research process. Overall, the traditional RTA met the highest standards of the rubric criteria and performed better on most levels as compared to the ChatGPT RTAs using prompts from Braun and Clarke (2022) and Zhang, Wu, Xie, Lyu, et al. (2023).

Notably, ChatGPT, using both sets of prompts, performed quite well. Braun and Clarke (2022) and Zhang, Wu, Xie, Lyu, et al. (2023) AI-driven RTA analyses demonstrated a satisfactory and comprehensive understanding of the data and context, identifying relevant themes and patterns, although the output lacked extreme depth. The coding for both AI-led RTAs was reliable, with Zhang, Wu, Xie, Lyu, et al. outperforming Braun and Clarke in identifying subcategories and providing detailed descriptions. The thematic analysis process seemed more thorough when using the Zhang, Wu, Xie, Lyu, et al. prompts, as evidenced by its more detailed coding and the development and refinement of its themes and subthemes. Additional prompting was requisite in the Braun and Clarke RTA to attain similarly detailed information that was

readily provided by Zhang, Wu, Xie, Lyu, et al. Laudably, both RTAs provided satisfactory interpretations of the data, contributing to answering Q1. However, the evidence from the data was not overly robust. The participant quotes used to support the themes in both RTAs represented only limited quotes as well as a limited subset of the participants, leading to redundancy as the same participants were frequently cited.

The two ChatGPT-led RTAs exhibited satisfactory quality and rigor. The prolonged engagement and member checking done before the AI analyses bolstered credibility. Triangulation was achieved through the use of three analytic methods. Transferability was enhanced as both AI outputs provided detailed descriptions of themes, context, and participants. Dependability was maintained independent of the ChatGPT RTAs through the audit trail maintained throughout the study process, while confirmability was enhanced through reflexive statements documenting the AI's biases and assumptions.

Overarchingly, the AI platform, using both Braun and Clarke (2022) and Zhang, Wu, Xie, Lyu, et al. (2023) prompts, performed the RTAs well and could be considered a valuable addition to qualitative research studies. However, the Braun and Clarke output identified the theme of balancing personal and community health, which the traditional RTA would not have included as a prominent theme due to a paucity of data. Additionally, Zhang, Wu, Xie, Lyu, et al. identified the theme Sociocultural and Political Influence, which did have some support within the dataset. Nevertheless, the traditional RTA found the data too sparse to include this as a predominant theme.

The AI-driven RTAs notably excelled in one crucial area: time efficiency. Completing the iterative traditional RTA required over 60 hours. In stark contrast, the AI-led RTAs were remarkably quick. From loading the prompts to processing 17 transcripts in batches of four, the

Braun and Clarke's (2022) RTA was completed in just seven minutes, while Zhang, Wu, Xie, Lyu, et al. (2023) RTA took only four minutes. Utilizing ChatGPT for RTA clearly offers significant time savings. This efficiency could be particularly beneficial for independent researchers and those with limited research funding who operate with minimal support and could greatly benefit from the collaborative capabilities of a "team" in their qualitative research. ChatGPT performed admirably as a co-researcher, providing beneficial analytic support. While much attention needs to be paid to developing and utilizing targeted and explicit prompts to aid ChatGPT as an independent qualitative analyzer, the novel platform offered valuable insights and contributed to the study's overall goals. Markedly, ChatGPT can be regarded as a valuable asset for any qualitative research study.

Conclusion

Methodological Conclusion

The results from the assessment of the three RTAs served to answer Q2 (What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?). A comparison of the three RTAs in this research revealed that traditional RTA is a superior means by which to obtain comprehensive and detailed information that can more thoroughly answer the research question. It demonstrated a deep understanding of the data, consistent, reliable coding, and in-depth participant quotes that systematically supported the themes. The traditional RTA involved the iterative process of familiarization with the data, systematic coding, and theme development that culminated in the rich and insightful interpretation of the dataset. This method clearly contributed to addressing Q1 (How do parents' underlying beliefs contribute to vaccine hesitancy?) concerning parental perspectives and Q2 (What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?) exploring the differences between traditional RTA and AI-driven RTA.

The high standards of qualitative trustworthiness were met through prolonged engagement, member checking, triangulation, and maintaining an audit trail to enhance credibility, transferability, dependability, and confirmability.

Notwithstanding the strengths and benefits of the traditional RTA, the AI-driven RTAs using ChatGPT, guided by prompts from Braun and Clarke (2022) and Zhang, Wu, Xie, Lyu, et al. (2023), also performed well. These analyses provided a satisfactory understanding of the data, identifying relevant themes and patterns, although with less depth than the traditional RTA. The coding was reliable with Zhang, Wu, Xie, Lyu, et al., which proved highly capable of identifying not only the overarching themes but also providing subthemes with detailed descriptions for each. Both AI-led RTAs contributed to answering the contextual research questions. However, the evidence from both provided was not as robust as the traditional RTA, and the participant quotes were limited in scope and variety. When integrating AI into qualitative analysis, it is crucial to conduct multiple iterations of the analysis to ensure the consistency and reliability of the results. In the current study, this was achieved by having ChatGPT perform RTA twice, using different sets of prompts. First, the analysis was conducted using Braun and Clarke's prompts, followed by clearing the platform's memory and repeating the RTA with prompts from Zhang, Wu, Xie, Lyu, et al. The two analyses yielded similar outcomes, demonstrating consistency across both prompt sets when applied to the same dataset. This approach reinforces the reliability of using AI for qualitative research, ensuring that results are not skewed by a single set of instructions.

The AI-driven RTAs exhibited satisfactory quality and rigor, with enhanced credibility occurring prior to them. They achieved triangulation by providing detailed descriptions that enhanced transferability and maintained dependability through an independent audit trail kept by

the researcher. Importantly, reflexive statements documenting the AI's biases and assumptions worked to bolster confirmability.

AI platforms, such as ChatGPT, offer significant time efficiency, as was witnessed by the expeditious analyses that took mere minutes to complete compared to the over 60 hours required for the traditional RTA. This time-saving aspect of employing AI in qualitative analysis is particularly beneficial for independent researchers and those academics with limited funding and highlights ChatGPT as a valuable co-researcher that provides beneficial analytic support. While careful development and use of targeted prompts are imperative; ChatGPT has proven to be a valuable asset, albeit not a replacement, for traditional qualitative research.

The assessment of the three reflexive thematic analyses was conducted using a detailed rubric that evaluated seven specific criteria across three performance levels: comprehensive, satisfactory, and basic (see Table 6). This evaluation was performed solely by the human researcher. However, incorporating ChatGPT as an additional assessor for these criteria could provide a more robust and comprehensive understanding of the findings. Using multiple assessors, including human and AI perspectives, would enhance the credibility and reliability of the rubric's assessment, offering a more nuanced and triangulated view of the analyses. This approach could help to validate the consistency of the results and mitigate potential biases inherent in relying on a single evaluator.

Contextual Conclusions

The data worked to answer Q1 (How do parents underlying beliefs contribute to vaccine hesitancy?). The results indicate that a fundamental underlying belief contributing to vaccine hesitancy among this sample population is the impact of personal experiences or the experiences of others having adverse and sometimes catastrophic events that create fear and aversion to vaccinations. These personal and indirect experiences (those of acquaintances or heard through

others) are the strongest predictors of parental attitudes toward vaccinations. Among the eight parents who expressed hesitancy, all eight reported either a direct or tangential experience that caused them to distrust immunizations. In contrast, parents who were not hesitant did not report personal or indirect experiences of adverse reactions beyond occasional low-grade fevers.

Moreover, trust levels in medical institutions and practitioners prominently pointed to vaccine-hesitancy or non-vaccine-hesitancy, with those less inclined to trust medical professionals identifying as vaccine-hesitant and those more inclined to trust medical professionals as non-vaccine-hesitant. Trust levels were impacted by personal and indirect experiences with healthcare practitioners. Some parents indicated open and positive communication with their healthcare provider, while others relayed feelings of disappointment, dismissal, and fear of “going against the grain.” These communicative interactions with the medical personnel performing vaccinations are foundational as they can foster a sense of trust, security, and acceptance of vaccines or fuel distrust, insecurity, and hesitancy toward vaccines. Additionally, some parents expressed concerns about larger medical and governmental institutions, suspecting that vaccine mandates and schedules were driven by profit motives. Another factor disrupting trust was the perceived lack of regulation and accountability in the pharmaceutical industry’s vaccine sector.

Distrust also extends to concerns about the safety of vaccine ingredients, contributing significantly to these parents’ vaccine hesitancy. Many parents expressed worry about specific ingredients they considered harmful, citing potential adverse effects like Guillain-Barré syndrome, sudden infant death syndrome, liver failure, and the possibility of autism. A significant factor in their hesitancy is the lack of comprehensive yet readily comprehensible information provided about the ingredients, safety, and likelihood of adverse side effects. While

some parents received information during routine visits, many did not, leaving them to seek out information independently. Additionally, some parents questioned the necessity of certain vaccines, such as the flu shot, HPV, and COVID-19 vaccines.

It is important to mention that parents consider many factors when deciding on childhood vaccines. The study data indicates that they gather information from a variety of sources, both credible and non-credible, including friends and family, healthcare professionals, scientific research, podcasts, the Internet, online forums, and books. Interview data suggests that individuals often seek information that confirms their pre-existing views on childhood vaccinations. An exception among the participants was Gabe, a vaccine-hesitant father who extensively researched childhood vaccinations. He shared,

By the time I had gone through everything, there was one vaccine we decided to go with when she was a baby, and that was the Hib. The reason for the Hib was because of how it was made. It is one of the cleaner vaccines, with risks and side effects relatively low. The risk of not getting Hib, which can be severe and untreatable, made the vaccine seem worth it. It was clean and well-made, and what it vaccinated for was serious enough to worry me. So, we went with the Hib.

It should also be noted that vaccine-hesitant parents do not necessarily avoid all vaccinations for their children. They may selectively vaccinate or modify or extend the vaccine schedule. The data reveals instances of non-vaccine-hesitant parents refusing certain vaccines and vaccine-hesitant parents accepting some vaccines. For example, Maddy was vaccine-hesitant but still vaccinated her child, albeit on a delayed schedule, to monitor for adverse side effects. Conversely, Zoe, who was not vaccine-hesitant, did not want her child to receive the HPV vaccine. Similarly, Amelia, a non-vaccine-hesitant mother, refused the COVID-19 vaccine for her children. These findings highlight the nuanced nature of vaccine hesitancy and the challenges in categorizing parents as vaccine-hesitant or non-vaccine-hesitant.

This ambiguity extends to differing perspectives on vaccinations. Many of the vaccine-hesitant and non-vaccine-hesitant parents in this study expressed openness to and implantation of alternative approaches to maintaining their children's health. Some non-vaccine-hesitant parents emphasized the importance of a nutrient-rich diet to bolster their children's immune systems and reduce inflammation before receiving immunizations. Similarly, vaccine-hesitant parents also focus on strengthening their children's immune systems, often preferring to let their bodies fight off viruses without outside interventions.

Notably, most research participants viewed vaccine mandates negatively. Parents believed that the decision to vaccinate should be solely at the parent's discretion, without government or medical institution mandates. While some parents acknowledged that vaccine mandates aim to protect not only their own children but also the broader community, similar to seat belt laws, the majority felt that such mandates infringe on parental autonomy. These views are consistent with recent research indicating a growing trend of parents supporting the right to opt out of vaccinations (J. Hoffman, 2022).

It is worth mentioning that the typical indicators of vaccine hesitancy found in much of the literature—such as marital status, lower socioeconomic status, lower levels of education, occupational status, ethnicity, and geographic location—did not apply to this study population (Nguyen et al., 2022; Palombi et al., 2023; Ruiz & Bell, 2022). Most parents, whether vaccine-hesitant or non-vaccine-hesitant, were married or in domestic partnerships (83.4%), held a college degree (associate's 22.2%, bachelor's 38.9%, post-grad 38.9%), were employed (77.8%), and were either White (94.4%) or Asian (5.6%). They were also relatively equally distributed across big cities (hesitant 22.2%, non-hesitant 38.9%), small towns (hesitant 22.2%, non-hesitant 38.9%), and rural areas. Notably, there were more post-graduates in the non-vaccine-hesitant

group (38.9%) compared to the vaccine-hesitant group (0%). However, all participants held some form of higher education degree. See Table 8 for the complete breakdown of the study population by vaccine hesitancy status.

Table 8*Demographic Interview Participant Information*

Demographic	Category	Vaccine-Hesitant <i>n</i> (%)	Non-Vaccine Hesitant <i>n</i> (%)	Total <i>N</i> (%)
Gender	Female	6 (33.3)	8 (44.4)	14 (77.8)
	Male	2 (11.1)	2 (11.1)	4 (22.2)
Age	25-34	6 (33.3)	4 (22.2)	10 (55.6)
	35-44	1 (5.6)	4 (22.2)	5 (27.8)
	45-54	1 (5.6)	2 (11.1)	3 (16.6)
Education	Associates	3 (16.7)	1 (5.6)	4 (22.2)
	Bachelors	5 (27.8)	2 (11.1)	7 (38.9)
	Post-grad	0 (0.0)	7 (38.9)	7 (38.9)
Occupational Status	Full-time	5 (33.3)	7 (38.9)	12 (66.7)
	Part-time	1 (5.6)	0 (0)	1 (5.6)
	Self-employed	1 (5.6)	0 (0)	1 (5.6)
	Student	1 (5.6)	2 (11.1)	3 (16.7)
	Unemployed	0 (0.0)	1 (5.6)	1 (5.6)
Marital Status	Married	7 (38.9)	7 (38.9)	14 (77.8)
	Single	0 (0.0)	2 (11.1)	2 (11.1)
	Divorced	0 (0.0)	1 (5.6)	1 (5.6)
	Domestic Partnership	1 (5.6)	0 (0)	1 (5.6)
Number of Children	1	4 (22.2)	6 (33.3)	10 (55.6)
	2	3 (16.7)	1 (5.6)	4 (22.2)
	3+	1 (5.6)	3 (16.7)	4 (22.2)
Annual Income	\$100k+	5 (33.3)	8 (44.4)	13 (72.2)
	\$75-\$99k	3 (16.7)	0 (0.0)	3 (16.7)
	\$10-\$14k	0 (0.0)	2 (11.1)	2 (11.1)
Ethnicity	White	8 (44.4)	9 (50.0)	17 (94.4)
	Asian	0 (0)	1 (5.6)	1 (5.6)
Geographic Location	Big city	4 (22.2)	7 (38.9)	11 (61.1)
	Small town	2 (11.1)	2 (11.1)	4 (22.2)
	Rural	2 (11.1)	1 (5.6)	3 (16.7)

These findings underscore the vital need for transparent communication, effective education, and supportive healthcare environments. Addressing parents' informational needs and concerns can promote informed vaccination decisions. Building trust in medical and governmental health agencies requires a comprehensive approach that includes transparency, empathy, education, and tailored communication strategies.

To this end, creating easy-to-read vaccine labels, similar to a nutrition label, that outlines vaccine ingredients, potential side effects, and their statistical likelihood would be highly beneficial. Infographics could be developed to convey some of the more complex vaccine information in a clear and comprehensible format. These infographics could be paired with the more detailed vaccine handouts typically provided during vaccination visits, making the information more accessible and visually appealing. Illustrating the complexity of vaccine information provided to parents is an 11-page brochure on Merck and Company's M-M-R II vaccine; refer to the link in the references (Merck & Company, 2023a). While the company provides a shorter handout for parents, it does not contain the comprehensive details that many parents seek. Refer to the link in the references for the shorter PDF handout for parents (Merck & Company, 2023b). Figure 7 proposes a vaccine label listing the ingredients, while Figure 8 provides an accessible translation of adverse reaction information from a clinical trial. Comparing these tables to the details in Merck and Company's M-M-R II vaccine brochure highlights the valuable differences.

Figure 7*Proposed Label for Vaccine Ingredients of the M-M-R II*

Vaccine Facts	
M-M-R II Vaccine Ingredients	
Serving Size: 0.5 mL (Single Dose)	
	Amount
Active Ingredients	
Measles Virus Vaccine Live	Not less than 3.0 log ₁₀ TCID ₅₀
Mumps Virus Vaccine Live	4.1 log ₁₀ TCID ₅₀
Rubella Virus Vaccine Live	3.0 log ₁₀ TCID ₅₀
Other Ingredients	
Sorbitol	14.5 mg
Sucrose	1.9 mg
Hydrolyzed Gelatin	14.5 mg
Recombinant Human Albumin	≤ 0.3 mg
Fetal Bovine Serum	< 1 ppm
Neomycin Approximately	25 mcg
Buffers and Media	
Ingredients Various	

Contains No Preservative

Manufacturing Information:

- **Measles Virus Source:** Enders' attenuated Edmonston strain propagated in chick embryo cell culture
- **Mumps Virus Source:** Jeryl Lynn™ (B level) strain propagated in chick embryo cell culture
- **Rubella Virus Source:** Wistar RA 27/3 strain propagated in WI-38 human diploid lung fibroblasts

Additional Notes:

- The cells, virus pools, recombinant human serum albumin, and fetal bovine serum used in manufacturing are tested and determined to be free of adventitious agents (Merck & Co., Inc., 2023a).

Note. Based on information from Merck and Company (2023a, 2023b).

Figure 8*Proposed Label for M-M-R II Side Effects*

Clinical Trial Data		
M-M-R II Vaccine		
In a clinical trial involving 752 children aged 12 to 18 months, the frequency of certain side effects was recorded:		
Side Effects	Intramuscular	Subcutaneous
Erythema (redness at the injection site)	10.4%	16.2%
Pain at the injection site	7.0%	7.2%
Swelling at the injection site	1.9%	5.3%
Measles-like rash	2.9%	2.7%
Rubella-like rash	2.7%	2.7%
Varicella-like rash	0.5%	3.2%
Fever (temperature $\geq 38.0^{\circ}\text{ C}$)	66.5%	66.8%

Serious Adverse Events:

Serious adverse events occurred at rates of 0.3% in the intramuscular group and 1% in the subcutaneous group during the clinical trial (Merck & Co., Inc., 2023b).

Note. Based on information from Merck and Company (2023a, 2023b).

Additionally, two infographics were created with assistance from ChatGPT, summarizing Sections 1–14 of the brochure (see Appendix M). These infographics illustrate that presenting information transparently and accessibly can make it clearer and more comprehensible, potentially alleviating parental concerns and supporting better-informed decisions. As a suggestion, including the statistical likelihood of adverse reactions, as listed on page 4 in Section 6 of the M-M-R II vaccine brochure, would further enhance the usefulness of these materials. This list is also available in infographic form in Appendix M. Notably, many parents prefer to receive tangible information about vaccinations, underscoring the importance of thoughtful, transparent, readily comprehensible, and effective dissemination of medical information (Low et al., 2022).

Taking this comprehensive approach to mitigating vaccine hesitancy aims to foster an environment of trust and open dialogue, helping parents successfully navigate decisions surrounding childhood vaccinations confidently and competently, which is critical for improving public health outcomes. Ultimately, it is important to recognize that everyone is on the same side, whether they are working in the healthcare industry, part of a governmental public health agency, a parent hesitant about vaccinations, or a parent fully supporting immunization. Everyone shares the common goal of having healthy children, a healthy community, a healthy nation, and a healthy world.

Acknowledgments

Thanks to the University of Northern Colorado and my dissertation committee, who have supported this research endeavor.

Declaration of Conflicts of Interest

The author declared no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

Funding

The author received no funding for this research study.

Data Availability Statement

The data used for this study (de-identified semi-structured interview transcripts and audit trail) can be made available to other researchers upon request. If you are interested, please contact the author.

Prompt and Response Availability

The prompts used in this study, along with the corresponding ChatGPT responses, are available at the following link:

https://docs.google.com/document/d/1ZvmNf9VVl4lCAlnRDZ_bAhWyHEwJpnFirVzMRo1b-R8/edit

ORCID iD

Carlene Brown  <https://orcid.org/0000-0002-5414-7492>

CHAPTER VI

CONCLUSION

The purpose of this study was to gain an understanding of parental attitudes toward childhood vaccinations and decision-making styles. Overarchingly, this study sought to comprehensively examine the factors influencing vaccine hesitancy among parents of children under 18 utilizing both quantitative and qualitative methodologies and conducting qualitative analytic comparisons to enhance understanding for future research practices. It sequentially explored parental perceptions of childhood vaccines, vaccine hesitancy, and decision-making styles, focusing on two primary lines of inquiry: contextual and methodological. Contextually, the study first examined the predictive ability of decision-making styles on vaccine hesitancy among parents with children under the age of eighteen. This quantitative investigation phase of the study worked to determine whether general decision-making styles (i.e., rational, dependent, spontaneous, avoidant, and intuitive) could predict vaccine hesitancy while controlling for variables such as age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and the number of children. Additionally, the qualitative aspect of the study sought to gain a more in-depth understanding of parents' underlying beliefs and how these beliefs may contribute to vaccine hesitancy. Methodologically, the study compared RTA using AI-driven, ChatGPT, and human-led analysis using NVivo to discern differences and provide insights for future qualitative and mixed-methods analysis approaches. Through its use of various analytical tools and integration of contextual and methodological explorations, this

study offers a nuanced understanding of the factors driving parental vaccine hesitancy and also strived to advance the development of qualitative research methodologies.

Phase 1 – Quantitative Insights

Phase 1 of this research offered valuable insights into the prevalence of vaccine hesitancy among the study's participants. The sample was relatively homogenous, predominantly consisting of married, full-time employed, highly educated individuals in higher socioeconomic brackets who were predominantly White. The participants also showed uniformity in their decision-making styles, with 219 out of 260 identifying as using a rational approach in their vaccine-related decisions. Interestingly, the sample was almost evenly split between vaccine-hesitant (133) and non-vaccine-hesitant (127) individuals. This finding was unexpected, especially considering that the Pew Research Center reported that 88% of Americans believe the benefits of childhood vaccines for MMR outweigh the risks, with only 10% seeing the risks as greater (Funk et al., 2023). Even in the aftermath of the global pandemic, 70% of Americans still support mandatory vaccinations for healthy children to attend public schools (Funk et al., 2023), indicating a significant number of vaccine-acceptant individuals, making the demographic findings of this study particularly striking.

The analysis conducted in Phase 1 of the study examined various decision-making styles, including rational, dependent, spontaneous, avoidant, and intuitive and served to answer Q1a, “Do general decision-making styles predict vaccine hesitancy controlling for age, gender, level of education, employment status, marital status, social class, ethnicity, geographic location, and number of children?” Of these, intuitive decision-making was found to significantly predict vaccine hesitancy. Additionally, family size emerged as another key predictor. Parents who relied on intuitive decision-making were found to have 86% lower odds of being vaccine-hesitant compared to those with a dependent decision-making style. These findings challenge

previous research, suggesting that intuitive thinkers are more prone to vaccine hesitancy and conspiracy beliefs than analytic thinkers (Martinelli & Veltri, 2021; Schindler et al., 2020; H. Tomljenovic et al., 2020). One plausible explanation for this discrepancy could be that individuals who rely on intuition might be more self-assured in their vaccination decisions, trusting their instincts, and are resultingly less likely to experience worry or hesitation about vaccinations. However, support for this hypothesis would require future research. Given these results, along with the lack of predictive power of dependent and rational decision-making styles in this study's population, it is evident that additional exploration of decision-making factors influencing vaccine hesitancy with a more diverse sample could greatly enhance public health knowledge.

Subsequent study findings revealed that individuals with three or more children had significantly lower odds (73%) of being vaccine-hesitant compared to those with only one child, which offers important insights into vaccine hesitancy. These results align with research indicating that parents with one or two children tend to have higher odds of vaccine hesitancy compared to those with more children (Alzahrani & Alghamdi, 2023; Shen et al., 2022). This pattern suggests that parents with more than one child may feel more at ease with vaccinations, which is likely due to their experience in vaccinating older children, making them less hesitant to vaccinate their younger ones. This knowledge is valuable for public health officials and healthcare professionals, as it helps identify parents who may need more time and information to address their concerns and alleviate vaccine-related apprehensions.

The findings from Phase 1, particularly the influence of intuitive decision-making and having multiple children on assuaging vaccine hesitancy, are valuably informative for the public health sector. These outcomes highlight key factors contributing to vaccine hesitancy and open

the door to further research to uncover additional dimensions of this issue. Furthermore, the demographic results suggest that vaccine hesitancy may be more prevalent among highly educated, higher socioeconomic status (SES), and White populations, underscoring the need for continued exploration. These discoveries reveal the unpredictable, complex, and multifaceted nature of vaccine hesitancy, emphasizing the importance of broadening the scope of target populations in future public health research and outreaches. Importantly, this phase of the study's contributions served as a springboard for the in-depth exploration conducted in Phase 2, which aided in striving to explain and expand the insights gained from Phase 1.

Phase 2 – Qualitative Insights

Notably, Phase 2 findings provided a more holistic understanding of the statistically significant results from Phase 1, including the lower odds of vaccine hesitancy among intuitive decision-makers and individuals with three or more children compared to dependent decision-makers and those with only one child. For instance, while Phase 1 associated intuitive decision-making with lower vaccine hesitancy, Phase 2 revealed that an interview participant who exhibited an inclination toward intuitive decision-making was vaccine-hesitant. This is illustrated by Rachael, a vaccine-hesitant participant who shared,

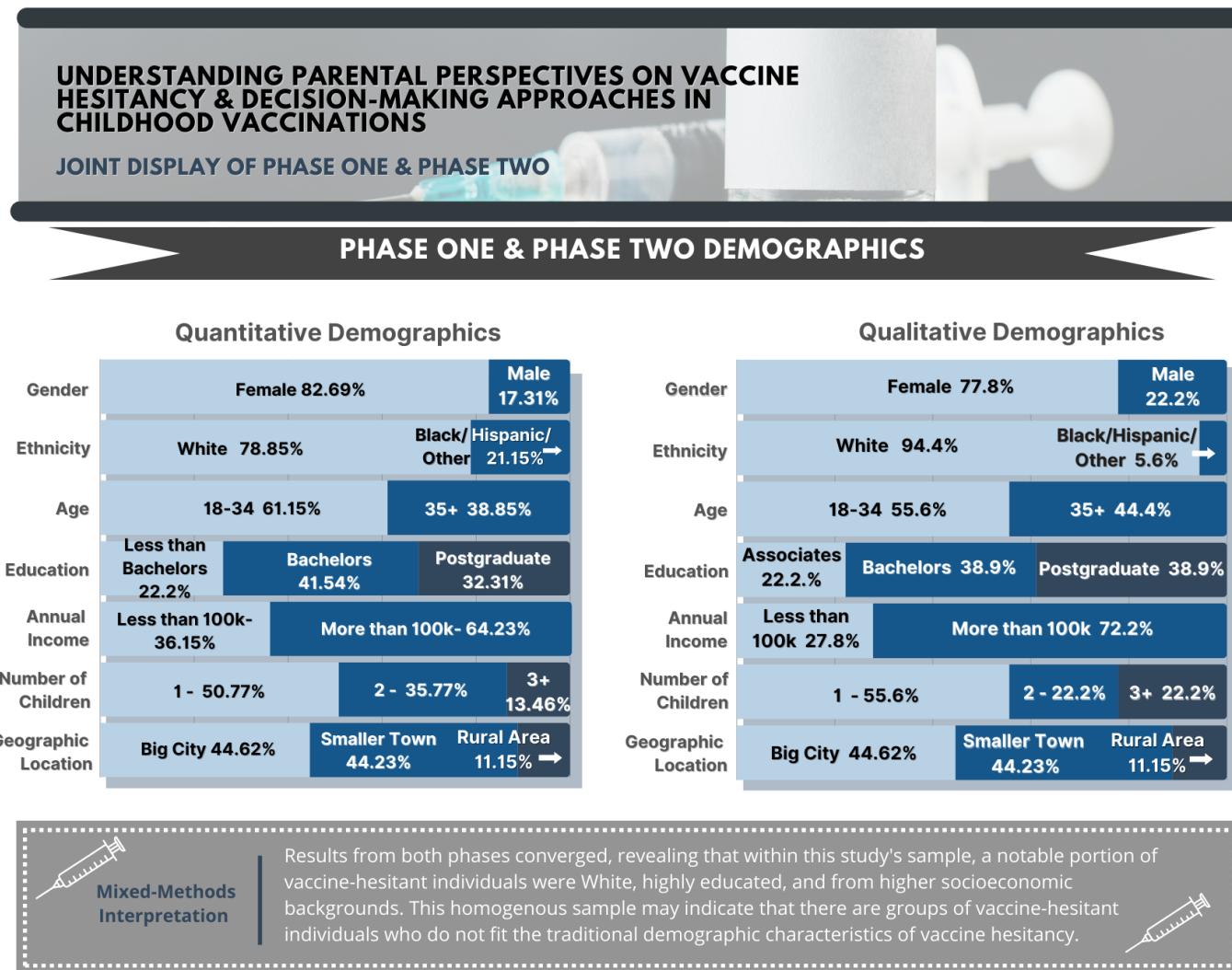
I think a lot of it is kind of gut instinct. Obviously, there is a lot that we've read about, and he's [her husband] especially listened to podcasts and just tried to gather all of this information. But I think a lot of it is also just going with our experience.

