

Understanding the predictors of vaccine hesitancy in caregivers of under-five children and impact on childhood vaccination uptake in Ondo State, Nigeria.

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Abstract

Routine childhood vaccination is responsible for the survival of millions of children under five years annually, with 154 million deaths averted in the past 50 years through protection from vaccine-preventable diseases. The reluctance of some parents, however, to accept vaccines for their children undermines herd immunity and compromises global public health.

Research Aim: This thesis investigated the prevalence and predictors of vaccine hesitancy in caregivers of under-five children and the effect on their vaccination practices and immunisation uptake in Ondo State, Nigeria.

Methodology: Data were collected from 450 caregivers using two validated vaccine hesitancy data tools and three focus group discussions with 23 participants in a sequential explanatory mixed methods study. Data analyses included descriptive, regression, and mediation analyses with bootstrapping using process macro and thematic analysis, with the findings integrated into a joint display.

Findings: Results indicated that prevalence of vaccine hesitancy (28.2%) was driven by five narrative themes: Perceived risk of adverse effects of vaccines; cultural beliefs, traditional practices, and spirituality; social networks and interactions with health workers; unfavourable attitude and lack of vaccination knowledge; and phobia, with complementary coherence to quantitative findings. Employment status ($OR=1.87$, $p=.005$), age of index child ($OR=2.05$, $p=.034$) and knowledge ($OR=1.87$, $p=.005$) significantly predicted vaccine hesitancy. Furthermore, caregivers' attitudes partially mediate the effect of vaccine hesitancy on vaccination outcomes, with the mechanism of action explained using belief-behaviour inference theory.

Boosting of childhood vaccine uptake was dependent on caregivers' confidence in the importance and effectiveness of vaccines to make their child healthy.

Conclusion: This research identified a benefit-driven acceptance behaviour among caregivers and confirmed that vaccine hesitancy negatively impacts vaccine uptake with the relationship mediated by attitudinal and contextual factors. The findings provide valuable insights for enhancing vaccination uptake in Ondo State, Nigeria, through multi-sectoral policy development and service improvement.

Dedication

This thesis is dedicated to the one who has the power to create, nurture, protect and preserve. The one who gave me life and sustained me on this journey. His name is Yahweh. My God. My Keeper. My Protector. My Provider. I give Him all the glory.

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Table of Content

Abstract	ii
Dedication	iv
Acknowledgements	v
Table of Content	vii
List of Table	xv
List of Figures	xvii
Glossary of Abbreviations	xviii
Glossary of Terms	xx
Chapter One: Introduction	1
1.1. Background to the study	1
1.2. Benefits of Immunisation Programmes	3
1.3. Routine Immunisation Programmes	4
1.4. Childhood immunisation coverage and global vaccination trends.	5
1.5. The Nigeria childhood vaccination context	6
1.6. Vaccine Acceptance	7
1.7. Vaccine Hesitancy	8
1.7.1. Vaccine-Hesitant Individual	11
1.7.2. Vaccine Hesitancy Theoretical Model	13
1.8. Statement of problem	15
1.9. Gap in literature/justification for the study	17
1.10. Vaccine hesitancy in Nigeria	19
1.11. Chapter Summary	23
Chapter Two: Systematic Literature Review	25
2.0. Chapter overview	25
2.1. Purpose of the SLR	25
2.2. Protocol for the Systematic Literature Review	26
2.3. Search Strategy	26
2.4. Inclusion Criteria	27
2.5. Exclusion Criteria	28
2.6. Search Result	28

2.7. Data Extraction	29
2.8. Statement of findings	29
2.9. Overview of Reviewed Articles	31
2.9.1. Study design and study setting.....	31
2.9.2. Questionnaire/Survey instrument used	32
2.9.3. Sample Size.....	32
2.9.4. Theoretical frameworks	33
2.10. Critical appraisal of identified papers under themes.....	33
2.10.1 Individual/Group Influences	34
2.10.2. Societal Factors (Contextual Issues).....	43
2.10.3 Vaccines and Vaccination-Related Issues	51
2.10.4. Existential Issues.....	55
2.11. Discussion of Systematic Literature Review	56
2.12. Limitation of the Systematic Literature Review	67
2.13. Conclusion	67
2.14. Chapter Summary	72
Chapter Three: Conceptual Framework on Vaccine Hesitancy.....	73
3.0 Introduction.....	73
3.1. Overview of the models used in this research.	73
3.2. The Health Belief Model (HBM).....	74
3.3. COM-B Model	76
3.4. The PEN-3 cultural model	77
3.5. Social Cohesion Theory	78
3.6. The 5A model	79
3.7. The 3C model.....	81
3.8. The 5C Psychological Model.....	82
3.9. Overlap of the 3C, 5A and 5C Models of Understanding Vaccine Hesitancy	84
3.10. Application of Conceptual Models in Research on Vaccine Hesitancy in Ondo State, Nigeria.....	85
3.11. Conclusion and Chapter Summary	88
Chapter Four: Methodology.....	89
4.0. Introduction.....	89

4.1. Methodology	90
4.2. Rationale for underpinning the theoretical framework of the study.	90
4.2.1. Epistemology	91
4.2.2. The link between ontology, epistemology, and methodology	92
4.2.3. Pragmatism	92
4.3. Research Approach	97
4.4. Primary research	98
4.4.0. Methods.....	98
4.4.1. Research design	99
4.4.2. Ethical Approval	99
4.4.3. Study location	99
4.4.4. Study Population.....	101
4.4.5. Inclusion and Exclusion Criteria.....	102
4.4.6. Sample Size Determination for Quantitative Study.....	103
4.4.7. Sampling Technique	105
4.5. Quantitative data collection	109
4.5.1. Preliminary visit to the health centres.....	109
4.5.2. Instruments of data collection for quantitative study.....	109
4.5.3. Recruitment and Training of Research Assistants.	111
4.6. Pilot Study.....	111
4.6.1. Reflexivity on the pilot study.....	116
4.7. Quantitative data collection with use of questionnaires	117
4.7.1 Compilation of data, data cleaning, and analysis.....	117
4.7.2. Data cleaning in SPSS	117
4.7.3. Operationalisation of variables	118
4.8. Qualitative Study	118
4.8.1. Focus Group Discussions.....	118
Chapter Five: Data Analysis and Methods	122
5.1. Analysis of quantitative data.....	122
5.1.1. Respondents' sociodemographic characteristics and categorization.	122
5.1.2. Prevalence of Vaccine Hesitancy.....	122
5.1.3. Sociodemographic Determinants of Parental Vaccine Hesitancy	123

5.1.4. Caregivers' Knowledge of Vaccine-Preventable Diseases and Vaccination Schedule.	125
5.1.5. Knowledge scores based on vaccine hesitancy status and age	126
5.1.6. Knowledge as predictors of parental vaccine hesitancy	126
5.1.7. Measuring parental attitude to childhood vaccination	126
5.1.8. Caregivers' Attitude on Childhood Vaccination	127
5.1.9. Attitudinal variables and caregivers' beliefs using the VHS Likert scale.	128
5.1.10. Intention to Vaccinate	128
5.1.11. Sources of vaccination information and distribution based on age.	129
5.1.12. Impact of sources of vaccination information on knowledge status, vaccine hesitancy status and intention to vaccinate.	130
5.1.13. Trust variables' frequency and relationship with vaccination Practice.	130
5.1.13. Vaccination Behaviour	131
5.1.14. Mediation Analysis	132
5.2. Analysis of the qualitative data	134
5.2.1. Colloquial or cultural language and qualitative narrative	135
5.2.2. Thematic Analysis Framework	136
5.2.3. Phase One (Familiarisation with the Transcript)	136
5.2.4. Phase Two (development of initial codes)	138
5.2.5. Phase Three: Searching for themes	139
5.2.6. Phase Four: Reviewing of themes	140
5.2.7. Phase Five: Defining and naming themes	142
5.2.8. Significance of the Word Cloud to the research question	142
Chapter Six: Survey Results	144
6.0. Introduction	144
6.1. Sociodemographic characteristics of the caregivers	144
6.2. Prevalence of Vaccine Hesitancy	145
6.3. Relationship between socio-demographic variables and vaccine hesitancy	148
6.4. Caregivers' characteristics and influence on parental vaccine hesitancy	148
6.5. Impact of caregivers' knowledge of vaccination on vaccine hesitancy status	151
6.6. Mean knowledge score based on age categories and vaccine hesitancy status.	151
6.7. Caregivers' knowledge as determinants of parental vaccine hesitancy	153

6.8. Parental attitude to childhood vaccination	154
6.9. Respondents' attitude and beliefs on childhood vaccination	154
6.10. Attitude and belief variables as determinants of PACV status	156
6.11. Caregiver's belief about childhood vaccination based on the VHS Likert Scale	156
6.12. Intention to Vaccinate	159
6.13. Sources of vaccination information based on caregivers' preference and age	161
6.14. Determinants of intention to vaccinate based on source of vaccination information	161
6.15: Hesitancy and knowledge status based on sources of vaccination information	161
6.16. Trust of caregivers concerning childhood vaccination	163
6.17. Vaccination Behaviour	165
6.18. Characteristics of caregivers that were vaccine refusers.	166
6.19. Mediation analysis of the effect of PACV on vaccination behaviour	167
Chapter Seven: Findings of the qualitative study	171
7.0. Introduction	171
7.1. My Positionality as a Researcher	171
7.2. Demographics: Background information about participants.	172
7.3. Presentation and Organisation of the Findings	172
7.4. Thematic presentation of results	172
7.4.1. Theme One: Perceived efficacy of vaccine in disease prevention and general wellbeing	173
7.4.2. Theme Two: Non-vaccine related promoters of vaccine uptake	177
7.5. Themes based on the second research question.	180
7.5.1. Theme One: Perceived risk and adverse reaction of vaccines	180
7.5.2. Theme Two: Cultural beliefs, traditional practices and spirituality	184
7.5.3. Theme 3: Social networks and interaction with health workers	186
7.5.4. Theme Four: Attitude and lack of Vaccination Knowledge.	189
7.5.5. Theme Five: Phobia	191
7.6. Conclusion	192
Chapter Eight: Integration of Research Findings	194
8.0. Introduction	194
8.1. Joint Display	195
8.2. Types of joint display	195

8.3. Processes for the integration of quantitative and qualitative findings	196
8.4. Method of Integration	197
8.5. Integration of the findings in this study	205
8.5.1. Boosting Childhood Vaccination: Reason for Vaccination	205
8.5.2. Boosting Childhood Vaccination: Reason for Vaccination	206
8.5.3. Caregivers' Intention to Vaccinate	206
8.5.4. Vaccine hesitancy	208
8.5.5. Vaccination Behaviour.....	209
8.6. Conclusion and chapter summary	210
Chapter Nine: Discussion	212
9.1. Introduction.....	212
9.2. Summary of key findings.....	213
9.3. Boosting Childhood Vaccination.....	215
9.3.1. Caregivers' reasons for vaccination.....	215
9.3.2. Caregivers' enablers of vaccination.....	218
9.4. Parental intention to vaccinate precedes every successful vaccine uptake.....	224
9.4.0. Introduction.....	224
9.4.1. Caregivers have a protective instinct towards their children.	226
9.4.2. Belief in the non-severity of Vaccine Preventable Diseases (VPD).....	230
9.4.3. Poor access to vaccination centres reduces intentions to vaccinate.....	231
9.4.4. Caregivers' knowledge deficit reduces intention to vaccinate	233
9.4.5. Caregivers' level of trust promotes intention to vaccinate	236
9.4.6. Caregivers' gender plays a role in intention to vaccinate.	238
9.5. Prevalence of Vaccine Hesitancy: Contexts, Determinants, and Predictors.....	239
9.5.1. Prevalence and determinants of vaccine hesitancy	239
9.5.2. Caregivers' sociodemographic characteristics influence vaccine hesitancy.	241
9.5.3. Lack of appropriate knowledge by caregivers promotes vaccine hesitancy.....	245
9.5.4. Caregivers' perceived risk and adverse reaction to vaccines	249
9.5.5. Community and social network influences vaccine hesitancy	254
9.5.6. Health systems, health workers' attitudes, and vaccine administration.....	258
9.5.7. Cultural beliefs and traditional practices	265
9.5.8. Dependence on natural immunity and spirituality	268

9.6. Vaccination Behaviour.....	272
9.6.0. Introduction.....	272
9.6.1. Self-reported vaccination behaviour.	273
9.6.2. Characteristics and vaccination beliefs (attitude) of vaccine refusers.	276
9.6.3. Caregivers' Vaccination Attitudes and Beliefs on Vaccination Behaviour	278
9.6.4. Explicit and Implicit Attitudes and Vaccination behaviours.	279
9.6.5. Belief-behaviour inference model and vaccination behaviour of caregivers.....	281
9.6.6. Determinants and Implications of Vaccine Refusal.....	282
9.7. Prediction of Vaccination Behaviour through Mediation Analysis.....	284
9.8. Strengths and Limitations of the Study.....	285
Chapter 10: Recommendations and Conclusion	289
10.1. Introduction.....	289
10.2. Summary of Key Findings, Impact of Research, and Contribution to Knowledge ..	289
10.3.Recommendations.....	293
10.3.1. Service and Practice Improvement.	294
10.3.2. Education.	295
10.3.3. Policy	295
10.3.4. Health System Strengthening.....	297
10.3.5. Research.....	298
10.4. Conclusion	299
References.....	301
Appendix.....	351
Appendix 2.1: Protocol specification for the SLR.....	351
Appendix 2.2: Summary of searches from various databases	354
Appendix 2.3: PRISMA Flowchart showing the article search strategy	355
Appendix 2.4 Data Extraction Table of reviewed articles in the SLR.....	356
Appendix 3.1. Permission to use the image at Figure 3.2.....	384
Appendix 3.2 Permission to use the image at Figure 3.3.....	384
Appendix 4.1 Ethical approval from National Ethics Committee, Nigeria	385
Appendix 4.2 Ethical approval from University of Essex Ethics Committee.	386
Appendix 4.3: Permission letter to have access to Health Centres in Akure South LGA.	387
Appendix 4.4. Permission to use the image at Figure 4.2.....	388

Appendix 4.5: Questionnaire for quantitative studies.....	391
Appendix 4.6: Protocol for the training of Research Assistants	397
Appendix 4.7. Focus Group Schedule	403
Appendix 4.8: Spreadsheet for questionnaire administration	405
Appendix 5.1: Categorisation/dichotomisation of variables.....	406
Appendix 5.2: Initial codes for FGD one.....	407
Appendix 5.3: Initial codes for FGD two	408
Appendix 5.4: Initial codes for FGD three	409
Appendix 5.5. Code book for the 3 FGDs transcripts	410
Appendix 5.6. Frequency distribution of the words in the word cloud.	419
Appendix 5.7: Sociodemographic characteristics of participants of the focus groups	422
Appendix 6.1: Output of the mediation analysis using Hayes Process macro on SPSS....	423

List of Table

Table 2.1: Summary of SLR findings	29
Table 2.2: Geographical distribution of included studies.	32
Table 2.3: The five relationships between maternal education status and vaccine hesitancy	40
Table 4.1: Names of wards and health facilities per ward in Akure South LGA	108
Table 5.1: Models for mediation analysis.....	132
Table 5.2: Phases of Reflexive Thematic Analysis	137
Table 5.3: Preliminary themes developed at Phase Three of the Thematic Analysis.....	139
Table 6.1: Sociodemographic Characteristics of Respondents.....	146
Table 6.2: Parental perception of vaccination.....	147
Table 6.3: Parental vaccine hesitancy status by sociodemographic factors.....	149
Table 6.4: Caregivers' sociodemographic characteristics as determinants of vaccine hesitancy	150
Table 6.5: Caregivers' knowledge Status	152
Table 6.6: Caregivers' knowledge scores and mean score value.....	152
Table 6.7: Caregivers' knowledge of vaccination schedule and vaccine preventable diseases..	152
Table 6.8: Caregivers' knowledge as determinants of parental vaccine hesitancy.....	153
Table 6.9: Parental attitude about childhood vaccination (PACV).....	155
Table 6.10: Effect of the attitude variables on Parental Attitude to Childhood Vaccination (PACV)	157
Table 6.11: Caregivers beliefs on childhood vaccination based on VHS Likert scale.	158
Table 6.12: Association between selected variables and the future vaccination behaviour of caregivers	160
Table 6.13: Sources of vaccination information based on preference and age.....	162

Table 6.14: Sources of vaccination information as determinants of intention to vaccinate.	162
Table 6.15: Sources of vaccination information as determinants of vaccine hesitancy and knowledge status.	163
Table 6.16: Trust level of caregivers and parental attitude to childhood vaccination (PACV) and intention to vaccinate.	165
Table 6.17: Distribution of caregivers based on vaccination behaviour.....	166
Table 6.18 : Effect of key variables on caregivers' vaccination behaviour.....	166
Table 6.19: Characteristics of caregivers that were vaccine refusers	167
Table 6.20: Mediation paths between the independent variable and the mediator variables.	168
Table 6.21: Mediation path between the independent and dependent variables with mediator (Attitude).....	168
Table 6.22: Mediation path between the independent and dependent variables with mediator (Knowledge)	169
Table 6.23: Direct and indirect effects of X (PACV) on Y (Vaccination Behaviour).....	169
Table 6.24: Direct and indirect effects of X (PACV) on Y (Vaccination Behaviour).....	169
Table 8.1: Major types of joint displays	196
Table 8.2 Joint display of Theme One (Boosting childhood vaccination)	198
Table 8.3 Joint display of Theme Two (Intention to vaccinate)	199
Table 8.4. Linkages of Key Findings in Theme One and Two.....	200
Table 8.5.. Joint display of Theme Three (Vaccine Hesitancy).....	201
Table 8.6. Joint display of Theme Four (Vaccination Behaviour)	203
Table 8.7. Linkages of Key Findings in Theme Three and Four	204