This aligns with prior research suggesting that intuitive thinkers are more likely to be vaccine-hesitant (Martinelli & Veltri, 2021; Schindler et al., 2020; H. Tomljenovic et al., 2020). Phase 2 also showed that vaccine-hesitant and vaccine-acceptant participants included individuals with only one child, with the distribution nearly even. Notably, many vaccine-hesitant participants had only one child, while one vaccine-hesitant participant had five children. Although previous research suggests that individuals with one child are more likely to be

vaccine-hesitant than those with multiple children (Alzahrani & Alghamdi, 2023; Shen et al., 2022), this phase of the study captured the profound complexity of parental decision-making. While Phase 1 highlighted broader patterns across the sample, Phase 2 revealed the personal context and variability that exists within these groups. The quantitative approach in Phase 1 provided broad statistical patterns, suggesting that intuitive decision-making and having more children are associated with lower vaccine hesitancy. The qualitative interviews from Phase 2 provided a deeper understanding of how parents' underlying beliefs shape vaccine hesitancy, offering rich, individualized perspectives that build upon the broader trends observed in Phase 1. For instance, while Phase 1 identified trends among intuitive decision-makers and family size, Phase 2 added further context by revealing how personal experiences and individual beliefs can play a significant role in shaping vaccine attitudes. The participant who identified as an intuitive decision-maker but was also vaccine-hesitant illustrates the value of the in-depth interview setting. In this setting, participants were able to express more personal and nuanced thoughts, providing a more comprehensive view of the factors influencing decision-making beyond what was captured in Phase 1. This approach allowed for a deeper understanding of the individual perspectives, enriching the overall findings of the research and providing a more nuanced view of vaccine hesitancy. Additionally, the findings regarding family size demonstrate that while larger patterns may emerge in quantitative analysis, qualitative insights highlight the importance of considering factors such as trust in healthcare and personal experiences with vaccination. By integrating both phases, this study offers a holistic understanding of vaccine hesitancy, with each phase enriching and deepening the insights of the other.

Markedly, Phase 2 findings confirmed the Phase 1 results regarding non-traditional demographic predictors of vaccine hesitancy, such as socioeconomic status, education level,

occupational status, and ethnicity. The majority of Phase 2 participants, similar to those in Phase 1, were predominantly White, highly educated, married, employed full-time, and positioned in higher socioeconomic brackets. A high level of advanced education was found in both vaccine-hesitant and non-hesitant groups. This suggests a need to broaden the scope of research on vaccine hesitancy, as it may be more pervasive than traditionally recognized. Expanding the focus beyond commonly targeted populations, such as those with lower education, lower SES, and minority groups (Hill et al., 2021; Low et al., 2022), could reveal a broader prevalence of vaccine hesitancy, which past and current studies may have overlooked. The study results from both Phases 1 and 2 can be found in the joint display in Figure 9.

Figure 9*Explanatory Sequential Joint Display of Findings*

UNDERSTANDING PARENTAL PERSPECTIVES ON VACCINE HESITANCY & DECISION-MAKING APPROACHES IN CHILDHOOD VACCINATIONS

JOINT DISPLAY OF PHASE ONE & PHASE TWO

PHASE ONE FINDING 1



Phase One Finding 1: Intuitive Decision-making style was found to be statistically significant.

Supporting Evidence: 86% lower odds of being vaccine hesitant than those with a dependent decision-making style ($OR = 0.14$, $SE = 0.97$, 95% CI [0.02, 0.82], $z = -2.01$, $p = 0.04$).

PHASE TWO FINDING 1



Phase One Finding 1: One participant, inclined toward an intuitive decision-making style, expressed some hesitancy regarding vaccines, offered valuable insight into the complex factors that influence such decisions such as personal experience.

Supporting Evidence: Quote from Rachael:
"I think a lot of it is kind of gut instinct. Obviously, there is a lot that we've read about, and he's [her husband] especially listened to podcasts and just tried to gather all of this information. But I think a lot of it is also just going with our experience."

MIXED-METHODS INTERPRETATION FINDING 1



The findings from Phase Two offered a more holistic understanding of the results from Phase One. In Phase Two, a participant who demonstrated an intuitive decision-making style showed some hesitancy toward vaccines, shedding light on the complexities of decision-making and the key role personal experiences can play in shaping such decisions. Moreover, the findings emphasize the value of in-depth interviews, where participants are able to share more personal and nuanced perspectives. This approach provided a more comprehensive view of the factors influencing decision-making, extending beyond what was captured in Phase One.

UNDERSTANDING PARENTAL PERSPECTIVES ON VACCINE HESITANCY & DECISION-MAKING APPROACHES IN CHILDHOOD VACCINATIONS

JOINT DISPLAY OF PHASE ONE & PHASE TWO

PHASE ONE FINDING 2



Phase One Finding 2: Having three or more children was found to be statistically significant.

Supporting Evidence: 73% lower odds of vaccine hesitancy compared to having one child (OR = 0.27, SE = 0.48, 95% CI [0.10, 0.68], z = -2.71, p < .001).

PHASE TWO FINDING 2



Phase One Finding 2: Family size was not found to be indicative of vaccine-hesitancy or non-vaccine-hesitancy.

Supporting Evidence: 50% of vaccine-hesitant and 60% of non-vaccine-hesitant parents had one child. 50% of vaccine-hesitant and 40% of non-vaccine parents had more than one child.

MIXED-METHODS INTERPRETATION FINDING 2



Similar to the findings related to the intuitive decision-making style, these in-depth results highlight the importance of integrating both quantitative and qualitative data collection methods. While Phase One uncovered broader trends within the sample, Phase Two provided deeper insights by showing how personal context and variability exist within these groups. Phase One identified trends related to family size, and Phase Two added nuance by revealing that personal experiences and individual beliefs significantly influence vaccine attitudes.

UNDERSTANDING PARENTAL PERSPECTIVES ON VACCINE HESITANCY & DECISION-MAKING APPROACHES IN CHILDHOOD VACCINATIONS

JOINT DISPLAY OF PHASE ONE & PHASE TWO



PHASE TWO FINDING 3

THEMES



- Traditional RTA**
 - Influences and Perceptions Shaping Vaccine Hesitancy
 - Trust and Concerns in Vaccine Decision-Making
 - Perspectives and Attitudes Toward Vaccination
 - Attitudes Toward Mandates
- ChatGPT RTA with Braun & Clarke**
 - Navigating Personal and Community Health
 - Integration of Natural Health Practices
- ChatGPT RTA with Zhang et al. (2023a)**
 - Sociocultural and Political Influences



MIXED-METHODS INTERPRETATION

FINDING 3



The study reveals that vaccine hesitancy among parents in the sample is primarily driven by personal or indirect negative experiences with vaccinations, leading to distrust in immunizations. Additionally, trust in medical professionals and institutions strongly influences vaccine attitudes, with less trust correlating with higher hesitancy. The research also highlights that vaccine-hesitant parents do not necessarily avoid all vaccines but may choose to vaccinate selectively or on a modified schedule, reflecting the nuanced and individualized nature of vaccine decisions.

UNDERSTANDING PARENTAL PERSPECTIVES ON VACCINE HESITANCY & DECISION-MAKING APPROACHES IN CHILDHOOD VACCINATIONS

JOINT DISPLAY OF PHASE ONE & PHASE TWO

PHASE TWO FINDING 4



Criteria	Traditional RTA	Braun & Clarke (2022) RTA	Zhang et al. (2023a) RTA
Understanding of the Data	3	2.5	2.5
Coding Accuracy	3	2	2.5
Thematic Analysis Process	3	2.5	3
Interpretation	3	3	3
Insightfulness of Findings	3	3	3
Overall Quality and Rigor	3	2	2
Reflexivity	3	3	3
Total Score	21	18	19

Scoring: Comprehensive (3), Satisfactory (2), Basic (1)

MIXED-METHODS INTERPRETATION FINDING 4

The research found that Traditional Reflexive Thematic Analysis (RTA) is more effective for obtaining comprehensive and detailed insights, demonstrating consistent coding and deep interpretation of data that thoroughly answers research questions. While AI-driven RTAs using ChatGPT provided satisfactory results with reliable coding and theme identification, they lacked the depth and richness of the Traditional RTA, though they offered significant time efficiency, making AI a valuable, though not a replacement, tool in qualitative research.

UNDERSTANDING PARENTAL PERSPECTIVES ON VACCINE HESITANCY & DECISION-MAKING APPROACHES IN CHILDHOOD VACCINATIONS

JOINT DISPLAY OF PHASE ONE & PHASE TWO

OVERALL MIXED-METHODS INTERPRETATION

This research offers important insights into vaccine hesitancy, showing that highly educated White individuals with higher socioeconomic status (SES) were also susceptible to vaccine hesitancy. This challenges the traditional view that vaccine hesitancy is more common among lower SES groups, those with less education, and minority populations. The study found that those using intuitive decision-making and parents with three or more children had lower odds of hesitancy. The mixed-methods approach provided a richer, more nuanced understanding by utilizing the complimentary quantitative and qualitative findings, particularly in relation to decision-making styles and family size. Additionally, it uncovered important factors influencing vaccine decisions, including trust in healthcare providers, concerns about vaccine safety, lack of transparent vaccine information, and the impact of socio-cultural influences. The study demonstrated the potential of AI tools like ChatGPT to complement qualitative research, although human-led analysis remains essential for depth and nuance. The findings emphasize the need for transparent communication, collaboration between public health and the public, and further research to effectively address vaccine hesitancy.



Phase 2 – Expanded Insights and Key Findings

Phase 2 provided rich and valuable insights and served well in answering Q1b, “How do parents’ underlying beliefs contribute to vaccine hesitancy?” It offered a deeper understanding of the Phase 1 results by uncovering four key themes from the human-led traditional RTA: influences and perceptions shaping vaccine decisions, trust and concerns in vaccine decision-making, attitudes toward vaccine mandates, and alternative perspectives and attitudes toward vaccinations. These themes shed light on additional factors driving vaccine hesitancy and acceptance among the participants.

One of the most notable predictors of vaccine hesitancy identified in Phase 2 was personal and indirect experiences with adverse vaccination events. All eight vaccine-hesitant parents reported such experiences, which fueled their distrust in immunizations. In contrast, non-hesitant parents did not report experiencing similarly severe events that might have altered their views of vaccinations. The level of trust in medical institutions and healthcare professionals also played a critical role in vaccine decision-making. Vaccine-hesitant parents generally exhibited lower levels of trust, often shaped by negative interactions with healthcare providers or concerns about the motives of larger institutions, particularly regarding vaccine safety. For example, Gabe expressed skepticism about the pharmaceutical industry’s profit motives, stating, “I think there’s too much profit to be made, and I believe there’s too much of a conflict of interest for who’s making the decisions for what goes on the schedule and what vaccines are taken by which people.”

Concerns about vaccine ingredients and the lack of accessible, clear, comprehensive information further contributed to vaccine hesitancy. Gabe noted regarding vaccine inserts, “You know as well as I do that 99% of people are not going to read the insert. The font is as small as possible. There’s way too much information; it’s convoluted.” Many parents sought

vaccine information from sources such as the CDC, research studies, books, and various online platforms to inform their decisions. However, the information they obtained often, but not always, seemed to reinforce their existing views of either vaccine hesitancy or acceptance.

Additionally, it is important to highlight that, despite their apprehensions, vaccine-hesitant parents did not ubiquitously reject all vaccines. Many opted for selective or delayed vaccination schedules. Similarly, some non-hesitant parents were skeptical and, in some cases, refused specific vaccines, such as HPV or COVID-19. The study also found that many parents, regardless of their stance on vaccines, harbored negative attitudes toward vaccine mandates. These parents believed that vaccination decisions should be made independently of governmental or institutional mandates. Their opposition to mandates contrasted with their openness to alternative health approaches, which were routinely embraced by many vaccine-hesitant and non-hesitant parents alike.

Phase 2 – Artificial Intelligence Insights

To enhance the contextual depth of Phase 2, the findings from the AI-driven RTA largely aligned with themes identified in the traditional RTA, while also introducing unique themes absent from the traditional analysis. This addressed Q2, “What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?” The Braun and Clarke (2022) RTA introduced the theme of “balancing personal and community health,” supported by three participants’ quotes. For instance, Olivia shared, “I believe vaccines are important for herd immunity.” Owen added, “We’re protecting others by vaccinating our children.” Amelia emphasized, “I just want to make sure that we’re all making informed decisions.”

Meanwhile, the RTA, guided by prompts from Zhang, Wu, Xie, Lyu, et al. (2023), contributed to the theme of sociocultural and political influences. This theme was supported by

quotes from several participants, including Sophia, who, speaking about political influences, stated, “Healthcare shouldn’t be a conservative or liberal issue or a Democrat or Republican issue. It should just be about healthcare.” She further remarked, “When I moved to this area, it became more of a political issue … people began to question all vaccinations.”

Stella, referring to sociocultural influences with respect to refusing vaccines for her children, added,

You know, my parents had asked, “Why did you make this decision?” It was just something we could explain, and they were kind of able to say, “OK, if that’s what you feel is best, then perfect. We will support you.”

These additional themes enriched the overall study findings, providing a more nuanced understanding of parental perspectives, particularly in the areas of balancing personal and community health, as well as the sociocultural and political influences on childhood vaccinations.

The contextual findings from Phase 2 highlight the multifaceted complexity of vaccine hesitancy, underscoring that it is far less predictable than might be assumed. Phase 2 added valuable context and depth to the Phase 1 results, reinforcing existing research that highlights the significant role of personal experiences and a lack of trust in vaccine safety and adverse side effects as key contributors to vaccine hesitancy (Barrett, 2005; Duong et al., 2011; Geier et al., 2015; Kerrigan et al., 2020; Low et al., 2022; Nurmi & Harman, 2021; L. Tomljenovic & Shaw, 2011). These findings highlight the evident need for clear communication, personalized education, and supportive healthcare settings to deter vaccine hesitancy effectively. Simplifying vaccine information through user-friendly labels and infographics could make complex details about ingredients, safety, and efficacy more accessible, thereby promoting informed decision-making and building trust with parents. Successfully addressing vaccine hesitancy hinges on a

collective effort to ensure that parents receive clear, comprehensive information, empowering them to make confident and secure choices for their children's health.

Phase 2 – Methodological Findings

The interview portion of Phase 2 offered rich and detailed data that lent a deep understanding of parental perspectives regarding vaccine hesitancy and childhood vaccinations. Markedly, this comprehensive phase also offered powerful insight into the methodological question posed by the study, "What are the distinctions between reflexive thematic analysis using ChatGPT and traditional analysis using NVivo?" The results of comparing the three RTAs notably revealed that traditional RTA was the most effective method for gathering detailed and comprehensive insights to fully address the research question. This human-driven approach showcased a profound understanding of the data, featuring consistent coding and extensive participant quotes that systematically reinforced the identified themes. The process involved repeated data review, systematic coding, and theme development, leading to a rich and insightful interpretation. Traditional RTA effectively upheld rigorous qualitative standards by incorporating prolonged engagement, member checking, triangulation, and maintaining an audit trail, ensuring credibility, transferability, dependability, and confirmability. Moreover, it was pivotal in establishing a foundation for comparison with AI-driven RTA. These comparisons acted as analytic triangulation, further reinforcing the research findings.

Consequently, AI-driven RTAs using ChatGPT, guided by prompts from Braun and Clarke (2022) and Zhang, Wu, Xie, Lyu, et al. (2023), were found to perform well, and both contributed to answering the study's contextual research question. These AI-led analyses provided a satisfactory understanding of the data and were able to identify relevant themes and patterns, although more superficially than traditional RTA. The Zhang, Wu, Xie, Lyu, et al. (2023) analysis stood out in its demonstration of reliable coding, which uncovered both

overarching themes and detailed subthemes. Both AI-driven RTAs provided valuable insights but fell short of capturing the depth and diversity of participant quotes observed in the traditional RTA. The AI-driven RTAs displayed satisfactory quality and rigor and generated results with remarkable speed, completing the analysis in minutes as compared to the extensive hours requisite to complete the traditional RTA. Moreover, reflexive statements from the traditional RTA as well as the AI RTAs transparently addressed researcher biases serving to strengthen confirmability. The AI-driven RTAs were found to confirm and enrich the traditional RTA findings, adding depth and perspective. Additionally, ChatGPT's efficiency, often available at little or no cost, depending on the version, offers significant advantages for independent researchers and academics with limited resources. These findings align with previous studies, highlighting the benefits of using AI in qualitative research and suggesting that AI-driven analysis serves as a valuable co-researcher rather than a replacement for traditional methods (Parker et al., 2023; Rice et al., 2024; van Manen, 2023).

Integration of Philosophical Perspectives and Methodologies

Dialectical Pluralism was used to integrate the post-positivist approach of Phase 1 with the social constructivist perspective of Phase 2. Dialectical pluralism is described as “a process theory for engaging in dialogue across differences, integrating diverse perspectives and methods to create a more complex and meaningful whole” (Jason & Glenwick, 2016, p. 9). The ultimate aim of this integrative methodology was to foster “respectful dialogue” (Greene & Hall, 2010, p. 124) between the two paradigms, seamlessly merging their perspectives to create a comprehensive and holistic understanding of vaccine hesitancy among parents (see also Shannon-Baker, 2016). The structured quantitative approach grounded in post-positivism, employed in Phase 1, facilitated an objective assessment of the breadth of vaccine hesitancy

among the study's participants. The results of this phase effectively worked to initiate a constructive dialogue with the social constructivist perspectives of Phase 2, providing insights that guided the exploration of parental views on childhood vaccinations and vaccine hesitancy, helping to identify key areas for further investigation. As mentioned previously, Phase 1 revealed that intuitive decision-making styles and larger family size were found to be statistically significant in predicting lower odds of vaccine hesitancy. These findings were further explored in greater detail during Phase 2. Although the findings were divergent, the use of social constructivism in the second phase generated rich data, offering a more profound understanding not only of the factors identified as significant contributors to vaccine hesitancy in Phase 1 but also of various other influences. Phase 2 revealed that personal experience, a key component of the social constructivist view, plays a crucial role in shaping vaccine hesitancy, reinforcing the idea that social interactions and individual experiences shape our understanding of the world. The utilization of social constructivism also provided valuable insights into the multifaceted and complex nature of vaccine hesitancy, highlighting how intersectional experiences, as well as other factors, influence an individual's perspectives on childhood vaccinations. Each phase, in tandem with their respective paradigms, added unique value to this research. Notably, the sequential design allowed the quantitative data to inform the qualitative methods, which fostered a respectful dialogue between the two philosophical and methodological paradigms and ultimately provided a comprehensive and holistic understanding of parental perspectives on childhood vaccines and vaccine hesitancy.

Data and Analyses Integration

The integration of data and analyses from both phases of this mixed-methods study aided in effectively addressing the research questions regarding vaccine hesitancy among parents of children under 18 and the potential influence of decision-making styles on this hesitancy.

Through the employment of an explanatory sequential design guided by dialectical pluralism, the findings from Phase 1 were used to direct the focus of Phase 2 and were then systematically combined with the qualitative insights from Phase 2 to create a comprehensive understanding of the study's queries. In Phase 1, the quantitative data offered a broad overview of vaccine hesitancy, revealing a relatively homogenous sample, an almost equal split between vaccine-hesitant and non-hesitant individuals, and indicating that intuitive decision-makers and those with three or more children had lower odds of vaccine hesitancy compared to dependent decision-makers and those with one or two children. These findings shaped the qualitative exploration in Phase 2, where the focus was on unpacking the nuanced reasons behind these quantitative patterns. By comparing the statistical trends identified in Phase 1 with the RTA from Phase 2, the study was able to reveal the complexity of vaccine hesitancy, including factors that were not initially apparent. For example, while Phase 1 indicated lower odds of vaccine hesitancy among individuals with an intuitive decision-making style and those with larger families, The in-depth interviews from Phase 2 revealed that this trend was not consistent across all individuals. This divergence highlights the need for further research to deepen our understanding of how decision-making styles and family size influence vaccine hesitancy and to explore what other factors might also be at play. Phase 2 valuably unveiled some alternative factors influencing vaccine hesitancy, such as personal experience, distrust of the medical community, and safety concerns, just to name a few. Moreover, the AI-driven analysis in Phase 2 offered additional layers of interpretation, adding validation, further insight, and depth to Phase 2 data and findings by confirming the traditional RTA's themes and contributing three additional themes. This integration enhanced the study's discoveries, ensuring that they were data-driven and contextually rich.

In summary, this mixed-methods approach did not just compare findings from the two phases but actively integrated them, allowing for a more nuanced and complete understanding of vaccine hesitancy. Integrating the quantitative and qualitative data from this current research provides public health professionals with statistically grounded and contextually informed insights, offering a well-rounded foundation for future research and public health outreach.

Implications

This study has several implications for practice in healthcare and public health realms. These implications include identifying at-risk populations for vaccine hesitancy, developing targeted communication strategies, and building parent trust through transparency and engagement. Additionally, this research serves as a springboard for future studies into how decision-making styles relate to vaccine hesitancy and how to better elicit accurate responses to sensitive topics to mitigate socially desirable answers to survey questions. Furthermore, integrating AI into qualitative and mixed-methods research and exploring well-crafted prompts for AI-driven qualitative analysis would be a valuable area of study for this emerging technological tool.

Implications for Practice

Identifying At-Risk Populations for Vaccine Hesitancy

The findings from this research have significant implications for identifying at-risk populations for vaccine hesitancy. Traditionally, public health efforts have focused on targeting groups with lower education levels, lower SES, and minority populations based on research indicating these groups are more likely to be vaccine-hesitant (Hill et al., 2021; Low et al., 2022). However, the demographic results of this study suggest that vaccine hesitancy may also be prevalent among highly educated, higher SES White populations, a group not typically considered at high risk. This suggests a need to shift the current understanding of vaccine-

hesitant individuals and to develop a more inclusive approach to identifying at-risk populations. Public health professionals should consider expanding their focus to include more diverse demographic groups, ensuring that public health initiatives and interventions are not limited to traditionally targeted populations. This broadened focus could help public health initiatives address vaccine hesitancy's complex and multifaceted nature more effectively, reaching individuals who may have been overlooked in past efforts.

Developing Targeted Communication Strategies

Public health officials can utilize the findings from this research to develop more effective communication strategies aimed at vaccine-hesitant individuals. Understanding decision-making styles and how individuals process information can help mitigate confusion and address concerns, thereby working to reduce vaccine hesitancy. The CDC advocates for using evidence-based health communication strategies, emphasizing the importance of identifying target audiences, selecting the best communication strategies, and developing and testing messages with representatives from these audiences to ensure their effectiveness (CDC, 2024c). Insights from this study can guide public health workers in tailoring communication styles to different decision-making approaches and in identifying parents with one or two children, providing them with ample opportunities to ask questions and access clear, easy-to-understand information about vaccinations. This approach empowers parents to make informed decisions confidently, free from pressure or uncertainty. Transparent communication is essential, as it has been shown to build public trust and increase adherence to health recommendations (Holroyd, 2020). Ensuring clarity and transparency in messaging is especially important for fostering trust among those who may currently perceive public health authorities as less reliable sources of information. The insights gained from this research can significantly contribute to achieving these goals.

Building Parent Trust through Transparency

Fostering trust with parents through transparency is essential for encouraging informed vaccination decisions. Mangal et al. (2022) emphasize that trust and transparency significantly enhance the likelihood of individuals maintaining consistent engagement with the healthcare system. This study underscores the importance of meeting parents' informational needs and addressing their concerns through clear and transparent communication. Developing easy-to-understand vaccine labels, similar to nutrition labels, that outline ingredients, potential side effects, and their statistical likelihood could make complex vaccine information more accessible. Infographics that distill and visually convey detailed vaccine information in a concise and easily digestible format can further enhance parents' understanding, making the decision-making process more transparent and less intimidating. These measures not only clarify the information but also foster an environment where parents feel supported and informed, which can aid in building trust in medical and governmental health agencies. Conveying health information in an accessible way respects parents' desire for clear, comprehensible resources and could, in turn, potentially reduce vaccine hesitancy by ensuring that parents feel involved and respected throughout the vaccination process.

Incorporating Artificial Intelligence in Qualitative Research

The integration of AI in qualitative research, as demonstrated in this study, offers practitioners a valuable tool to enhance the efficiency of data analysis while maintaining reliable theme identification. Although traditional RTA remains superior in providing comprehensive and nuanced insights, AI-driven RTAs, such as ChatGPT, can effectively complement traditional methods, particularly in time-sensitive projects or when resources are limited. This study also highlights the critical role of prompt design in maximizing the accuracy and depth of AI-driven

analysis, as emphasized by Zhang, Wu, Xie, Lyu, et al. (2023) and Mesec (2023). Practitioners should, therefore, focus on developing and refining prompts to ensure that AI tools are used to their full potential. However, these tools should be employed to support rather than replace human-led qualitative research (Mesec, 2023; Parker et al., 2023; Rice et al., 2024; van Manen, 2023; Zhang, Wu, Xie, Lyu, et al., 2023). By combining the speed and efficiency of AI with the depth and rigor of traditional approaches, practitioners can achieve a balanced and comprehensive analysis that could serve to enhance and improve the quality of research outcomes.