List of Figures

Figure 1.1:Vaccine hesitancy theoretical framework	14
Figure 2.1:Vaccine Hesitancy-Educational Status Paradox.....	39
Figure 3.1: Schematic diagram on the constructs of the Health Belief Model.	75
Figure 3.2: 3C model of vaccine hesitancy Source:(MacDonald, 2015)	82
Figure 3 .3: 5C model of factors influencing vaccine hesitancy and vaccine acceptance	84
Figure 3.4: A summary of models and their application in the research	87
Figure 4.1: Research Framework.....	98
Figure 4.2: Map of Nigeria showing Ondo State	100
Figure 4.3: Map of Ondo State showing the study location (Akure South LGA)	101
Figure 4.4: Multistage sampling frame for the study.....	107
Figure 5.1: The mediation pathway for model 1.....	133
Figure 5.2: Mediation pathway for Model 2	133
Figure 5.3: Schematic diagram of the themes and subthemes for first research question	141
Figure 5.4: Schematic diagram of the themes and subthemes for second research question.	141
Figure 5.5: Word Cloud showing a cluster of words associated with the codes	143
Figure 6.1: Summary of the path coefficient of the mediation analysis	170
Figure 7.1: Schematic diagram showing the themes and the subthemes	173
Figure 9.1: Theoretical pathway between vaccine hesitancy and vaccine uptake	213
Figure 9.2: Intention towards vaccination across a spectrum	276

Glossary of Abbreviations

AEFI	Adverse event following immunisation
CAM	Complementary and alternative medicine
CAQDAS	Computer-assisted qualitative data analysis software
CE	Community Engagement
DTP	Diphtheria, tetanus and pertussis
EPI	Expanded Programme on Immunisation
FGD	Focus Group Discussion
HBM	Health Belief Model
HCP	Health care Practitioner
Hep B	Hepatitis B
HPV	Human papillomavirus
LGA	Local Government Area
MMR	Measles-mumps-rubella vaccine
NPHCDA	National Primary Health Care Development Agency
PACV	Parent Attitude about Childhood Vaccines
PHE	Public Health England
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
RI	Routine Immunisation
SCT	Social Cohesion Theory
SDG	Sustainable Development Goals

SEM	Social Ecological Model
SES	Social Economic Status
SPSS	Statistical Package for the Social Sciences
SVI	Sources of Vaccination Information
UK	United Kingdom
USA	United States of America
VH	Vaccine Hesitancy
VI	Vaccination Information
VHI	Vaccine Hesitant Individual
VHP	Vaccine Hesitant Parents
VHS	Vaccine Hesitancy Scale

Glossary of Terms

Adverse event following immunisation: An adverse event following immunization (AEFI) is defined as any untoward medical occurrence following immunization which does not necessarily have a causal relationship to the vaccine. The adverse event may be any unfavourable or unintended sign, abnormal laboratory finding, symptom or disease (WHO, 2018a).

Caregiver: Refers to anyone who is directly involved in caring for the child or making the decision to vaccinate the child. This could be the parent, grandparent or guardian.

Conspiracy theory: A conspiracy theory is a belief that some secret, but influential organization is responsible for an event or phenomena.

Herd immunity occurs when a large percentage of the community becomes immune to a disease, often through immunisation, thus providing protection to those who are not immune.

Immunisation schedule/vaccination schedule: This is a series of vaccinations, including the timing of all doses, which may be either recommended or compulsory, depending on the country of residence.

Immunisation: A process by which an individual becomes protected against a disease through the act of vaccination. While vaccination introduces the vaccine into a person's body, immunization enables the body to develop immunity, subsequently recognize the disease, and protect the person from future infections by that particular disease agent.

Immunity: Immunity refers to the ability of the body to protect itself against illness or to produce antibodies against pathogens. It enables the human body to recognize self and non-self-components, thereby destroying and excluding foreign antigenic substances such as viruses.

Routine immunization: The process of delivering recommended vaccination to children under one year of age. It involves an efficient interaction between vaccines, the health workers who administer the vaccines, and the children who receive the vaccines, with the goal of fully immunizing all those who need to be protected against VPDs.

Vaccination Coverage: Vaccination coverage refers to the proportion of a population that has received vaccinations, which is a critical output indicator of vaccination programmes.

Vaccination Behaviour: Vaccination behaviour encompasses the psychological factors, intentions, and actions surrounding vaccine decisions. Vaccination behaviour refers to the actions and decisions individuals make regarding vaccinations

Vaccination Outcome: This refers to the eventual action which emerges from the vaccination decision taken by a person. This outcome is binary, that is to accept or refuse vaccines.

Vaccine decision making: This term refers to the decision to accept or reject vaccines.

Vaccines: A biological product which when administered to an individual, can stimulate the person's immune system to build up biological defence system against a particular disease and protect the individual from infection by that disease agent.

Vaccine Acceptance: The term refers to the willingness and intention to receive a vaccination. This can manifest as active demand, passive acceptance, or a desire to vaccinate despite concerns. The term 'vaccination acceptance' implies that, when presented with an opportunity to vaccinate, an individual or a community chooses to do so.

Vaccine Hesitancy: Vaccine hesitancy has been described by the World Health Organisation as any delay or refusal to accept immunisation despite the availability of vaccines. This term refers to the decision to accept or reject vaccines.

Vaccine Refusal: Vaccine or Vaccination refusal is defined as the decision by individuals or guardians to forgo recommended vaccinations, often due to reasons such as cost, safety concerns, or a lack of perceived risk for associated illnesses. It is also the deliberate and consistent decision not to vaccinate oneself or one's children despite having access to and eligibility for vaccination.

Vaccine Uptake: Actual receipt of a vaccine.

Vaccination: The process by which vaccines are introduced into an individual's body for the purpose of inducing immunity against a particular disease. Vaccination can be administered orally, by injection, or by nasal spray.

Vaccine-preventable disease (VPD): This is an infectious disease for which can be prevented by vaccination

Chapter One: Introduction

1.1. Background to the study

One of the key primary tools for supporting child survival against common childhood diseases, particularly from birth to five years of age, is the administration of life-saving vaccines to children in prescribed proportions according to country-specific immunisation schedules (Pollard and Bijker, 2021; UNICEF, 2025). Vaccines have been known to control several deadly childhood diseases, including meningitis, diphtheria, hepatitis B, measles, mumps, polio, pertussis, rubella, pneumonia, tetanus, and rotavirus diarrhoea (Hussain, 2019) . Vaccination has led to a dramatic reduction in morbidity and mortality in all countries around the world (Baggio and Gétaz, 2019; Talbird *et al.*, 2022), and several studies have established that childhood immunisation plays a key role in the protection of young children against killer diseases, preventing close to three million deaths annually (Nalley and Maduka, 2019; Lindstrand *et al.*, 2021) WHO, 2021). Since the inception of the Expanded Programme on Immunisation (EPI) in 1974, vaccination has averted over 154 million deaths, out of which 146 million were children younger than 5 years (Shattock *et al.*, 2024). On the strength of the foregoing, vaccination is regarded as foremost economically-efficient public health interventions (Nandi and Shet, 2020; Boccalini, 2025).

The vaccination process, however, is contentious, with many parents globally hesitating or refusing to accept vaccines due to diverse reasons (Wiley *et al.*, 2023). According to Baggio and Gétaz (2019), more people are challenging the justification for vaccination, and the question, “Why vaccinate?” is rising because the success of routine childhood vaccination programmes, manifested by a decline in children’s morbidity and mortality, has created a false sense of safety and the impression that vaccination might not be needed. The reluctance of such parents to accept vaccines for their children, despite the availability of vaccines, portends a

significant risk of resurgence of vaccine-preventable diseases (VPD) (Rumetta, Abdul-Hadi and Lee, 2020; Parums, 2024) with grave implications for herd immunity and global public health (Feemster and Szipszky, 2020). For instance, in spite of the huge benefits of vaccination, progress in immunisation coverage stagnated in many countries around the world in 2020 (Nnaji *et al.*, 2021), partly due to the COVID-19 debacle, and remained so in 2023, with an increase of 2.7 million in the total number of un- and under-vaccinated children compared to pre-pandemic levels in 2019 (WHO, 2024a; Haeuser *et al.*, 2025).

These parental choices made on behalf of their children, driven by vaccine hesitancy, have been reported to have contributed to poor immunisation status in developing countries and implicated in outbreaks of vaccine-preventable diseases such as measles, whooping cough, rubella, and mumps in many parts of the world (Attwell *et al.*, 2019; Pandey *et al.*, 2019; Bidari and Yang, 2024). Vaccine hesitancy is a complex phenomenon driven by behavioural patterns that are influenced by socio-cultural, emotional, and experiential factors (Kumar *et al.*, 2016; Liu and Li, 2021), and manifesting as geographical clustering of epidemics (Galagali, Kinikar and Kumar, 2022). These behavioural patterns determine positive and negative perceptions of vaccine uptake. The World Health Organisation (WHO) considers vaccine hesitancy as one of the 10 threats to global health (WHO, 2019b). Thus, it is vital to identify, comprehend, and use the "how," "why," and "when" of vaccine hesitancy to design interventions to reduce it.

The enormous risk that vaccine hesitancy poses to global public health is acknowledged by the sheer number of studies focused on unravelling its driving factors in high-income countries (Wagner *et al.*, 2019), while the mechanism of action in low- and middle-income countries (LMICs), such as Nigeria, remains unclear due to a lack of focused research. According to the World Bank (2022), vaccine hesitancy in developing countries is poorly understood because most studies have focused on high-income countries, and the few studies in developing countries lack cross-country comparability or national representation. Sayegh *et al.* (2022)

explained that the situation is due to the fact that high-income countries are at the forefront of contemporary global health education. Furthermore, Yegros-Yegros *et al.* (2020) posit that global research outputs are more concern with issues that are of special interest to the health needs of high-income countries leading to the neglect of health challenges prominent in lower-income countries. Hence, a mixed methods approach will be used to gain an understanding of the underlining causes of vaccine hesitancy among caregivers of under-five children in Akure South Local Government Area in Ondo State, Nigeria. The predictors of vaccine hesitancy in the study location will also be determined.

1.2. Benefits of Immunisation Programmes

Vaccination has made an enormous contribution to global health (Sampaio *et al.*, 2022; Shattock *et al.*, 2024), and the early success of vaccination programmes has brought about global acceptance of vaccines (Ophori *et al.*, 2014; Lindstrand *et al.*, 2021; WHO, 2023a). In addition to its direct impact on population health, immunisation brings added value by reducing the burden of disease for individuals, families, and communities (WHO, 2004; Piot *et al.*, 2019; Chevalier-Cottin *et al.*, 2020). For example, Nandi and Shet (2020) reported a positive effect of measles vaccine on children's immunological memory and which invariably improved the child's health and cognitive ability with better performance in schools.

Important milestones such as the eradication of smallpox, the elimination of poliomyelitis and diphtheria (Montero *et al.*, 2024) have been achieved with the aid of vaccines while the development of vaccines for the prevention of diarrhoea, human papillomavirus (HPV) infection-induced diseases, malaria, and a host of other diseases (Sáfadi, 2023), are significant breakthroughs in the last twenty years. For instance, Zhou *et al.* (2024) reported that routine childhood vaccination in the U.S has prevented approximately 508 million cases of illness

among the children that were born between 1995 and 2023, culminating in substantial financial savings.

1.3. Routine Immunisation Programmes

The success of routine immunisation (RI) programmes depends on the availability and accessibility of quality vaccines that are delivered effectively to children in conducive environments by qualified healthcare providers (Shen, Fields and McQuestion, 2014). To achieve this, national immunisation programmes require uninterrupted availability of high-quality and affordable vaccines (Gianfredi *et al.*, 2021). Also, the demand and uptake of vaccines and use of vaccination services by eligible children for whom caregivers make vaccination decisions (Bedford *et al.*, 2018) are critical to the outcome of the RI. A successful routine immunisation system, according to Sodha and Dietz (2015), involves the synchronisation of multiple programme components to provide a child with the opportunity to be successfully vaccinated. The coordination, management, and supervision of the multiple vaccination programme components is carried out by the government's public health agencies, such as Public Health England (PHE) in England and the National Primary Health Care Development Agency (NPHCDA) in Nigeria, to name a few. The successful immunisation of children, therefore, is dependent on vaccine procurement and its successful delivery to the vaccination centres (Gianfredi *et al.*, 2021), constant maintenance through a functioning cold chain, handling and administration, data recording and reporting, and appropriate vaccine demand creation and promotion through interaction with caregivers of young children (Sodha and Dietz, 2015; Blanc *et al.*, 2024).

The Africa Routine Immunisation System Essentials (ARISE) project commissioned a study in 2012 in three countries (Cameroon, Ethiopia, and Ghana) to identify drivers of successful immunisation programmes (LaFond *et al.*, 2014). The six success factors identified according

to LaFond *et al.* (2014) were political and social commitment to routine immunisation; actions of development partners; engagement of community-centred health worker; Health system and community partnership; regular review of programme and health worker performance; and immunisation services tailored towards community needs.

Globally, unequal access to vaccines that prevent vaccine-preventable diseases in infants, children, and adults (Rodrigues and Plotkin, 2020), has been well established. For instance, findings from a longitudinal study in England on inequalities in uptake of childhood vaccination from 2019 to 2023 showed that uptake rates for five key childhood vaccines decreased below the World Health Organisation's 95% uptake target with noticeable regional differences (Flatt *et al.*, 2024). Report of a study involving the use of the Vaccine Economics Research for Sustainability and Equity (VERSE), a tool that produces a composite equity metric (Mak *et al.*, 2023), indicated that socioeconomic status and maternal education level were the greatest contributors towards a child's immunisation status and for inequity in vaccination coverage in Nigeria. Mohammed *et al.* (2024) further confirmed that substantial inequalities existed in Nigeria characterised by regional variations and caused by logistical, socio-economic and cultural factors, and health systems failures.

1.4. Childhood immunisation coverage and global vaccination trends.

The establishment of the Expanded Programme on Immunisation (EPI) in the 70s was a game-changing strategy to ensure that all children globally were given the correct doses of vaccines at the right time. However, despite the provisions of free vaccination services, particularly in Africa (Fatiregun *et al.*, 2021) and the obvious importance of vaccines and their ready availability, among other healthcare incentives for children under the age of five (Singh *et al.*, 2022), the immunisation status in many low-income countries remains below the level required for herd immunity. This is so because a significant proportion of children still do not receive

their childhood vaccinations across the globe, and the situation is critical in low- and middle-income settings (Bobo *et al.*, 2022). Global vaccination coverage continued to decline in 2021, with 25 million children under the age of one year missing out on lifesaving vaccines, which is the highest number since 2009, 2 million more than in 2020, and 6 million more than in 2019 (WHO, 2022). A major reason for this decline is that the health systems have been strained with the COVID-19 pandemic and associated disruptions over the past three years (Babatunde *et al.*, 2022; Okeke *et al.*, 2022; Fatani, Shamayleh and Alshraideh, 2024). Therefore, African countries lag behind, with significant gaps in child immunisation found in Angola, Chad, Nigeria, Guinea, and across West and Central Africa (Kazungu and Adetifa, 2017; Dimitrova *et al.*, 2023).

1.5. The Nigeria childhood vaccination context

The Expanded Programme on Immunisation was adopted in Nigeria in 1984 (Ophori *et al.*, 2014) and provided the foundation for effective vaccination of eligible children in the country. The programme, named the National Programme on Immunisation, is designed to make vaccines available and create awareness on the need for caregivers, particularly mothers, to vaccinate their children starting from the neonatal stage and proceed to complete the entire immunisation cycle. Consistent progress has been made from inception, however, reversals to the gains made in previous years and its inherent implications, prompted Ogunniyi (2024a) to assert that Nigeria still needs to make significant progress in its routine immunisation programme.

The performance of routine immunisation systems in a community is generally measured by the level of coverage with the third dose of diphtheria-tetanus-pertussis-containing vaccine (DTP3) (Dong, Rhoda and Mercer, 2020; Pond *et al.*, 2021). The DTP3 coverage in Nigeria has been less than 60% in the past 10 years, well below the coverage rate of 85% required to

achieve herd immunity (UNICEF, 2022). The situation is the same in Ondo State, located in the south-western part of Nigeria, where this study was conducted. The National Immunisation Survey report for 2021 indicated that the immunisation coverage percentages for DTP and measles in Ondo State, Nigeria, were 63% and 66%, respectively. These values are far below the percentage coverage of 94% and 85% for achieving herd immunity for measles and DTP, respectively. Also, the coverage level for 2022, 2023 and 2024 were all lower than the percentage coverage that will guarantee herd immunity and safeguard children against vaccine-preventable diseases.