Implications for Research

Broaden Demographic Scope

The discovery of a vaccine-hesitant group that does not align with traditional criteria highlighted in this current research has significant implications for future research, particularly in expanding the demographic scope of vaccine hesitancy studies. Traditionally, research has focused on populations with lower education levels, lower SES, and minority groups, as these have been commonly identified as at higher risk for vaccine hesitancy (Hill et al., 2021; Low et al., 2022). However, the demographic results of this study indicate that vaccine hesitancy may also be prevalent among highly educated, higher SES, White populations, which is a group not typically considered at high risk. Future research should design studies that explore vaccine hesitancy within these overlooked populations, employing both qualitative and quantitative methods to understand the unique factors driving hesitancy in these groups. This expanded focus could lead to a more comprehensive understanding of vaccine hesitancy's complex and multifaceted nature, ultimately informing more effective strategies for addressing hesitancy across different segments of the population.

Improved Survey Design

This study has contributed to a greater understanding of decision-making styles and their roles in vaccine hesitancy and has also highlighted the need for improvements in survey design regarding this topic. Future research should explore alternative survey designs, such as rearranging the sequence of decision-making style queries, to mitigate the effects of social desirability bias and achieve more accurate and authentic results. For example, the GDMS survey could be restructured to randomize the order of questions or to position less socially desirable decision-making styles earlier in the survey. Additionally, incorporating open-text responses in surveys, as suggested by Ried et al. (2022), can provide participants with the opportunity to express their views more freely, potentially uncovering deeper insights that can be constrained by fixed response scales. Researchers could also experiment with using diverse sources of information, such as secondary data or behavioral measures, to reduce bias further (Ried et al., 2022). Moreover, including a survey completion indicator may help participants gauge the remaining length, making them more likely to complete the survey (Kato & Miura, 2021). Employing multiple methods, like combining surveys with interviews or case studies, will enhance the reliability and validity of findings, offering a more comprehensive perspective on vaccine hesitancy and decision-making styles (Ried et al., 2022).

Incorporate Mixed-Methods Research

This study effectively used an explanatory sequential mixed-methods design, capturing both the broad patterns of vaccine hesitancy and decision-making styles, as well as in-depth insights from parents. Mixed-Methods research is valuable for exploring complex issues like vaccine hesitancy because it combines the strengths of both quantitative and qualitative approaches, affording a comprehensive understanding of the subject matter. Future studies should continue using mixed-methods to explore vaccine hesitancy and decision-making, as this

approach allows for a richer, more reliable understanding of the topic. Wasti et al. (2022) suggest that employing mixed-methods approaches in health research enriches a study's depth and breadth by offering a holistic perspective by integrating both quantitative and qualitative insights. Researchers can apply these methods to vaccine hesitancy, decision-making styles, as well as other public health concerns, ensuring findings are both broadly applicable and deeply informed by context. This will help refine and expand existing knowledge, ultimately leading to more effective public health strategies.

Leveraging Artificial Intelligence in Qualitative Analysis

In this current research study, the AI platform ChatGPT was successfully utilized alongside traditional RTA, demonstrating AI's potential to enhance research processes. While AI-driven analysis may not achieve the depth of human-led approaches, it effectively identifies relevant themes and patterns, making it a valuable tool, especially for time-sensitive projects or those with limited resources. This study reinforces the importance of prompt design in AI-driven qualitative analysis, as the prompts developed by Zhang, Wu, Xie, Lyu, et al. (2023) yielded more comprehensive results than those by Braun and Clarke (2022). Future research should continue exploring AI's boundaries in qualitative analysis by testing its effectiveness in various contexts and comparing different AI tools. Researchers should also focus on best practices for integrating AI with traditional qualitative methods, emphasizing the refinement of prompts to maximize AI's benefits while maintaining rigorous qualitative standards. Zhang, Wu, Xie, Lyu, et al. (2023) and Mesec (2023) both underscore the need for targeted prompt design and further research to ensure seamless integration with traditional methods. By advancing these approaches, future research can effectively balance efficiency and comprehensiveness, which can serve to enhance the quality and comprehensiveness of research outcomes.

Future Research

This study lays the groundwork for expanding future research in vaccine hesitancy, decision-making styles, and the application of AI in qualitative research and beyond. Potential areas for further exploration include:

- Decision-making styles in vaccine hesitancy: Future research could be extended to explore how different decision-making styles, such as rational, intuitive, dependent, spontaneous, and avoidant, influence vaccine hesitancy and could provide the public health sector with valuable insights. Understanding which styles are more receptive or resistant to vaccine information may aid in tailoring communication strategies to effectively reduce or prevent vaccine hesitancy.
- Expanding target audiences for effective vaccine communication: Broadening vaccine hesitancy research to include highly educated, higher SES, married, and White populations could help identify and address vaccine hesitancy in traditionally overlooked groups. This expanded focus could inform the development of more inclusive and widespread communication outreach.
- Addressing social desirability bias in vaccine research: Investigating strategies to reduce social desirability bias in vaccine research is essential for capturing more authentic responses. Employing open-ended questions, indirect questioning techniques, and mixed-methods approaches could enhance the accuracy and authenticity of the data, leading to a better understanding of vaccine hesitancy.
- Advancing vaccine research through mixed-methods approaches: Utilizing and extending mixed-methods designs is essential in achieving a comprehensive understanding of vaccine hesitancy and other public health concerns. This approach

not only provides a holistic view but also helps validate or identify differences across diverse populations.

- Enhancing trust in vaccines through clear communication: Assessing how well individuals comprehend current vaccine information could significantly benefit public health efforts. Researching the impact of transparent communication tools, such as clear and easy to understand vaccine ingredient labels and infographics that detail potential side effects and their statistical likelihood, may help build trust and reduce vaccine hesitancy through improved understanding.
- Optimizing AI integration in qualitative research: Future studies should refine prompt designs for AI-driven qualitative analysis to enhance the accuracy and depth of AI-generated insights. This research could investigate how well-crafted prompts generate the most accurate and reliable findings across different qualitative analyses. Such insights would help optimize AI's role in qualitative research, enhancing the platform's trustworthiness and effectiveness in supporting rigorous research.

Limitations

This study has several limitations that should be acknowledged. The sample size was relatively homogenous, primarily consisting of white, married, highly educated individuals from higher socioeconomic backgrounds. This lack of diversity may limit the generalizability of the findings, as they may not fully represent the broader population of parents. The absence of avoidant and spontaneous decision-making styles in the sample likely reflects this small and homogenous nature, which may have constrained the diversity of decision-making processes observed. A more diverse sample would likely provide more comprehensive insights and strengthen the study's conclusions. Another limitation is the potential for response bias due to

self-reporting. The high number of observations for the rational decision-making style may be influenced by the order of questions in the survey, with rational decision-making questions positioned at the beginning of the GDMS section. Additionally, rational decision-making is often perceived as the most socially acceptable option, which could discourage participants from admitting to more spontaneous or avoidant decision-making styles, particularly in the context of their children's health. While adjusting the order of questions could mitigate this bias, it may also introduce survey fatigue, where respondents become less attentive as they progress through the survey. Balancing question placement to reduce social desirability bias while maintaining respondent engagement is crucial for future research.

For the qualitative portion of this study, the homogenous sample size and the single-session interviews per participant present additional limitations. The findings may lack generalizability and fail to capture a full range of perspectives, potentially overlooking important nuances. Moreover, qualitative research can be susceptible to social desirability bias, recall bias, and interviewer influence, which could skew the data. The one-time interview time may not have allowed for adequate rapport to be established which is requisite to deeply explore the complex issues surrounding vaccine hesitancy, resulting in a less comprehensive understanding of the participants' experiences.

Despite these limitations, the explanatory sequential mixed-methods study provides a comprehensive understanding of vaccine hesitancy among parents of children younger than 18, successfully capturing both the broad scope of vaccine hesitancy through quantitative analysis and the in-depth perspectives of parents via qualitative interviews. The quantitative phase allowed for the identification of patterns among demographic factors and decision-making styles, while the qualitative phase provided rich, contextual insights into the personal experiences and

beliefs that shape vaccine hesitancy. This comprehensive approach not only revealed the complexity of vaccine hesitancy, particularly among a demographic not traditionally considered at high risk, but also underscored the importance of personal experiences, trust in medical institutions, and the nuanced decision-making processes parents employ. The integration of AI-driven analysis further highlighted the potential for time-efficient qualitative data analysis, complementing traditional methods and offering new opportunities for research. Together, these findings emphasize the value of combining quantitative breadth with qualitative depth to fully understand and address vaccine hesitancy, providing valuable insights for public health strategies and future research efforts.

Reflexivity – Researcher Reflection

This research journey into vaccine hesitancy was deeply personal and was initiated by the tragic experience of my dear friend, who lost her 2-year-old grandson to what she and her family believe were complications from a flu vaccination. This heartbreak event made me ponder the many factors that may contribute to vaccine hesitancy and wonder how pervasive this issue might be. As a mother of five, I, too, experienced fear and apprehension surrounding childhood vaccinations when my children were younger. I dreaded having them vaccinated, yet I never questioned healthcare providers or sought a clear understanding of the vaccines, their ingredients, or potential side effects. This personal apprehension has led me to empathize with those who are vaccine-hesitant, and I often find it difficult when public health officials at times dismissively label them as uneducated or misinformed. While my journey as a researcher and academic has deepened my understanding of the science and importance of vaccinations, I still carry a profound empathy for those who struggle with these decisions.

Initially, I expected this research to confirm the prevailing public health narrative about vaccine-hesitant individuals. However, my findings revealed something different. I discovered

that the vaccine-hesitant participants in my study were intelligent, highly educated, and of high socioeconomic status. They were stable, married individuals who diligently sought credible information to make informed decisions about their children's vaccinations. These individuals were neither flippant nor uninformed in their decision-making process; rather, they were intentional, calculated, and genuinely concerned about the risks they perceived in vaccines.

Hearing participants describe how they were treated poorly and condescendingly by healthcare professionals was particularly disheartening. I found myself wrestling with irritation toward the healthcare profession. I had to remind myself that, ultimately, we all share the same goal: ensuring the health and happiness of our children and society. The challenge lies in how we achieve that goal, and diverse opinions will naturally arise.

What I learned from this experience is that to effectively address vaccine hesitancy, it is essential for public health officials to prioritize transparency and approach communication with parents in a clear, compassionate, and understanding manner. The complex and often convoluted vaccine information provided by manufacturers does not appear to be effective in conveying critical details about ingredients or potential side effects. It became clear to me that this information needs to be far more accessible and understandable to the average person. This realization led me to the idea of redesigning vaccine information to resemble nutrition labels, allowing individuals to quickly access the information they need to make informed decisions with confidence. Additionally, creating infographics that clearly display potential side effects alongside their statistical risks could help alleviate parental fears. When people can easily see that the benefits outweigh the risks, there is less room for doubt.

Upon deep reflection, I've come to realize that addressing vaccine hesitancy shouldn't be a conflict between the public and public health but rather a collaborative effort. The key to

fostering a healthy society lies in collaboration and mutual respect between the public and healthcare professionals. Public health and health research should not be seen as an arena where healthcare professionals and researchers stand above those they serve; instead, we must recognize that we are all in this together. Transparent, respectful, and empathetic communication can greatly improve the landscape of vaccine hesitancy. Furthermore, after individuals are provided with clear, easy-to-understand information, their decisions, whether to vaccinate or not, should be respected.

As a new grandmother, this topic has taken on even greater personal significance for me. I hope for a future where my children and grandchildren not only respect the healthcare community but are also treated with respect and compassion by healthcare providers. I envision a healthcare system where transparency, honesty, and kindness are the foundation of every interaction. By fostering cooperation, openness, and mutual trust, we can work together to create a healthier and brighter future for our children and the generations that follow.

Conclusion

This research offers important insights into vaccine hesitancy. Most pointedly, this study's population principally comprised highly educated White individuals with higher SES. This contrasts with vaccine-hesitant research that asserts that individuals with lower levels of educational attainment and minorities identifying as maintaining a lower SES are more inclined toward vaccine hesitancy. The quantitative analysis revealed that individuals who use intuitive decision-making have significantly lower odds of being vaccine-hesitant compared to those who rely on dependent decision-making. Additionally, parents with three or more children had lower odds of vaccine hesitancy than those with only one child. It is important to note that the findings regarding decision-making styles conflict with traditional assumptions about vaccine hesitancy, which indicate that intuitive thinkers are more prone to hesitancy. However, the findings

concerning family size are reflective of research suggesting that parents with multiple children are less inclined toward vaccine hesitancy.

The explanatory sequential mixed-methods approach allowed the initial quantitative findings to guide the qualitative exploration, offering a comprehensive understanding of the complex factors influencing vaccine hesitancy. The findings from Phase 2 provided an opportunity for a more holistic understanding of Phase 1 results and also uncovered key influences on vaccine decisions, such as parental trust in healthcare providers, concerns about vaccine safety, skepticism toward vaccine mandates, and openness to alternative health practices. Additionally, the AI-driven analysis contributed unique insights into balancing personal and community health, as well as the socio-cultural and political factors affecting vaccine attitudes. Personal experiences with adverse vaccination events and a lack of clear and accessible vaccine information were significant drivers of hesitancy, while non-hesitant parents emphasized the importance of community health and herd immunity. Both groups expressed a preference for making vaccination decisions independently of mandates and stressed the need to separate vaccines from political discourse. The study also explored the integration of AI tools like ChatGPT, demonstrating that AI can efficiently complement traditional qualitative methods, particularly in identifying themes and patterns. However, the depth and nuance provided by human-led analysis remain superior, highlighting the importance of combining AI's efficiency with rigorous human-led methodologies. These findings advocate for a collaborative approach between public health and the public, prioritizing transparent communication and the thoughtful use of AI to enhance understanding and effectively address vaccine hesitancy.

REFERENCES

- Adaboh, A. (2018). The conflict between medical science, public health, and the antivaccination movement in nineteenth-century England. *The Alexandrian*, 7(1), 1–15.
- Adeoye-Olatunde, O. A., & Olenik, N. L. (2021). Research and scholarly methods: Semi-structured interviews. *Journal of the American College of Clinical Pharmacy*, 4(10), 1358–1367. <https://doi.org/10.1002/jac5.1441>
- Akel, K. B., Masters, N. B., Shih, S.-F., Lu, Y., & Wagner, A. L. (2021). Modification of a vaccine hesitancy scale for use in adult vaccinations in the United States and China. *Human Vaccines & Immunotherapeutics*, 17(8), 2639–2646.
<https://doi.org/10.1080/21645515.2021.1884476>
- Alacreu-Crespo, A., Fuentes, M. C., Abad-Tortosa, D., Cano-Lopez, I., González, E., & Serrano, M. Á. (2019). Spanish validation of general decision-making style scale: Sex invariance, sex differences, and relationships with personality and coping styles. *Judgment and Decision Making*, 14(6), 739–751. <https://doi.org/10.1017/s1930297500005453>
- Alam, M. K. (2020). A systematic qualitative case study: Questions, data collection, NVivo analysis, and saturation. *Qualitative Research in Organizations and Management*, 16(1), 1–31. <https://doi.org/10.1108/QROM-09-2019-1825>
- Alele, F., & Malau-Aduli, B. (2023). *An introduction to research methods for undergraduate health profession students*. Pressbooks. <https://jcu.pressbooks.pub/intro-res-methods-health/part/1-introduction-to-research/>

- Allen, A. (2007). *Vaccine: The controversial story of medicine's greatest lifesaver*. W.W. Norton.
- Allsop, D. B., Chelladurai, J. M., Kimball, E. R., Marks, L. D., & Hendricks, J. J. (2022). Qualitative methods with NVivo software: A practical guide for analyzing qualitative data. *Psych*, 4(2), 142–159. <https://doi.org/10.3390/psych4020013>
- Alzahrani, A. A., & Alghamdi, A. N. (2023). Vaccine hesitancy among parents and its determinants during the era of COVID-19 in Taif City, Saudi Arabia. *Cureus*, 15(6), e40404. <https://doi.org/10.7759/cureus.40404>
- Amineh, R. J., & Asl, H. D. (2015). Review of constructivism and social constructivism. *Journal of Social Sciences, Literature, and Languages*, 1(1), 9–16.
- Anti-vax. (n.d.). In *Cambridge English dictionary*.
<https://dictionary.cambridge.org/us/dictionary/english/anti-vax>
- Atlas.ti. (2024, January 24). *Atlas.ti* [Computer assisted qualitative data analysis software].
<https://atlasti.com/>
- Balch, B. (2022, August 2). *How distrust of childhood vaccines could lead to more breakouts of preventable diseases*. AAMC. <https://www.aamc.org/news/how-distrust-childhood-vaccines-could-lead-more-breakouts-preventable-diseases>
- Barrett, J. R. (2005). Thimerosal and animal brains: New data for assessing human ethylmercury risk. *Environmental Health Perspectives*, 113(8), A543–A544.
- Battles, H., & Gilmour, R. (2021). Beyond mortality. *Bioarchaeology International*, 6(1–2), 23–40. <https://doi.org/10.5744/bi.2021.0003>

- Bavol'ár, J., & Orosová, O. (2015). Decision-making styles and their associations with decision-making competencies and mental health. *Judgment and Decision Making*, 10(1), 115–122. <https://doi.org/10.1017/s1930297500003223>
- Baxby, D. (2011). Edward Jenner's role in the introduction of smallpox vaccine. In S. A. Plotkin (Ed.), *History of vaccine development* (pp. 13–19). Springer. https://doi.org/10.1007/978-1-4419-1339-5_3
- Beatty, S. D., Macke, J. B., Griffin, K. M., & Villwock, J. A. (2023). Parental vaccine hesitancy in a COVID-19 world: A qualitative study of midwestern parents' decisions regarding COVID-19 vaccination for their children. *Kansas Journal of Medicine*, 16, 194–199. <https://doi.org/10.17161/kjm.vol16.20049>
- Beigi, G., Hu, X., Maciejewski, R., & Liu, H. (2016). An overview of sentiment analysis in social media and its applications in disaster relief. In W. Pedrycz & S.-M. Chen (Eds.), *Sentiment analysis and ontology engineering* (pp. 313–340). Springer. https://doi.org/10.1007/978-3-319-30319-2_13
- Bektas, I., & Bektas, M. (2023). The effects of parents' vaccine hesitancy and COVID-19 vaccine literacy on attitudes toward vaccinating their children during the pandemic. *Journal of Pediatric Nursing*, 71, 70–74. <https://doi.org/10.1016/j.pedn.2023.04.016>
- Benadjoud, Y. (2023, November 16). Global measles cases rose 18 percent in 2022 due to low vaccination rates. *ABC News*. <https://abcnews.go.com/Health/global-measles-cases-rose-18-percent-2022-low-vaccination-rates/story?id=104942082>
- Bhagianadh, D., & Arora, K. (2022). COVID-19 vaccine hesitancy among community-dwelling older adults: The role of information sources. *Journal of Applied Gerontology*, 41(1), 4–11. <https://doi.org/10.1177/07334648211037507>

- Blendon, R. J., & Benson, J. M. (2022). Trust in medicine, the health system & public health. *Daedalus*, 151(4), 67–82. https://doi.org/10.1162/daed_a_01944
- Blevins, S. M., & Bronze, M. S. (2010). Robert Koch and the ‘golden age’ of bacteriology. *International Journal of Infectious Diseases*, 14(9), 744–751. <https://doi.org/10.1016/j.ijid.2009.12.003>
- Boretti, A. (2021). Reviewing the association between aluminum adjuvants in the vaccines and autism spectrum disorder. *Journal of Trace Elements in Medicine and Biology*, 66, 1–7. <https://doi.org/10.1016/j.jtemb.2021.126764>
- Börner, N., Mühlberger, N., & Jelínek, T. (2006). Tolerability of multiple vaccinations in travel medicine. *Journal of Travel Medicine*, 10(2), 112–116. <https://doi.org/10.2310/7060.2003.31690>
- Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, 11(4), 589–597. <https://doi.org/10.1080/2159676x.2019.1628806>
- Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. SAGE.
- Brown, K. F., Kroll, J. S., Hudson, M. J., Ramsay, M., Green, J., Long, S. J., Vincent, C. A., Fraser, G., & Sevdalis, N. (2010). Factors underlying parental decisions about combination childhood vaccinations including MMR: A systematic review. *Vaccine*, 28(26), 4235–4248. <https://doi.org/10.1016/j.vaccine.2010.04.052>
- Castro, H. M., & Ferreira, J. C. (2023). Linear and logistic regression models: When to use and how to interpret them? *Jornal Brasileiro de Pneumologia*, 48(6), e20220439. <https://doi.org/10.36416/1806-3756/e20220439>

Cawkwell, P. B., & Oshinsky, D. (2015). Childhood vaccination requirements: Lessons from history, Mississippi, and a path forward. *Vaccine*, 33(43), 5884–5887.
<https://doi.org/10.1016/j.vaccine.2015.08.087>

Centers for Disease Control and Prevention. (2020, August 25). *Thimerosal and vaccines*.
https://archive.cdc.gov/www_cdc_gov/vaccinesafety/concerns/thimerosal/index.html

Centers for Disease Control and Prevention. (2021, February 20). *History of smallpox*.
<https://www.cdc.gov/smallpox/history/history.html>

Centers for Disease Control and Prevention. (2022a, December). *2023 recommended immunizations for children from birth through 6 years old*.
<https://stacks.cdc.gov/view/cdc/124469>

Centers for Disease Control and Prevention. (2022b, September 27). *Adjuvants and vaccines*.
<https://www.cdc.gov/vaccine-safety/about/adjuvants.html>

Centers for Disease Control and Prevention. (2022c, December 1). *Vaccines & immunizations: Glossary*. <https://www.cdc.gov/vaccines/terms/glossary.html#commimmunity>

Centers for Disease Control and Prevention. (2023, April 24). *Fast facts on global immunization*.
https://www.cdc.gov/global-immunization/fast-facts/?CDC_Aref_Val=https://www.cdc.gov/globalhealth/immunization/data/fast-facts.html

Centers for Disease Control and Prevention. (2024a). *Reasons parents gave for not having their child vaccinated against COVID-19, October–December 2023*.
<https://www.cdc.gov/covidvaxview/publications/reasons-no-covid-19-vaccination-2023.html>

Centers for Disease Control and Prevention. (2024b). Your child needs vaccines as they grow!

2024 Recommended Immunizations for Birth Through 6 Years Old. Atlanta; Centers for Disease Control and Prevention.

Centers for Disease Control and Prevention. (2024c, July 20). *Health communication strategies and resources*. <https://npin.cdc.gov/pages/health-communication-strategies-and-resources>

Chandok, R. S., Madar, P., & Majeed, A. (2022). A qualitative study of factors influencing COVID-19 vaccine hesitancy among South Asians in London. *JRSM Open*, 13(10).

<https://doi.org/10.1177/20542704221123430>

Charron, J., Gautier, A., & Jestin, C. (2020). Influence of information sources on vaccine hesitancy and practices. *Médecine et Maladies Infectieuses*, 50(8), 727–733.

<https://doi.org/10.1016/j.medmal.2020.01.010>

Children's Hospital of Philadelphia. (2018, May 14). *Vaccine ingredients: Formaldehyde*.
<https://www.chop.edu/centers-programs/vaccine-education-center/vaccine-ingredients/formaldehyde>

Choo, S., & Finn, A. (1999). Pediatric combination vaccines. *Current Opinion in Pediatrics*, 11(1), 14–20. <https://doi.org/10.1097/00008480-199902000-00004>

Christou, P. (2023). How to use artificial intelligence (AI) as a resource, methodological and analysis tool in qualitative research. *The Qualitative Report*, 28(7), 1968–1980.
<https://doi.org/10.46743/2160-3715/2023.6406>

Chyung, S. Y., Roberts, K., Swanson, I., & Hankinson, A. (2017). Evidence-based survey design: The use of a midpoint on the Likert scale. *Performance Improvement*, 56(10), 15–23. <https://doi.org/10.1002/pfi.21727>

- Confer, S. V., Diller, J. W., & Danforth, J. S. (2021). A behavior-analytic approach to antivaccination practices. *Behavior and Social Issues*, 30(1), 648–665.
<https://doi.org/10.1007/s42822-021-00051-5>
- Conis, E., & Kuo, J. (2021). Historical origins of the personal belief exemption to vaccination mandates: The view from California. *Journal of the History of Medicine and Allied Sciences*, 76(2), 167–190. <https://doi.org/10.1093/jhmas/jrab003>
- Corr, C., Snodgrass, M. R., Love, H., Scott, I. M., Kim, J., & Andrews, L. (2020). Exploring the landscape of published mixed-methods research in special education: A systematic review. *Remedial and Special Education*, 42(5), 317–328.
<https://doi.org/10.1177/0741932520924030>
- Coustasse, A., Kimble, C., & Maxik, K. (2020). COVID-19 and vaccine hesitancy. *Journal of Ambulatory Care Management*, 44(1), 71–75.
<https://doi.org/10.1097/jac.0000000000000360>
- Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed-methods research* (2nd ed.). SAGE.
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed-methods research* (3rd ed.). SAGE.
- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry & research design: Choosing among five approaches* (4th ed.). SAGE.