1.6. Vaccine Acceptance

Vaccines acceptance is an important predictor of vaccine uptake (Dyda *et al.*, 2020). According to Tuckerman, Kaufman, and Danchin (2022), acceptance across the lifespan is significant to global public health, while the success of vaccination efforts is dependent on societal acceptance as well as on the efficacy of vaccines (Said *et al.*, 2024). Nevertheless, millions of children remain under- or unvaccinated and vulnerable to vaccine-preventable diseases. This condition has public health implications, as those who are not vaccinated are at a higher risk of infection from vaccine-preventable diseases (Dyda *et al.*, 2020). The term ‘vaccination acceptance’ refers to the willingness and intention to receive a vaccination. The decision to receive a vaccine is based upon a rational conscious assessment of the risk involved if accepted or declined (Feemster, 2013). However, it is also important to recognise that making vaccines available does not necessarily provide individuals with a viable opportunity to vaccinate. Although “vaccine acceptance” and “vaccine uptake” may have similar definition, the level of acceptance may be different from actual uptake, since vaccine acceptance may be high in some instances but correspond to reduced uptake. This is because ‘acceptance’ does not take into account factors such as availability of vaccines or structural factors (Richman *et al.*, 2025) that can inhibit access. Furthermore, some people may vaccinate even though they have questions

and concerns and such caregivers were referred to as “cautious acceptors” by Orhierhor *et al.* (2023). Factors contributing to vaccination acceptance are complex, context-specific, and vary across time, place, and type of vaccine.

1.7. Vaccine Hesitancy

The WHO Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy defined it as the delay in acceptance or refusal of vaccination despite the availability of vaccination services (MacDonald, 2015). The group described vaccine hesitancy as a behaviour influenced by a number of factors, including concerns about confidence, complacency, and convenience (MacDonald, 2015). In this definition, they referred to confidence as distrust in the vaccine or the vaccine provider; complacency was interpreted as perceiving no need for a vaccine or not recognising the value of the vaccine, while the issue of convenience has to do with access to vaccines (Larson *et al.*, 2015). The WHO emphasised the serious nature of vaccine hesitancy by revealing that it has the potential to cause a significant reversal in important public health progress achieved over the past century (WHO, 2021).

Jarret *et al.* (2015) projected vaccine hesitancy as a “period of indecision” around accepting a vaccination while Bedford *et al.* (2018), opined that “vaccine hesitancy” is a term that should not be used to explain all cases of partial or non-vaccination. The authors proposed that the term “vaccine hesitancy” should be used more precisely and be differentiated from factors that have to do with access to vaccines to avoid the risk of identifying solutions that do not match the problem in a particular community or population. They concluded that development of appropriate policies and strategies targeted to the specific drivers of low vaccination coverage in each population can only be achieved when a clear distinction is made between factors that limit vaccine acceptance. Vaccine hesitancy is also conceived from the perspective where vaccination actions are contingent on people’s emotional feelings about vaccines coupled with

the social processes that moderate vaccine acceptance (Tuckerman, Kaufman and Danchin, 2022). Renewed attention is focused on the spread of infection by vaccine hesitancy due to the increased outbreaks of vaccine-preventable diseases (Phadke *et al.*, 2016; Wong, Wong and AbuBakar, 2020; Oliveira *et al.*, 2022) in many regions in the world. It has also been reported that vaccine hesitancy among parents is linked to outbreaks of VPDs in African countries and internationally (Cataldi and O’Leary, 2021; McGregor and Goldman, 2021a; Ngandjon *et al.*, 2022).

Currently, vaccine hesitancy is garnering unprecedented global attention, and despite significant advancements in academic research and publications, several knowledge gaps still persist (Cooper *et al.*, 2018). Since the evidence from research in high-income countries (HICs) cannot be used to fully explain the vaccine hesitancy phenomenon in African countries due to its context-specificity, there is an urgent need to intensify research to determine factors that contribute to vaccine hesitancy in Africa. Such an endeavour aligns with WHO recommendations, which stipulates that plans to measure and curtail country-specific vaccine hesitancy must be integrated into national immunisation programmes (Oduwole *et al.*, 2022). Furthermore, while justifying the basis for research into why parents refuse vaccination in Finland, Nurmi and Harman (2022)) argued that the complexity and context-specificity of vaccine hesitancy demand that research explore how vaccine hesitancy and refusal emerge on time scales beyond North America and Europe.

Vaccine hesitancy is the precursor for vaccine refusal. While the three concepts of vaccine hesitancy, vaccine opposition (active, ideological, or organised resistance to vaccination), and vaccine refusal are interrelated, they are actually different from one another (Uğrak *et al.*, 2025). One issue that has brought opacity to the discussion on vaccine hesitancy is the projection of vaccine hesitancy by the WHO Strategic Advisory Group of Experts (SAGE) Working Group on Vaccine Hesitancy as a refusal (MacDonald, 2015) instead of a reluctance

(transient refusal) to accept vaccine. A clearer definition of vaccine hesitancy was proposed by Larson and colleagues in 2022 as a state of indecision and uncertainty about vaccination before a decision is made to act (or not act) (Larson, Gakidou and Murray, 2022). Vaccine refusal was described by Uğrak *et al.* (2025) as the deliberate and consistent decision to decline vaccinations for self or a child regardless of vaccine access and eligibility. The implication of this insight is that while vaccine hesitancy is transient, vaccine refusal is permanent.

When parents hesitate to accept vaccines for their children, there are two outcomes, and both are potentially harmful for the child and population health (Damnjanović *et al.*, 2018). The first outcome is that parents may later choose to accept the vaccine, but by then it may be too late, as an infection could have occurred during the vulnerable period when the child was not protected. The second outcome is that the parent refuses completely to accept the vaccine, and the child remains unvaccinated, thereby being open to infection while putting the local population's health at risk (Phadke *et al.*, 2016).

The public health implications when some children are unvaccinated is that they are at a higher risk of infection from vaccine-preventable diseases (Dyda *et al.*, 2020). Studies by Kumar *et al.* (2016) and Lubanga *et al.* (2024) attributed outbreaks of VPD in several parts of the world to under-vaccinated or non-vaccinated communities. A study by Phadke *et al.* (2016) in the United States on measles and pertussis reported that vaccine refusal has been associated with outbreaks of various VPDs, and the most direct measure of vaccine refusal is the rate of parents claiming non-medical exemptions to school immunisation requirements. Results of primary studies and systematic literature reviews in Africa showed that some parents/caregivers refused immunisation services due to the belief that vaccines are 'harmful' and 'expired' and could cause 'physical disability' and/or 'death' among their children (Bangura *et al.*, 2020; Isezuo and Adamu, 2022), while Mbonigaba *et al.* (2021) implicated vaccine hesitancy as one of the

major causes of vaccine refusal in Africa- a trend driven largely by institutional mistrust (Stoop et al. 2021).

1.7.1. Vaccine-Hesitant Individual

Vaccine-hesitant individuals (VHIs) are the ones that refuse a particular type of vaccine or all the types of vaccines (Dubé, Gagnon and MacDonald, 2015; Kumar *et al.*, 2016). According to Benin *et al.* (2006), cited in Limaye *et al.* (2021a), vaccine-hesitant individuals may delay and/or accept vaccines according to the recommended schedule but still be uncertain in their decisions. Vaccine-hesitant individuals encompass various categories of people across different demographic indices, such as age, race, socioeconomic status, and geographical location, positioned along a continuum that ranges from total acceptors to complete refusers (Larson *et al.*, 2015). Predicated on this, Romijnders et al. (Romijnders *et al.*, 2019) classified mothers in Germany into three groups of acceptors, partial acceptors, and refusers according to their level of vaccine hesitancy. Furthermore, the findings of a scoping review of existing literature from Kenya, Malawi, and Ethiopia by Adamu et al. (2021) showed that vaccine hesitancy in African settings is driven by a complex set of interrelated and interdependent factors, which included caregiver-related factors, health systems-related factors, and community context.

Vaccine-hesitant parents (VHPs) are defined by Williams (2014) as parents who follow alternative vaccine schedules or refuse one or more childhood vaccinations. Studies have indicated that VHPs also question the necessity of vaccinations and prefer their child acquire the disease rather than develop immunity through vaccination (Gowda and Dempsey, 2013; Kumar *et al.*, 2016; McKee and Bohannon, 2016). Surveys or interviews conducted with VHPs indicate they are more likely to perceive vaccines as not safe (Williams, 2014), and believe that vaccines contain suspicious products, which could endanger child health (Chow *et al.*,

2017). VHPs may have acquired misinformation about the risks and benefits of childhood vaccines through social networks or the internet (Limaye *et al.*, 2021b). The misinformation eventually results in a lack of confidence in the vaccination programme and the emergence of a vaccine-hesitant community. The occurrence of vaccine hesitancy lead to rejection and non-completion of vaccination schedule (Ngandjon *et al.*, 2022; Limaye *et al.*, 2021a).

Since the outbreak of Covid-19, the WHO has termed behaviours that twist information on a health issue, particularly those intended to discourage the uptake of a health commodity, as 'infodemic.' 'Infodemic' has been defined as too much information, including false or misleading information, in digital and physical environments during a disease outbreak (Chiolero, 2022; Wilhelm *et al.*, 2023; WHO, 2023c). Similarly, Zielinski (2021) identified the spread of bad information as the third recognised characteristic of an infodemic, following volume and velocity. An example of the harmful effect of infodemics can be seen in Wakefield's article linking the MMR vaccine and autism, which was later declared to be fraudulent (Godlee, Smith and Marcovitch, 2011). Parents experienced vaccination reluctance following the release of the Wakefield study in 1998 on the supposed MMR vaccine-autism relationship, and despite several well-conducted epidemiological studies refuting any link, some vaccine-hesitant parents reported the phenomenon as a concern (Davidson, 2017; Mohammed, A.S. *et al.*, 2022). A similar situation occurred in Nigeria in 2003 when rumours were spread that the polio vaccines had been contaminated with anti-fertility agents and the HIV virus (Jegede, 2007). This rumour ultimately led to the boycott of polio immunisation in the northern part of the country (Ghinai *et al.*, 2013; Ekwebelem *et al.*, 2021), leading to a devastating consequence with Nigeria alone accounting for 86% of all the polio cases on the continent (Tomori, 2018).

1.7.2. Vaccine Hesitancy Theoretical Model

Theories help researchers and practitioners to make sense of complex events and situations by providing new insights into intricate and confusing phenomena (Levenstein et al., 2023). Since vaccine hesitancy results from the interplay of behaviours among childhood vaccine decision-makers, a theoretical framework will effectively illustrate the interconnections between various factors in the vaccination landscape and their influence on vaccine uptake. The schematic diagram in Figure 1.1 depicts the relationship between the key concepts of vaccine (availability, accessibility, affordability), behavioural outcomes (vaccine hesitancy), vaccine-related behaviours of parents making childhood vaccine decisions, vaccine hesitancy implications (vaccination coverage, herd immunity), and impact on public health (resurgence of vaccine-preventable diseases). To appreciate the vaccine hesitancy phenomenon, it is important to understand the effect of the contributing factors on vaccination outcomes. The contributing factors consist of personal (sociodemographic characteristics), vaccine (vaccine knowledge, attitude), health systems (health workers' characteristics, immunisation location, doses and guidelines) and community factors (social norms, religion and culture).

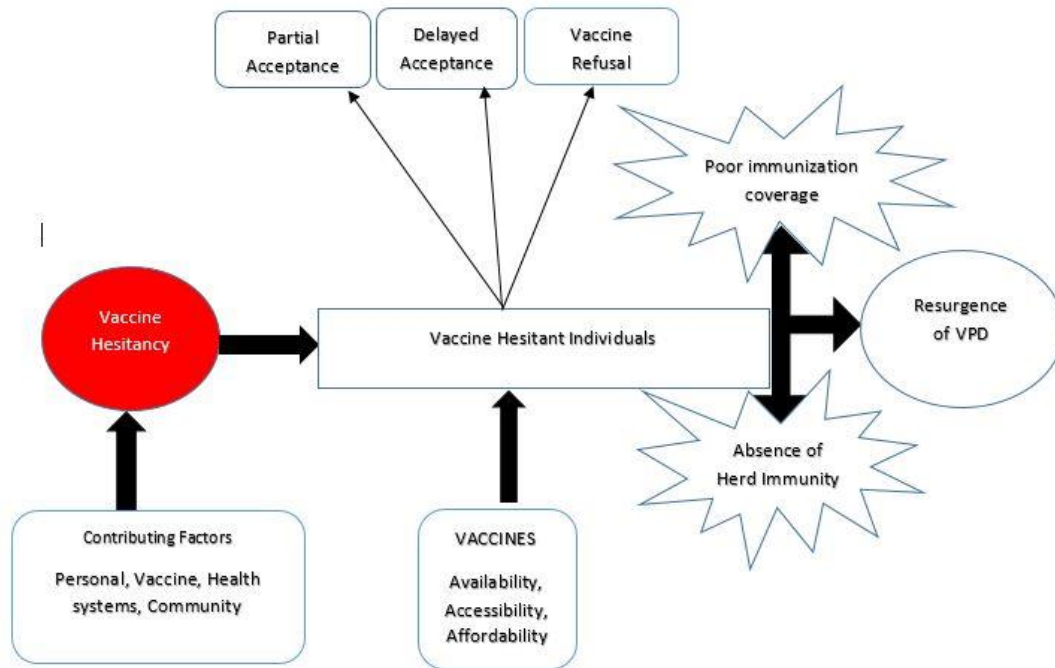


Figure .1.1:Vaccine hesitancy theoretical framework

Source: Literature synthesis by researcher

1.7.3. Consequences of Vaccine Hesitancy

The safety and effectiveness of vaccines in controlling and limiting vaccine-preventable diseases has been demonstrated and confirmed by several studies (Shattock *et al.*, 2024; WHO, 2025). Some parents, however, continue to have multiple concerns and misconceptions regarding childhood vaccinations fuelled by conspiracy theories and narratives (Bangura *et al.*, 2020; Gabis *et al.*, 2022; Taubert *et al.*, 2024) even in communities with high vaccination rates (Haire *et al.*, 2018; Olson, Berry and Kumar, 2020; Holford *et al.*, 2023; Taubert *et al.*, 2024). According to Coelho *et al.* (2022), increased belief in vaccination conspiracy theories predicts increases in vaccination hesitancy. Such parents hesitate to accept or refuse vaccination completely or in part for their children. Exactly ten years ago, Salmon *et al.* (2015)) in the article “*Vaccine Hesitancy: Causes, Consequences and a Call to Action*” hinged the consequences of vaccine hesitancy on its ability to undermine the potential of vaccines to

reduce suffering, save lives, and curb healthcare spending, not by reducing the efficacy of vaccines nor their safety, but by discouraging and demotivating parents from accepting available and affordable vaccines. A call to action was made that it was imperative and urgent to control vaccine hesitancy due to its potential to impact herd immunity negatively with devastating consequences for global public health (Salmon *et al.*, 2015). Ten years later, the problem of vaccination hesitancy persists and has become a major threat to global health, accompanied by local and contextualised public health distortions.

1.8. Statement of problem

Vaccine hesitancy remains a concern globally and in the African region due to diverse reasons and factors, although vaccines are free of charge for eligible children (Cooper *et al.*, 2018; Ngandjon *et al.*, 2022). According to Wiysonge (2019), vaccine hesitancy poses a threat in Africa, and it is pervasive, misinformed, and contagious because it is fuelled by false rumours and conspiracy theories. The impact of vaccine hesitancy on parental acceptance of routine childhood vaccines is recognised worldwide as a growing problem due to the aversion and opposition of parents to uptake of vaccines necessary to maintain the success of vaccination (Dubé *et al.*, 2019).

It has been established that vaccine hesitancy is associated with a decrease in vaccine coverage and an increase in vaccine-preventable disease outbreaks in some developed countries. A report of the United States' Centre for Disease Control and Prevention (CDC) on national immunisation revealed that more than one-third of US children between the ages of 19 and 35 months were not following the recommended early childhood immunisation schedule (Olson, Berry and Kumar, 2020) which made the population vulnerable to vaccine-preventable disease outbreaks.

A systematic literature review conducted by Hammond (2020) in South Carolina, US, reveals that there is a gap between perceived vaccine importance and perceived vaccine safety in developed nations because many respondents believed that vaccines are important and efficient but lacked confidence and trust in the safety of vaccines. Furthermore, numerous reasons, such as perceived fears of adverse effects of vaccines (Hussain *et al.*, 2018), too many doses of vaccines to be taken at a time (Ventola, 2016), and not knowing why certain doses of vaccines are needed in the first few years of a child's life with respect to protection against some of the most serious childhood infectious diseases (Anderson, 2014), are issues of vaccine safety that have been observed in developed countries. The implication of this trend about vaccines in the last decade in England (a developed country) is that MMR uptake dropped below the WHO target of 95% coverage of both doses of MMR required for achieving herd immunity (Thompson *et al.*, 2023).

Evidence from Africa has also shown that the vaccine hesitancy issue constitutes a barrier to the uptake of vital vaccines. A study by Sabahelzain *et al.* (2022b) revealed that uptake of the measles vaccine is directly influenced by measles vaccine hesitancy among parents in Sudan, while Ngandjon *et al.* (2022) reported that vaccine hesitancy has delayed the eradication of polio in Nigeria and Cameroon. A study by Utazi *et al.* (2019) in which vaccination coverage was explored across five LMICs (Nigeria, Ethiopia, the Democratic Republic of Congo (DRC), Cambodia, and Mozambique) showed substantial gaps in the coverage of DTP1, particularly in Nigeria, DRC, and Ethiopia. The sub-optimal coverage in the affected countries is due to vaccine hesitancy or refusal fuelled by parental concerns on vaccine safety, vaccine constituents, and vaccine importance, among other factors.

It is, therefore, essential to identify and understand determinants of parental opinion, perception, belief and attitude regarding vaccination, as these shape the progression towards vaccine hesitancy and ultimately dictate vaccine uptake in Nigeria.

1.9. Gap in literature/justification for the study

Various studies have attempted to document the factors, determinants, and predictors of vaccine hesitancy and the effect on childhood vaccination (McGregor and Goldman, 2021b; Guaraldi, Montalti and Gori, 2023; Hansen *et al.*, 2025). However, most of these studies have been concentrated in high-income countries (HICs), with only a few in low- and middle-income countries (LMICs) (Woods *et al.*, 2023; Sahdra *et al.*, 2024). A comparison of the key factors responsible for vaccine hesitancy in high-income countries (HICs) and low- and middle-income countries (LMICs) revealed a marked difference in the variables responsible for this phenomenon (Balsamo *et al.*, 2025). Trust in and access to healthcare providers, rising levels of economic hardship, and the lack of equal contribution to decision-making between parents are significantly associated with vaccine uptake in high-income countries (Bertoncello *et al.*, 2020; Schellenberg and Crizzle, 2020). However, in LMICs such as Nigeria, vaccine hesitancy is predicted by a combination of health system factors (Phillips *et al.*, 2017, 2018; Bianchi *et al.*, 2019), socio-cultural variables (economic status, ethnicity and religion), and trust in government programmes (Ohammah, 2020).

The scenario in Africa can be viewed through the lens of Masters *et al.* (2018) and Adeyanju *et al.* (2021), who carried out cross-sectional studies on vaccine hesitancy in Ethiopia and Malawi, respectively. The study reported a strong association between vaccine hesitancy and an infant's untimely vaccination, despite high vaccine coverage. The authors reported that caregivers that are unemployed and believe in rumours and misinformation usually have lower confidence in vaccine safety and efficacy. Sociodemographic factors (which include age, gender, religion, education, and employment) and trust in healthcare workers were also reported by Adeyanju *et al.* (2021b) as predictors of vaccination intention. However, the results from the following studies fall short in explaining the African context.

Africa is a very large and diverse continent with 54 countries and about 2000 languages (Munteanu, 2024), and 520 of these are spoken in Nigeria ('Languages of Nigeria', 2025). The vastness and diverse nature of Africa, therefore, impose many variations and disparities in health indices on different communities and countries dictated by their cultural inclinations and social norms (Mouteyica and Ngepah, 2025; Oke and Sibomana, 2025). The relationship between language, culture, and social norms is well-documented (Yusuf and Olagbemi, 1998). This is significant when studying vaccine hesitancy, a complex phenomenon whose origins reside in a convergence of historical, cultural, psychological, and societal influences (Qadrie *et al.*, 2023) with manifestations embedded in emotional, psychological and physical experiences (Gavaruzzi *et al.*, 2021). Since causes of vaccine hesitancy vary from country to country, and were context-specific, Dube *et al.* (2014) and Kumar *et al.* (2016) posit that the identification of locally relevant causal factors and development of strategies to address them is pertinent.

Vaccine hesitancy is a phenomenon that is not well understood in Nigeria. Due to its context-specificity—encompassing cultural, socioeconomic, and spatial factors—findings from other African countries cannot be used to frame its dimension in Nigeria. This is also predicated on the large population of Nigeria which predisposes it to wide country level and in-country health statistics variability (Angell *et al.*, 2022; Adesola *et al.*, 2024). The historical foundation of hesitancy in Nigeria is rooted in the misfortune of the polio vaccine in Kano, which led to a boycott of vaccination in the country's northern region in 2003 (Ghinai *et al.*, 2013). Furthermore, there is a culture of medical mistrust fuelled by misinformation, leading to a "confidence gap" (Ogueji *et al.*, 2024; Souvatzi *et al.*, 2024) that threatens Nigeria's herd immunity. Consequently, vaccination data from Nigeria has been poor due to an amalgam of reasons whose mechanisms of action, both independent and joint, are not well understood.

Ondo State, the study location for this research, is situated in the southern part of the country and is currently plagued by the unbridled migration of clinical staff. Since 2020, this "brain drain" has left clinics understaffed and eroded trust in service delivery. A study in Ondo will help identify whether "hesitancy" is an ideological refusal or a rational response to systemic failures. Understanding these barriers in Ondo State provides a template that can be scaled to secure Nigeria's immunization future and protect its most vulnerable citizens.

1.10. Vaccine hesitancy in Nigeria

There is a dearth of primary studies on parental vaccine hesitancy on childhood vaccination in Nigeria (Adeyanju, Sprengholz and Betsch, 2022). Hence, most studies on childhood vaccination in Nigeria have targeted the factors and determinants of childhood immunisation coverage and completion, and not predictors of vaccine hesitancy specifically. This position has been validated by several studies on factors affecting immunisation coverage in Nigeria. For example, Adisa et al. (2016), in a descriptive cross-sectional study on childhood immunisation perception and uptake among mothers of under-five children attending immunisation clinics in Osogbo, Osun State, Nigeria, discovered that the immunisation coverage in the study location is still low despite the global and local efforts made for improvement. They also concluded that improving the waiting time for mothers is necessary. The study, however, did not mention vaccine hesitancy as one of the causes for the low immunisation status. In Ondo State, Fatiregun et al. (2021) averred that several cases of Missed Opportunities to Vaccinate (MOV) are an indication that the vaccination programme in the Southern part of Nigeria may be experiencing a decline.

Ogunlade and Abdulraheem (2025) identified parental negligence, fear of side effects, and accessibility issues due to financial constraints as the most common reasons for partial and low

levels of immunisation in Nigeria. In other studies, in southern Nigeria, knowledge of mothers and adult males about childhood immunisation was found to be significantly correlated with completeness of vaccinations. It was also reported that having good knowledge of childhood immunisation and a high educational status positively influence a mother's compliance with child immunisation (Agboola *et al.*, 2015; Konwea, David and Ogunsile, 2018). For example, two studies carried out in Akure North LGA in a location contiguous to the proposed study area for my primary research (Oluwafemi and Adesina, 2019; Olabode, 2023) only assessed the immunisation coverage of children under 5 years and the knowledge, attitude, and practice of mothers on immunisation, while that in Akure South LGA (Daniel *et al.*, 2024) was also on immunisation coverage of 0 to 2 years without any reference to parental vaccine hesitancy.

A review of the findings of all the studies mentioned above revealed that accessibility, vaccine safety, and service characteristics, in addition to some specific sociodemographic variables, were the key determinants for immunisation status. The national government of Nigeria, with the support of several international organisations, such as WHO, UNICEF, and JPEIGO, has made considerable efforts to reverse the poor immunisation indices in the country. The progress, however, remains poor, as evident from WHO and UNICEF data, although there is a 2028 target for the reversal of the status of 80% of zero-dose children (Ogunniyi, 2024b).

Vaccination coverage gaps remain a substantial problem in Nigeria, and insufficient vaccination of children renders significant segments of the population vulnerable to VPD (Lubanga *et al.*, 2024). Various studies have also documented the negative impact of armed conflicts and political unrest on immunisation coverage in Nigeria (Sato, 2019; Wigley *et al.*, 2022). The large population of Nigeria was implicated by Bobo *et al.* (2022) as one of the contributing causes of low immunisation coverage in Nigeria when compared to other African countries like Ghana, Burundi, and Rwanda, based on the analysis of the Demographic and Health Survey (DHS) data from 25 sub-Saharan African countries, since the volume of children

to vaccinate can place pressure on the health systems. A recent study by Sabo *et al.* (2025) in Northern Nigeria centred on determinants of routine immunisation coverage among under-five children. Although vaccine hesitancy was not a priority, the study identified distance from the vaccination centre as the primary barrier to complete immunisation.

Recent studies in Nigeria that mentioned vaccine hesitancy were not primary studies on childhood vaccination, and hence the prevalence and predictors of vaccine hesitancy, a key research objective in this thesis, could not be deduced from any of the studies. For instance, Yusuf *et al.* (2024) explored the connection between conspiracy theories, vaccine hesitancy, and vaccination acceptance in Nigeria through a conceptual review. Likewise, Agbede *et al.* (2024) conducted a review that integrated existing research on language obstacles, cultural beliefs, and vaccination reluctance across distinct ethnic groups in Nigeria. Gulumbe *et al.*'s (2024) contribution to the vaccine hesitancy discourse in Nigeria was through a narrative synthesis of historical lessons, contemporary challenges, and global solidarity framed from the perspective of Nigeria's struggle against the worst diphtheria outbreak in decades.

However, the primary study on vaccine hesitancy in Nigeria by Adeyanju, Sprengholz, and Betsch (2022) was conducted not on parental vaccine hesitancy towards childhood vaccination but to understand the drivers of vaccine hesitancy among pregnant women in Nigeria. The outcome of this study cannot be used to frame parental vaccine hesitancy since the focus was not the child but the pregnant woman, since health-seeking behaviour for self is different from when a child is involved. A more recent study by Adeyanju and Betsch (2024) used a qualitative study to investigate the vaccination decision process, and there was no definite reference to vaccine hesitancy. A definite study on vaccine hesitancy in Nigeria by Ogbuabor and Chime (2021) focused on prevalence and predictors of vaccine hesitancy among expectant mothers in Enugu metropolis, South-east Nigeria while Yusuf *et al.* (2024) study centred on parental vaccine hesitancy to human papillomavirus (HPV) vaccines among parents or

caregivers of children aged 9 to 14 years in northern Nigeria leaving a gap in data concerning caregivers of children between 0 and 5 years.

Despite sustained efforts to understand factors affecting vaccination uptake in Nigeria, and particularly in Ondo State, there has been no research investigating the predictors of vaccine hesitancy and refusal among caregivers of under-five children in Akure South Local Government Area, Ondo State, Nigeria, where the government renders free medical services for children under five. This gap resonates with the position of Cooper *et al.* (2018) that most interventions in Africa have been ineffective in reducing vaccine hesitancy due to paucity of data on its primary determinants. Cooper *et al.* (2018), therefore, emphasise a compelling need to expand the understanding of the context-specific causes and implications of vaccine hesitancy within different African settings and differentiate hesitancy from other reasons why individuals are not (completely) vaccinated in the region. Against the background that vaccine hesitancy is complex, shaped by multiple psychological, sociological, and contextual factors (Peretti-Watel *et al.*, 2015; Erchick *et al.*, 2022), and the admonition of the World Health Organization (WHO) to national governments to determine factors that are specific to their context as part of their national vaccination initiatives (Cooper *et al.*, 2018), this research will help in offering important perspectives on the pattern of vaccine hesitancy in LMICs in Africa. Furthermore, Mansoor, Grindem and Kidd (2024) proposed that a comprehensive, culturally sensitive approach should be adopted for addressing vaccine hesitancy in rural populations taking into consideration the unique factors shaping attitudes toward vaccines in these communities.

The dearth of primary studies on vaccine hesitancy in the study area (Akure South Local Government Area, Ondo State, Southwest, Nigeria) creates a demand for parental vaccine hesitancy study among caregivers of under-5 children. The knowledge generated from such a study could inform practice through the design and implementation of intervention strategies

that take cognisance of locally relevant factors, while also shaping the direction of further research.

This research will benefit from the perspective of a clinician. The patient-physician relationship is one built on trust and patient's respect for and believe in the opinion of the physician. According to Opel (2023), parents more frequently discussed their concerns about vaccines with their child's doctor who are viewed as a trusted source of vaccine information. Resting on this, a researcher who is primarily a physician can leverage on the existing trust quotient to obtain more intuitive responses from participants thereby given a more accurate picture of the vaccination situation in the study location. This is important because intuition has been associated with vaccination behaviour (Martinelli and Veltri, 2021; Schindler, Schindler and Pfattheicher, 2021). The researcher undertaking this study is a physician with over fifteen years of experience working with children under five at the infant welfare clinic in Nigeria. Hence, a practitioner's contribution to the body of existing knowledge on vaccine hesitancy, particularly in Nigeria, will be made.

The outcome of a systematic literature review conducted to further explore the extent of this problem is presented in the next chapter.

1.11. Chapter Summary

In chapter one the critical issue of vaccine hesitancy (VH) among parents of children under five years was explored, highlighting the importance of vaccines in ensuring child survival and preventing vaccine preventable diseases (VPD). It further discusses the implications of decreased vaccination coverage, particularly in developing countries like Nigeria, where VH has contributed to the resurgence of VPD. The phenomenon of vaccine hesitancy is identified as a complex behaviour influenced by socio-cultural, emotional, and experiential factors. The global and African context of vaccine hesitancy was also discussed, highlighting its impact on

immunisation programs and disease outbreaks. Despite free vaccination initiatives, there remains widespread hesitancy driven by factors like mistrust in vaccine safety and effectiveness in both developed and developing countries, like Nigeria. The long-term implications of low vaccine uptake threaten the success of vaccination efforts and overall public health, especially in under-resourced regions. It was therefore emphasised that there was the need for a deeper understanding of the causes of vaccine hesitancy in the study area in Akure South Local Government Area, Ondo State, Nigeria, through robust research by a researcher who has engaged in clinical services at the infant welfare clinic, especially as current literature lacks robust insights into this area. In chapter two, I reported the processes and outcome of a systematic literature review (SLR) conducted to gain deeper insights into what is known about vaccine hesitancy globally and the current gaps in knowledge so that the research can be shaped appropriately.

Chapter Two: Systematic Literature Review

2.0. Chapter overview

The previous chapter was an overview of the importance of immunisation to child survival. It was also identified that acceptance of such vital vaccines is hindered globally by the concept of vaccine hesitancy. The consequences of this on vaccination coverage globally, and particularly in the study area, were highlighted. This chapter covers the definition and purpose of a Systematic Literature Review (SLR) and the processes through which an SLR was conducted on the prevalence and determinants of vaccine hesitancy. This chapter further outlined the analysis of the SLR findings and how conclusions were drawn to reveal gaps in knowledge, which was used to streamline the aims and objectives of this research.

2.1. Purpose of the SLR

This SLR reviewed extant literature on the predictors, factors, or determinants of vaccine hesitancy in caregivers of children under five and the effect on childhood vaccination uptake. Hence, the aim of the systematic review was to explore in detail the evidence around the predictors of vaccine hesitancy in caregivers of children under five and how this affects their decision-making with regard to their child's vaccination. The factors were categorised into domains and themes for a proper deconstruction of the phenomenon while projecting existing gaps in studies that can be the basis for further studies.

The predictors and determinants identified were discussed will help in taking appropriate context-specific informed decisions and how the findings in each study was used to design interventions to combat vaccine hesitancy in specific populations.

The specific questions asked were:

1. What are the determinants of vaccine hesitancy, rejection, and complete childhood immunisation?
2. What is the impact and relationship between the determinants and childhood immunisation uptake?

2.2. Protocol for the Systematic Literature Review

The development of a protocol prior to the commencement of an SLR is important to ensure a transparent and high-quality outcome (Peat *et al.*, 2014; Serghiou *et al.*, 2021). The protocol for this SLR is in Appendix 2.1.

2.3. Search Strategy

The search focused on research investigating the reasons for vaccine hesitancy in caregivers of children under five and the relationship that exists between the predictors of vaccine hesitancy and the child's immunisation uptake. The databases specified in the protocol were searched, and the reference sections of the articles and publications retrieved from the databases were also perused to identify all relevant articles. To identify relevant papers, Medline, CINAHL Ultimate, PubMed, Web of Science, Scopus Science Direct databases, and Google Scholar were searched independently. Search terms were generated independently using the Boolean operators "AND", "OR", and "NOT. In addition to database searching, references of all included studies were also searched. The search terms used include "predictors", "vaccine hesitancy", and "childhood vaccinations". Synonyms including 'factors', 'determinants', 'indicators', 'vaccine acceptance', 'vaccine refusal', 'vaccine delays', 'childhood immunisation', and 'under-five vaccinations' were also used. Appendix 2.2 shows the exact search by database. During the search of the academic databases, filters were used to limit the publications. Articles published between 2010 and 2023 were included. The range 1st January 2010 to 31st January 2023 was selected because it covers a little over a decade dating to when the issue of vaccine

hesitancy began to become a matter of public health concern and the WHO had to come up with a Strategic Advisory Group of Experts on vaccine hesitancy (Nuwarda *et al.*, 2022). More importantly, the 2023 cut-off is because the search of the databases was completed in 2023. Furthermore, bearing in mind that Larson and his colleagues had earlier published an SLR titled '*Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: A systematic review of published literature, 2007–2012*' in 2015, which included studies from 2007 to 2012 (a 5-year period), a 13-year period was therefore adopted for the study, though 5 to 10 years is often prescribed for SLR. According to Sauer and Seuring (2023), it is hard to specify a certain time period covered, but if developments of a field should be analysed, a five-year period might be a typical lower threshold.