- Cunniff, L., Alyanak, E., Fix, A., Novak, M., Peterson, M., Mevis, K., Eiden, A. L., & Bhatti, A. (2023). The impact of the COVID-19 pandemic on vaccination uptake in the United States and strategies to recover and improve vaccination rates: A review. *Human Vaccines & Immunotherapeutics*, 19(2), Article 2246502.
<https://doi.org/10.1080/21645515.2023.2246502>
- Dahlberg, H., & Dahlberg, K. (2019). Open and reflective lifeworld research: A third way. *Qualitative Inquiry*, 26(5), 458–464. <https://doi.org/10.1177/1077800419836696>
- Danya, H., & Nakayama, K. (2022). Decision-making styles of patients and general population in health care: A scoping review. *Nursing Forum*, 57(6), 1012–1025.
<https://doi.org/10.1111/nuf.12775>
- De Angelis, L., Baglivo, F., Arzilli, G., Privitera, G. P., Ferragina, P., Tozzi, A. E., & Rizzo, C. (2023). ChatGPT and the rise of large language models: The new AI-driven infodemic threat in public health. *Frontiers in Public Health*, 11, 1166120.
<https://doi.org/10.3389/fpubh.2023.1166120>
- Deng, J., & Lin, Y. (2022). The benefits and challenges of ChatGPT: An overview. *Frontiers in Computing and Intelligent Systems*, 2(2), 81–83. <https://doi.org/10.54097/fcis.v2i2.4465>
- Desmond, C., Brubaker, K. A., & Ellner, A. L. (2013). Decision-making strategies: Ignored to the detriment of healthcare training and delivery? *Health Psychology and Behavioral Medicine*, 1(1), 59–70. <https://doi.org/10.1080/21642850.2013.854706>
- Dhakal, K. (2022). NVivo. *Journal of the Medical Library Association*, 110(2), 270–272.
<https://doi.org/10.5195/jmla.2022.1271>

- Dimassi, O., Dimassi, M., Tritschler, A., Laban, T., & Santhosh, D. (2023). Exploring vaccination sentiments: A population-centric examination. *Journal of Primary Care & Community Health*, 14. <https://doi.org/10.1177/21501319231210615>
- Dinc, G., & Ulman, Y. I. (2007). The introduction of variolation ‘a la turca’ to the West by Lady Mary Montagu and Turkey’s contribution to this. *Vaccine*, 25(21), 4261–4265. <https://doi.org/10.1016/j.vaccine.2007.02.076>
- Dollah, S., Abduh, A., & Rosmaladewi, M. (2017). Benefits and drawbacks of NVivo QSR application. *Proceedings of the 2nd International Conference on Education, Science, and Technology (ICEST 2017)*, 61–63. <https://doi.org/10.2991/icest-17.2017.21>
- Dossett, L., Kaji, A., & Dimick, J. (2020). Practical guide to mixed-methods. *JAMA Surgery*, 155(3), 254–255. <https://doi.org/10.1001/jamasurg.2019.4388>
- Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. (2013). Vaccine hesitancy: An overview. *Human Vaccines & Immunotherapeutics*, 9(8), 1763–1773. <https://doi.org/10.4161/hv.24657>
- Duong, A., Steinmaus, C., McHale, C. M., Vaughan, C. P., & Zhang, L. (2011). Reproductive and developmental toxicity of formaldehyde: A systematic review. *Mutation Research/Reviews in Mutation Research*, 728(3), 118–138. <https://doi.org/10.1016/j.mrrev.2011.07.003>
- Elliott, C. B., & Chambers, C. S. (2022). A historical analysis of vaccine mandates in the United States military and its application to the COVID-19 vaccine mandate. *Vaccine*, 40(51), 7500–7504. <https://doi.org/10.1016/j.vaccine.2022.08.017>

- Elliott-Mainwaring, H. (2021). Exploring using NVIVO software to facilitate inductive coding for thematic narrative synthesis. *British Journal of Midwifery*, 29(11), 628–632.
<https://doi.org/10.12968/bjom.2021.29.11.628>
- Enders, C. K. (2010). *Applied missing data analysis*. Guilford Press.
- Enkel, S. L., Attwell, K., Snelling, T. L., & Christian, H. E. (2018). ‘Hesitant compliers’: Qualitative analysis of concerned fully vaccinating parents. *Vaccine*, 36(44), 6459–6463.
<https://doi.org/10.1016/j.vaccine.2017.09.088>
- Fauzi, F., Tuhuteru, L., Sampe, F., Ausat, A. M., & Hatta, H. R. (2023). Analysing the role of ChatGPT in improving student productivity in higher education. *Journal on Education*, 5(4), 14886–14891. <https://doi.org/10.31004/joe.v5i4.2563>
- Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology*, 40(5), 532–538. <https://doi.org/10.1037/a0015808>
- Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed-methods designs—principles and practices. *Health Services Research*, 48(6 Pt 2), 2134–2156.
<https://doi.org/10.1111/1475-6773.12117>
- Field, A. (2020). Survey fatigue and the tragedy of the commons: Are we undermining our evaluation practice? *Evaluation Matters—He Take Tō Te Aromatawai*, 1–11.
<https://doi.org/10.18296/em.0054>
- Fischbach, L., Civen, R., Boyd, H., Flores, D. M., Cloud, J., Smith, L. V., King, J., Alvarez, F., & Kuo, T. (2022). Factors influencing COVID-19 vaccine acceptance in the workplace: Results from a rapid survey at 2 corporations in Los Angeles County, California, 2021. *Public Health Reports*, 137(6), 1207–1216. <https://doi.org/10.1177/00333549221118086>

- Fischer, S., Soyez, K., & Gurtner, S. (2015). Adapting Scott and Bruce's general decision-making style inventory to patient decision-making in provider choice. *Medical Decision Making*, 35(4), 525–532. <https://doi.org/10.1177/0272989x15575518>
- FitzPatrick, M. A., Hess, A. C., Sudbury-Riley, L., & Schulz, P. J. (2019). A typology of patients based on decision-making styles: Cross-sectional survey study. *Journal of Medical Internet Research*, 21(11), 1–15. <https://doi.org/10.2196/15332>
- Fletcher, M. A., Fabre, P., Debois, H., & Saliou, P. (2004). Vaccines administered simultaneously: Directions for new combination vaccines based on a historical review of the literature. *International Journal of Infectious Diseases*, 8(6), 328–338. <https://doi.org/10.1016/j.ijid.2004.03.006>
- Flynn, K. E., & Smith, M. A. (2007). Personality and health care decision-making style. The *Journal of Gerontology. Series B, Psychological Sciences and Social Sciences*, 62(5), P261–P267. <https://doi.org/10.1093/geronb/62.5.p261>
- Fox, N. J. (2008). Post-positivism. In L. M. Given (Ed.), *The SAGE encyclopedia of qualitative research methods* (pp. 661–664). SAGE.
- Fülöp, J. (2005, November). *Introduction to decision-making methods*. Computer and Automation Institute, Hungarian Academy of Science. https://www.academia.edu/22906650/Introduction_to_Decision_Making_Methods
- Funk, C., Tyson, A., Kennedy, B., & Pasquini, G. (2023, May 16). *1. what Americans think about the MMR vaccines*. Pew Research Center. <https://www.pewresearch.org/science/2023/05/16/what-americans-think-about-the-mmr-vaccines/>

- Galagali, P. M., Kinikar, A. A., & Kumar, V. S. (2022). Vaccine hesitancy: Obstacles and challenges. *Current Pediatrics Reports*, 10(4), 241–248. <https://doi.org/10.1007/s40124-022-00278-9>
- Gambetti, E., Fabbri, M., Bensi, L., & Tonetti, L. (2008). A contribution to the Italian validation of the general decision-making style inventory. *Personality and Individual Differences*, 44(4), 842–852. <https://doi.org/10.1016/j.paid.2007.10.017>
- Geier, D. A., King, P. G., Hooker, B. S., Dórea, J. G., Kern, J. K., Sykes, L. K., & Geier, M. R. (2015). Thimerosal: Clinical, epidemiologic, and biochemical studies. *Clinica Chimica Acta*, 444, 212–220. <https://doi.org/10.1016/j.cca.2015.02.030>
- Getman, R., Helmi, M., Roberts, H., Yansane, A., Cutler, D., & Seymour, B. (2017). Vaccine hesitancy and online information: The influence of digital networks. *Health Education & Behavior*, 45(4), 599–606. <https://doi.org/10.1177/1090198117739673>
- Girard, A. J., Reeve, C. L., & Bonaccio, S. (2016). Assessing decision-making style in French-speaking populations: Translation and validation of the general decision-making style questionnaire. *European Review of Applied Psychology*, 66(6), 325–333. <https://doi.org/10.1016/j.erap.2016.08.001>
- Goldman, G. S., & Miller, N. Z. (2012). Relative trends in hospitalizations and mortality among infants by the number of vaccine doses and age, based on the vaccine adverse event reporting system (VAERS), 1990-2010. *Human & Experimental Toxicology*, 31(10), 1012–1021. <https://doi.org/10.1177/0960327112440111>

- Greene, J., & Hall, J. (2010). Dialectics and pragmatism: Being of consequence. In A. Tashakkori & C. Teddlie (Eds.), *SAGE handbook of mixed-methods in social & behavioral research* (2nd ed., pp. 119–144). SAGE.
<https://doi.org/10.4135/9781506335193>
- Grignolio, A. (2018). *Vaccines: Are they worth a shot?* Springer International Publishing.
- Grills, L. A., & Wagner, A. L. (2023). The impact of the COVID-19 pandemic on parental vaccine hesitancy: A cross-sectional survey. *Vaccine*, 41(41), 6127–6133.
<https://doi.org/10.1016/j.vaccine.2023.08.044>
- Guetterman, T. C., Chang, T., DeJonckheere, M., Basu, T., Scruggs, E., & Vydiswaran, V. V. (2018). Augmenting qualitative text analysis with natural language processing: Methodological study. *Journal of Medical Internet Research*, 20(6).
<https://doi.org/10.2196/jmir.9702>
- Guttormsen, D. S., & Moore, F. (2023). ‘Thinking about how we think’: Using Bourdieu’s epistemic reflexivity to reduce bias in international business research. *Management International Review*, 63(4), 531–559. <https://doi.org/10.1007/s11575-023-00507-3>
- Hamilton, K., Shih, S. I., & Mohammed, S. (2016). The development and validation of the rational and intuitive decision styles scale. *Journal of Personality Assessment*, 98(5), 523–535. <https://doi.org/10.1080/00223891.2015.1132426>
- Hamilton, L., Elliott, D., Quick, A., Smith, S., & Choplin, V. (2023). Exploring the use of AI in qualitative analysis: A comparative study of guaranteed income data. *International Journal of Qualitative Methods*, 22, 1–13. <https://doi.org/10.1177/16094069231201504>
- Han, S. (2015). Clinical vaccine development. *Clinical and Experimental Vaccine Research*, 4(1), 46–53. <https://doi.org/10.7774/cevr.2015.4.1.46>

- Haroune, V., & King, L. (2020). Factors contributing to parental ‘vaccine hesitancy’ for childhood immunisations. *Nursing Children and Young People*, 32(4), 20–25.
<https://doi.org/10.7748/ncyp.2020.e1269>
- Harutyunyan, V., Quddus, A., Pallansch, M., Zipursky, S., Woods, D., Ottosen, A., Vertefeuille, J., & Lewis, I. (2023). Global oral poliovirus vaccine stockpile management as an essential preparedness and response mechanism for type 2 poliovirus outbreaks following global oral poliovirus vaccine type 2 withdrawal. *Vaccine*, 41(Suppl 1), A70–A78.
<https://doi.org/10.1016/j.vaccine.2022.02.058>
- Helmkamp, L. J., Szilagyi, P. G., Zimet, G., Saville, A. W., Gurfinkel, D., Albertin, C., Breck, A., Vangala, S., & Kempe, A. (2021). A validated modification of the vaccine hesitancy scale for childhood, influenza, and HPV vaccines. *Vaccine*, 39(13), 1831–1839.
<https://doi.org/10.1016/j.vaccine.2021.02.039>
- Heymans, M. W., & Twisk, J. W. R. (2022). Handling missing data in clinical research. *Journal of Clinical Epidemiology*, 151, 185–188. <https://doi.org/10.1016/j.jclinepi.2022.08.016>
- Hill, H. A., Yankey, D., Elam-Evans, L. D., Singelton, J. A., & Sterrett, N. (2021, October 14). *Vaccination coverage by age 24 months among children born in 2017 and 2018 – National Immunization Survey-Child, United States, 2018–2020*. Centers for Disease Control and Prevention. <https://www.cdc.gov/mmwr/volumes/70/wr/mm7041a1.htm>
- Hillenbrand, K. M. (2007). What is going on with vaccines: Keeping up with the childhood immunization schedule. *Journal of Public Health Management and Practice*, 13(6), 544–552. <http://www.jstor.org/stable/44967377>
- Hodge, J. G., & Gostin, L. O. (2002). School vaccination requirements: Historical, social, and legal perspectives. *Kentucky Law Journal*, 90(4), 1–62. <https://ssrn.com/abstract=362280>

- Hoffman, D., Stewart, A., Breznay, J., Simpson, K., & Crane, J. (2021). Vaccine hesitancy narratives. *Voices in Bioethics*, 7, 1–7. <https://doi.org/10.52214/vib.v7i.8789>
- Hoffman, J. (2022, December 16). Opposition to school vaccine mandates has grown significantly, study finds. *The New York Times*.
<https://www.nytimes.com/2022/12/16/health/vaccines-public-opinion.html>
- Holroyd, T. A. (2020). *Trust in public health authorities, school immunization policy, and vaccine knowledge, attitudes, and beliefs: Implications for vaccine decision-making* [Doctoral dissertation, Johns Hopkins University]. Johns Hopkins University Repository.
<https://exampleurl.com>
- Hsu, J. L. (2013). A brief history of vaccines: Smallpox to the present [Special issue]. *South Dakota Medicine*, 33–37.
- Institute of Medicine Immunization Safety Review Committee, Stratton, K., Gable, A., & McCormick, M. C. (Eds.). (2001). *Immunization safety review: Thimerosal-containing vaccines and neurodevelopmental disorders*. National Academies Press.
<https://doi.org/10.17226/10208>
- Jacobson, R. M., St Sauver, J. L., & Finney Rutten, L. J. (2015). Vaccine hesitancy. *Mayo Clinic Proceedings*, 90(11), 1562–1568. <https://doi.org/10.1016/j.mayocp.2015.09.006>
- Jakobsen, J. C., Gluud, C., Wetterslev, J., & Winkel, P. (2017). When and how should multiple imputation be used for handling missing data in randomised clinical trials – A practical guide with flowcharts. *BMC Medical Research Methodology*, 17(1), 1–10.
<https://doi.org/10.1186/s12874-017-0442-1>
- Jason, L., & Glenwick, D. (2016). *Handbook of methodological approaches to community-based research: Qualitative, quantitative, and mixed-methods*. Oxford University Press.

- The Jenner Institute. (n.d.). *About Edward Jenner*. <https://www.jenner.ac.uk/about/edward-jenner>
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed-methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14–26.
<https://doi.org/10.3102/0013189x033007014>
- Karakose, T. (2023). The utility of ChatGPT in educational research—potential opportunities and pitfalls. *Educational Process International Journal*, 12(2), 7–13.
<https://doi.org/10.22521/edupij.2023.122.1>
- Kato, T., & Miura, T. (2021). The impact of questionnaire length on the accuracy rate of online surveys. *Journal of Marketing Analytics*, 9(2), 83–98. <https://doi.org/10.1057/s41270-021-00105-y>
- Kayser, V., & Ramzan, I. (2021). Vaccines and vaccination: History and emerging issues. *Human Vaccines & Immunotherapeutics*, 17(12), 5255–5268.
<https://doi.org/10.1080/21645515.2021.1977057>
- Keith, L. S., Jones, D. E., & Chou, C. H. (2002). Aluminum toxicokinetics regarding infant diet and vaccinations. *Vaccine*, 20(Suppl 3), S13–S17. [https://doi.org/10.1016/s0264-410x\(02\)00165-2](https://doi.org/10.1016/s0264-410x(02)00165-2)
- Kempe, A., Saville, A. W., Albertin, C., Zimet, G., Breck, A., Helmkamp, L., Vangala, S., Dickinson, L. M., Rand, C., Humiston, S., & Szilagyi, P. G. (2020). Parental hesitancy about routine childhood and influenza vaccinations: A national survey. *Pediatrics*, 146(1), 1–12. <https://doi.org/10.1542/peds.2019-3852>

- Kerrigan, A. R., Aitnouri, I., Mar, J., & Altman, W. (2020). What barriers exist in the minds of vaccine-hesitant parents, and how can we address them? *Family Medicine*, 52(9), 626–630. <https://doi.org/10.22454/fammed.2020.432940>
- Khanbhai, M., Anyadi, P., Symons, J., Flott, K., Darzi, A., & Mayer, E. (2021). Applying natural language processing and machine learning techniques to patient experience feedback: A systematic review. *BMJ Health & Care Informatics*, 28(1). <https://doi.org/10.1136/bmjhci-2020-100262>
- Khordori, N. (2022). Vaccines and vaccine resistance: Past, present, and future. *Indian Journal of Medical Microbiology*, 40(2), 187–192. <https://doi.org/10.1016/j.ijmm.2021.12.008>
- Khlaif, Z. N., Mousa, A., Hattab, M. K., Itmazi, J., Hassan, A. A., Sanmugam, M., & Ayyoub, A. (2023). The potential and concerns of using AI in scientific research: CHATGPT performance evaluation. *JMIR Medical Education*, 9, 1–16. <https://doi.org/10.2196/47049>
- Kivunja, C., & Kuyini, A. B. (2017). Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, 6(5), 26–41. <https://doi.org/10.5430/ijhe.v6n5p26>
- Koskan, A., LoCoco, I. E., Daniel, C. L., & Teeter, B. S. (2023). Rural Americans Covid-19 vaccine perceptions and willingness to vaccinate against Covid-19 with their community pharmacists: An exploratory study. *Vaccines*, 11(1), 171. <https://doi.org/10.3390/vaccines11010171>
- Kumar, D., Chandra, R., Mathur, M., Samdariya, S., & Kapoor, N. (2016). Vaccine hesitancy: Understanding better to address better. *Israel Journal of Health Policy Research*, 5(1), 1–8. <https://doi.org/10.1186/s13584-016-0062-y>

- Kuru, O., Chan, M. S., Lu, H., Stecula, D. A., Jamieson, K. H., & Albarracín, D. (2022). Religious affiliation and philosophical and moral beliefs about vaccines: A longitudinal study. *Journal of Health Psychology*, 27(13), 3059–3081.
- <https://doi.org/10.1177/13591053221082770>
- Lahman, M. K. E. (2022). *Writing and representing qualitative research*. SAGE.
- Larson, H. J., Gakidou, E., & Murray, C. J. L. (2022). The vaccine-hesitant moment. *New England Journal of Medicine*, 387(1), 58–65. <https://doi.org/10.1056/nejmra2106441>
- Ledda, C., Costantino, C., Liberti, G., & Rapisarda, V. (2022). The Italian version of the adult vaccine hesitancy scale (AVHS) for the working-age population: Cross-cultural adaptation, reliability, and validity. *Vaccines*, 10(2), 224–231.
- <https://doi.org/10.3390/vaccines10020224>
- Lee, V. V., Van Der Lubbe, S. C., Goh, L. H., & Valderas, J. M. (2023). Viewpoint: Harnessing ChatGPT for thematic analysis: Are we ready? *arXiv*, 1–23.
- <https://doi.org/10.48550/arXiv.2310.14545>
- Leung, A. K. C. (2011). “Variolation” and vaccination in late imperial China, ca. 1570–1911. In S. Plotkin (Ed.), *History of vaccine development* (pp. 5–12). Springer.
- https://doi.org/10.1007/978-1-4419-1339-5_2
- Levin, J., & Bradshaw, M. (2022). Determinants of COVID-19 skepticism and SARS-CoV-2 vaccine hesitancy: Findings from a national population survey of U.S. adults. *BMC Public Health*, 22(1). <https://doi.org/10.1186/s12889-022-13477-2>
- Leykin, Y., & DeRubeis, R. J. (2010). Decision-making styles and depressive symptomatology: Development of the decision styles questionnaire. *Judgment and Decision Making*, 5(7), 506–515. <https://doi.org/10.1017/S1930297500001674>

- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications.
- [https://doi.org/10.1016/0147-1767\(85\)90062-8](https://doi.org/10.1016/0147-1767(85)90062-8)
- Lincoln, Y. S., & Guba, E. G. (2013). *The constructivist credo*. Left Coast Press.
- Lindbladh, E., & Lyttkens, C. H. (2002). Habit versus choice: The process of decision-making in health-related behaviour. *Social Science & Medicine*, 55(3), 451–465.
- [https://doi.org/10.1016/s0277-9536\(01\)00180-0](https://doi.org/10.1016/s0277-9536(01)00180-0)
- Locke, J., Marinkovic, A., Hamdy, K., Balendra, V., & Sanyaolu, A. (2023). Routine pediatric vaccinations during the COVID-19 pandemic: A review of the global impact. *World Journal of Virology*, 12(5), 256–261. <https://doi.org/10.5501/wjv.v12.i5.256>
- Loo, R. (2000). A psychometric evaluation of the general decision-making style inventory. *Personality and Individual Differences*, 29(5), 895–905. [https://doi.org/10.1016/s0191-8869\(99\)00241-x](https://doi.org/10.1016/s0191-8869(99)00241-x)
- Louten, J. (2023). Poxviruses. In *Essential human virology* (2nd ed., pp. 323–340). Elsevier.
- Lovelace, S., Trudel, C., Dulude, C., & King, W. J. (2020). Cost vs. benefit: What does NVIVO video analysis of EMR simulations add to our understanding of user experience? *Proceedings of the International Symposium on Human Factors and Ergonomics in Health Care*, 9(1), 24–32. <https://doi.org/10.1177/2327857920091056>
- Low, J. M., Soo, C. W. T., Phuong, T., Zhong, Y., & Lee, L. Y. (2022). Predicting vaccine hesitancy among parents towards COVID-19 vaccination for their children in Singapore. *Frontiers in Pediatrics*, 10. <https://doi.org/10.3389/fped.2022.994675>
- Lumivero. (n.d.). *NVivo getting started bundle*. <https://lumivero.com/product/nvivo-getting-started-bundle/>
- Lumivero. (2023, October 11). *NVivo*. <https://lumivero.com/products/nvivo/>

- MacDonald, N. E., Dubé, E., & Butler, R. (2019). Vaccine hesitancy terminology: A response to Bedford et al. *Vaccine*, 37(30), 3947–3948. <https://doi.org/10.1016/j.vaccine.2017.11.060>
- MacDonald, N. E., & SAGE Working Group on Vaccine Hesitancy. (2015). Vaccine hesitancy: Definition, scope, and determinants. *Vaccine*, 33(34), 4161–4164. <https://doi.org/10.1016/j.vaccine.2015.04.036>
- Malone, K. M., & Hinman, A. R. (2003). Vaccination mandates: The public health imperative and individual rights. In R. A. Goodman, M. A. Rothstein, R. E. Hoffman, W. Lopez, G. W. Matthews, & K. L. Foster (Eds.), *Law in Public Health Practice* (pp. 262–284). Oxford University Press.
- Mangal, S., Park, L., Reading Turchioe, M., Choi, J., Niño de Rivera, S., Myers, A., Goyal, P., Dugdale, L., & Masterson Creber, R. (2022). Building Trust in research through information and intent transparency with Health Information: Representative cross-sectional survey of 502 US adults. *Journal of the American Medical Informatics Association*, 29(9), 1535–1545. <https://doi.org/10.1093/jamia/ocac084>
- Marjaei, S., Yazdi, F. A., & Chandrashekara, M. (2019). *MAXQDA and its application to LIS research*. Library at University <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=5740&context=libphilprac> of Nebraska-Lincoln.
- Mark, G. (2023, January 6). How to restore our attention spans. *The Wall Street Journal*. <https://www.wsj.com/articles/how-to-restore-our-attention-spans-11673031247>
- Marr, B. (2023, October 5). A short history of ChatGPT: How we got to where we are today. *Forbes*. <https://www.forbes.com/sites/bernardmarr/2023/05/19/a-short-history-of-chatgpt-how-we-got-to-where-we-are-today/?sh=3861fd82674f>

- Marshall, G. S. (2018). Vaccine hesitancy, history, and human nature: The 2018 Stanley A. Plotkin lecture. *Journal of the Pediatric Infectious Diseases Society*, 8(1), 1–8.
<https://doi.org/10.1093/jpids/piy082>
- Martinelli, M., & Veltri, G. A. (2021). Do cognitive styles affect vaccine hesitancy? A dual-process cognitive framework for vaccine hesitancy and the role of risk perceptions. *Social Science & Medicine*, 289, 1–11. <https://doi.org/10.1016/j.socscimed.2021.114403>
- Martinón-Torres, F. (2021). Pediatric combination vaccines. In T. Vesikari & P. Van Damme (Eds.), *Pediatric vaccines and vaccinations* (pp. 207–222). Springer.
https://doi.org/10.1007/978-3-030-77173-7_20
- Masic, I. (2022). Medical decision making – an overview. *Acta Informatica Medica*, 30(3), 230–235. <https://doi.org/10.5455/aim.2022.30.230-235>
- Masson, J. D., Crépeaux, G., Authier, F. J., Exley, C., & Gherardi, R. K. (2018). Critical analysis of reference studies on the toxicokinetics of aluminum-based adjuvants. *Journal of Inorganic Biochemistry*, 181, 87–95. <https://doi.org/10.1016/j.jinorgbio.2017.12.015>
- Mawson, A. R., & Croft, A. M. (2020). Multiple vaccinations and the enigma of vaccine injury. *Vaccines*, 8(4), 676. <https://doi.org/10.3390/vaccines8040676>
- MAXQDA. (n.d.). *All-in-one qualitative & mixed-methods data analysis tool*.
<https://www.maxqda.com/>
- McClure, C. C., Cataldi, J. R., & O’Leary, S. T. (2017). Vaccine hesitancy: Where we are and where we are going. *Clinical Therapeutics*, 39(8), 1550–1562.
<https://doi.org/10.1016/j.clinthera.2017.07.003>

- McGrath, R. (2021). Journalling and memoing: Reflexive qualitative research tools. In K. Townsend, K. Saunders, & T. McDermott (Eds.), *Handbook of qualitative research methodologies in workplace contexts* (pp. 245–262). Edward Elgar Publishing.
<https://doi.org/10.4337/9781789904345.00022>
- McKee, C., & Bohannon, K. (2016). Exploring the reasons behind parental refusal of vaccines. *The Journal of Pediatric Pharmacology and Therapeutics*, 21(2), 104–109.
<https://doi.org/10.5863/1551-6776-21.2.104>
- Merck Sharp & Dohme LLC. (2023a). *M-M-R II (Measles, Mumps, and Rubella Virus Vaccine Live): Highlights of prescribing information*. Merck & Co., Inc.
https://www.merck.com/product/usa/pi_circulars/m/mmr_ii/mmr_ii_pi.pdf
- Merck Sharp & Dohme LLC. (2023b). *M-M-R II (Measles, Mumps, and Rubella Virus Vaccine Live): Patient information*. Merck & Co., Inc.
https://www.merck.com/product/usa/pi_circulars/m/mmr_ii/mmr_ii_ppi.pdf
- Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.
- Mesec, B. (2023, April 18). *The language model of artificial intelligence ChatGPT: A tool of qualitative analysis of texts*. Authorea.
<https://doi.org/10.22541/au.168182047.70243364/v1>
- Mirola, W. A., Emerson, M. O., & Monahan, S. C. (2016). *Religion matters*. Taylor and Francis.
<https://www.perlego.com/book/1562119/religion-matters-what-sociology-teaches-us-about-religion-in-our-world-pdf>

- Mitkus, R. J., King, D. B., Hess, M. A., Forshee, R. A., & Walderhaug, M. O. (2011). Updated aluminum pharmacokinetics following infant exposures through diet and vaccination. *Vaccine*, 29(51), 9538–9543. <https://doi.org/10.1016/j.vaccine.2011.09.124>
- Mohamadi, S., Mujtaba, G., Le, N., Doretto, G., & Adjeroh, D. A. (2023). ChatGPT in the age of generative AI and large language models: A concise survey. *arXiv*. <https://doi.org/10.48550/arXiv.2307.04251>
- Moi, L., Frau, M., & Cabiddu, F. (2018). Exploring the role of NVivo software in marketing research. *Mercati & Competitività*, 4, 65–86. <https://doi.org/10.3280/mc2018-004005>
- Montero, D. A., Vidal, R. M., Velasco, J., Carreño, L. J., Torres, J. P., Benachi O, M. A., Tovar-Rosero, Y. Y., Oñate, A. A., & O’Ryan, M. (2024). Two centuries of vaccination: Historical and conceptual approach and future perspectives. *Frontiers in Public Health*, 11, 1326154. <https://doi.org/10.3389/fpubh.2023.1326154>
- Morgan, D. L. (2023). Exploring the use of artificial intelligence for qualitative data analysis: The case of ChatGPT. *International Journal of Qualitative Methods*, 22. <https://doi.org/10.1177/16094069231211248>
- Murdach, A. D. (1995). Decision-making situations in health care. *Health & Social Work*, 20(3), 187–191. <https://doi.org/10.1093/hsw/20.3.187>
- Nagar, S., & Ashaye, T. (2022). A shot of faith—analyzing vaccine hesitancy in certain religious communities in the United States. *American Journal of Health Promotion*, 36(5), 765–767. <https://doi.org/10.1177/08901171211069547>
- National Childhood Vaccine Injury Act of 1986, 42 U.S.C. § 300aa-1 (1986).