2.4. Inclusion Criteria

Studies were included if they were published in peer-reviewed journals and written in English. Quantitative, qualitative, and mixed methods of primary studies investigating parental vaccine hesitancy regardless of whether they considered one or a combination of vaccines or vaccine-preventable diseases were included. Studies were included if the participants were mothers, fathers, or any extended family members like grandparents, uncles, and aunties who take care of children under five. Studies (qualitative, quantitative, and mixed) from any setting globally where childhood vaccination is provided were included. Studies using measuring tools or scales for vaccine hesitancy were included to provide appropriate information on the questionnaire to be used for the primary research. No geographical constraints were applied. Only studies that were related to human vaccines were considered.

2.5. Exclusion Criteria

Studies were excluded if they investigated adult and adolescent vaccination or if they were not reported in the English language. Studies on Covid-19 vaccine hesitancy were also excluded since the focus is on routine childhood vaccination.

2.6. Search Result

The searches yielded 133 articles on MEDLINE, 35 articles on CINAHL Ultimate, 432 articles on Science Direct, 36 articles on PubMed, 18 articles on Web of Science collections, and 315 articles on Scopus. Appendix 2.3 displays the PRISMA flowchart illustrating the article search strategy. The search procedure for Google Scholar involved the use of the search term "*childhood vaccination and vaccine hesitancy*", which yielded 25,100 articles and was further reduced to 17,400 after limiting the date range between 2010 and 2023. The 17,400 articles were subjected to an advanced search where it was specified that *childhood vaccination and vaccine hesitancy* should appear in the title of the article to be selected, and this reduced the search result to 17 articles on Google Scholar. Searching of databases was done between June 2022 and February 2023. 986 papers were identified, including the 17 relevant articles from Google Scholar. Thereafter, 105 duplicate papers were removed, leaving 881 papers. The next stage was the screening of the 881 papers. Titles and abstracts of articles were screened for inclusion and exclusion. 761 ineligible articles were removed for unmatched contents, yielding only 120 eligible papers. Thereafter, 88 articles related to topics other than childhood vaccination, including non-primary studies, dissertations, commentaries, opinions, and editorials, were removed after the full-text perusal. 32 papers were included for appraisal using the JBI critical appraisal tool.

2.7. Data Extraction

Data from the selected papers were extracted and categorised using the critical appraisal framework developed by Raby and McNaughton (2021) for evaluating research to examine study validity, adequacy, and the potential applicability of the results. This tool was complemented with the JBI critical appraisal tool, resulting in the inclusion of 32 papers in the study. Data were entered according to author, originating country, study aims, study participant, study setting, sample type, methodology, data collection tool used, study design, study findings or results, and limitations. Papers with low quality were excluded from the study.

2.8. Statement of findings

Larson *et al.* (2015) averred that the more the domain of vaccine hesitancy that is recognised, the more the need for new interventions to address emerging issues. In this SLR, a fourth domain categorised as “existential factors” was identified in addition to the three domains previously reported by Larson *et al.* (2015). The summary of findings is presented in Table 2.1.

Table 2.1: Summary of SLR findings

S/N	DOMAIN	CONSTRUCT	REVIEW OBSERVATION (Factors promoting Vaccine hesitancy noticed in the articles reviewed)
	Individual and social group influences	Knowledge/awareness	Insufficient knowledge to make good vaccination decisions.
		Sociodemographic/ socioeconomic factors	Rising level of perceived economic hardship. Lower parental education. Vaccination being a low priority for busy parents.
		Risk/Benefits (perceived/heuristic)	Issues about safety and concerns about serious side effects of vaccine. Parents believing their children were not likely to contract vaccine preventable diseases. Risks of various diseases assessed to be lower than the risk of vaccination.
		Beliefs and attitudes about health and prevention	Beliefs that new vaccines carry more risks than old ones. Doubts about relationship between vaccines and autism.

		Health system and providers trust and personal experience	Shortage of health workers, difficulties in accessing the vaccination service, uncooperative vaccine providers, and unavailability of vaccination material. Distrust in health system and provider. Lack of ease of access to booking appointments. Lack of child friendly facilities. For example, due to the higher-than-average number of children in each family. Lack of waiting room space for small children to play and store their buggies are identified by parents as an issue. Long waiting times in the immunization centre before attending to clients. Pressure on providers of immunization services due to having to manage a high proportion of young children with no additional resource.
		Immunization product use as a social norm	The presence of porcine gelatin in the influenza vaccine made several parents to reject it due to faith reasons.
		Experience with past vaccination	Routine duplication of previous vaccination related decision made for an elder sibling. Negative experience of vaccination.
		Mode of delivery	Fear of needles and potential side effect
		Role of healthcare professionals	Lack of recommendation by pediatricians; parent-provider trust.
		Costs	Invisible cost; opportunity cost of going for vaccination.
		Risk/benefits (scientific)	There were concerns about side effects.
		Mode of administration	Objection to the vaccine administration, fear of the vaccine administration for their children, concern about pain during vaccination.
		Vaccination schedule	Absence of delivery services, unavailability of vaccines at scheduled time.
	Contextual influences	Communication and media environment	Exposure to negative content and unreliable information about the vaccine from untrusted sources.
		Influential leaders	No observation
		Religion/culture/gender/socio-economic	Rejection of vaccine due to faith reason because the vaccine contains porcine gelatin.
		Politics/policies	No observation
		Geographic barriers	Rural/urban variation
		Historical influences	No observation
		Pharma industries	Distrust of pharmaceutical companies; experience with drug trials.
	Vaccines/ vaccination specific issues	Anxiety about vaccine side effect/quality/quantity and duration	Too many doses of vaccine given at once. There were concerns about side effects.

		Risk/benefit	
		Introduction of a new vaccines or a new formulation	Lack of trust in public health authorities, physicians, and academics; parent-provider trust.
		Mode of administration	Fear of needles and potential side effect.
		Design of vaccination program/mode of delivery	Lack of trust in public health authorities, physicians, and academics; parent-provider trust
		Reliability and/or source of vaccine supply	Unavailability of vaccination material
		Vaccination schedule	Difficulties in accessing the vaccination service
		Costs	Difficulties in accessing the vaccination service, Invisible cost; opportunity cost of going for vaccination
		Role of healthcare professionals	Uncooperative vaccine providers; lack of trust in public health authorities, physicians, and academics; parent-provider trust.
	Existential issues	Welfare and concern for the child; social conflicts and social tension	Love and affection for the child, indirect cost of immunization

2.9. Overview of Reviewed Articles

The extraction table in appendix 2.2 presented an overview of all the 32 papers reviewed consisting of 19 quantitative papers, 9 qualitative papers and 4 mixed method papers. The table provided a breakdown of each paper according to the author of paper, country of origin, research settings, methodology used, research design, sample size, type of respondents, research aim, outcomes and limitations.

2.9.1. Study design and study setting

The geographical distribution of the 32 studies included 10 from Europe, 9 were studies in Africa, eight were conducted in Asia, 3 of the studies were in North America, 2 in Australia and a single study in South America. The distribution of the studies is presented in Table 2.2.

Table 2.2: Geographical distribution of included studies.

EUROPE (10)	UK (4), Italy (2), Slovenia, Greece, Turkey, France
AFRICA (9)	Nigeria (4), Ethiopia, Cameroon, Gambia, Sudan, Tanzania
ASIA (7)	India (3), Malaysia (2), China, Nepal,
NORTH AMERICA (3)	USA (2), Canada
AUSTRALIA (2)	Australia (2)
SOUTH AMERICA (1)	Peru

2.9.2. Questionnaire/Survey instrument used

There were significant differences in the way in which data were collected and questionnaires were developed and the questions asked in each of the studies. Some of the studies did not indicate whether a standardized questionnaire was used or how the survey instrument was developed, thereby increasing the risk of bias. Among those that utilised standardized questionnaires, the Parent Attitude about Childhood Vaccines (PACV) survey tool was mostly used.

2.9.3. Sample Size

Variations were also observed in the sampling method and sample sizes of the studies included in the SLR. The sampling methods used in the studies were diverse, ranging from cluster sampling by Dasgupta *et al.* (2018), stratified sampling by Sabahelzain *et al.* (2022c), multistage sampling by Touray *et al.* (2021), and systematic random sampling by Ghosh *et al.* (2022), which were all examples of probability sampling methods consistent with a quantitative study. The sample size of the studies included in the SLR were diverse from as low as 194 and 200 (Dasgupta *et al.*, 2018; Touray *et al.*, 2021) respectively to a sample size of 500 in the study by Sabahelzain *et al.* (2022c) and as high as 2100 by Ghosh *et al.* (2022). According to Bujang (2021), a study must be conducted using a sufficiently large sample size that can detect

the target effect size with an acceptable margin of error. All the studies utilised a multivariate analysis to identify the independent predictors of vaccine hesitancy. Unlike the other 3 studies (Dasgupta *et al.*, 2018; Touray *et al.*, 2021; Ghosh *et al.*, 2022), the study by Sabahelzain *et al.* (2022c) was only on the measles vaccine and not on all the vaccines specified by WHO for children under five.

2.9.4. Theoretical frameworks

The Health Belief Model (HBM) and Socio-ecological Model (SEM) were the most used theoretical frameworks to support the development of questionnaires. Dyda *et al.* (2020) state that the HBM posits that perceptions of susceptibility, severity, benefit, and barriers, cues to action, and self-efficacy predict behaviour, while the SEM highlights actions and actors at four impact levels-personal, institutional, community and policy (Kilanowski, 2017; Olaniyan, Isiguzo and Hawk, 2021). None of the studies reviewed made use of the 5C model as their conceptual framework. The 5C model of vaccine hesitancy measures the “psychological antecedents of vaccination” and explain vaccine hesitancy from the perspective of five factors consisting of confidence, complacency, convenience/constraint, “calculation” and “collective responsibility” (Betsch *et al.*, 2018).

This systematic review of the current literature confirms that very few mixed method studies (Glanz *et al.*, 2013; Letley *et al.*, 2018a; Akwataghibe *et al.*, 2019; Vasudevan *et al.*, 2020) have been carried out globally (Nigeria inclusive) with respect to childhood vaccination and vaccine hesitancy.

2.10. Critical appraisal of identified papers under themes

In this systematic literature review (SLR), four broad thematic areas were identified from the thirty-two (32) papers and discussed based on their commonality and divergence. The four

themes were: (i) individual/group influences, (ii) contextual issues, (iii) vaccine and vaccination-related issues, and (iv) existential issues.

2.10.1 Individual/Group Influences

This centres on biological and sociological characteristics such as race, gender, culture, attitudes, personality, motives, values, self-esteem, education, and employment (Mishra, 2022). The factors to be discussed under this theme are the parental sociodemographic and socioeconomic variables and the influence on parental vaccination decisions. These sociodemographic factors are not modifiable factors and are crucial for understanding vaccination trends and designing targeted interventions.

2.10.1.1. Sociodemographic Status

The sociodemographic status of parents has been reported as a predictor of vaccine hesitancy in previous systematic literature reviews (Olson, Berry and Kumar, 2020; Obohwemu, Christie-de Jong and Ling, 2022; Mavundza, Cooper and Wiysonge, 2023). Family size, nature of family, maternal age, and level of education were observed to be significant demographic factors for predicting vaccine hesitancy.

2.10.1.2. Family size and type

Five studies (Dasgupta *et al.*, 2018; Touray *et al.*, 2021; Cherian *et al.*, 2022; Ghosh *et al.*, 2022; Sabahelzain *et al.*, 2022c) considered family size and family type (nuclear or extended) as a predictor of vaccine hesitancy.

Sabahelzain *et al.* (2022c) argued that families with a large family size are more likely not to complete the immunization schedule because a large family size might affect the mothers' ability to care for the younger children while Girmay and Dadi (2019) explained that such mothers might not have enough time to travel for immunization. They rationalised that this would pose a challenge to resource-poor families, as larger families consume more resources,

thereby impacting their livelihoods negatively. When household income is limited, it is often deployed to meet the essentials, particularly food, and hence other activities or expenditures that may exert direct or indirect costs without obvious and immediate benefit to their livelihood are often not given priority. Touray *et al.* (2021) succinctly captured this explanation that larger families tend to put conflicting demands on mothers, restricting the time and resources available to care for each child. Therefore, having a larger family may impose an additional burden of domestic care on mothers and thereby reduce time available for vaccination visits. Two studies (Dasgupta *et al.*, 2018; Cherian *et al.*, 2022) identified the nature of family (whether extended or nuclear) as a predictor of vaccine hesitancy. Cherian *et al.* (2022) carried out a community-based cross-sectional descriptive study on the prevalence and predictors of vaccine hesitancy. The study, which was conducted in Dallupura, an urbanized agglomeration of New Delhi, had a sample size of 350 caregivers and targeted the predictors of vaccine hesitancy and specifically collected information on family type using a survey. Cherian *et al.* (2022) reported that belonging to a nuclear family increases the odds of non-vaccination because knowledge on vaccination and the desire to vaccinate are often internalised without benefiting from the guidance from other experienced senior family members in making positive vaccination decisions about the child. It is also postulated that the problem is aggravated if the mother is the only caregiver, is busy due to household or other jobs, is sick, pregnant, or has to take care of other children.

2.10.1.3. Effect of Maternal Age.

Four studies (Azizi, Kew and Moy, 2017; Chung-Delgado, Valdivia Venero and Vu, 2021; Isezuo and Adamu, 2022; Sabahelzain *et al.*, 2022a) explored the influence of mother's age on childhood vaccine uptake. The dispersed distribution of the study locations (Peru in South America, Nigeria in West Africa, Sudan in North Africa, and Malaysia in Asia) underscores the fact that the effect of maternal age is not limited to one region, although it is relevant only

in low- and middle-income countries. The study in Peru (Chung-Delgado, Valdivia Venero and Vu, 2021) was a descriptive, cross-sectional study that used the Spanish version of the validated Parent Attitudes about Childhood Vaccines (PACV) survey tool over the telephone. Respondents (552) were identified through convenience purposive sampling. The study reported that mothers that were less than 29yrs old showed a greater level of vaccine hesitancy. Likewise, a cross-sectional study involving 650 respondents carried out in Malaysia by Azizi, Kew and Moy (2017) also used a Parent Attitudes about Childhood Vaccines (PACV) questionnaire in the Malay language where parents from younger age groups and mothers expecting their first child were significantly more vaccine hesitant. Two studies (Azizi, Kew and Moy, 2017; Chung-Delgado, Valdivia Venero and Vu, 2021) used the non-English validated PACV tool and the multivariate logistic regression method to test the associations between vaccine hesitancy and socio-demographic factors such as maternal age and this was found to be significant.

Collaborating these findings, the bivariate and logistic regression analysis of the data collected by Isezuo and Adamu (2022) in a health facility in Sokoto metropolis, Nigeria, also revealed maternal age, as a significant predictor of vaccine hesitancy. The study had a sample size of 406, used the English version of the PACV tool, and recruitment of participants was done using a multi-stage sampling technique. Isezuo and Adamu (2022) further explained that the outcome was not unexpected given that young mothers are likely to be less educated and less experienced. Furthermore, the marriage practices in the study location in Northern Nigeria, where early and child marriage is common and poor acceptance of formal education is prevalent, may contribute to the observed outcome. Findings by Sabahelzain *et al.* (2022a) showed that measles vaccine hesitancy increases as the age of the mother and the number of children increase. This, they explained, was because elderly Sudanese mothers are hesitant towards vaccination when they have many children. The explanation adduced for this is

cultural and may not be fit for general application. This finding is significant because it shows that vaccine hesitancy increases with increasing maternal age. This is contrary to the outcome of the other studies, where young mothers were reported to be hesitant. The implication of this is that there is the need to further study the factors that influence the behaviour of young vaccine-hesitant mothers and the relationship between maternal age and vaccine uptake.

2.10.1.4. Level of Education

The level of education of parents is a key factor for determining the likelihood of the acceptance of vaccination by caregivers of children under five (Mora and Trapero-Bertran, 2018). Seven studies out of the 32 papers reviewed (Azizi, Kew and Moy, 2017; Taylor *et al.*, 2017; Dasgupta *et al.*, 2018; Bertonecello *et al.*, 2020; Chung-Delgado, Valdivia Venero and Vu, 2021; Touray *et al.*, 2021; Ghosh *et al.*, 2022), identified educational status as a predictor of vaccine uptake. Five types of relationships were observed between educational status and parental vaccination behaviour in the papers that indicated a relationship with educational level and vaccination behaviour. The five relationships between educational level and vaccine hesitancy reported in this systematic literature review are based on maternal educational level. The maternal education level ranges from no education to tertiary education. The first relationship is that when the parents are well educated, up to tertiary level, they have a better understanding of vaccines and vaccine benefits. In this category of parents, education is an enabler and a cue to vaccinate their children. A study by Girmay and Dadi (2019) established that mothers who attained a secondary or higher level of education were 2.39 times more likely to have fully immunized children.

The second relationship is that more educated females are more likely to refuse vaccination than the non-educated females because education gets them exposed to a lot of negative and conspiracy-driven information on vaccination which, though it may not deter them from

accepting vaccination in the long run, may cause hesitation and decision atrophy. This relationship was confirmed by Taylor *et al.* (2017) in a study on vaccine hesitancy and polio vaccine in the northern part of Nigeria, where a higher risk of refusal of oral polio vaccine (OPV) among wealthier, more literate urban households was reported. The study was based on a purposive sampling survey of 1653 households in high- and low-performing rural, semi-urban and urban areas of three high-risk states, Sokoto, Kano, and Bauchi, in northern Nigeria.

The third relationship is that mothers with little education do not reject vaccines because they do not ask questions since most of the vaccine decisions for their children are made by a third party, which may be a partner or a family member. According to Balgovind and Mohammadnezhad (2022), decision-making in such women is influenced by personal, family, or others' experience or external sources. The second and third relationships documented in this SLR are summed up by Chung-Delgado, Valdivia Venero and Vu (2021) as the level of vaccine hesitancy being inversely proportional to the level of mothers' education, as observed in the study done in Peru. The second and third relationships are represented with a schematic diagram referred to as Vaccine Hesitancy-Educational Status Paradox. The essence of the figure is that there is an inverse relationship between maternal education level and vaccine hesitancy. Simply put, when mothers are educated, the vaccine hesitancy increases, and when mothers are not educated, vaccine hesitancy reduces. Conversely, when mothers are educated, the vaccine hesitancy decreases, and when mothers are not educated, vaccine hesitancy increases. Hence, as the level of education goes up, the willingness to accept the vaccine reduces, as presented in the figure 2.1.

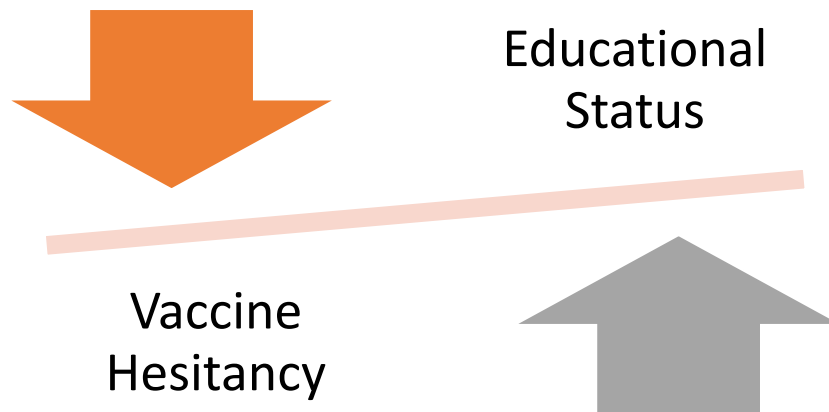


Figure 2.1: Vaccine Hesitancy-Educational Status Paradox

(Developed by the Author)

The fourth relationship observed is that the lower the educational status of mothers, the more likely they are to refuse vaccines since such mothers are less likely to complete their child's immunization schedule (Bertoncello *et al.*, 2020; Dasgupta *et al.*, 2018; and Touray *et al.*, 2021). Bertoncello *et al.* (2020), in a cross-sectional study with a sample size of 3865 using a convenient sampling technique and an online survey, reported that lower parental education was significantly associated with vaccine refusal. Ghosh *et al.* (2020) also reported that mothers who had no education or low-level education were more likely to have incompletely immunized children when compared to educated mothers. The fifth relationship was reported by Azizi, Kew and Moy (2017), who found that sociodemographic characteristic such as educational level did not have any significant association with vaccine hesitancy. Only one study by Isezuo and Adamu (2022) reported fathers' tertiary education as predictors of vaccine hesitancy. The reason for this is that the location of the study was in the northern part of Nigeria, where vaccine decision-making is patriarchal in nature, and this has a cultural foundation. However, a systematic literature review involving 26 studies in Ethiopia on predictors of

immunization coverage among 12–23-month-old children carried out by (Nour *et al.*, 2020) revealed that eight studies indicated maternal education status as a significant predictor of vaccine uptake, while three studies indicated fathers' educational status as significantly associated with immunization coverage in Ethiopia. The implication of the five relationships is presented in table 2.2.

Table 2.3: The five relationships between maternal education and vaccine hesitancy

Relationship	Education Level	Vaccine Hesitancy	Implication
1 st relationship	High Education	Low or no VH	Readiness to accept vaccine
2 nd relationship	High Education	High VH	Hesitate to accept vaccine
3 rd relationship	Low Education	Low or no VH	Readiness to accept vaccine
4 th relationship	Low Education	High VH	Hesitate to accept vaccine
5 th relationship	Low or High Education	No significant effect	Has no effect on vaccine uptake

In this SLR, maternal education was treated as a distinct parameter from parental socioeconomic status.

2.10.1.5. Socioeconomic Status

Previous systematic literature reviews (Bangura *et al.*, 2020) have reported the socioeconomic status of parents as a predictor of vaccine hesitancy. In this review, 8 studies in Malaysia (Azizi, Kew and Moy, 2017), Italy (Bertoncello *et al.*, 2020), Australia (Costa-Pinto *et al.*, 2018), China (Du *et al.*, 2021), India (Ghosh *et al.*, 2022), France (Peretti-Watel *et al.*, 2019), Nigeria (Taylor *et al.*, 2017), and The Gambia (Touray *et al.*, 2021) reported elements of socioeconomic status as significant factors for vaccine hesitancy. Factors including type/level of employment, rising level of economic hardship, and employment/income status of caregivers are predictors of vaccine hesitancy. The study carried out in Gambia (Touray *et al.*,

2021) revealed that children of caregivers that are farmers are less likely to complete their immunisation schedule. This may be explained with an assumption that in low-income settings such as The Gambia, caregivers engaged in subsistence farming are disproportionately represented in lower socio-economic strata and tend to have limited formal education, factors that are associated with reduced knowledge and awareness of childhood immunisation. Furthermore, the distance to the healthcare centre from their farms may constitute an accessibility challenge, coupled with the reluctance to leave their farm activities at the peak of the planting season.

According to Du *et al.* (2021), in a cross-sectional survey involving 2122 caregivers of children under the age of five in China, wealthier caregivers reported more information sources and were more likely to access needed vaccines for their children. The author posited that the information will positively influence the caregivers' perceptions of the need for vaccination. The foregoing assertion is similar to the findings of a community-based qualitative study carried out in France by Peretti-Watel *et al.* (2019), where 25 mothers of under-five schoolchildren were selected from two different socio-economic settings (high and low). The respondents were engaged in an in-depth interview using a semi-structured interview guide. The study discovered a positive influence of higher socioeconomic status on vaccine uptake. This is, however, contrary to the report of Taylor *et al.* (2017) in a cross-sectional survey study carried out in the northern part of Nigeria, where caregivers who are wealthier and reside in the urban areas were discovered to be more likely to refuse vaccination than the poor.

Rising level of perceived economic hardship as reported by Bertoncello *et al.* (2020) was also associated with vaccine hesitancy in caregivers of under-fives in Italy. This specific association between vaccine hesitancy and family economic hardship may be linked with the issue of convenience as it affects vaccine uptake. Accessibility as a component of convenience may be hindered when there is economic hardship, as caregivers may not be able to afford

transportation fees to the vaccination site, especially long-distance sites, even though immunisation is made freely available for children under five. This type of scenario plays out in low-income/developing countries like Nigeria. Azizi, Kew and Moy (2017) and Costa-Pinto *et al.* (2018), in studies carried out in Malaysia and Australia, respectively, reported little and no evidence of association between household income and socioeconomic status. There may be a likelihood that different forms of non-compliance emerged in different socio-economic settings. Rural non-compliance may have been shaped by poverty and illiteracy, inhibiting household access to information and rendering families more susceptible to vaccine rumours and fears (Taylor *et al.*, 2017; Pugliese-Garcia *et al.*, 2018; Ojo *et al.*, 2023). However, access to a wider range of information may shape non-compliance in urban areas. This again depicts the complexity and context specificity of vaccine hesitancy and the need for further study.

It is also noted that none of the studies included in this review used the notion of social class to explain the impact of socioeconomic factors on vaccination decisions. Glassman and Szymczak (2022) argued that drawing on the notion of social class can help illuminate how and why parents of different social statuses may experience vaccine decision-making in distinct ways. Socioeconomic status is typically defined by a combination of one's financial income and level of education and occupation. However, beyond socioeconomic status, social class is a marker of one's positioning within society related to one's socioeconomic status and is often thought of as a culture that carries with it group membership, norms, and socialisation patterns (Deutsch, 2017). Glassman and Szymczak (2022) explained that social class is important because it incorporates a degree of analytical complexity that is missed in discussions of socioeconomic status (SES). In the qualitative study carried out in the USA by Glassman and Szymczak (2022) to elicit a narrative of mothers' medical decision-making in the context of their social and family backgrounds, they found that social class may be one factor shaping the experience of vaccine hesitancy by impacting mothers' relationships with institutional

authorities that they perceive as having more or less power in their decision-making. The foregoing also provides an alternative lens for considering the socioeconomic data to be collected in my primary study.

2.10.2. Societal Factors (Contextual Issues)

Five categories of contextual factors were associated with childhood immunisation and vaccine hesitancy in this review, and these are (i) vaccine information, (ii) trust, (iii) social and group norms, religion, and cultural perspectives, (iv) geographic barriers, and (v) health system factors. May (2013) defined context as ‘complex adaptive systems that form the dynamic environment(s) in which implementation processes are situated.’ Each of the five contextual factors will be appraised critically because of their importance, although Rodgers *et al.* (2025) claimed that contextual factors are often underreported in systematic reviews of public health interventions.

2.10.2.1 Vaccination Information

The source of information on vaccination from sources based on settings (community health events, health facilities); channels (radio, TV, social media); and messengers (community health workers, faith leaders) plays a key role in acceptance of vaccination or otherwise. In this review, 12 studies carried out in China (Du *et al.*, 2021), the UK (Letley *et al.*, 2018a), Australia (Costa-Pinto *et al.*, 2018), Italy ((Napolitano, D’Alessandro and Angelillo, 2018; Bertoncello *et al.*, 2020), Malaysia (Azizi, Kew and Moy, 2017), Slovenia (Vrdelja *et al.*, 2018), India (Dasgupta *et al.*, 2018), Greece (Gkentzi *et al.*, 2021), Nigeria (Taylor *et al.*, 2017; Isezuo and Adamu, 2022) and Sudan (Sabahelzain *et al.*, 2022a) identified issues surrounding vaccination information as strategic for vaccination uptake. These articles constitute about 34% of all 32 papers included in the SLR.

According to Letley *et al.* (2018), lack of community information may affect acceptance of vaccines negatively. Napolitano, D'Alessandro and Angelillo (2018) also reported in their study that more than half of parents expressed the desire to receive additional information about childhood vaccination. Dasgupta *et al.* (2018) cited having no reliable source of vaccination information as a major reason for vaccine hesitancy, while Vasudevan *et al.* (2020) identified access to vaccine information as a key driver of the difference between vaccine hesitancy and acceptance. However, the study did not specify the particular type of information the caregivers wanted.

Poor or inadequate communication, while not considered a specific determinant, can contribute to vaccine hesitancy and negatively influence vaccination coverage (Biasio *et al.*, 2016). The study by Du *et al.* (2021) in China reported that the odds for vaccine hesitancy in caregivers when information is obtained from professionals was low, while it was very high when the source is the media. They argued that most caregivers (72%) used multiple sources to access vaccination-related information. Around 81%, 63%, and 26% of caregivers reported professional sources, media, and peers as their primary information sources, respectively. The authors reported that caregivers who reported professional information sources had significantly higher odds of being confident about the safety of vaccines and lower odds of being hesitant toward vaccination than those who did not. Caregivers who reported the media as a primary information source had significantly higher odds of being hesitant toward vaccination than those who did not. Bertoncetto *et al.* (2020), in their study done in Italy, indicated that the right quantum of vaccination information was necessary to drive vaccine uptake and reduce vaccine hesitancy. This was further confirmed by Sabahelzain *et al.* (2022a) in the study carried out among caregivers of children under five in Sudan. The authors revealed that parental exposure to anti-vaccination information or materials was found to be a significant predictor of parental vaccine hesitancy in Sudan.

Gkentzi *et al.* (2021) carried out a cross-sectional prospective survey on parents of children attending public primary compulsory education in the city of Patras, Greece, where a stratified sample design was used. They reported in the study that the main vaccine information source for Greek parents was their primary care provider (90.8%), but doubts still exist about the relationship between vaccines and autism in about one-third of them. Also, Costa-Pinto *et al.* (2018), in a cross-sectional survey done in Australia using convenience sampling to recruit 612 mothers of under-fives (consisting of 301 and 311 mothers) from a tertiary hospital and maternity health centre in a community setting, identified healthcare providers as the most commonly accessed and trusted information source. They revealed that despite the high level of trust in healthcare providers, they still have doubts about the information on both the benefits and the risks of vaccination. A similar situation was reported by Vrdelja *et al.* (2018) in a cross-sectional study carried out in Slovenia. Through a convenience sampling method, 1704 mothers of children under five were selected. The study was carried out in a health facility. Information was collected from the respondents using a self-administered questionnaire. The study shows that mothers most often seek information about vaccination from friends or online and that the more they search for information online, the more concerned they are about the safety of vaccines, though their communication about vaccines also becomes more active. A scenario from an African country played out in the health facility-based quantitative cross-sectional survey study conducted using a multistage sampling method in Nigeria by Isezuo and Adamu (2022). Information was collected from 406 parents of children under five using a validated PACV questionnaire administered by an interviewer. The study identified concern for safety from negative information received as a significant predictor of vaccine hesitancy. Almost 30% of caregivers in this study confessed to receiving negative information about vaccination even though their sources of information were not asked. A large proportion got information on “handicap”, most probably referring to vaccine-associated paralytic polio and perceived

infertility in the future (Isezuo and Adamu, 2022). The information gap noticed in the respondents in this study may be because of an incidence of rumours spread in the northern part of Nigeria about the polio vaccine side effects. According to Jegede (2007), the rumour and argument of political and religious leaders of Kano, Zamfara, and Kaduna states that the polio vaccine contained anti-fertility agents in northern Nigeria in 2003 brought the immunisation campaign to a halt by calling on parents not to allow their children to be immunised. The scenarios above reiterate the issue of confidence with vaccination based on how and where caregivers access information on vaccination and whether the quantum of information available is enough to make the right vaccination decision. This further highlights the complexity of vaccine hesitancy as a behaviour and the need to explore this through further research.

2.10.2.2 Trust

Five studies (Glanz *et al.*, 2013; Ward *et al.*, 2017; Musa *et al.*, 2019; Çelik, Turan and Üner, 2021; Paul *et al.*, 2022) out of the 32 included papers in this SLR reported trust as the reason for participants' hesitation. The most cited reason for general population hesitancy towards vaccination is safety concerns (Cadeddu *et al.*, 2021; Abdalla *et al.*, 2023), which is trust related.

Five trust issues were identified in this SLR, and these were:

- lack of trust in the information provided about vaccines by paediatricians and other health workers (Glanz *et al.*, 2013)
- distrust of traditional scientific evidence such as several narratives around vaccinations (Ward *et al.*, 2017)
- lack of mutual trust between service seekers and service providers (Paul *et al.*, 2022)

- distrust of the pharmaceutical industry (Musa *et al.*, 2019) and,
- distrust of health systems and providers (Musa *et al.*, 2019)

Çelik, Turan and Üner (2021) identified trust as a driver of vaccine hesitancy in a study conducted with mothers living in Ankara, Turkey. The qualitative study used twenty-three (23) semi-structured interviews to understand how mothers decide about child vaccination and the attitudes, perceptions, and beliefs underlying these decisions. Glanz *et al.* (2013) carried out a mixed-method study with parents of children aged <4 years in the US. Four focus groups were conducted with a total of thirteen parents who refused vaccination, and three focus groups were conducted with a total of eleven parents who delayed vaccination. Based on findings from the focus groups, a survey was developed, pilot tested, and mailed to a stratified sample of 854 parents who accepted (n = 500), delayed (n = 227), or refused (n = 127) vaccinations for one of their children. Survey results were analysed by chi-square tests and multivariable logistic regression. Glanz *et al.* (2013) reported that there is overall trust in the paediatrician but a lack of trust in the information they provided about vaccines. Parents did not believe their paediatrician provided "balanced" information on both the benefits and risks of vaccination.

Ward *et al.* (2017) carried out an interpretative, qualitative study in which a semi-structured interview was undertaken to better understand parental vaccine hesitancy and influences upon parental experiences. Through snowball sampling, 29 participants were selected, and the report indicated that parents value their capacity to question and distrust traditional scientific evidence, such as several narratives around vaccinations, stating that people need to gather their own evidence before blindly trusting a doctor. In the case of Paul *et al.* (2022), it was a study carried out to understand the barriers to and facilitators of immunisation in Makwanpur, Nepal, from both the demand- and supply-sides. This study adopted a grounded theory design in which 76 participants were involved in an in-depth interview (N=10), key informant

interviews (N=12), and focus group discussions (N=54). The study reported lack of mutual trust between service seekers and service providers as a prominent barrier. Musa *et al.* 's (2019) survey in Malaysia reported that respondents had distrust of the pharmaceutical industry and distrust of health systems and providers. It was observed that three of the articles were qualitative studies (Ward *et al.*, 2017; Çelik, Turan and Üner, 2021; Paul *et al.*, 2022), one (Glanz *et al.*, 2013) was a mixed study, and one (Musa *et al.*, 2019) was a quantitative study.