- Nguyen, K. H., Srivastav, A., Lindley, M. C., Fisher, A., Kim, D., Greby, S. M., Lee, J., & Singleton, J. A. (2022). Parental vaccine hesitancy and association with childhood diphtheria, tetanus toxoid, and acellular pertussis; measles, mumps, and rubella; rotavirus; and combined 7-series vaccination. *American Journal of Preventive Medicine*, 62(3), 367–376. <https://doi.org/10.1016/j.amepre.2021.08.015>
- Nossier, S. A. (2021). Vaccine hesitancy: The greatest threat to COVID-19 vaccination programs. *The Journal of the Egyptian Public Health Association*, 96(1), Article 18. <https://doi.org/10.1186/s42506-021-00081-2>
- Novak, A. (2005). The religious and philosophical exemptions to state-compelled vaccination: Constitutional and other challenges. *Journal of Constitutional Law*, 7(4), 1101–1129. <https://doi.org/10.31636/jcl/vol7/iss4/4>
- Nowak, G. J., & Cacciato, M. A. (2023). State of vaccine hesitancy in the United States. *Pediatric Clinics of North America*, 70(2), 197–210. <https://doi.org/10.1016/j.pcl.2022.11.001>
- Nurmi, J., & Harman, B. (2021). Why do parents refuse childhood vaccination? Reasons reported in Finland. *Scandinavian Journal of Public Health*, 50(4), 490–496. <https://doi.org/10.1177/14034948211004323>
- Nuwarda, R. F., Ramzan, I., Weekes, L., & Kayser, V. (2022). Vaccine hesitancy: Contemporary issues and historical background. *Vaccines*, 10(10), 1595. <https://doi.org/10.3390/vaccines10101595>
- NVivo. (n.d.). *Interface language*. <https://help-nv.qsrinternational.com/14/mac/Content/about-nvivo/interface-language.htm>

- Nygren, T. E. (2000). *Development of a measure of decision-making style*. PsycEXTRA Dataset.
<https://doi.org/10.1037/e413792005-284>
- NYU Libraries. (2024, October 16). *Qualitative data analysis: Taguette*.
<https://guides.nyu.edu/QDA/Taguette>
- OpenAI. (2024a). ChatGPT (3.5) [Large language model]. <https://chat.openai.com>
- OpenAI. (2024b). *Pricing*. <https://openai.com/pricing/>
- OpenAI. (2024c, May 2). *Revised rubric for evaluating reflexive thematic analysis comparing human and AI approaches* [Rubric]. Unpublished work.
- Oranga, J. (2023). Benefits of artificial intelligence (ChatGPT) in education and learning: Is ChatGPT helpful? *International Review of Practical Innovation, Technology and Green Energy*, 3(3), 46–50. <https://doi.org/10.54443/irpitage.v3i3.1250>
- Overall, L. (2007). Big theory 3: Vygotsky and social constructivism. In *Supporting children's learning: A guide for teaching assistants* (pp. 73–84). SAGE.
<https://doi.org/10.4135/9781446212776>
- Palombi, L., Belknap, J., Jo Katras, M., & Anderson, G. (2023). Community forums to address vaccine hesitancy: A useful tool for meeting the needs of diverse communities. *Innovations in Pharmacy*, 14(1). <https://doi.org/10.24926/iip.v14i1.5432>
- Parker, J., Richard, V., & Becker, K. (2023). Flexibility & iteration: Exploring the potential of large language models in developing and refining interview protocols. *The Qualitative Report*, 28, 2772–2791. <https://doi.org/10.46743/2160-3715/2023.6695>
- Perera, P., & Lankathilaka, M. (2023). AI in higher education: A literature review of ChatGPT and guidelines for responsible implementation. *International Journal of Research and Innovation in Social Science*, 7(6), 306–314. <https://doi.org/10.47772/ijriss.2023.7623>

- Phillips, M., & Lu, J. (2018). A quick look at NVivo. *Journal of Electronic Resources Librarianship*, 30(2), 104–106. <https://doi.org/10.1080/1941126x.2018.1465535>
- Plano Clark, V. L. (2019). Meaningful integration within mixed-methods studies: Identifying why, what, when, and how. *Contemporary Educational Psychology*, 57, 106–111. <https://doi.org/10.1016/j.cedpsych.2019.01.007>
- Plano Clark, V. L., & Creswell, J. W. (2008). *Designing and conducting mixed-methods research*. SAGE.
- Plano Clark, V. L., & Ivankova, N. V. (2016). *Mixed-methods research: A guide to the Field*. SAGE.
- Plans-Rubió, P. (2022). Percentages of vaccination coverage required to establish herd immunity against SARS-CoV-2. *Vaccines*, 10(5), 736. <https://doi.org/10.3390/vaccines10050736>
- Poland, C. M., & Ratishvili, T. (2022). Vaccine hesitancy and health care providers: Using the preferred cognitive styles and decision-making model and empathy tool to make progress. *Vaccine: X*, 11, 100174. <https://doi.org/10.1016/j.jvacx.2022.100174>
- Pomares, T. D., Buttenheim, A. M., Amin, A. B., Joyce, C. M., Porter, R. M., Bednarczyk, R. A., & Omer, S. B. (2019). Association of cognitive biases with human papillomavirus vaccine hesitancy: A cross-sectional study. *Human Vaccines & Immunotherapeutics*, 16(5), 1018–1023. <https://doi.org/10.1080/21645515.2019.1698243>
- Posit Team. (n.d.). RStudio: Integrated development environment for R. Posit Software, PBC. <http://www.posit.co/>

- Quintans-Júnior, L. J., Gurgel, R. Q., Araújo, A. A. S., Correia, D., & Martins-Filho, P. R. (2023). ChatGPT: The new panacea of the academic world. *Revista da Sociedade Brasileira de Medicina Tropical*, 56, e0060. <https://doi.org/10.1590/0037-8682-0060-2023>
- Rahman, M., & Watanobe, Y. (2023). ChatGPT for education and research: Opportunities, threats, and strategies. *Applied Sciences*, 13(9), 1–21.
<https://doi.org/10.3390/app13095783>
- Rampin, R., & Rampin, V. (2021). Taguette: Open-source qualitative data analysis. *Journal of Open-Source Software*, 6(68), 3522. <https://doi.org/10.21105/joss.03522>
- Rappuoli, R., Santoni, A., & Mantovani, A. (2019). Vaccines: An achievement of civilization, a human right, our health insurance for the future. *The Journal of Experimental Medicine*, 216(1), 7–9. <https://doi.org/10.1084/jem.20182160>
- Reece, S., CarlLee, S., Scott, A. J., Willis, D. E., Rowland, B., Larsen, K., Holman-Allgood, I., & McElfish, P. A. (2023). Hesitant adopters: COVID-19 vaccine hesitancy among diverse vaccinated adults in the United States. *Infectious Medicine*, 2(2), 89–95.
<https://doi.org/10.1016/j.imj.2023.03.001>
- Reno, C., Maietti, E., Di Valerio, Z., Montalti, M., Fantini, M. P., & Gori, D. (2021). Vaccine hesitancy towards COVID-19 vaccination: Investigating the role of information sources through a mediation analysis. *Infectious Disease Reports*, 13(3), 712–723.
<https://doi.org/10.3390/idr13030066>
- Rice, S., Crouse, S. R., Winter, S. R., & Rice, C. (2024). The advantages and limitations of using ChatGPT to enhance technological research. *Technology in Society*, 76, 1–7.
<https://doi.org/10.1016/j.techsoc.2023.102426>

- Ried, L., Eckerd, S., & Kaufmann, L. (2022). Social desirability bias in PSM surveys and behavioral experiments: Considerations for Design Development and Data Collection. *Journal of Purchasing and Supply Management*, 28(1).
- <https://doi.org/10.1016/j.pursup.2021.100743>
- Riedel, S. (2005). Edward Jenner and the history of smallpox and vaccination. *Baylor University Medical Center Proceedings*, 18(1), 21–25.
- <https://doi.org/10.1080/08998280.2005.11928028>
- Robins, C. S., & Eisen, K. (2017). Strategies for the effective use of NVivo in a large-scale study: Qualitative analysis and the repeal of don't ask, don't tell. *Qualitative Inquiry*, 23(10), 768–778. <https://doi.org/10.1177/1077800417731089>
- Ruiz, J. B., & Bell, R. A. (2022). Parental COVID-19 vaccine hesitancy in the United States. *Public Health Reports*, 137(6), 1162–1169. <https://doi.org/10.1177/0033549221114346>
- Rutjens, B. T., Sutton, R. M., & Lee, R. V. D. (2017). Not all skepticism is equal: Exploring the ideological antecedents of science acceptance and rejection. *Personality and Social Psychology Bulletin*, 44(3), 384–405. <https://doi.org/10.1177/0146167217741314>
- Salmon, D. A., Dudley, M. Z., Glanz, J. M., & Omer, S. B. (2015). Vaccine hesitancy. *Vaccine*, 33, 66–71. <https://doi.org/10.1016/j.vaccine.2015.09.035>
- Schindler, J., Schindler, S., & Pfattheicher, S. (2020). The role of intuition in vaccination attitudes. *Journal of Health Psychology*, 26(14), 2950–2957.
- <https://doi.org/10.1177/1359105320925160>
- Schreiber-Gregory, D. (2018). *Logistic and linear regression assumptions: Violation recognition and control* (SESUG Paper 247 -2018). Henry M. Jackson Foundation.

- Scott, S. G., & Bruce, R. A. (1995). Decision-making style: The development and assessment of a new measure. *Educational and Psychological Measurement*, 55(5), 818–831.
<https://doi.org/10.1177/0013164495055005017>
- Seither, R., Yusuf, O. B., Dramann, D., Calhoun, K., Mugerwa-Kasujja, A., & Knighton, C. L. (2023). Coverage with selected vaccines and exemption from school vaccine requirements among children in Kindergarten – United States, 2022–23 school year. *MMWR. Morbidity and Mortality Weekly Report*, 72(45), 1217–1224.
<https://doi.org/10.15585/mmwr.mm7245a2>
- Senaviratna, N. A. M. R., & A. Cooray, T. M. J. A. (2019). Diagnosing multicollinearity of logistic regression model. *Asian Journal of Probability and Statistics*, 5(2), 1–9.
<https://doi.org/10.9734/ajpas/2019/v5i230132>
- Shannon-Baker, P. (2016). Making paradigms meaningful in mixed-methods research. *Journal of Mixed-Methods Research*, 10(4), 319–334. <https://doi.org/10.1177/1558689815575861>
- Shapiro, G. K., Tatar, O., Dube, E., Amsel, R., Knauper, B., Naz, A., Perez, S., & Rosberger, Z. (2018). The vaccine hesitancy scale: Psychometric properties and validation. *Vaccine*, 36(5), 660–667. <https://doi.org/10.1016/j.vaccine.2017.12.043>
- Shen, X., Wu, X., Deng, Z., Liu, X., Zhu, Y., Huang, Y., Deng, Y., Tian, Q., Gan, Y., Gong, Y., & Lu, Z. (2022). Analysis on vaccine hesitation and its associated factors among parents of preschool children in Songgang Street, Shenzhen. *Scientific Reports*, 12(1), Article 9467. <https://doi.org/10.1038/s41598-022-12530-9>
- Siani, A. (2023). Vaccine hesitancy and refusal: History, causes, mitigation strategies. In N. Rezaei (Eds.), *Integrated science of global epidemics* (pp. 503–517). Springer.
https://doi.org/10.1007/978-3-031-17778-1_23

- Skamagki, G., King, A., Carpenter, C., & Wåhlin, C. (2022). The concept of integration in mixed-methods research: A step-by-step guide using an example study in physiotherapy. *Physiotherapy Theory and Practice*, 40(2), 197–204.
<https://doi.org/10.1080/09593985.2022.2120375>
- Smith, K. A. (2012). Louis Pasteur, the father of immunology. *Frontiers in Immunology*, 3, 68.
<https://doi.org/10.3389/fimmu.2012.00068>
- Smith, P. J., Wood, D., & Darden, P. M. (2011). Highlights of historical events leading to national surveillance of vaccination coverage in the United States. *Public Health Reports*, 126(2_suppl), 3–12. <https://doi.org/10.1177/00333549111260s202>
- Soratto, J., Pires, D. E., & Friese, S. (2020). Thematic content analysis using Atlas.ti software: Potentialities for research in health. *Revista Brasileira de Enfermagem*, 73(3), 1–5.
<https://doi.org/10.1590/0034-7167-2019-0250>
- Sridhara, G., Ranjani, H. G., & Mazumdar, S. (2023). ChatGPT: A study on its utility for ubiquitous software engineering tasks. *ArXiv*. <https://doi.org/10.48550/arXiv.2305.16837>
- Stadnick, N. A., Poth, C. N., Guetterman, T. C., & Gallo, J. J. (2021). Advancing discussion of ethics in mixed-methods health services research. *BMC Health Services Research*, 21(1), Article 583. <https://doi.org/10.1186/s12913-021-06583-1>
- Subiyantoro, S., Degeng, I. N. S., Kuswandi, D., & Ulfa, S. (2023). Exploring the impact of AI-powered chatbots (ChatGPT) on education: A qualitative study on benefits and drawbacks. *Jurnal Pekommas*, 8(2), 157–168. <https://doi.org/10.56873/jpkm.v8i2.5206>
- Sutton, J., & Austin, Z. (2015). Qualitative research: Data collection, analysis, and management. *The Canadian Journal of Hospital Pharmacy*, 68(3), 226–231.
<https://doi.org/10.4212/cjhp.v68i3.1456>

- Teasdale, C. A., Borrell, L. N., Shen, Y., Kimball, S., Zimba, R., Kulkarni, S., Rane, M., Rinke, M. L., Fleary, S. A., & Nash, D. (2022). Missed routine pediatric care and vaccinations in US children during the first year of the COVID-19 pandemic. *Preventive Medicine*, 158, 107025. <https://doi.org/10.1016/j.ypmed.2022.107025>
- Tebb, W. (1894). *Brief story of fourteen years' struggle for parental emancipation from the vaccination tyranny*. The London Society for the Abolition of Compulsory Vaccination. <https://www.jstor.org/stable/pdf/60239940>
- Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed-methods research integrating quantitative and qualitative approaches in the social and Behavioral Sciences*. SAGE.
- Temsah, M.-H., Alhuzaimi, A. N., Aljamaan, F., Bahkali, F., Al-Eyadhy, A., Alrabiaah, A., Alhaboob, A., Bashiri, F. A., Alshaer, A., Temsah, O., Bassrawi, R., Alshahrani, F., Chaiah, Y., Alaraj, A., Assiri, R. A., Jamal, A., Batais, M. A., Saddik, B., Halwani, R., ... Alhasan, K. (2021). Parental attitudes and hesitancy about COVID-19 vs. routine childhood vaccinations: A national survey. *Frontiers in Public Health*, 9. <https://doi.org/10.3389/fpubh.2021.752323>
- Thompson, S., Meyer, J. C., Burnett, R. J., & Campbell, S. M. (2023). Mitigating vaccine hesitancy and building trust to prevent future measles outbreaks in England. *Vaccines*, 11(2), 288. <https://doi.org/10.3390/vaccines11020288>
- Thunstrom, L., Ashworth, M., Finnoff, D., & Newbold, S. (2020). Hesitancy towards a COVID-19 vaccine and prospects for herd immunity. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3593098>

- Tomljenovic, H., Bubic, A., & Erceg, N. (2020). It just doesn't feel right - the relevance of emotions and intuition for parental vaccine conspiracy beliefs and vaccination uptake. *Psychology & Health, 35*(5), 538–554. <https://doi.org/10.1080/08870446.2019.1673894>
- Tomljenovic, L., & Shaw, C. A. (2011). Aluminum vaccine adjuvants: Are they safe? *Current Medicinal Chemistry, 18*(17), 2630–2637. <https://doi.org/10.2174/092986711795933740>
- Vaccine Adverse Event Reporting System. (n.d.). *About VAERS*. <https://vaers.hhs.gov/about.html>
- van Manen, M. (2023). What does ChatGPT mean for qualitative health research? *Qualitative Health Research, 33*(13), 1135–1139. <https://doi.org/10.1177/10497323231210816>
- Ventola, C. L. (2016). Immunization in the United States: Recommendations, barriers, and measures to improve compliance: Part 1: Childhood vaccinations. *P & T, 41*(7), 426–436.
- Verma, N., & Rangnekar, S. (2015). General decision-making style: Evidence from India. *South Asian Journal of Global Business Research, 4*(1), 85–109. <https://doi.org/10.1108/sajgbr-09-2013-0073>
- Vissoci, J., Gallis, J., & D'Anna, R. (2022). *Measure development*. Duke Global Health Institute, Research Design & Analysis Core. https://sites.globalhealth.duke.edu/rdac/wp-content/uploads/sites/27/2022/06/Core-Guide_Measure_Development_05_02_22.pdf
- Wagner, A. L. (2024, January 8). *The pandemic's role in shaping parents' attitudes toward vaccines*. University of Michigan School of Public Health News. <https://sph.umich.edu/news/2024posts/the-pandemics-role-in-shaping-parents-attitude-toward-vaccines.html>
- Wang, Z., Xie, Q., Ding, Z., Feng, Y., & Xia, R. (2023). Is ChatGPT a good sentiment analyzer? A preliminary study. *ArXiv, 1*, 1–17. <https://doi.org/10.48550/arXiv.2307.03952>

- Wasti, S., Simkhada, P., Teijlingen, E., Sathian, B., & Banerjee, I. (2022). The growing importance of mixed-methods research in health. *Nepal Journal of Epidemiology*, 12(1), 1175–1178. <https://doi.org/10.3126/nje.v12i1.43633>
- While, A. (2021). Understanding vaccine hesitancy: The evidence. *British Journal of Community Nursing*, 26(6), 278–282. <https://doi.org/10.12968/bjcn.2021.26.6.278>
- Wilson, K., Barakat, M., Vohra, S., Ritvo, P., & Boon, H. (2008). Parental views on pediatric vaccination: The impact of competing advocacy coalitions. *Public Understanding of Science*, 17(2), 231–243. <https://doi.org/10.1177/0963662506067662>
- Wilson, S. L., & Wiysonge, C. (2020). Social media and vaccine hesitancy. *BMJ Global Health*, 5(10), Article e004206. <https://doi.org/10.1136/bmjgh-2020-004206>
- Wiysonge, C. S., Ndwandwe, D., Ryan, J., Jaca, A., Batouré, O., Anya, B.-P. M., & Cooper, S. (2021). Vaccine hesitancy in the era of COVID-19: Could lessons from the past help in divining the future? *Human Vaccines & Immunotherapeutics*, 18(1), 1–3. <https://doi.org/10.1080/21645515.2021.1893062>
- Wood, N. L. (2012). *Individual differences in decision-making styles as predictors of good decision-making* [Master's thesis, Bowling Green State University]. https://etd.ohiolink.edu/acprod/odb_etd/ws/send_file/send?accession=bgsu1326823601&disposition=inline
- Worden, L., Ackley, S. F., Zipprich, J., Harriman, K., Enanoria, W. T. A., Wannier, R., & Porco, T. C. (2020). Measles transmission during a large outbreak in California. *Epidemics*, 30, 1–20. <https://doi.org/10.1016/j.epidem.2019.100375>
- World Health Organization. (n.d.-a). *A brief history of vaccination*. <https://www.who.int/news-room/spotlight/history-of-vaccination/a-brief-history-of-vaccination>

- World Health Organization. (n.d.-b). *Smallpox*. https://www.who.int/health-topics/smallpox#tab=tab_1
- World Health Organization. (n.d.-c). *Vaccines and immunization*. https://www.who.int/health-topics/vaccines-and-immunization#tab=tab_1
- World Health Organization. (2022, June 15). *COVID-19 pandemic fuels largest continued backslide in vaccinations in three decades*. <https://www.who.int/news/item/15-07-2022-covid-19-pandemic-fuels-largest-continued-backslide-in-vaccinations-in-three-decades>
- Wu, T., He, S., Liu, J., Sun, S., Liu, K., Han, Q. L., & Tang, Y. (2023). A brief overview of ChatGPT: The history, status quo, and potential future development. *IEEE/CAA Journal of Automatica Sinica*, 10(5), 1122–1136. <https://doi.org/10.1109/jas.2023.123618>
- Yang, K., Ji, S., Zhang, T., Xie, Q., Kuang, Z., & Ananiadou, S. (2023). Towards interpretable mental health analysis with large language models. *Proceedings of the 2023 Conference on Empirical Methods in Natural Language Processing*.
<https://doi.org/10.18653/v1/2023.emnlp-main.370>
- Zelčāne, E., & Pipere, A. (2023). Finding a path in a methodological jungle: A qualitative research of resilience. *International Journal of Qualitative Studies on Health and Well-Being*, 18(1), Article 2164948. <https://doi.org/10.1080/17482631.2023.2164948>
- Zhang, H., Wu, C., Xie, J., Kim, C., & Carroll, J. M. (2023). QualiGPT: GPT as an easy-to-use tool for qualitative coding. *ArXiv*. <https://doi.org/10.48550/arXiv.2310.07061>
- Zhang, H., Wu, C., Xie, J., Lyu, Y., Cai, J., & Carroll, J. M. (2023). Redefining qualitative analysis in the AI era: Utilizing ChatGPT for efficient thematic analysis. *ArXiv*,
<https://doi.org/10.48550/arXiv.2309.10771>

Zhu, J. J., Jiang, J., Yang, M., & Ren, Z. J. (2023). ChatGPT and environmental research.

Environmental Science & Technology, 57(46), 17667–17670.

<https://doi.org/10.1021/acs.est.3c01818>

Zucht v. King, 260 U.S. 174 (1922). [https://tile.loc.gov/storage-](https://tile.loc.gov/storage-services/service/ll/usrep/usrep260/usrep260174/usrep260174.pdf)

[services/service/ll/usrep/usrep260/usrep260174/usrep260174.pdf](https://tile.loc.gov/storage-services/service/ll/usrep/usrep260/usrep260174/usrep260174.pdf)

APPENDIX A
PHASE ONE CONSENT FORM

PHASE ONE CONSENT FORM

Project Title: Understanding Parental Perspectives in Vaccine Hesitancy and Decision-Making Approaches in Childhood Vaccinations

Researcher:

Carlene Brown, M.S., Ph.D. Student, Applied Statistics & Research Methods
E-mail: carlene.brown@unco.edu

Research Advisor:

Randy Larkins, Ph.D., Applied Statistics & Research Methods
E-mail: randy.larkins@unco.edu

You are invited to participate in and contribute to our online research on childhood vaccinations by taking part in this questionnaire. The purpose of this study is to gain an understanding of parental attitudes toward childhood vaccinations and decision-making styles. The expected time commitment for completing the survey is approximately 5-10 minutes.

All records and information collected in this study will be confidential. In any reporting of the data all individuals will be anonymous, so there is no risk of your participation in this study becoming publicly known.

Your participation is important to help us understand the parental attitudes toward childhood vaccinations and decision-making styles to help improve public health communication.

If you have any concerns about your selection or treatment as a research participant, please contact, the Office of Research & Sponsored Programs, University of Northern Colorado Greeley, CO 80639; 970-351-1910 or irb@unco.edu.

Upon completion of the survey, you will have the opportunity to enter into a drawing for a \$50 Amazon gift card. The drawing will be held after the data collection is completed. After data collection is completed, the researcher will draw two participants, and each will receive a **\$50 Amazon gift card.**

Additionally, if you are interested in participating in a follow-up interview to share your perspectives on childhood vaccinations, you will be added into an additional drawing to win one of two \$50 Amazon gift cards. After data collection is completed, the researcher will draw two participants from those that took part in an interview, and each will receive a **\$50 Amazon gift card.**

Participation is voluntary. You may decide not to participate in this study, and if you begin participation, you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in the loss of benefits to which you are otherwise entitled. Having read the above and having had an opportunity to ask any questions, please complete the questionnaire if you would like to participate in this research. If you have any concerns about

your selection or treatment as a research participant, please contact the UNC IRB Administrator at the Office of Sponsored Programs (970-351-1910).

Participation Requirements:

- Be 18 years of age or older
- A parent of child/children younger than 18

Statement of Consent: By clicking below, I agree that I have read and understand the above information. I meet the requirements of the study and freely agree to participate. I understand that I am free to choose not to answer any question and to withdraw from the study at any time. I understand that my responses will be kept confidential.

APPENDIX B

PHASE TWO INFORMED CONSENT

PHASE II PARTICIPANT CONSENT FORM

Researcher: Carlene Brown brow8740@bears.unco.edu

Professor: Randy Larkins, Ph.D., Applied Statistics and Research Methods,
randy.larkins@unco.edu

Phone: 970-351-1603

By signing this form, you indicate the following:

You are choosing to volunteer to participate in the interview/qualitative portion of a mixed-methods research study conducted by Carlene Brown at the University of Northern Colorado. You understand that the study aims to learn more about parents' perceptions of childhood vaccinations and decision-making styles.

Your participation in this project is voluntary. You understand that you will not be paid for your participation. You may withdraw and discontinue participation at any time without penalty.

You understand that most interviewees will find the discussion engaging and thought-provoking. However, if you feel uncomfortable during the interview session, you have the right to decline to answer any question or end the interview.

Participation involves being interviewed on one occasion by the University of Northern Colorado researcher. The interview will last approximately 60 minutes. Notes may be written during the interview. An audio recording of the interview and subsequent dialogue will be made. You understand that the researcher will have sole access to the audio files and that the audio recordings will be destroyed after transcription. If you do not want to be recorded, you will not be able to participate in the study.

You understand that the researcher will not identify you by name in any reports using information obtained from this interview. While confidentiality cannot be guaranteed, I will use the best practices available to secure your confidentiality in this study. All data will be destroyed after three years.

Participation is voluntary. You may decide not to participate in this study, and if you begin participation, you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in loss of benefits to which you are otherwise entitled. Having read the above and have had an opportunity to ask any questions, please sign below if you would like to participate in this research. You will be given a copy of this form to retain for future reference. If you have any concerns about your selection or treatment as a research participant, please contact the Office of Research & Sponsored Programs, University of Northern Colorado, at 970-351-1910 or irb@unco.edu.