2.10.2.3. Social and Group Norms, Religion, and Cultural Perspectives

Faith, reasons and social norms were highlighted as reasons for vaccine refusal and hesitancy. Paterson, Chantler and Larson (2018) , in the study carried out in the United Kingdom, reported that several parents interviewed declined the influenza vaccine for faith reasons due to the presence of porcine gelatine in the vaccine. The heterogeneity and religious pluralism of UK society may have been responsible for it. There are documented concerns about the raw materials used for vaccine production, such as porcine and non-halal ingredients of vaccines (Kibongani Volet *et al.*, 2022), and the teachings and beliefs of various religious groups relating to Ramadan and the fasting period (Jinarong *et al.*, 2023). For instance, Kuru *et al.* (2022) conducted a longitudinal study in the USA (a high-income country) on religious affiliation and philosophical and moral beliefs about vaccines. It was reported that stronger philosophical beliefs predicted more negative attitudes toward the uptake of the flu, measles-mumps-rubella (MMR), and human papillomavirus (HPV) vaccines.

Ngandjon *et al.* (2022), in a quantitative cross-sectional study in Cameroon, a low-income country in Africa, selected 160 mothers of under-fives using a random sampling technique. The study took place in the Foubot district, which is a rural location in the Noun Division, West Region of Cameroon. Information was collected from the respondent using an interviewer-administered questionnaire. The study reported that 40% of the mothers were vaccine hesitant,

while religion was associated with vaccine acceptance. The study did not, however, explain how religion mediates vaccine hesitancy. Cultural beliefs against immunisation are found to be destructive towards childhood immunisation uptake in Africa. This could probably be due to the circulation of false narratives via the use of either family or religious networks towards vaccines. The process through which religion and culture exert influence on vaccination behaviour was not explained in this study.

Out of the 32 papers included in this review, three studies (Dubé *et al.*, 2016; Letley *et al.*, 2018a; Gorman *et al.*, 2020) reported an association between social norms and vaccination intention. Letley *et al.* (2018) reported that there was no evidence of community resistance relating to cultural norms, opinion, or religion against vaccination in the study carried out in a Jewish community in London, UK. However, Gorman *et al.* (2020) conducted a quantitative study that investigated the reasons behind the low uptake of nasal influenza vaccination among Polish pupils in Edinburgh, Scotland, surveying 365 Polish parents using a validated vaccine hesitancy scale (VHS) tool. The outcome of the study revealed that Polish migrants in Scotland come with their beliefs about vaccination, and these beliefs become blended opinions because of cultural transition and transformation in the UK. The mechanism and processes of how this transformation occurs were not captured by the study by Gorman *et al.* (2020), which was quantitative. This will therefore explore the concept of social norms through a qualitative study in my primary study.

2.10.2.4. Geographic Barriers

Geographic barriers pertain to the issue of spatial accessibility. This focusses on the time taken to reach the health facility and the antenatal care received by the mother. It also relates to the place of birth of the children, which has been observed as a cue for action in accessing vaccination by the mothers. According to Vasudevan *et al.* (2020), in a mixed methods study

involving a cross-sectional survey (n = 134) and four focus group discussions (FGDs, n = 38) with mothers of children under 2 years of age in a region in Tanzania, timeliness of vaccinations was lower and varied by vaccine. In addition, a rural-urban dichotomy of vaccine access, in which rural mothers reported more vaccine-related concerns compared to urban mothers, was reported. The key outputs of the study in Tanzania were that there was a great concern related to poor geographic accessibility, unreliability of services, and missed opportunities for vaccinations. These findings fit into the convenience domain of the 3C and 5C models and the accessibility domain of the 5A model of vaccine hesitancy. The 3C, 5C and 5A models are frameworks developed for the study of vaccine hesitancy in individuals. The 3C consist of three pillars (confidence, convenience and complacency), 5C has five pillars (confidence, convenience/constraints, complacency, calculation and collective responsibility), and 5A (accessibility, affordability, awareness, acceptance and activation).

2.10.2.5. Health System Factors

Health care systems vary considerably across countries in many respects and on the basis of this Reibling, Ariaans and Wendt (2019) proposed a typology of healthcare system predicated on supply, public-private mix, institutional access regulations, primary care orientation and performance management in prevention and quality of care. Furthermore, Anandaciva (2023) stated that effective vaccination programmes can be a marker of the effectiveness of a health systems concerning timely access to routine care to prevent further illness and death.

Health service factors and service characteristics were observed in the data set as key determinants of vaccine acceptance. In this SLR, six studies (Letley *et al.*, 2018; Akwataghibe *et al.*, 2019; Vasudevan *et al.*, 2020; Du *et al.*, 2021; Cherian *et al.*, 2022; Ghosh *et al.*, 2022) reported health system factors as a significant factor for vaccine hesitancy.

Akwataghibe *et al.* (2019) carried out a cross-sectional study in Remo-North, Ogun State, Nigeria, using mixed methods, which included a survey of caregivers of 215 children, 25 semi-structured interviews with stakeholders involved in immunisation service delivery, and 16 focus group discussions with community men and women (n = 98). Data was analysed using the SAGE Working Group Vaccine Hesitancy model. Health system factors such as absence of delivery services, shortage of health workers, unavailability of vaccines at scheduled times, and indirect cost of immunisation were identified as direct contributors to the vaccination practice of caregivers, while Vasudevan *et al.* (2020) and Letley *et al.* (2018) mentioned ease of access to booking appointments, child-friendly facilities, reducing waiting times, and rural-urban dichotomy with respect to literacy and access to information as key drivers of vaccine hesitancy.

In terms of health behaviours, a study in India reported that the ease of access to antenatal care promotes positive vaccination behaviour (Cherian *et al.*, 2022), while giving birth at a health facility (Du *et al.*, 2021; Ghosh *et al.*, 2022) is a positive cue for immunisation.

2.10.3 Vaccines and Vaccination-Related Issues

Vaccines or vaccine-specific issues are directly or indirectly related to the VH attitude. Every vaccine has its own production process and problems associated with it. Hence, it is subject to different degrees of hesitancy. There have been doubts about the reliability and constituents of specific vaccines, such as thimerosal, porcine, albumin, or aluminium-based additives (Eldred *et al.*, 2006; Zulkarnain *et al.*, 2021). This theme will include discussion on (i) perceived safety and efficacy, (ii) knowledge/awareness of vaccine-preventable diseases (VPD), (iii) vaccine access, (iv) vaccination schedule, process, and experience, and (v) concern for autism.

2.10.3.1. Perceived Safety and Efficacy

Fourteen studies (Dubé *et al.*, 2016; Blaisdell *et al.*, 2016; Azizi, Kew and Moy, 2017; Letley *et al.*, 2018; Napolitano, D'Alessandro and Angelillo, 2018; Paterson, Chantler and Larson, 2018; Vrdelja *et al.*, 2018; Gorman *et al.*, 2020; Vasudevan *et al.*, 2020; Chung-Delgado, Valdivia Venero and Vu, 2021; Cherian *et al.*, 2022; Ghosh *et al.*, 2022; Isezuo and Adamu, 2022; Sabahelzain *et al.*, 2022a) out of the 32 articles included in this study referred to the issue of perceived safety and efficacy of vaccines as a significant factor that influences the decision to vaccinate by caregivers of eligible children. The concerns are varied, but they all pertain to whether the vaccines are safe for the children and whether they will be effective enough to protect their children from diseases. The fears are expressed as anxiety about vaccine side effects, quality, quantity, and duration and the efficiency and safety of the vaccine.

Three studies in the UK (Blaisdell *et al.*, 2016; Paterson, Chantler and Larson, 2018; Gorman *et al.*, 2020) reported on vaccine-related issues. While Blaisdell *et al.* (2016) and Paterson, Chantler and Larson (2018) were qualitative, Gorman *et al.* (2020,) in a quantitative study carried out in Scotland, involved 128 respondents. The study highlighted concerns about side effects, new vaccines, and the accuracy of professional advice and information sources as predictors of vaccine hesitancy.

The participants in the study of Blaisdell *et al.* (2016) were 42 English-speaking vaccine hesitant parents (VHPs) recruited with a convenience sampling technique. The study employed semi-structured focus group interviews with 42 VHPs to elicit parents' perceptions and thought processes regarding the risks associated with vaccination and non-vaccination, the sources of these perceptions, and their approach to decision-making about vaccination for their children. Participants were provided a \$75 incentive for participation. The study revealed that VHPs engage in various reasoning processes and tend to perceive risks of vaccination as greater than

the risks of VPDs. Likewise, Paterson, Chantler and Larson (2018) carried out a qualitative study in the United Kingdom involving 38 eligible mothers who were recruited using a purposive sampling technique. Information was accessed from the participants through an interview. The study revealed that parents expressed concerns about influenza vaccine effectiveness and vaccine side effects. It should, however, be noted that the provision of monetary incentives in the study by Blaisdell *et al.* (2016) has the ability to introduce a level of bias to the research study.

According to Vasudevan *et al.* (2020), in a mixed study involving a cross-sectional survey (n = 134) and four focus group discussions (FGDs, n = 38) with mothers of children under 2 years of age in a region in Tanzania, mothers participating in FGDs indicated high perceived risk of vaccine-preventable illnesses but expressed concerns related to poor geographic accessibility, unreliability of services, and missed opportunities for vaccinations.

2.10.3.2. Knowledge/awareness of Vaccine-Preventable Diseases

Parental knowledge of vaccine-preventable diseases has been documented in this study as a significant factor for vaccine hesitancy. Ngandjon *et al.* (2022) carried out a quantitative study in Cameroon with the aim of identifying the predictors associated with vaccine acceptance. The study recruited 160 mothers using a simple random sampling technique. A pre-tested structured questionnaire was used to collect information from the participants. Factors such as age-appropriate vaccination, knowledge of vaccine-preventable diseases (VPD), and religion were associated with vaccine acceptance. The study concluded that poor knowledge of VPDs is a matter of concern, as it contributes to vaccine hesitancy. Similar results have been reported by other studies (Azizi, Kew and Moy, 2017; Taylor *et al.*, 2017) that reported on maternal knowledge. All four studies were, however, conducted in Africa (one in Cameroon and three in Nigeria). It was, however, observed that the questions that were used to measure the

knowledge of VPDs were not the same in all the studies. There is a need for a standardised knowledge question on VPDs.

2.10.3.3. Vaccine Access

Access to vaccines is one of the domains in the 5A model of vaccine hesitancy conceptual model. The “convenience” component of the 3C and 5C vaccine hesitancy conceptual model also deals with access. Three studies (Cherian *et al.*, 2022; Price, McColl and Visram, 2022; Sabahelzain *et al.*, 2022a) identified vaccine access as a significant factor in vaccine uptake.

(Price, McColl and Visram, 2022) identified a lack of convenient access to vaccination opportunities in a descriptive qualitative investigation of parents’ perceptions of the barriers and facilitators to flu vaccination for pre-school children. 12 participants were recruited through various communication channels to maximise sample variation. Twelve participants (six with vaccinated children and six whose children were not vaccinated) took part in a semi-structured interview via Zoom. Transcripts were coded using NVivo 12, and data were thematically analysed using the COM-B model of health behaviour change.

2.10.3.4. Vaccination schedule, process and experience

Musa *et al.* (2019) carried out a cross-sectional quantitative study involving 337 participants using the WHO-validated tool of VH and the Parents Attitude towards Childhood Vaccine (PACV) scale. Some of the factors reported as mediators of vaccination behaviour were introduction to a new vaccine and negative past experiences of vaccinations. A study by Cherian *et al.* (2022) revealed that too many doses of vaccine given at once, the mode of vaccine delivery, lack of family support, fear of needles, and potential side effects were concerns raised by respondents. Furthermore, Peretti-Watel *et al.* (2019) reported that some parents routinely repeat the previous vaccination-related decision made for an elder sibling. This may either have a positive or negative effect on vaccine uptake.

Chung-Delgado, Valdivia Venero and Vu (2021) reported the number of vaccines to be administered as a key challenge to parents, while Costa-Pinto *et al.* (2018) stated that parents are concerned about the number of vaccines given in the first 2 years, coupled with apprehension about vaccine ingredients, allergies that may develop, and the potential weakening of the child's immunity.

2.10.3.5. Concern about Autism

As a fallout of the Wakefield scandal, which erroneously linked vaccines with autism in children, as reported by several studies (DeStefano and Chen, 1999; Taylor *et al.*, 1999; Rao and Andrade, 2011; DeStefano and Shimabukuro, 2019), some parents continue to express doubts about the uptake of vaccines because of their potential to cause autism. In the study by Gkentzi *et al.* (2021) on attitudes and beliefs of parents about routine childhood vaccination in Greece, involving 1227 mothers of preschool children, it was reported that doubts still exist in about one-third of the respondents regarding the relationship between vaccines and autism. In the case of the study by Costa-Pinto *et al.* (2018) in Australia, up to 11% of the 3612 respondents mentioned autism as a risk factor for not taking vaccines.

2.10.4. Existential Issues

Existential factors are whatever plays a key role in people's search for what gives their lives meaning (Léonard and Arnsperger, 2009). In this review it was observed that existential considerations involve factors like love for a child (Dubé *et al.*, 2016; Olaniyan, Isiguzo and Hawk, 2021). The existential factor was documented in a community-based qualitative study in Lagos, Nigeria, carried out by Olaniyan, Isiguzo, and Hawk (2021) using a convenience sample of 44 mothers/carers of children under five, 24 community leaders, and 19 healthcare workers (routine immunisation focal persons) working in the primary healthcare setting in Lagos State. The study made use of the Socio-Ecological Model (SEM) to explore caregivers'

immunisation knowledge and their welfare and love for their children. The study revealed that caregivers' welfare and love of children was another individual-level factor that participants described as being important to consider for its role in immunisation, as it could facilitate uptake for people who were aware of the importance of immunisation or act as a barrier for those who had misperceptions about immunisation.

2.11. Discussion of Systematic Literature Review

In this section, the four themes in the findings (individual/group influences, social network, vaccine and vaccination issues, and existential factors) were discussed using the 5C model of vaccine hesitancy as a theoretical framework.

The wide geographical distribution of the 32 studies included in the SLR further attests to the fact that vaccine hesitancy is a global phenomenon that is being addressed globally because of the disruptive effect it can have on global vaccination uptake, as witnessed during the Covid-19 pandemic (Basu *et al.*, 2023; Tanzer *et al.*, 2024). It is also an affirmation of the global response of the research community to the clarion call by WHO for a collective effort on context-specific knowledge production on vaccine hesitancy. Also, the heterogeneity and non-uniformity of the data tools used in all the articles concerning survey instrument development, method of data collection, and whether the questionnaire was standardised or not made synthesis or comparison of findings a challenge, thereby increasing the risk of bias.

Individual/Group Influences

The “individual/group influences” took into account the aspects that are unique to an individual since vaccination is ultimately an individual choice, and parents and caregivers taking vaccination decisions for their children involves individual-level decision-making (Baldwin, Tiro and Zimet, 2023). Individual or group influences are influences arising from personal perception of the vaccines or influences of the social and peer environment (MacDonald, 2015).

The effect of family size and family types as predictors of vaccine hesitancy was explored through the prism of the 5C model. Families with a large family size were “constrained” and are more likely not to complete the immunisation schedule because large family size might affect the mothers’ ability to care for the younger children (Sabahelzain *et al.*, 2022c). Large family size reduces the “convenience” available to mothers since such mothers might not have enough time to travel for immunisation (Girmay and Dadi, 2019). Furthermore, large family size poses a challenge to resource-poor families, as larger families consume more resources, thereby impacting their livelihoods negatively. Furthermore, when household income is limited in poor communities, resources are rationed, and there is greater “calculation” (deliberation) in the choice of actions to be taken. Greater emphasis is always on meeting dietary needs, so activities or expenditures lacking obvious and immediate benefit to their livelihood are often deprioritized. This scenario is particularly prominent in low-income countries such as Ethiopia, The Gambia, and Nigeria, where the birth rate and family size tend to be very high as a result of widespread desire for large families (Bongaarts, 2020). This situation was captured as “carer’s time constraints” in a systematic literature review by Périères *et al.* (2022), revealing that a large family size has a negative effect on vaccination status, while a nuclear family (which is generally small) also has a negative effect on vaccination status. This finding brings up a contradiction and highlights the complexity involved in issues of vaccination. The contradictions in the findings provide a cogent basis for future research to examine the effect of the complex interactions between family size and type of family on vaccine uptake and hesitancy.