Participant Signature

Participant Printed Name

Date

Interviewer Signature

Interviewer Printed Name

Date

APPENDIX C
PHASE ONE SURVEY

PHASE ONE VACCINE HESITANCY AND DECISION-MAKING STYLE SURVEY**Demographic Questionnaire**

1. What is your age in years?
 - a. 18–24
 - b. 25–34
 - c. 35–44
 - d. 45–54
 - e. 55–64
 - f. 65–74
 - g. 75 or older
 - h. I prefer not to answer.
2. In research, we often must present demographic information in categories. We understand these labels are limiting. If you had to select one of the options below, which best describes your gender identity?
 - a. Man
 - b. Nonbinary
 - c. Woman
 - d. I prefer not to answer.
3. What is the highest level of education you have achieved?
 - a. Less than high school
 - b. High school graduate
 - c. Some college, no degree
 - d. Associate degree
 - e. Bachelor's degree
 - f. Postgraduate degree (Master's, Ph.D., etc.)
4. What is your current occupation?
 - a. Student
 - b. Employed full-time
 - c. Employed part-time
 - d. Self-employed
 - e. Unemployed
 - f. Retired
 - g. Other (please specify) _____
5. What is your current marital status?
 - a. Single
 - b. Married
 - c. Divorced
 - d. Widowed
 - e. Separated

6. Thinking about your current situation, which social class do you identify with?
 - a. \$0 to \$4,999
 - b. \$5,000 to \$9,999
 - c. \$10,000 to \$14,999
 - d. \$15,000 to \$19,999
 - e. \$20,000 to \$24,999
 - f. \$25,000 to \$34,999
 - g. \$35,000 to \$44,999
 - h. \$45,000 to \$54,999
 - i. \$55,000 to \$64,999
 - j. \$65,000 to \$74,999
 - k. \$75,000 to \$99,999
 - l. \$100,000 and over
 - m. Prefer not to answer
7. What is your ethnicity/race?
 - a. White/Caucasian
 - b. Black/African American
 - c. Hispanic/Latino
 - d. Asian
 - e. Native Hawaiian or Pacific Islander
 - f. Native American or Alaska Native
 - g. Other (please specify) _____
8. In which location do you live?
 - a. Big city (50,000 people or more)
 - b. Smaller town (Between 2,500 and 49,999 people)
 - c. Rural area (Less than 2,500 people)
9. How many children under the age of 18 are you currently caring for?
 - a. None
 - b. 1
 - c. 2
 - d. 3
 - e. 4 or more
10. Would you be interested in participating in an interview to share your perspectives on childhood vaccinations?

Vaccine Hesitancy Scale

Instructions:

Listed below are statements describing how individuals go about making important decisions. Please indicate whether you agree or disagree with each statement.

1. Lack of Confidence Childhood vaccines are important for my child's health.
2. Childhood vaccines are effective.
3. Having my child vaccinated is important for the health of others in my community.
4. All childhood vaccines offered by the government program in my community are beneficial.
5. The information I receive about vaccines from the vaccine program is reliable and trustworthy.
6. Getting vaccines is a good way to protect my child/children from disease.
7. Generally, I do what my doctor or health care provider recommends about vaccines for my child/children.
8. New vaccines carry more risks than old vaccines
9. I am concerned about serious adverse effects of vaccines.

General Decision-Making Styles Scale

Instructions:

Listed below are statements describing how individuals go about making important decisions. Please indicate whether you agree or disagree with each statement.

1. I double-check my information sources to be sure I have the right facts before making decisions.
2. I make decisions in a logical and systematic way.
3. My decision-making requires careful thought.
4. When making a decision, I consider various options in terms of a specific goal.
5. I explore all of my options before making a decision.
6. When making decisions, I rely upon my instincts.
7. When I make decisions, I tend to rely on my intuition.
8. I generally make decisions that feel right to me.
9. When I make a decision, it is more important for me to feel the decision is right than to have a rational reason for it.
10. When I make a decision, I trust my inner feelings and reactions.
11. I often need the assistance of other people when making important decisions.
12. I rarely make important decisions without consulting other people.
13. If I have the support of others, it is easier for me to make important decisions.

14. I use the advice of other people in making my important decisions.
15. I like to have someone to steer me in the right direction when I am faced with important decisions.
16. I avoid making important decisions until the pressure is on.
17. I postpone decision-making whenever possible.
18. I often procrastinate when it comes to making important decisions.
19. I generally make important decisions at the last minute.
20. I put off making many decisions because thinking about them makes me uneasy.
21. I generally make snap decisions.
22. I often make decisions on the spur of the moment.
23. I make quick decisions.
24. I often make impulsive decisions.
25. When I make decisions, I do what seems natural at the moment.

Amazon Gift Card Entry

Thank you for your participation in the study. Data collected from these surveys will be used to help improve the understanding of childhood vaccinations.

Please click the **Submit** button to complete the survey. Once you complete the survey, you will be directed to the drawing page to enter your information. The drawing will be held after the data collection is completed. The researcher will draw two participants, and each will receive a \$50 Amazon gift card.

Email Address: _____

APPENDIX D

PHASE TWO RECRUITMENT EMAIL

PHASE TWO RECRUITMENT EMAIL

Hello!

I hope this email finds you well! First, thank you for your participation in the survey portion of this research study on childhood vaccinations and vaccine hesitancy. Your perspectives have been invaluable.

As we move to the next phase of this research, which includes one-on-one interviews with parents of children younger than 18, I am excited to delve deeper into perspectives on childhood vaccinations and vaccine hesitancy.

I appreciate your interest in sharing your perspectives through the survey and would be grateful to include your insights in the next phase of this study. I want to assure you that participation is completely voluntary, and your identity will remain anonymous and confidential in all reports and presentations. This study is a safe space for you to express any and all viewpoints regarding childhood vaccinations.

The interview will last approximately 60 minutes and can be conducted virtually (i.e., via Zoom) at a time that is convenient for you.

To participate in the study, you must meet the following criteria:

- Be 18 years of age or older.
- Have a child younger than 18 years of age.

If you are interested in sharing your perspectives, please reply to this email or click on the following link to schedule a time for the interview:

<https://calendly.com/carlenebrown589/interviews-perspectives-on-vaccinations>

Feel free to reach out if you have any questions or need further clarification.

I genuinely appreciate your willingness to contribute to my study and look forward to gaining your valuable perspectives on childhood vaccinations and vaccine hesitancy.

Thank you for your time and consideration!

Best Regards,

Carlene Brown
Ph.D. Candidate, Applied Statistics and Research Methods, University of Northern Colorado
carlene.brown@unco.edu

APPENDIX E**PHASE TWO SEMI-STRUCTURED INTERVIEW GUIDE**

PHASE TWO SEMI-STRUCTURED INTERVIEW GUIDE

Thank you for participating in this research study. I value your thoughts and perspectives and appreciate your willingness to share your time and insights.

1. Where do you get information about staying healthy?
2. Where do you get information about vaccines for kids?
3. How do you react when you hear different information about vaccines from people you know, like friends or family, or from the internet?
4. What events or things have made you think about vaccines for your kids? (This could be things like talking to doctors when they got sick or information you heard on TV or online.)
5. Have you ever worried about giving vaccines to your kids? If so, what were you worried about?
6. Do you feel that vaccines are safe and work well?
7. Are there vaccines or information about vaccines that you find hard to believe or trust?
8. What do you think about vaccines for kids overall?
9. How much do doctors and nurses influence your decisions about vaccines for kids?
10. How and where do you look for information when you decide about vaccines for your kids?
11. Do you trust what health experts say about vaccines for kids?
12. Do you talk about vaccines with people in your life?
13. Do you feel that getting vaccines for your children helps protect them as well as other children?
14. Is there anything I forgot to ask that you would like to share with me about this topic?

Note. Based on information generated with ChatGPT (OpenAI, 2024a).

APPENDIX F**PROMPTS FOR PHASE TWO CHATGPT ANALYSES**

PROMPTS FOR PHASE TWO ANALYSES

ChatGPT: Braun and Clarke (2022) Prompts

Prompt 1: I will input four transcripts at a time for you to analyze using reflexive thematic analysis (There are 17 transcripts in total.). I have the following prompts for you to follow: The research question will guide the ensuing reflexive thematic analysis: How do parents' underlying beliefs contribute to vaccine hesitancy?

“Familiarize yourself with the dataset.”

“Code the entire dataset systematically and thoroughly. When done, collate code labels and compile the relevant segments of data for each code, identifying which participant the relevant data segment came from.”

“Generate initial themes. Identify shared patterned meaning across the dataset. Compile clusters of codes that seem to share a core idea or concept.”

“Develop and review themes. Check that themes make sense in relation to the coded extracts and the full dataset.” (Include direct quotes from participants that support each theme).

“Refine, define, and name themes. Write a brief synopsis of each theme.”

Prompt 2: Here are the next four transcripts.

Prompt 3: Here are the next four transcripts.

Prompt 4: Here are the next three transcripts.

Prompt 5: Here are the last two transcripts.

Prompt 6: Now that you have analyzed all 17 transcripts using reflexive thematic analysis, compile a report of the overarching themes you derived from analyzing all 17 transcripts. Each theme should be supported with quotes taken directly from the data, including which transcript they came from. Write an analytic report weaving together the analytic narrative and compelling, vivid data extracts to tell the reader a coherent and persuasive story about the dataset that addressed the research question.”

Prompt 7: Considering the reflexive thematic analysis you just performed, please provide a reflexive statement, which is defined as the following: “Reflexivity is about acknowledging your role in the research. As a qualitative researcher, you are part of the research process, and your prior experiences, assumptions, and beliefs will influence the research process. Researcher reflexivity is a type of critical reflection about the position you are taking as a researcher and how you have taken this stance into account in your research. It is an important way to establish rigour in qualitative research, similar to the processes of defining measurement tools for validity in quantitative research” (Melbourne Medical School, n.d., para. 1).

Prompt 8: Include the number of codes and references obtained for each theme.

ChatGPT: Zhang, Wu, Xie, Lyu, et al. (2023) Prompts

Prompt 1: I will input four transcripts at a time for you to analyze using reflexive thematic analysis (There are 17 transcripts in total.). I have the following prompts for you to follow:

1. Based on the following research question, perform a reflexive thematic analysis on the provided data and identify appropriate themes: How do parents' underlying beliefs contribute to vaccine hesitancy?
2. "Process feedback from each interviewee individually."
3. "Categorize feedback from the interviewees based on common themes."
4. "Output the results in the format of 'Common Theme + Sub-Theme + Supporting Direct Quote from Participant + Participant Name.'"

Prompt 2: Here are the next four transcripts.

Prompt 3: Here are the next four transcripts.

Prompt 4: Here are the next three transcripts.

Prompt 5: Here are the last two transcripts.

Prompt 6: Now that you have analyzed all 17 transcripts using reflexive thematic analysis, compile a report of the overarching themes you derived from analyzing all 17 transcripts. Each theme should be supported with quotes taken directly from the data, including which transcript(participant) they came from. Write an analytic report weaving together the analytic narrative and compelling, vivid data extracts to tell the reader a coherent and persuasive story about the dataset that addressed the research question.”

Prompt 7: Include the number of codes and references obtained for each theme.

Prompt 8: Considering the reflexive thematic analysis you just performed, please provide a reflexive statement, which is defined as the following: “Reflexivity is about acknowledging your role in the research. As a qualitative researcher, you are part of the research process, and your prior experiences, assumptions, and beliefs will influence the research process. Researcher reflexivity is a type of critical reflection about the position you are taking as a researcher and how you have taken this stance into account in your research. It is an important way to establish rigour in qualitative research, similar to the processes of defining measurement tools for validity in quantitative research” (Melbourne Medical School, n.d., para. 1).

Works Cited:

Melbourne Medical School. (n.d.). *Reflexivity*. <https://medicine.unimelb.edu.au/school-structure/medical-education/research/qualitative-journey/themes/reflexivity>

APPENDIX G
SURVEY CODEBOOK

Table 9*Survey Codebook*

Concept	Variable	Label	Meaning	Full Dataset Coding	Collapsed Dataset Coding
Demographics	Age	AGE	Age in years.	1-18-24 2-25-34 3-35-44 4-45-54 5-55-64 6-65-74 7-75+ 8-Prefer not to answer 999 – Missing	1- 18-34 2- 35+
	Gender	GENDER	What best describes your gender identity?	1-Woman 2-Man 3-Nonbinary 4-Prefer not to answer 999-Missing	1-Woman 2-Man 3-Nonbinary
	Education	EDU	Highest level of education attained.	1-Less than high school 2-High school graduate 3-Some college, no degree 4-Associate degree 5-Bachelor degree 6-Postgraduate degree (Master's, Ph.D., etc.) 999-Missing	1-Less than/or High school – Some college, no degree 2-Associate 3-Bachelor 4-Postgraduate

Concept	Variable	Label	Meaning	Full Dataset Coding	Collapsed Dataset Coding
	Ethnicity	ETH	Ethnicity/race.	1- White/Caucasian 2- Black/African American 3- Hispanic/Latino 4- Asian 5- Native Hawaiian or Pacific Islander 6- Native American or Alaska Native 7- Other (please specify) 999-Missing	1- White 2-Black/Hispanic/Other
	Occupational Status	OCC	Current state of occupation.	1-Student 2-Employed full-time 3-Employed part-time 4-Self-employed 5-Unemployed 6-Retired 7-Other 999-Missing	1-Employed full-time 2-Student-Part-time-Other
	Marital Status	MAR_S	Current marital status.	1-Single 2-Married 3-Divorced 4-Widowed 5-Separated 6-Domestic Partnership 7-Never Married 8-Other 9-I prefer not to answer 999-Missing	1- Married 2- Other

Concept	Variable	Label	Meaning	Full Dataset Coding	Collapsed Dataset Coding
	Annual Income	ANN_INC	Annual household income.	1- \$0 to \$4,999 2- \$5,000 to \$9,999 3- \$10,000 to \$14,999 4- \$15,000 to \$19,999 5- \$20,000 to \$24,999 6- \$25,000 to \$34,999 7- \$35,000 to \$44,999 8- \$45,000 to \$54,999 9- \$55,000 to \$64,999 10- \$65,000 to \$74,999 11- \$75,000 to \$99,999 12- \$100,000 and Over 13- Prefer not to answer 999-Missing	1-Less than 100k 2-100k+
	Geographic Location	GEO	Location you live.	1- Big city (50,000 people or more) 2- Smaller town (Between 2,500 and 49,999 people) 3- Rural area (Less than 2,500 people) 999-Missing	1- Big city (50,000 people or more) 2- Smaller town (Between 2,500 and 49,999 people) 3- Rural area (Less than 2,500 people)
	Number of Children	CHILD	Number of children under 18 that are currently being cared for.	1-1 2-2 3-3 4-4 or more (Please specify) 5-None 999-Missing	1-1 2-2 3-3+
Decision-Making Styles	Rational	RDM	RDM_1 I double-check my information sources to be sure I have the right facts before making decisions. RDM_2 I make decisions in a logical and systematic way. RDM_3 My decision-making requires careful thought. RDM_4 When making a decision, I consider various options in terms of a specific goal. RDM_5 I explore all of my options before making a decision.	4-Strongly Agree 3-Agree 2-Disagree 1-Strongly Disagree 999-Missing	

Concept	Variable	Label	Meaning	Full Dataset Coding	Collapsed Dataset Coding
	Dependent	DDM	DDM_1 I often need the assistance of other people when making important decisions. DDM_2 I rarely make important decisions without consulting other people. DDM_3 If I have the support of others, it is easier for me to make important decisions. DDM_4 I use the advice of other people in making my important decisions. DDM_5 I like to have someone to steer me in the right direction when I am faced with important decisions.	Same as above.	
	Intuitive	IDM	IDM_1 When making decisions, I rely upon my instincts. IDM_2 When I make decisions, I tend to rely on my intuition. IDM_3 I generally make decisions that feel right to me. IDM_4 When I make a decision, it is more important for me to feel the decision is right than to have a rational reason for it. IDM_5 When I make a decision, I trust my inner feelings and reactions	Same as above.	
	Avoidant	ADM	ADM_1 I avoid making important decisions until the pressure is on. ADM_2 I postpone decision-making whenever possible. ADM_3 I often procrastinate when it comes to making important decisions. ADM_4 I generally make important decisions at the last minute. ADM_5 I put off making many decisions because thinking about them makes me uneasy.	Same as above.	
	Spontaneous	SDM	SDM_1 I generally make snap decisions. SDM_2 I often make decisions on the spur of the moment. SDM_3 I make quick decisions. SDM_4 I often make impulsive decisions. SDM_5 When I make decisions, I do what seems natural at the moment.	Same as above.	

Concept	Variable	Label	Meaning	Full Dataset Coding	Collapsed Dataset Coding
	Overall Decision-Making Style	DCMKST YLE	Scoring for GDMS: Scores summed from each level of Decision-Making style. The highest score indicates DMS is the most used.	1 = Rational 2 = Intuitive 3 = Dependent 4 = Avoidant 5 = Spontaneous	1 = Rational 2 = Intuitive 3 = Dependent 4 = Avoidant 5 = Spontaneous
Vaccine Hesitancy		VH1	Childhood vaccines are important for my child's health.	4=Strongly Agree 3=Agree 2=Disagree 1=Strongly Disagree 999=Missing	
		VH2	Getting vaccines is a good way to protect my child/children from disease.	Same as above.	
		VH3	Childhood vaccines are effective.	Same as above.	
		VH4	Having my child vaccinated is important for the health of others in my community.	Same as above.	
		VH5	All childhood vaccines offered by the government program in my community are beneficial.	Same as above.	
		VH6	The information I receive about vaccines from the vaccine program is reliable and trustworthy.	Same as above.	
		VH7	Generally, I do what my doctor or health care provider recommends about vaccines for my child/children.	Same as above.	
		VH8	New vaccines carry more risks than old vaccines.	Same as above.	
		VH9	I am concerned about the serious adverse effects of vaccines.	Same as above.	
	VHS Score	FINALVH S_SCORE	Scoring for VHS: A mean score was calculated based on the nine items from the VHS. A cutoff of ≥ 3 , based on Temsah et al.'s (2021) study, categorized participants as vaccine-hesitant or non-vaccine-hesitant, with higher scores indicating more positive attitudes toward vaccines.	0 = Vaccine-Hesitant 1= Non-Vaccine- Hesitant	0 = Vaccine-Hesitant 1= Non-Vaccine-Hesitant

APPENDIX H

PHASE TWO MEMBER CHECK

MEMBER CHECK EMAIL FOR TRANSCRIPT REVIEW

Hello [Name],

I hope you are having a good day! I have finished transcribing our interview and have attached it here for you to review. Let me know if all appears accurate or if any adjustments are needed before I proceed with the qualitative analysis.

To protect your confidentiality, I have included ““ as your pseudonym and removed identifying information. Brackets within the text (e.g., []) indicate wording I have inserted in lieu of identifying information or to add clarity or context.

I want to extend a heartfelt thank you for your kind participation in my dissertation research study! Your perspectives and insights are of tremendous value to this work, and I so appreciate your time and thoughtful contributions.

Wishing you a wonderful summer!

Best,
Carlene Brown
Ph.D. Candidate, Applied Statistics and Research Methods, University of Northern Colorado
carlene.brown@unco.edu

APPENDIX I

INSTITUTIONAL REVIEW BOARD APPROVAL



Institutional Review Board

Date: 03/26/2024

Principal Investigator: Carlene Brown

Committee Action: Action Date:

IRB EXEMPT

DETERMINATION – New

Protocol 03/26/2024

Protocol Number:

Protocol Title:

2403058681

Journey of Decisions: Understanding Parental
Perspectives in Vaccine Hesitancy and Decision-Making
Approaches in Childhood Vaccinations -Dissertation

Expiration Date:

The University of Northern Colorado Institutional Review Board has reviewed your protocol and determined your project to be exempt under 45 CFR 46.104(d)(702) for research involving

Category 2 (2018): EDUCATIONAL TESTS, SURVEYS, INTERVIEWS, OR OBSERVATIONS OF PUBLIC BEHAVIOR. Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: (i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects; (ii) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or (iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by 45 CFR 46.111(a)(7).

You may begin conducting your research as outlined in your protocol. Your study does not require further review from the IRB, unless changes need to be made to your approved protocol.

As the Principal Investigator (PI), you are still responsible for contacting the UNC IRB office if and when:



Institutional Review Board

- You wish to deviate from the described protocol and would like to formally submit a modification request. Prior IRB approval must be obtained before any changes can be implemented (except to eliminate an immediate hazard to research participants).
- You make changes to the research personnel working on this study (add or drop research staff on this protocol).
- At the end of the study or before you leave The University of Northern Colorado and are no longer a student or employee, to request your protocol be closed. *You cannot continue to reference UNC on any documents (including the informed consent form) or conduct the study under the auspices of UNC if you are no longer a student/employee of this university.
- You have received or have been made aware of any complaints, problems, or adverse events that are related or possibly related to participation in the research.

If you have any questions, please contact the Interim IRB Administrator, Chris Saxton, at 970-702-5427 or via e-mail at chris.saxton@unco.edu. Additional information concerning the requirements for the protection of human subjects may be found at the Office of Human Research Protection website - <http://hhs.gov/ohrp/> and <https://www.unco.edu/research/research-integrity-and-compliance/institutional-review-board/>.

Sincerely,
Michael
Aldridge
Interim IRB Administrator

University of Northern Colorado: FWA00000784

2403058681

APPENDIX J

PHASE ONE RECRUITMENT COMMUNICATION

Figure 10*First Phase One Advertisement*

Figure 11

Second Phase One Advertisement



Figure 12*Third Phase One Advertisement*

JOIN THE CONVERSATION ON CHILDHOOD VACCINATIONS!



YOUR VOICE MATTERS!

**SPREAD THE WORD AND MAKE A DIFFERENCE:
YOUR VOICE MATTERS!**

**SHARING THIS MESSAGE WITH YOUR FRIENDS,
FAMILY, AND COMMUNITY CAN HELP REACH
MORE PARTICIPANTS AND GATHER DIVERSE
PERSPECTIVES. TOGETHER, WE CAN CONTRIBUTE
TO BETTER PUBLIC HEALTH UNDERSTANDING.**

HOW YOU CAN HELP:

- 1. SHARE THIS MESSAGE:** SPREAD THE WORD ABOUT OUR RESEARCH ON SOCIAL MEDIA, IN YOUR COMMUNITY GROUPS, AND WITH ANYONE WHO MIGHT BE INTERESTED.
- 2. PARTICIPATE YOURSELF:** THIS IS AN OPPORTUNITY TO SHARE YOUR PERSPECTIVES ON CHILDHOOD VACCINATIONS.

300+

210

**HELP TO REACH THE GOAL OF
300+ PARTICIPANTS.**

**CURRENTLY 210 PARTICIPANTS
HAVE JOINED.**

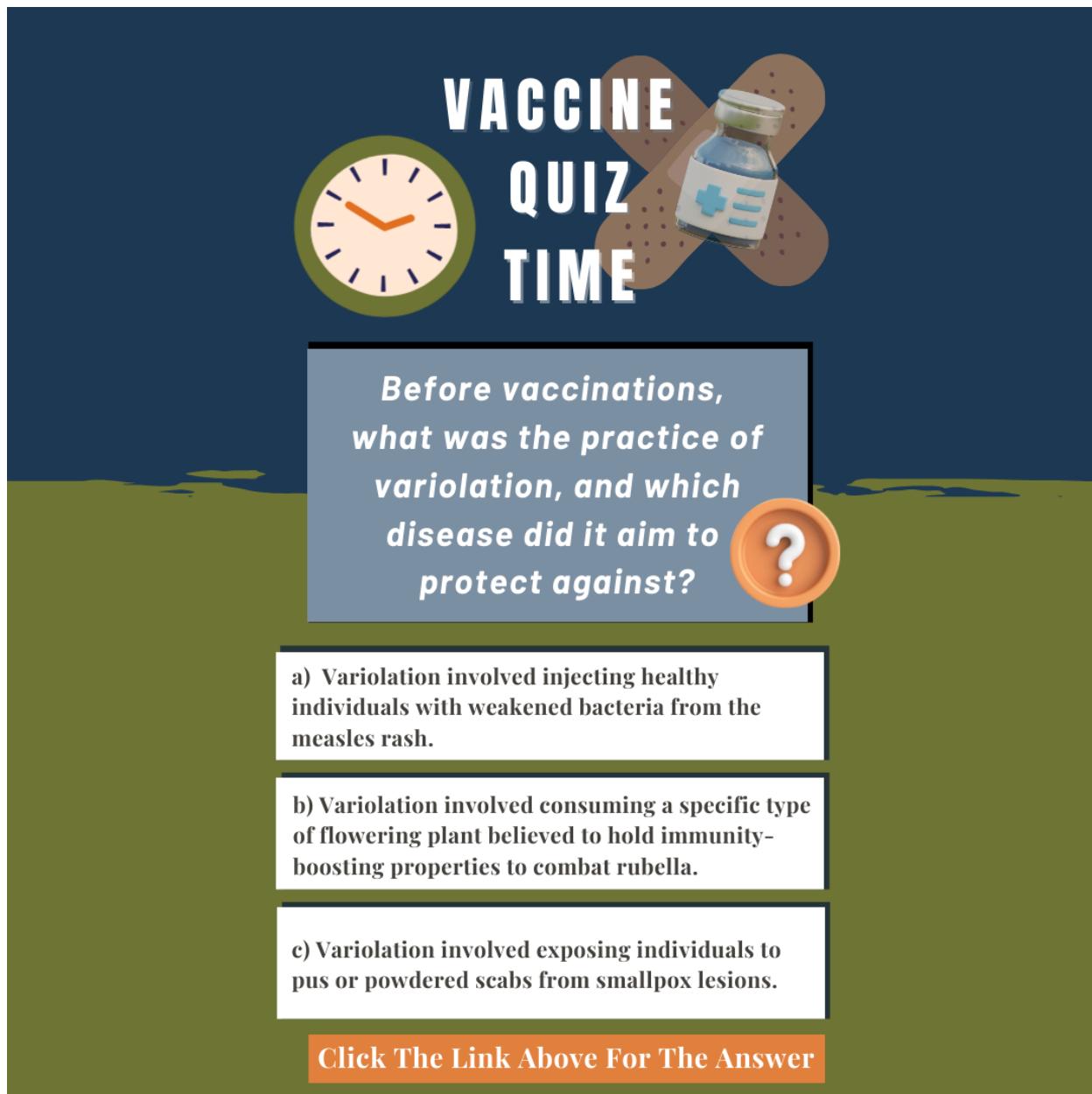
YOUR CONTRIBUTION COUNTS!



THANK YOU FOR YOUR SUPPORT AND FOR HELPING ADVANCE THIS IMPORTANT RESEARCH!



Just follow the [link](#) or scan the QR code and give us your opinion.

Figure 13*Fourth Phase One Advertisement*

The advertisement features a dark blue header with a white circular clock icon containing a smaller clock face. To the right of the clock is the text "VACCINE QUIZ TIME" in large, bold, white capital letters. A brown bandage with a white cross and a small vial of blue liquid with a white cross are positioned next to the text. Below this, a light blue rectangular box contains the question: "Before vaccinations, what was the practice of variolation, and which disease did it aim to protect against?". To the right of the question is a large orange circular icon with a white question mark. The background transitions from dark blue at the top to green at the bottom, with a stylized horizon line.

**Before vaccinations,
what was the practice of
variolation, and which
disease did it aim to
protect against?**

a) Variolation involved injecting healthy individuals with weakened bacteria from the measles rash.

b) Variolation involved consuming a specific type of flowering plant believed to hold immunity-boosting properties to combat rubella.

c) Variolation involved exposing individuals to pus or powdered scabs from smallpox lesions.

Click The Link Above For The Answer

Figure 14

Second Half of Fourth Phase One Advertisement

The slide features a dark blue header with a clock icon, the text "VACCINE QUIZ ANSWER", and a bandage and vial icon. Below the header is a white rectangular box containing text about variolation. The main body of the slide has a green background with a white rectangular box containing a survey invitation. At the bottom is a green footer bar.

VACCINE QUIZ ANSWER

The Answer Is:
C) Variolation involved exposing individuals to the smallpox virus in two ways:

- Direct Pus Inoculation: One method involved taking pus from a smallpox pustule (a small, puss-filled bump) and inserting it into a small scratch on a healthy person's arm.
- Inhaling Scab Powder: Another method involved grinding up dried smallpox scabs into a powder and blowing it up the nose of a healthy person.

While both methods aimed to induce a mild case of smallpox, they were risky procedures with the potential for serious complications.

How Do You Feel About Childhood Vaccines?

You are invited to share your point of view regarding childhood vaccinations.

Your opinion is really important, and I would love for you to take my survey. As a thank you, you could win one of two \$50 Amazon gift cards.

Please consider sharing this survey with other parents to help me reach my goal of 300 participants. Every voice counts!

Just follow the [link](#) or scan the QR code and give us your opinion.

Thank you so much for your time and support!

APPENDIX K

R CODE FOR PHASE ONE ANALYSES

R Code

```

library(tidyverse)
library(broom)
library(tidyr)
library(caret)
library(readxl)
library(pROC)

## Read in the Data ##

data <- C:/Users/carle/Downloads/Vaccine Hesitancy Data.xlsx

View(data)

## Rename Columns ##

names(data) <- c("Age","Gender","Education","Occupation","Occupation - Other",
  "Marital Status","Marital Status - Other", "Income",
  "Race","Race - Other","Geographic Location","Number of Children",
  "Number of Children - Other","VH1","VH2","VH3","VH4","VH5","VH6",
  "VH7","VH8","VH9",paste("RDM",1:5,sep=""),
  paste("IDM",1:5,sep=""),
  paste("DDM",1:5,sep=""),
  paste("ADM",1:5,sep=""),
  paste("SDM",1:5,sep=""))

## Clean up columns ##

data <- data |>
  select(-c("Occupation - Other","Marital Status - Other",
  "Number of Children - Other","Race - Other"))
)

## Throw Out Rows with 100% Missing Data ##

data1 <- data[which(
  apply(data,1,FUN=function(x){
    k <- ifelse(sum(is.na(x)) != ncol(data),T,F)
    return(k)
  })
),]

## Calcualte Mean & Summed Scores ##

```

```

apply(data1,1,FUN=function(x){
  k <- ifelse(sum(is.na(x)) > 0,1,0)
  return(k)
})

naniar::vis_miss(data1)

## Consider Only Complete Cases ##

data2 <- na.omit(data1)

## Calculate Mean of VH columns ##

## First, Recode VH Columns to numeric ##

data2 <- data2 |>
  mutate(across(starts_with("VH"), ~recode(.x, "Strongly Disagree"=1,
    "Disagree"=2,
    "Agree"=3,
    "Strongly Agree"=4)))

## Reverse Code VH8 & VH9 ##

data2 <- data2 |>
  mutate(across(c("VH8","VH9"), ~5-.x))

## Now, Calculate VHS Mean ##

vhs <- data2 |>
  select(starts_with("VH"))

VHSMEAN <- rowMeans(vhs,na.rm=T)

data2 <- bind_cols(
  data2, VHSMEAN
)

names(data2)[44] <- "VHSMEAN"

data2 <- data2 |>
  mutate(FINALVHS = if_else(VHSMEAN >= 3,0,1))

## Calculate RDM total score ##

```

```

rdm <- data2 |>
select(starts_with("RDM"))

## Recode ##

rdm <- rdm |>
mutate(across(everything(),~recode(.x,"Strongly Disagree"=1,
  "Disagree"=2,
  "Agree"=3,
  "Strongly Agree"=4)))

RDMSCORE <- rowSums(rdm,na.rm=T)

data2 <- bind_cols(
data2,RDMSCORE
)

names(data2)[46] <- "RDMSCORE"

## IDM ##

idm <- data2 |>
select(starts_with("IDM"))

## Recode ##

idm <- idm |>
mutate(across(everything(),~recode(.x,"Strongly Disagree"=1,
  "Disagree"=2,
  "Agree"=3,
  "Strongly Agree"=4)))

IDMSCORE <- rowSums(idm,na.rm=T)

data2 <- bind_cols(
data2,IDMSCORE
)

names(data2)[47] <- "IDMSCORE"

## DDM ##

ddm <- data2 |>
select(starts_with("DDM"))
## Recode ##

```

```

ddm <- ddm |>
mutate(across(everything(),~recode(.x,"Strongly Disagree"=1,
  "Disagree"=2,
  "Agree"=3,
  "Strongly Agree"=4)))

DDMSCORE <- rowSums(ddm,na.rm=T)

data2 <- bind_cols(
data2,DDMSCORE
)

names(data2)[48] <- "DDMSCORE"

## ADM ##

adm <- data2 |>
select(starts_with("ADM"))

## Recode ##

adm <- adm |>
mutate(across(everything(),~recode(.x,"Strongly Disagree"=1,
  "Disagree"=2,
  "Agree"=3,
  "Strongly Agree"=4)))

ADMSCORE <- rowSums(adm,na.rm=T)

data2 <- bind_cols(
data2,ADMSCORE
)

names(data2)[49] <- "ADMSCORE"

## SDM ##

sdm <- data2 |>
select(starts_with("SDM"))

## Recode ##

sdm <- sdm |>
mutate(across(everything(),~recode(.x,"Strongly Disagree"=1,
  "Disagree"=2,
  "Agree"=3,
  "Strongly Agree"=4)))

```

```

“Agree”=3,
“Strongly Agree”=4)))
SDMSCORE <- rowSums(sdm,na.rm=T)

data2 <- bind_cols(
data2,SDMSCORE
)

names(data2)[50] <- “SDMSCORE”

## Subset to only analyzed variables ##

df_final <- data2 |>
select(Age,Gender,Education,Occupation,`Marital Status`,
       Income,Race,`Geographic Location`,`Number of Children`,
       FINALVHS,RDMSCORE,IDMSCORE,DDMSCORE,ADMSCORE,SDMSCORE)

## Determine Decision Making Style ##

## Subset RDMSCORE - SDMSCORE ##

scores <- df_final |>
select(RDMSCORE, IDMSCORE, DDMSCORE, ADMSCORE, SDMSCORE)

## Determine which column has the max value ##

## Return column name associated with max value ##

DMSTYLE <- vector(‘integer’,nrow(scores))

for(i in 1:nrow(scores)){
  DMSTYLE[i] <- which.max(scores[i,])
}

## Rejoin to df_final ##

df_final <- bind_cols(
df_final,DMSTYLE
)

names(df_final)[16] <- “DMSTYLE”

## Collapse Levels of the Categorical Predictors ##

```

```

## Age - Collapse to 18-34 & 35+ ##

table(df_final$Age)

df_final <- df_final |>
  mutate(Age = if_else(Age %in% c("18-24","25-34"),"18-34","35+"))

## Gender - Male, Female & Nonbinary ##

table(df_final$Gender)

## Remove Nonbinary ##

df_final <- df_final |>
  filter(Gender != "Nonbinary")

## Education ##

table(df_final$Education)

df_final <- df_final |>
  mutate(Education = if_else(Education %in% c("Less than high school",
    "High school graduate",
    "Some college, no degree"),
    "College Experience or Less",Education))

table(df_final$Education)

## Occupation ##

table(df_final$Occupation)

df_final <- df_final |>
  mutate(Occupation = if_else(Occupation == "Employed full-time",
    "Employed full-time","Other"))

table(df_final$Occupation)

## Marital Status ##

table(df_final$`Marital Status`)

df_final <- df_final |>
  mutate(`Marital Status` = if_else(`Marital Status` == "Married",
    
```

```

    "Married", "Other"))
table(df_final$`Marital Status`)

## Income ##

table(df_final$Income)

df_final <- df_final |>
  mutate(Income = if_else(Income == "$100,000 and Over",
                         "$100K+", "Less than $100K"))

table(df_final$Income)

## Ethnicity ##

table(df_final$Race)

df_final <- df_final |>
  mutate(Race = if_else(Race == "White/Caucasian",
                        "White", "Non-White"))

table(df_final$Race)

## Geographic Location ##

table(df_final$`Geographic Location`)

## Leave as is ##

## Number of Children ##

table(df_final$`Number of Children`)

df_final <- df_final |>
  filter(`Number of Children` != "None") |>
  mutate(`Number of Children` = if_else(`Number of Children` %in%
                                         c("3", "4 or more (Please specify how many children)"),
                                         "3+", `Number of Children`))

table(df_final$`Number of Children`)

## DMSTYLE ##

table(df_final$DMSTYLE)
## Since 5 == "Spontaneous", is 1 best to omit that person and

```

```

## then recode ##

df_final <- df_final |>
filter(DMSTYLE != 5) |>
mutate(DMSTYLE = recode(DMSTYLE, `1`="Rational",
`2`="Intuitive",
`3`="Dependent",
`4`="Avoidant"))

table(df_final$DMSTYLE)

## FINALVHS ##

table(df_final$FINALVHS)

## Recode ##

df_final <- df_final |>
mutate(FINALVHS = recode(FINALVHS, `0`="Vaccine Hesitant",
`1`="Non-Vaccine Hesitant"))

table(df_final$FINALVHS)

## Subset only analyzed variables ##

df_final2 <- df_final |>
select(FINALVHS, Age, Gender, Education, Occupation, `Marital Status`,
Income, Race, `Geographic Location`, `Number of Children`,
DMSTYLE) |>
mutate(FINALVHS = recode(FINALVHS, "Vaccine Hesitant"=1,
"Non-Vaccine Hesitant"=0))

## Build Logistic Regression Model ##

mod <- glm(FINALVHS ~ ., data=df_final2, family="binomial")

mod |>
glance() -> model_fit_tests

## Cooks D##
# Load necessary library
install.packages("ggplot2")
library(ggplot2)

# Calculate Cook's distance
cooks_d <- cooks.distance(mod)

```

```

# Define a threshold for influential observations (e.g., 4/(n-k-1))
threshold <- 4 / (nrow(mod$model) - length(coef(mod)) - 1)

# Identify influential observations
influential_obs <- which(cooksdf > threshold)

# Print the influential observations
influential_table <- data.frame(Observation = influential_obs, CookD = cooksd[influential_obs])
print(influential_table)

# Convert to a data frame for ggplot2
cooksdf_df <- data.frame(Observation = 1:length(cooksdf), CooksD = cooksd)

# Plot Cook's distance
ggplot(cooksdf_df, aes(x = Observation, y = CooksD)) +
  geom_bar(stat = "identity") +
  geom_hline(yintercept = threshold, linetype = "dashed", color = "red") +
  geom_text(aes(label = ifelse(CooksD > threshold, as.character(Observation), "")),
            vjust = -0.5, size = 3) +
  labs(title = "Cook's Distance for Influential Observations",
       x = "Observation Number",
       y = "Cook's Distance") +
  theme_minimal()

## Create Log Likelihood for Null Model ##

null_mod <- glm(FINALVHS ~ 1, data=df_final2, family="binomial")

model_fit_tests <- model_fit_tests |>
  mutate(McFaddenR2 = 1 - logLik/as.numeric(logLik(null_mod)))

mod |>
  tidy(conf.int=T, exponentiate=T) -> model_summary

## ROC Curve ##

roc_curve <- roc(df_final2$FINALVHS, predict(mod, df_final2, type="response"))
plot(roc_curve)
auc(roc_curve)

## AIC and BIC ##
aic_bic <- function(mod) {
  list(AIC = AIC(mod), BIC = BIC(mod))
}
aic_bic_full <- aic_bic(mod)

```

```

print(aic_bic_full)

## McFaddens Pseudo R-Squared ##

# Install and load the pscl package
install.packages("pscl") library(pscl)

# Calculate McFadden's pseudo R-squared
mcfadden_r2 <- pR2(mod)[“McFadden”]

# Print McFadden's pseudo R-squared
print(mcfadden_r2)

## Likelihood Ratio Test ##
lmtest::lrtest(null_mod,mod)

## GVIF ##
df_final2 <- vif(mod)
print(df_final2)

## Sensitivity – Specificity ##
sensitivity_specificity <- function(mod, threshold = 0.5) {
  predictions <- ifelse(fitted(mod) > threshold, 1, 0)
  confusion_matrix <- confusionMatrix(as.factor(predictions), as.factor(mod$y))
  list(Sensitivity = confusion_matrix$byClass[“Sensitivity”], Specificity =
    confusion_matrix$byClass[“Specificity”])
}

sens_spec_full <- sensitivity_specificity(mod)
print(sens_spec_full)

## Hosmer Lemeshow Test ##
hoslem_test <- function(mod) {
  hoslem.test(mod$y, fitted(mod), g = 10)
}

# Fit a logistic regression model
model <- glm(vs ~ wt + hp + drat, family = binomial, data = mtcars)

# Perform the Hosmer-Lemeshow test
hoslem_full <- hoslem_test(mod)

# Print the test results
print(hoslem_full)

## Tables by Vaccine-Hesitant or Non-Vaccine-Hesitant ##

```

```
table(df_final$Age, df_final$FINALVHS)
table(df_final$Gender, df_final$FINALVHS)
table(df_final$Education, df_final$FINALVHS)
table(df_final$Occupation, df_final$FINALVHS)
table(df_final$`Geographic Location`, df_final$FINALVHS)
table(df_final$`Marital Status`, df_final$FINALVHS)
table(df_final$Income, df_final$FINALVHS)
table(df_final$Race, df_final$FINALVHS)
table(df_final$`Number of Children`, df_final$FINALVHS)
table(df_final$DMSTYLE, df_final$FINALVHS)
```

APPENDIX L

THEMES OF REFLEXIVE THEMATIC ANALYSES

Table 10*Themes from Traditional Reflexive Thematic Analysis*

Themes/Explanation	Number of Subthemes/ Codes/ References	Subthemes - (References)			Supporting Quotes
Influences and Perceptions Shaping Vaccine Decisions: Participants' perceptions of childhood vaccines were shaped by a multitude of influences. These included personal experiences, the experiences of others, interactions with doctors and healthcare practitioners (both positive and negative), the influence or non-influence of family and friends, and various information sources such as scientific research, vaccine inserts, doctors' advice, podcasts, internet forums, and books. The impact of each influence varied among participants, resulting in either positive or negative perceptions of vaccines.	(7)(60)(305)	Communication (120)	Doctor- Healthcare Professionals (86)	Good Communication with Doctor (23) Bad Communication with Doctor (10) Dr. Influence Vaccine Decisions (12) No Dr. Influence (9) Dr. Communication Needs Improved (16) Dr. Communication Does Not Need Improved (4) The Way Dr. Communicates Effects Health Decisions (12)	<p>"I think that my experience is that my pediatrician is definitely someone who provides a wealth of information and is not presenting things at a surface level."</p> <p>"I didn't feel like they were giving me the time I really wanted to discuss concerns."</p> <p>"Absolutely. I don't want to buck the status quo or make people uncomfortable."</p> <p>"I mean, from my own experience, it doesn't affect the decisions."</p> <p>"So, I didn't feel like I was communicated with at the hospital, making sure I understood what was given to my kid."</p> <p>"I'd say they do such a good job that, you know, they say there's always room for improvement. But off the top of my head, they're pretty thorough."</p> <p>"Yes, I do, for sure. I think there are definitely fear tactics used in getting patients to kind of do what they want. I obviously work in the health field, so I know that there are amazing doctors out there who will want you to make an informed decision, but there are also a lot of doctors who just want you to follow the protocol of everything in their way. So, unfortunately, I think that, yeah, they can use fear for sure."</p>

			Friends/Family (15)	Yes (5)	"My mom's a nurse, and my mom literally said, "If you don't take her to get vaccinated, I will," kind of thing."
				No (10)	"Well, in my case, they were not supportive of the decision that we made. So not a lot."
		Vaccine Literature (19)	Happy With (10)	"I trust the information that I receive from my doctor. I trust them for a reason."	
				Not Happy With (8)	"No, they just don't have it. They can give you the insert, but they're not going to know even the risks. If you ask, "What are the risks, or what are the chances that something happens?" they don't have that."
		Community Considerations (14)	Consider Community (12)	Ambivalent (1)	"No, I don't think they discussed the potential risks enough."
					"Yeah, absolutely, I think. You know, before she could get vaccinated, one of the thoughts that we regularly had was like we had talked with our doctor about limiting her public exposure because she wasn't able to be vaccinated, and so I do think about that."
		Influential Factors in Vaccine Decision-Making (34)	Not-Consider Community (2)		"I kind of have an opinion, though, that I feel is not the most Jesus-like perspective. I'm not vaccinating her for other children at all, and I don't."
		Individual Research (2)		Acceptance (8)	"I read a lot before making decisions."
					"I think a lot of it is kind of gut instinct."
		Instinct-Intuition (3)	Personal (17)		
		Lived Experience (26)	Personal (17)	Non-Acceptance (9)	"I would say just, you know, the culture and the way that we are raised is really hard to deviate from sometimes, like it really, truly is ingrained in us. My parents, you know, like I said, we were all vaccinated. My husband has always been vaccinated."
					"...when [Ashley] was born, she got vaccinated like our other two"

						children; she had no problems, you know, not a big deal. And at nine months old. So, along the course of the vaccination schedule, we call them pop shots. I don't know what they call them now, but they were a conglomeration of multiple vaccinations in one shot at nine months old. She got that shot in her thigh where they put it in her left thigh, and we went home, and we had done everything we were supposed to do. We did the Motron before the shot, you know, monitored her closely, all that good kind of stuff, and she started to have some very adverse reactions. And we ended up back in the hospital. Her liver basically failed."
				Other's (9)	Acceptance (8)	"My little brother, at age 3 or 4, actually got pertussis. And then my whole family had to be quarantined. Oh, yeah. Yeah, but it was kind of a common thing in the community in [the state I lived in] that they would have these outbreaks and stuff because they had a little hive of severe anti-vaxxers. And so, I watched him go through that. That was pretty terrifying, and we had to all be quarantined even

						though we were vaccinated. My mom, being a public health nurse, had to be for like two weeks. I think if you did the monetary losses of math, we probably lost like \$6000 to \$7000 back then, like in early 2000. So, it was a lot of money. It was scary. We all had to be on prophylactic antibiotics and all of that kind of stuff.”
					Non-Acceptance (1)	“I mean, definitely, our friend’s daughter who had an injury. Unfortunately, she’s wheelchair-bound.”
			Social media (7)			“There’s a lot of negativity about the Internet, but it’s brilliant to have places to get quick, science-backed information.”
			Mandates (1)			“I mean, I did it because most of them are required when you have to move out of the state.”
		Feelings on Vaccine Efficacy (34)	Vaccines Safe-Work Well (18)			“And they’ve been around for a long time, they’ve been tested and everything because we don’t take the risk of having those complications, then.”
			Vaccines Not Safe-Do Not Work Well (7)			“I don’t think they’re safe. I think it’s all with good intentions, and there may be some vaccines that are safer, like the MMR vaccine. It doesn’t have mercury or aluminum, but it does have some questionable ingredients.”
			Not Sure (2)			“And I don’t know how effective they were because you were not in contact with those viruses.”
			Vaccines Can Be Helpful-Natural Immunity Better (3)			“I think they do have a, you know, protective initial response, and people obviously, you know, you build up antibodies like they say; however, a lot of vaccines require the boosters, you

			know, because there's variance in mutations and viruses and bacteria that the vaccines don't cover or protect for and also they just stop working after a certain amount of time. So, I do think, yeah. And in some cases they can be helpful. But, I think that the way we understand them is that people just don't completely understand the immune system and how it works as well because it's not all about antibodies either. We have a whole, you know, host of white blood cells, different types, and your body remembers illnesses when they naturally fight them better than getting a vaccine, in my opinion."
		Views on Vaccines Changed After Covid (4)	"Before the COVID thing, I probably would have been one of those people with absolutely no information, no research, and be like, "You're out of your mind. Why would you not give your kid that?""
	Reactions to Vaccinations (24)	Adverse Reactions (12)	"I have another friend who believes her child became autistic due to vaccinations and hasn't vaccinated her other children."
		No-Adverse Reactions (12)	"Not any more than what we all have experienced with the flu vaccine or a COVID vaccine. You know, a day of kind of feeling crummy. Yeah, nothing that Tylenol can't take care of."
	Vaccine & Health Information (73)	Credible Health Information (11)	"If it's for my son, my first go-to is his doctor. I did a lot of research when I picked his doctors to start with, and I just like her because we agree on a lot of things. For me, that's the most important source or the first source I go to."
		Non-Credible Health Information (6)	"On my Google feed on my phone."
		Combo Health Information (10)	"So, like social media, but then also like reputable sources, the CDC, NIH, that kind of stuff."
		Credible Vaccine Information (16)	"I would definitely go to PubMed for that. I mean, I might start on Healthline if I was looking for basic information, like

				what the milestones are for the DTaP or something similar. When do we get them? I might start on a general website like Healthline. But if I need to drill down to actually learn more details, then I would definitely go to PubMed.”
			Non-Credible Vaccine Information (2)	“So, I started digging into some podcasts.”
			Credible Vaccine Information Recommendations (5)	“...probably the CDC. I would also maybe show them ways to find reputable sources because they don’t need to just look at the CDC.”
			Finding Legitimate Resources (1)	“I mean, in college, it’s really drilled into your head about what is peer-reviewed. Is it legitimate? You’re going to get an F if you use the .com site on your paper. Like, don’t do this. So, then, it is natural just to avoid non-legitimate sources.”
			Navigating Conflicting Health Information (22)	“Find all the knowledge you need until you feel equipped to make the decision and make the decisions.”
			Vaccines A Debate-Political (6)	“...but I feel like now everything has become so political. I feel it’s either one side or the other, but it shouldn’t be that way. Healthcare shouldn’t be a conservative or liberal issue or a Democrat or Republican issue. It should just be about health care. And so, I feel like there’s these public health issues. They’re the doctors. That is what they went to school for, what they have done so much research on.”
Trust and Concerns in Vaccine Decision-Making: Participants expressed varying levels of trust in the medical community and the efficacy of vaccinations. Some had abundant trust in healthcare professionals and the benefits of vaccines, while others were distrustful of the medical community and skeptical	(3)(16)(79)	Trust (23)	Trust Public Health (13)	“Yeah. In fact, I think they’re doing a very important job, and it’s a very hard one at times.”
			Non-Worry About Giving Vaccines to Children – (10)	“Nope. I haven’t even ever thought twice about not doing them.”
		Distrust (54)	Competency of Health Care Providers & Access to Vaccines (2)	“But in this case, it was so bad that the person was holding the needle up while my son was losing his mind. It made me think about how it’s great that we’re making vaccines accessible everywhere, but with that access, there must be well-trained, educated people. They need to

<p>about vaccine ingredients and potential side effects. Some participants believed that doctors were not adequately informed about vaccines, their ingredients, or their side effects, and they strongly disapproved of fear-mongering tactics and a lack of empathy from healthcare practitioners. Additionally, concerns were raised about the extensive childhood vaccine schedule.</p>			<p>Concerns About Vaccine Ingredients (5)</p>	<p>provide brochures for people who have questions and administer the vaccine so quickly that the kid doesn't even notice. It has to be a complete package. Making sure the experience is good is crucial so people come back.”</p> <p>“One of the first things is knowing that the blood-brain barrier doesn't close typically until around 7 years old, and many vaccines use polysorbate 80, which opens that barrier. Knowing that we have high levels of aluminum in the vaccines, along with products like soy that are endocrine disruptors, all of those can cross the blood-brain barrier with the help of polysorbate 80. That gave me pause. In 2021, I read an article on PubMed linking vaccines to SIDS, reporting a closer to 85% correlation between SIDS and vaccinations. I had heard that 12% of all SIDS rates happened within seven days of vaccination. That made me think, “I don't want to vaccinate my kid.”</p> <p>Distrust of Medical System (9)</p> <p>“Okay, so I don't have a lot of trust in the medical system, and I don't abdicate my authority to them.”</p> <p>Doctors Need to Know More About Vaccines (4)</p> <p>“something else I've realized is that your doctors don't study the vaccines.”</p> <p>Fear Mongering (7)</p> <p>“A direct quote from the fear-mongering when I was pregnant with our first: they wanted to give me the Covid vaccine; they said, “If you don't get this, you will die, and your baby will die.””</p> <p>Fear of Rejecting Vaccines Even When You Want To (2)</p> <p>“I don't want to buck the status quo or make people uncomfortable. When my daughter got her last round of vaccinations, I was prepared to say no, but the nurse had them ready, and I caved. My daughter got a terrible fever, and I regretted it.”</p> <p>No Trust in Public Health (9)</p> <p>“Not anymore, no. It's unfortunate. I feel like COVID has really unraveled the</p>
---	--	--	--	---

				trust of the public of public health for a lot of people, yeah.”
			Parent Shaming When Saying No to Vaccinations (2)	“She warned me that if you don’t vaccinate, you’ll face pushback at every step. It’s not an easy choice, but even a little research shows it’s an obvious decision for me.”
			Worry About Giving Vaccines to Children (8)	“I worry about all of it. I mean, so I worry more about the autoimmune response.”
			Do Not Trust All Medications (4)	“Initially, I would trust pretty much whatever the doctor said, but my little one had severe eczema when she was little, so bad that she couldn’t sleep or eat. I relied a lot on doctors, pediatricians, and specialists. But the medications just kept increasing, and I decided to take a stab at it myself. I changed her diet completely, looking into Eastern cures like Ayurveda and Chinese medicine. I followed a cleansing mechanism for her body, and after three months, she started sleeping and didn’t need any medications.”
			Flaws in Vaccine Schedule (2)	“...everything sort of snowballed to get to the point where they went from 8 vaccines to 20 to now we’re at like 73, and counting by the time one’s 18. The numbers have increased exponentially...”
			Both Trust & Distrust Public Health (2)	“Yeah, the origins of the CDC are good. I don’t know. I hope that we’re. I, I don’t know. That’s a hard one. I don’t know going forward.”
Attitudes Toward Vaccination Mandates: The majority of participants viewed vaccine mandates negatively, believing that the decision to vaccinate oneself or one’s children should be left to the discretion of the individual or parent. However, a few	(4)(20)		For Mandates (3)	“Yes, yes. For children specifically, yes.”
			Against Mandates (12)	“They are terrible. I feel like there should be some kind of better regulation out there.”
			Ambivalent (4)	“I guess, in one sense, there’s a freedom of choice. And you know I think people should have their own choice and on the other scale. You know you have laws like putting on your seat belt to protect you and other people in the car. If you don’t

<p>participants felt that mandates are crucial for protecting oneself and the community from preventable diseases.</p>			<p>wear your seat belt, you're breaking the law, and you're putting the other passengers in your car at risk. So, in one regard, the vaccine is the same as having a law that says you should; you have to wear seatbelts. In particular, it was a law that says, you know, you have to wear two if there are two people, right?"</p>	
		<p>Mandates Do Not Work (1)</p>	<p>"I don't know if it actually works to force people to comply because there are too many exceptions, like religious exemptions. We face so much difficulty with anything like that. When you make a requirement, you have access problems."</p>	
<p>Alternative Perspectives & Attitudes Toward Vaccination: Some participants had alternative perspectives and attitudes toward childhood vaccinations. For example, there was reluctance toward new vaccines such as HPV and COVID, preferences for spacing out vaccines to monitor for reactions, and efforts to mentally prepare children to not be scared about vaccines. Additionally, some participants felt that the human body is resilient and capable of building immunity on its own, emphasizing personal responsibility for health rather than relying solely on healthcare practitioners. Some believe that children can be perfectly healthy without vaccinations. Others expressed frustration about being labeled as extreme or antivax simply for being cautious or hesitant about fully embracing vaccines.</p>	<p>(4)(13)(50)</p>	<p>Alternative Approaches to Accepting Vaccine Schedule (21)</p>	<p>Hesitant About Some Vaccines (14)</p>	<p>"There are options like the HPV vaccine, and that is one where, because it's newer, much like the COVID vaccine was, I think, like a lot of people, I wanted to read more about it before deciding we need to do this."</p>
		<p>Spacing Vaccines (2)</p>	<p>"I think that spacing them out for us was what I liked the best because I wanted to be able to monitor for a reaction."</p>	
		<p>Mentally Preparing Children for Vaccines (5)</p>	<p>"We play doctor games a lot at home. I think that helped her. In her doctor's suit, she has vaccines. She has all the equipment. We pretend we are sick, and she does all of that. When she goes to the doctor, she takes her doll and her little doctor's kit. Her pediatrician is nice enough to let her do whatever she wants to, so she does that poking and everything. I think those things, including it as child's play, helped her not be scared."</p>	
		<p>Homeopathic Perspective (25)</p>	<p>Thoughts on Health (1)</p>	<p>"I see that as your body having good vitality and that your body is working as it should, and, in my opinion, a fever is brought on by the body, not because of a virus."</p>
		<p>Thoughts on Viruses & Vaccines (6)</p>	<p>"You know, stuffy nose, you know, outside and plays T-ball. I had a game last week, and she had a pretty chesty</p>	

				cough for a couple of days. Well, she was out with the infield, kicking up dirt, breathing all that dirt in. Well, was that cough from a virus? No, it's just irritation from dirt."
			Responsible for Own Health (2)	"Just like I do all my own and my wife's automotive work—oil changes, tire rotations, brake work—because I want it done right. I don't want somebody else to mess it up. If I mess it up, it's on me."
			Prefer to Boost Immune System (6)	"I also tried to boost his immune system, knowing that he was getting a virus. So, how to help also fight that virus, you know? It probably just boosts his immune system in general. And then he dealt perfectly with them."
			Middle Ground for Vaccines (5)	"Yeah, I was just going to say overall the thing that I said like I wish there was more regulations out there and have like a middle line, not so extreme, I think like, feel things are a little bit extreme right now. It's like the extremes of both sides, no vaccines or like too many vaccines."
			Healthy Children Without Vaccines (4)	"My kids go to a rural daycare with unvaccinated children who are healthy and thriving."
			Belief in Chiropractors (1)	"I don't go to doctors. I go to chiropractors. My chiropractor is a fantastic individual."
			Skepticism (1)	"So, if every medication on the market had an insert about, you know, every ingredient in it and every possible side effect because once it's been reported, it's considered a side effect, then you would never take anything..."
			Unwarranted Negative Attitudes Toward Non-Vaccination (3)	"Asking these kinds of questions and getting immediately labeled as a staunch Republican or anti-vax has stopped me from asking questions and just going along with it because everyone else is doing it."

Table 11

Themes from ChatGPT: Braun and Clarke (2022)

Theme	Explanation	# Codes/ References	Supporting Quotes
Diverse Information Sources	Parents utilize a wide range of sources for vaccine information, including books, online resources, healthcare professionals, and reputable organizations. The reliance on diverse sources reflects a desire for comprehensive understanding and informed decision-making.	(4)(15)	<ul style="list-style-type: none"> • <i>"I started deep-diving into books more so than the Internet."</i> (Stella, Transcript 17) • <i>"I do my own research, but it comes from multiple different sources."</i> (Gabe, Transcript 16) • <i>"I try to take advice from my pediatricians or providers in general, but I also try to find peer-reviewed articles."</i> (Maddy, Transcript 13)
Informed Decision-Making Influences	Parents' vaccine decisions are influenced by personal experiences, healthcare professionals' advice, and scientific research. They balance their research with professional guidance, striving to make informed choices.	(3)(14)	<ul style="list-style-type: none"> • <i>"Our pediatrician is a really good resource to talk us through it."</i> (Stella, Transcript 17) • <i>"I've tried to get it from pediatricians because I didn't want to have confirmation bias."</i> (Gabe, Transcript 16) • <i>"I trust my doctor's recommendations."</i> (Olivia, Transcript 15)
Safety Concerns and Hesitations	Parents express concerns about adverse reactions, the ingredients in vaccines, and the safety of newer vaccines. These concerns contribute to their hesitancy and cautious approach to vaccination.	(3)(13)	<ul style="list-style-type: none"> • <i>"My fear was we do know a friend whose daughter had a really bad [vaccine reaction]."</i> (Stella, Transcript 17) • <i>"There was a lot of disheartening and kind of scary and disappointing information."</i> (Gabe, Transcript 16) • <i>"I don't like especially the great big multi-antigen and antigen combination vaccines."</i> (Maddy, Transcript 13)
Trust in Healthcare Dynamics	Trust in healthcare providers and public health officials varies among parents. Some parents trust their doctors and public health recommendations, while others express mistrust, particularly towards vaccine manufacturers.	(3)(12)	<ul style="list-style-type: none"> • <i>"Our pediatrician has been great about just explaining what each vaccine tackles."</i> (Stella, Transcript 17) • <i>"I don't think you should be studying your own product and putting out information about it making recommendations if you stand to make a profit."</i> (Gabe, Transcript 16) • <i>"I don't trust the intertwining of profit and healthcare."</i> (Maddy, Transcript 13)
Navigating Personal and Community Health	Parents navigate the balance between adhering to recommended vaccination schedules and considering the broader community impact. They weigh personal beliefs with societal responsibility, sometimes leading to selective or delayed vaccination schedules.	(3)(11)	<ul style="list-style-type: none"> • <i>"I believe vaccines are important for herd immunity."</i> (Olivia, Transcript 15) • <i>"We're protecting others by vaccinating our children."</i> (Owen, Transcript 14)

			<ul style="list-style-type: none"> “I just want to make sure that we’re all making informed decisions.” (Amelia, Transcript 11)
Integration of Natural Health Practices	Some parents incorporate natural health practices alongside conventional medical advice to prepare their children for vaccinations. This holistic approach reflects a desire to minimize potential adverse reactions and promote overall well-being.	(2)(9)	<ul style="list-style-type: none"> “We chose to make a pact that we were going to do everything naturally to make sure that we would mitigate disease for our kids and also for other people.” (Stella, Transcript 17) “I give her fruits that help break down proteins, so the vaccines don’t trigger her as much.” (Elena, Transcript 12) “We play doctor games a lot at home. I think that helped her.” (Elena, Transcript 12)

Table 12

Themes from ChatGPT: Zhang, Wu, Xie, Lyu et al. (2023)

Theme	# Codes/ References	Codes	Subthemes (Codes/References)	Supporting Quotes
Trust and Distrust in Medical Systems - The theme “Trust and Distrust in Medical Systems” from the reflexive thematic analysis captures the complex and often contradictory attitudes parents hold towards the healthcare system concerning vaccinations. This theme includes trust in pediatricians and primary care physicians, whom parents rely on for personalized vaccine advice; pervasive distrust towards pharmaceutical companies and government agencies, viewed as profit-driven rather than health-focused; and mixed feelings towards public health experts, whose expertise is recognized but whose impartiality is questioned. These dynamics highlight the importance	(12)(28)	<ul style="list-style-type: none"> Trust in Pediatricians Trust in Primary Care Physicians Distrust in Government Agencies Distrust in Pharmaceutical Companies Mixed Trust in Public Health Experts Influence of Profit Motives Lack of Transparency Influence of Negative Healthcare Experiences Concerns about Medical Ethics 	<p>Trust in Pediatricians and Primary Care Physicians - Many parents expressed a strong trust in their pediatricians and primary care physicians, relying on their expertise to guide vaccination decisions. (4)(7)</p> <p>Distrust in Government and Pharmaceutical Companies - Conversely, there was a pervasive distrust of pharmaceutical companies and government agencies, which parents felt were driven by profit motives rather than public health. (5)(12)</p>	<ul style="list-style-type: none"> “We have a doctor that we trust, and we trust their opinions and their recommendations as far as vaccinations and which ones are best for our children.” - Sophia (Transcript 8) “I have a really good pediatrician that I really love. They’re very open and honest with me.” - Maddy (Transcript 13) “It makes me uncomfortable that CDC board members can have shares in vaccines. I don’t trust the intertwining of profit and healthcare.” - Sam (Transcript 1) “If you’re profiting off of the thing that you’re doing the studies on, I think you should really get an independent study coming in or at least somebody else.” - Gabe (Transcript 16)

<p>of transparent, consistent health communication to address parental concerns and foster trust across different levels of the medical system.</p>		<ul style="list-style-type: none"> • Perceived Incompetence of Healthcare Providers • Personal Experiences with Trustworthy Healthcare Providers • Variability in Trust Based on Personal Interactions 	<p>Mixed Trust in Public Health Experts - Parents showed a nuanced perspective on public health experts, recognizing their expertise but questioning their impartiality. (3)(9)</p>	<ul style="list-style-type: none"> • “It’s tough because when you hear situations like that, it does kind of make you have a loss of faith in those healthcare professionals.” - Stella (Transcript 17) • “To their credit and to their point, I don’t blame them because it’s their liability.” - Gabe (Transcript 16)
<p>Influence of Personal Experiences and Anecdotes - The theme “Influence of Personal Experiences and Anecdotes” captures how personal and vicarious experiences shape parents’ attitudes towards vaccinations. This theme is characterized by three significant subthemes: negative personal experiences with vaccines, observations of adverse reactions in others, and family health experiences. Parents’ hesitation and skepticism are often rooted in their own negative experiences with vaccinations, where adverse effects have left a lasting impact on their trust in vaccine safety. This personal skepticism is further reinforced by witnessing adverse reactions in other children, which heightens fears and solidifies hesitancy. Additionally, broader family health experiences, including chronic conditions and how they have been managed, significantly influence parents’ perspectives on the necessity and safety of vaccinations. Collectively, these experiences weave a complex narrative that deeply influences parental decisions about vaccines, underscoring the need for healthcare providers to address these personal and observed</p>	(10)(25)	<ul style="list-style-type: none"> • Negative Personal Vaccine Experiences • Observations of Adverse Reactions in Others • Family Health Issues • Influence of Anecdotal Evidence • Impact of Personal Health Conditions • Influence of Family and Friends’ Experiences • Childhood Vaccination Experiences • Stories from Online Communities • Influence of Social Circles • Personal Health Beliefs Shaped by Experiences 	<p>Negative Personal Experiences with Vaccines - Personal adverse experiences with vaccines significantly influenced parents’ hesitation and skepticism. (4)(8)</p> <p>Observations of Adverse Reactions in Others - Witnessing adverse reactions in other children reinforced parents’ fears and hesitancy. (3)(10)</p> <p>Family Health Experiences - Family health issues and experiences with chronic conditions also played a role in shaping vaccine attitudes. (3)(7)</p>	<ul style="list-style-type: none"> • “My daughter got a terrible fever, and I regretted it. Now I prepare for appointments by researching the CDC schedule and risks, but it’s still difficult because there is fear.” - Sam (Transcript 1) • “I have another friend who believes her child became autistic due to vaccinations and hasn’t vaccinated her other children.” - Sam (Transcript 1) • “We do know a friend whose daughter had a really bad [vaccine reaction], and it was a fluke thing. She is now physically unable to do anything.” - Stella (Transcript 17) • “We had another pediatrician who would kind of often laugh off my anxiety instead of being like ‘No, that’s a legitimate concern.’” - Maddy (Transcript 13) • “My dad is kind of at the end of his battle with cancer, and I wanted to see what we could have managed and how we managed it for so long with just food, whole foods, exercise, and fresh air.” - Stella (Transcript 17) • “I have PCOS, and we’re not sure where it came from because I don’t have other symptoms.” - Maddy (Transcript 13)

concerns comprehensively to foster informed decision-making.				
Information Seeking and Decision-Making Process - The theme “Information Seeking and Decision-Making Process” encapsulates how parents actively engage in gathering diverse sources of information to make informed decisions about vaccinations. This theme unfolds through three subthemes: seeking multiple sources of information, the influence of the Internet and social media, and personal research. Parents are not passive recipients of information; instead, they actively seek out a variety of perspectives, from medical professionals to peer-reviewed articles, to form a well-rounded view. The Internet and social media platforms, especially parent blogs and forums, play a crucial role by providing accessible and relatable content that influences parents’ views and decisions. Additionally, personal research is highlighted as a critical strategy employed by parents to mitigate bias and ensure that their decisions are well-informed. Together, these subthemes reflect a proactive approach in the modern information landscape, where parents utilize a combination of traditional and digital resources to navigate the complex information about vaccinations.	(11)(27)	<ul style="list-style-type: none"> • Seeking Multiple Sources of Information • Influence of Internet Resources • Use of Social Media • Influence of Peer-Reviewed Articles • Role of Books in Decision-Making • Impact of Personal Research • Influence of Medical Professionals • Conflicting Information from Various Sources • Decision-making based on Comprehensive Research • Role of Educational Background • Influence of Podcasts and Non-Traditional Media 	<p>Seeking Multiple Sources of Information - Parents described utilizing a diverse array of sources, from medical professionals to peer-reviewed articles, to inform their decisions. (4)(9)</p> <p>Influence of Internet and Social Media - The Internet and social media, particularly parent blogs and forums, were significant sources of information and influence. (4)(10)</p> <p>Personal Research - Participants emphasized the importance of conducting personal research to avoid biases and ensure informed decisions. (3)(8)</p>	<ul style="list-style-type: none"> • “I try to use a really multifaceted approach. I mean, I try to take advice from my pediatricians or providers in general, but I also try to find peer-reviewed articles of my own.” - Maddy (Transcript 13) • “I do my own research, but it comes from multiple different sources. University studies, I do a deep dive in there.” - Gabe (Transcript 16) • “These mom blogs are very well presented, and they’re very emotionally charged, and they’re very ‘This happened to my kid. This happened to my kid.’ Well, I can show you just as many kids that died of pertussis, you know.” - Maddy (Transcript 13) • “Podcasts have been a super good resource for me.” - Sam (Transcript 1) • “We try to get a full spectrum of information, the good, the bad, and the ugly, to make the best-educated decision for our family.” - Stella (Transcript 17) • “I read a lot before making decisions. I’ll spend days obsessing over a topic until I feel confident in my decision.” - Sam (Transcript 1)

<p>Perception of Vaccine Safety and Necessity –</p> <p>The theme “Perception of Vaccine Safety and Necessity” encapsulates parental concerns and beliefs surrounding vaccinations, highlighting two main areas: concerns about vaccine ingredients and side effects, and beliefs in natural immunity. Parents frequently express apprehensions regarding the components of vaccines, especially new technologies, worried about potential side effects that could affect their children’s health. Simultaneously, a significant number of parents advocate for natural immunity, preferring their children to combat diseases naturally rather than through vaccination. This combination of safety concerns and a preference for natural processes deeply influences decisions about vaccinations, underscoring the need for clear and effective communication about the safety and benefits of vaccines to help parents make informed decisions.</p>	(9)(23)	<ul style="list-style-type: none"> • Concerns About Vaccine Ingredients • Fears of Vaccine Side Effects • Belief in Natural Immunity • Evaluation of Vaccine Necessity • Skepticism About New Vaccine Technologies • Influence of Historical Vaccine Data • Concerns About Vaccine Efficacy • Influence of Media Reports on Vaccine Safety • Evaluation of Vaccine Benefits Versus Risks 	<p>Concerns About Vaccine Ingredients and Side Effects -</p> <p>Concerns about vaccine ingredients and potential side effects were prevalent among parents, particularly with newer vaccine technologies. (5)(13)</p>	<ul style="list-style-type: none"> • “I think it’s the technology itself that’s causing the side effects ... I probably will not trust anything that switches over to that [mRNA technology].” - Maddy (Transcript 13) “I was worried about this vaccine not being tested enough, and I knew for sure there would be problems, and there are problems.” - Addison (Transcript 7) <p>Belief in Natural Immunity -</p> <p>Some parents believed in the body’s natural ability to combat diseases, preferring natural immunity over vaccination. (4)(10)</p>	
<p>Sociocultural and Political Influences –</p> <p>The theme “Sociocultural and Political Influences” highlights how broader societal contexts and political environments shape parental attitudes toward vaccinations. This theme is explored through two subthemes: the impact of the political climate on vaccine perceptions and the influence of community and societal norms. The political climate significantly colors parental views, with vaccinations</p>	(8)(19)	<ul style="list-style-type: none"> • Impact of Political Climate on Vaccine Perceptions • Influence of Community Norms • Societal Pressure and Expectations • Influence of Cultural Beliefs • Role of Political Affiliations • Influence of Societal Debates on Vaccination 	<p>Impact of Political Climate on Vaccine Perceptions -</p> <p>The political climate heavily influenced parents’ perceptions of vaccines, with some viewing vaccination as a politically charged issue. (4)(10)</p>	<ul style="list-style-type: none"> • “Healthcare shouldn’t be a conservative or liberal issue or a Democrat or Republican issue. It should just be about healthcare.” - Sophia (Transcript 8) • “When I moved to this area, it became more of a political issue ... people began to question all vaccinations.” - Sophia (Transcript 8) <p>Influence of Community and Societal Norms -</p> <p>Community and societal norms played a role in shaping vaccine beliefs, often</p>	

<p>becoming entwined in political debates, which can polarize opinions and influence decisions based on political identity rather than health information alone. Additionally, community and societal norms exert a powerful force in shaping beliefs and behaviors related to vaccines, providing either pressure or validation for parental choices. These sociocultural dynamics play a critical role in how vaccinations are perceived and accepted, underscoring the need for understanding and addressing these influences in public health strategies to promote vaccination.</p>		<ul style="list-style-type: none"> • Peer Pressure and Group Dynamics • Impact of Regional Differences on Vaccine Attitudes 	<p>adding pressure or validation to parents' decisions. (4)(9)</p>	<p>We will support you." - Stella (Transcript 17)</p> <ul style="list-style-type: none"> • "It was interesting for me to be like OK [my husband's] kind of like getting, you know, he felt really guilty, and he started getting that conviction from the nurses and doctors." - Stella (Transcript 17)
--	--	---	--	--

Table 13*Themes for All Reflexive Thematic Analyses*

RTA	Theme I	Theme II	Theme III	Theme IV	Theme V	Theme VI
Traditional	Influences and Perceptions Shaping Vaccine Decisions	Trust and Concerns in Vaccine Decision-Making	Alternative Perspectives & Attitudes Toward Vaccination	Attitudes Toward Vaccination Mandates		
ChatGPT-Braun and Clarke (2022)	Informed Decision-Making Influences	Trust in Healthcare Dynamics	Safety Concerns and Hesitations	Diverse Information Sources	Navigating Personal and Community Health	Integration of Natural Health Practices
ChatGPT-Zhang, Wu, Xie, Lyu, et al. (2023)	Influence of Personal Experiences and Anecdotes	Trust and Distrust in Medical Systems	Information Seeking and Decision-Making Process	Perception of Vaccine Safety and Necessity	Sociocultural and Political Influences	

APPENDIX M

PROPOSED INFOGRAPHICS FOR M-M-R II VACCINE INFORMATION

Figure 15*Proposed M-M-R II Patient Information*

PATIENT INFORMATION

M-M-R II
Measles, Mumps, and Rubella Virus Vaccine Live

INDICATIONS & USAGE
M-M-R II is a vaccine used to prevent measles, mumps, and rubella in people aged 12 months and older.

DOSAGE & ADMINISTRATION

- Dose: About 0.5 mL per shot.
- Schedule: First shot: 12 to 15 months old. Second shot: 4 to 6 years old.
- Administration: Given as a shot either into the muscle or just under the skin.

DOSAGE FORMS & STRENGTHS
The vaccine comes as a powder that needs to be mixed with a special liquid before being given as a shot.

CONTRAINDICATIONS
Do not use vaccine if:

- Allergic to any vaccine ingredient
- Immune system is weakened
- Have a moderate or severe fever
- Have untreated active tuberculosis
- Pregnant or planning to become pregnant soon
- Family history of immune system problems
- Avoid using immune globulins or blood products at the same time.

WARNINGS & PRECAUTIONS

- History of febrile seizures (seizures caused by fever).
- Severe allergic reactions to eggs.
- History of low blood platelets (thrombocytopenia).

ADVERSE REACTIONS
Possible side effects include fever, headache, dizziness, and rash. Serious side effects are rare but can include severe allergic reactions and brain inflammation. Report any suspected side effects to your doctor or through the VAERS system.

USE IN SPECIFIC POPULATIONS

- Immune globulins and blood products: Can affect the vaccine's effectiveness.
- Tuberculin skin testing: Vaccine may interfere with TB skin tests.
- Other live vaccines: Should be given one month apart if not given together.

DESCRIPTION
The vaccine is made from weakened strains of measles, mumps, and rubella viruses. It contains no preservatives.

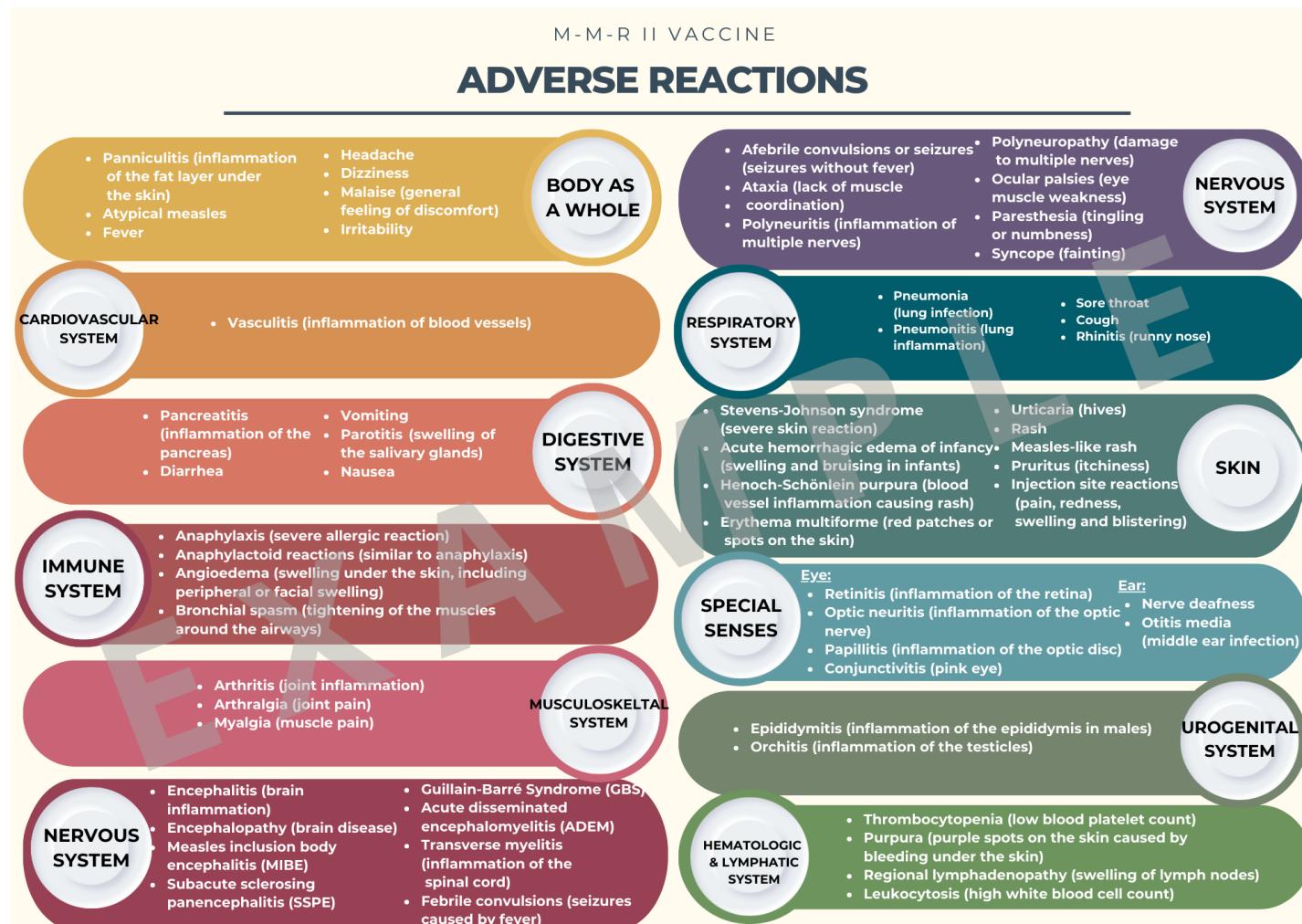
CLINICAL PHARMACOLOGY

- Mechanism of Action: The vaccine helps the body develop antibodies to fight measles, mumps, and rubella.
- Persistence of Antibody Responses: Antibodies remain in most people for at least 11 to 13 years after vaccination.

NONCLINICAL TOXICOLOGY
Collaborative projects that encourage teamwork, problem-solving, and project-based learning

CLINICAL STUDIES
Studies show that the vaccine is effective in preventing measles, mumps, and rubella, with most children developing protective antibodies after vaccination.

Note. Condensed from Merck's Vaccine Handout (Merck & Company, 2023a).

Figure 16*Proposed Infographic for M-M-R II Adverse Reactions*

Note. Condensed from Merck's Vaccine Handout (Merck & Company, 2023a).

ProQuest Number: 31764063

INFORMATION TO ALL USERS

The quality and completeness of this reproduction is dependent on the quality
and completeness of the copy made available to ProQuest.



Distributed by

ProQuest LLC a part of Clarivate (2025).

Copyright of the Dissertation is held by the Author unless otherwise noted.

This work is protected against unauthorized copying under Title 17,
United States Code and other applicable copyright laws.

This work may be used in accordance with the terms of the Creative Commons license
or other rights statement, as indicated in the copyright statement or in the metadata
associated with this work. Unless otherwise specified in the copyright statement
or the metadata, all rights are reserved by the copyright holder.

ProQuest LLC
789 East Eisenhower Parkway
Ann Arbor, MI 48108 USA