The effect of maternal age on vaccine hesitancy was mixed. While young mothers were reported to be more prone to be vaccine hesitant in some studies, hesitancy increases with increasing maternal age in some other studies. A study by Dubé *et al.* (2015) confirmed this observation that primiparous mothers were more likely to be vaccine hesitant than other

categories of mothers. Likewise, a qualitative study by Omobowale, Amodu and Amodu (2023) involving young mothers in Ibadan, Nigeria, explained that many adolescent and young mothers are faced with other challenges that are not health related, and immunising their wards does not top their priority list, thereby resulting in a high incidence of non- or under-vaccinated children among young mothers. They explained that the young mothers find it difficult to attend conventional immunisation centres due to stigmatisation, subtle hostility, and embarrassment they experienced during pregnancy and after in some of these centres. Applying the 5C framework of vaccine hesitancy to this situation will reveal that as the barriers (constraints) to immunisation increase for these young mothers, vaccination becomes increasingly not convenient for them. To change the vaccination behaviours of young mothers, accessing vaccination must be made more convenient while all constraints are removed. Parental knowledge of vaccine-preventable diseases was documented as a significant factor for vaccine hesitancy, and poor knowledge of VPDs contributes to vaccine hesitancy. This hypothesis is similar to the outcomes of Dubé *et al.*(2016), that vaccination knowledge promotes “confidence”. When a caregiver is confident about the importance, safety, and efficacy of a vaccine, there is a greater likelihood of uptake (Durkin *et al.*, 2023). The level of education of caregivers is also related to their vaccination knowledge, and it is a key factor for determining the likelihood of the acceptance of vaccination by caregivers of children under five (Mora and Trapero-Bertran, 2018). The education-vaccine hesitancy paradox identified in this SLR is two out of the five relationships possible between education and vaccine hesitancy. The complexity of vaccine hesitancy is shown due to the five relationships between educational level and vaccine hesitancy reported in this systematic literature review. When education fosters strong vaccination knowledge, it implies that there is “confidence” in the vaccines. Also, caregivers with high education are more likely to seek for vaccination information, demonstrating a degree of “calculation” before a vaccination decision is taken. When such an endeavour leads to

vaccination knowledge, there is reduced or no hesitancy, and if it brings out doubts, hesitancy decreases. Hence, all five relationships are feasible when deconstructed using the 5C framework of vaccine hesitancy. This observation is not, however, an isolated finding. Labbé *et al.* (2025) reported that education can have both positive and negative effects on vaccine hesitancy status. They posit that while education tends to reduce the degree of hesitancy in some people, it was revealed that education only promotes vaccine hesitancy in people that are not just hesitant but resistant. Similar outcomes have also been reported in other previous SLRs (Schellenberg and Crizzle, 2020; Balgovind and Mohammadnezhad, 2022; Mavundza, Cooper and Wiysonge, 2023).

Generally, the socioeconomic status of parents has been reported as a predictor of vaccine hesitancy in previous systematic literature reviews (Bangura *et al.*, 2020). The observation that the rising level of perceived economic hardship is a predictor of hesitancy as reported by Bertoncello *et al.* (2020) in this SLR may be linked with the issue of “convenience” as it affects vaccine uptake. Accessibility as a component of convenience may be hindered when there is economic hardship, as caregivers may not be able to afford transportation fees or access vaccination, leading to structural exclusion from the vaccination programme. This type of scenario plays out in low-income countries like Nigeria. There may be a likelihood that different forms of non-compliance emerged in different socio-economic settings. Vaccination uptake in rural communities may have been “constrained” by poverty and illiteracy, which inhibited household access to information and rendered families more susceptible to vaccine rumours and fears (Taylor *et al.*, 2017; Pugliese-Garcia *et al.*, 2018; Ojo *et al.*, 2023). However, urban non-compliance may also have been shaped by access to a wider range of information leading to “calculation” and “complacency”. This again depicts the complexity and context specificity of vaccine hesitancy and the need for further study. It is also noted that the notion of social class was not used by any of the studies in the SLR to frame the impact of

socioeconomic factors on vaccination decisions. Glassman and Szymczak (2022) argued that drawing on the notion of social class can help illuminate how and why parents of different social statuses may experience vaccine decision-making in distinct ways. Socioeconomic status is typically defined by a combination of one's financial income and level of education and occupation. However, beyond socioeconomic status, social class is a marker of one's positioning within society related to one's socioeconomic status and is often thought of as a culture that carries with it group membership, norms, and socialisation patterns (Deutsch, 2017). Glassman and Szymczak (2022) explained that social class is important because it incorporates a degree of analytical complexity that is missed in discussions of socioeconomic status (SES). In the qualitative study carried out in the USA by Glassman and Szymczak (2022) to elicit a narrative of mothers' medical decision-making in the context of their social and family backgrounds, they found that social class may be one factor shaping the experience of vaccine hesitancy by impacting mothers' relationships with institutional authorities that they perceive as having more or less power in their decision-making.

Societal Factors (Contextual Issues)

According to Rodgers *et al.* (2025), context include socioeconomic, cultural, and environmental factors and it plays a critical role in establishing how interventions achieve impact, why outcomes can vary and whether the interventions of interest can be translated from one context to another. Hence, a grounded understanding of the contextual factors influencing an issue of public health importance is vital.

In this SLR, the source of vaccination information is the context under which the caregiver will take a vaccination decision. The channel through which caregivers receive vaccination information is strategic for vaccination uptake. For example, caregivers got vaccination information from a multiplicity of sources. Some mothers still seek information about

vaccination from friends within their own close social networks in conformity with the practice in Southeast Asian countries (Stuetzle *et al.*, 2025). However, those who obtained vaccination information from professional information sources such as healthcare providers had significantly higher odds of being confident about the safety of vaccines and lower odds of being hesitant toward vaccination than those who did not. Similarly, caregivers who reported the social media as a primary information source had significantly higher odds of being hesitant toward vaccination than those who did not. Beyond the source of vaccination information, caregivers must have the agency to process information so as to take the right vaccination decision. Agency in this context refers to a caregiver's capacity to make informed decisions about vaccinations based on their understanding of relevant information, which is influenced by the quality of communication from healthcare providers, accessibility of vaccine information, personal beliefs and attitudes, and their ability to critically evaluate information from diverse sources, all embedded within a process of social engagement (Wagner *et al.*, 2024). For instance, despite the high level of trust in healthcare providers, parents still have doubts about the safety and risks associated with vaccination. The scenarios above reiterate the issue of confidence with vaccination based on how and where caregivers access information on vaccination and the degree of “calculation” deployed in processing the information. This further highlights the complexity of vaccine hesitancy as a behaviour and the need to explore this through further research.

Similar to other previous SLRs (Schellenberg and Crizzle, 2020; Stuetzle *et al.*, 2025), the findings show that trust is an important factor in vaccine uptake. Trust in this review is conceived from five perspectives, which jointly or severally influence vaccine hesitancy. This covers trust in the information provided about vaccines by paediatricians and other health workers (Glanz *et al.*, 2013), distrust of traditional scientific evidence such as several narratives around vaccinations (Ward *et al.*, 2017), lack of mutual trust between service seekers and

service providers (Paul *et al.*, 2022), distrust of the pharmaceutical industry, and distrust of health systems and providers (Musa *et al.*, 2019). However, trust can also be exhibited as a mistrust of government programmes and policies (Stuetzle *et al.*, 2025). This condition often exists when citizens do not believe in the legitimacy of the government. Nurmi and Jakoola (2023) explained that lack of trust in institutions that develop and promote vaccines is often understood as the problem of vaccine-hesitant individuals when addressing vaccine hesitancy in social research and in public health policy discourses. Addressing this issue in Africa, Stoop *et al.* (2021), having established that child vaccination rates in Africa are considerably lower in areas in which the local population displays high levels of mistrust towards local authorities, advised that local authorities must be empowered with resources and communication strategies to address institutional mistrust by building the confidence of local people in their institutions since trust inspires “confidence” while confidence promotes vaccine uptake.

Predicated on the potential impact of trust on vaccination uptake, Schellenberg and Crizzle (2020) advised that future studies should further examine the association between trust and vaccine uptake to determine the nature of the association, as this knowledge may help in tailoring behavioural change messages to caregivers. According to Olson, Berry and Kumar (2020), trust-based interventions should target parents early in pregnancy and target first-time mothers and parents, taking advantage of prenatal appointments and the first postnatal appointment since this is the time when parents form the opinion that shapes their final vaccination decision.

Faith, reasons and social norms were highlighted as reasons for vaccine refusal and hesitancy in some of the studies on the basis of the constituents of vaccines, particularly the raw materials used for vaccine production, such as porcine and non-halal ingredients of vaccines (Kibongani Volet *et al.*, 2022), facilitated by the teachings and beliefs of various religious groups (Jinarong *et al.*, 2023). The spread of such studies (US, UK, Nigeria, Cameroon) showed that the effect

of religion was not limited only to low- and middle-income countries. There was a consensus that stronger religious affiliations and philosophical beliefs and belonging to some religious group predicted more negative attitudes toward the uptake of vaccines. The association between social norms and vaccination intention observed in some of the papers in the SLR was ambivalent. While there was no evidence of group effect on vaccine hesitancy as a result of cultural norms or religious inclination in some, group beliefs about vaccination within some other community social networks hindered vaccine uptake. The mechanism and processes through which religion and culture and social norms exert influence on vaccination behaviour were, however, not explained in any of the articles reviewed. Therefore, the effect of religion, culture, and social norms on vaccine hesitancy should be explored in future study.

Another key determinant of vaccine hesitancy identified in the SLR was health system factors. It has been shown that better health system engagement was positively associated with vaccine uptake, confidence, and intent, although the strength of these associations varied across countries (Arsenault *et al.*, 2025). Health service factors and service characteristics were observed in the data set to be a key determinant of vaccine acceptance. Seven studies reported health system factors as a significant factor for vaccine hesitancy compared to only three articles in the SLR conducted by (Balgovind and Mohammadnezhad, 2022), while none made such reference in the study by (Stuetzle *et al.*, 2025). Most of the factors identified in this SLR as direct contributors to the vaccination practice of caregivers (absence of delivery services, shortage of health workers, unavailability of vaccines at scheduled time, and indirect cost of immunisation) and key drivers of vaccine hesitancy (ease of access to booking appointments, child-friendly facilities, reduced waiting times, access to information, ease of access to antenatal care) converge with the health systems factors reported by Balgovind and Mohammadnezhad (2022). The commonality in findings between both reviews with respect to

health system influence points to the fact that health system strengthening is an urgent requirement if vaccine hesitancy is to be reduced.

Vaccines and Vaccination-Related Issues

Concerns about vaccine safety were the most dominant issue in the studies included in the SLR. This was a common theme in virtually all the articles. There have been doubts about the reliability and constituents of specific vaccines fuelled by religious considerations and healthism (Mendonça and Hilário, 2023; Uğrak *et al.*, 2025). When religious groups boycott vaccination, they do so with a sense of “collective responsibility”, which is, however, negative to vaccine uptake. The fears are expressed as anxiety about vaccine side effects, quality, quantity, doses, efficiency, and safety of vaccines. Parents wear several lenses when viewing the issue of vaccines. They rationalise (calculate) vaccination outcomes, and they are stuck between the viewpoint of whether the infectious disease is severe enough to warrant the taking of a vaccine by their children or whether their children will be susceptible to the infectious disease if they do not accept a vaccine for them, and the concern may also be on the cost-benefit analysis of immunisation. Hence, it is a balancing act where the caregivers want to take a decision that will be favourable to their wards. “Confidence” in the vaccines and vaccination programme will, however, tilt the balance in favour of vaccine uptake. This shows in no small measure that confidence in the vaccines and vaccination programme is a key requirement for a successful vaccination programme. It should be noted that concerns about the process of vaccine administration encompassing the mode of vaccine delivery, fear of needles and potential side effects, anxiety on introduction to a new vaccine, negative past experiences of vaccinations, too many doses of vaccine given at once, apprehension on allergies that may develop and the potential weakening of the child’s immunity, and misconceptions caused by the Wakefield saga with the erroneous linkage of MMR vaccines to autism in children are all products of lack of confidence and proper communication.

Existential Crisis and Paradox

Existentialism is a philosophy centred on the belief that there's no inherent, predetermined meaning to life; instead, individuals are responsible for creating their own meaning and purpose through their choices, actions, and experiences. The concepts of freedom, responsibility, meaning, and authenticity are core constructs of existentialism (Aho, 2025) and are important in parental vaccination decision-making. According to Damnjanović *et al.* (2018), freedom, perception of danger (responsibility and meaning), and choice (authenticity) are correlates of intention to vaccinate. Caregivers' affection for their children can be a significant determinant of parental vaccination behaviour, but this attribute may either be a driver or a barrier to vaccine uptake. When viewed from the perspective of the benefit of vaccinating a child, a parent will ensure that the child is vaccinated fully. Conversely, if the lens is focusing on doubts concerning vaccine safety, parents may decline or hesitate to vaccinate their child, and thus it manifests as a barrier. In essence, for many parents, immunisation remains an emotional issue since choosing to vaccinate is an action that involves a deliberate intervention involving the child (Hamama-Raz, Ginossar-David and Ben-Ezra, 2016). The love or anxiety that a parent displays prior to the immunisation of a child may involve personal fear of needles, which is translated to the child; concern about the safety and efficacy of vaccines; and the risk and regret of the child contacting an illness that could have been prevented through vaccination. Hence, a vaccination decision to accept or reject a vaccine is an act of existential “responsibility” taken by the parent/carer to achieve the “freedom” necessary for release from the anxiety that accompanies the vaccination of the child. Having found “meaning” in the decision to be taken, parents, because of the affection for their children, will proceed to achieve “authenticity” by taking actions congruent with their values and desires, despite external pressures of social conformity. Therefore, the action or inaction of the parent toward vaccination becomes an existential paradox, which might result in feelings of regret both ways. According to Hamama-

Raz, Ginossar-David and Ben-Ezra (2016), parental attitudes toward vaccines and anticipated regret have a salient role when deciding whether or not to vaccinate children and contribute to the prediction of regret regarding vaccination. The existential actions taken by parents could also be manifestations of coping strategies used to master, tolerate, or minimise stressful events. The observation of Toth (2020), that parents who decide not to vaccinate their children display the identity of a rational, responsible, loving parent through expressions such as “I will not risk the love of my life”, is also part of the existential dilemma confronting parents when it comes to taking a vaccination decision about their child. Damnjanović et al. (2018) argued that since the decision to vaccinate is a socially forced choice that concerns a child's health, parents are circumspect and attach high importance to the vaccination decision. They further stressed that this dilemma may cause parents to overemphasise the potential side effects to the disadvantage of the benefits of vaccines. The state of the parent's health may also limit access to vaccinations for the child. Parental absence, due to physical unavailability such as being in the custody of law enforcement agents, reduced cognitive ability deriving from mental health problems, and physical disability, curtail the opportunity for such parents to express their parental feelings and take appropriate timely vaccination decision for the child. When a caregiver is not available to make the vaccination decision, the government should be able to assume authority for vaccination decisions for such a child, just like those who are in care.

In previous SLRs (Larson *et al.*, 2018; Balgovind and Mohammadnezhad, 2022; Obohwemu, Christie-de Jong and Ling, 2022; Mavundza, Cooper and Wiysonge, 2023; Bussink-Voorend *et al.*, 2025), the construct of love for the child was not identified as a determinant of vaccine hesitancy. This systematic literature review has led to the identification of the domain designated as “Existential issues”, which captures welfare and concern for the child with the construct “love and affection for the child” (Olaniyan, Isiguzo and Hawk, 2021). This was not

highlighted in previous systematic literature reviews. It is my expectation that this area will be properly explored with the focus group discussion in my primary research.

2.12. Limitation of the Systematic Literature Review

This review has some limitations that should be considered when interpreting results:

- I) The protocol of this systematic review was not registered.
- II) Only articles published in English were included in the analysis, and this might have led to an under-representation of findings from certain countries.
- III) A potential bias in the selection of studies is probable and cannot be completely ruled out, even though selection was reviewed by my supervisors. This may be due to non-identification of all available studies and bias applying the inclusion/exclusion guideline. Furthermore, grey literature was not screened. This bias was mitigated through a transparent reporting of the selection process by documenting the number of studies screened, assessed for eligibility, and included in the review using a PRISMA flowchart (Appendix2.3)

2.13. Conclusion

The aims, objectives, and research questions of my primary study are informed by the findings from this systematic literature review and the research gap identified. The gaps were on the basis of the study design and location of study and the gaps evident after the analyses of the four themes identified from reviewing the 32 studies (individual/group influences, contextual issues, vaccine- and vaccination-related issues, and existential issues).

Choice of research design

The study design and tool for data collection in the SLR was diverse. Only a few (less than 12% [n=4]) of the studies used a validated questionnaire. A validated questionnaire is a research tool that has been subjected to rigorous scientific testing for validity and reliability

(Ranganathan, Caduff and Frampton, 2024). Validity pertains to accuracy and it indicates that the questionnaire measures what it claims to measure while reliability centres on consistency meaning that the questionnaire yields consistent results time and time again when administered repeatedly even by different researchers. According to Koo and Yang (2025), the use of a validated questionnaire enhances comparability across studies, which strengthens both the generalizability and credibility of findings. Furthermore, it promotes time and resource savings. Likewise, only a few of the studies employed mixed methods approach despite its usefulness in answering complex questions in health (Draucker *et al.*, 2020) while revealing a more comprehensive information and insight on a phenomenon like vaccine hesitancy. Bearing in mind that a questionnaire cannot probe or ask additional questions about the perceptions, reasons, and experiences of the participants regarding vaccine uptake, collection of additional data using interviews and focus groups will compensate for some of the limitations in the findings. According to Greyson and Bettinger (2022), both quantitative and qualitative research have contributed to the characterisation of vaccine hesitancy and understanding of vaccine decision-making processes and trajectories. Hence, it is posited that the use of mixed methods in researching complex interventions is likely to enhance the overall quality of the evidence base. The four studies that made use of a mixed methods approach in the systematic literature review used a multiplicity of study designs and none used the explanatory sequential design. Akwataghibe *et al.* (2019) used a convergent (concurrent) mixed methods design where the quantitative and qualitative data were collected in parallel, within the same time frame. The other three studies (Glanz *et al.*, 2013; Letley *et al.*, 2018b; Vasudevan *et al.*, 2020) used an exploratory mixed methods designs starting with the qualitative phase and on the basis of findings from the focus groups/interviews with key informants/stakeholders, a survey was developed and used for the quantitative phase. The mixed methods sequential explanatory design consists of two distinct phases: quantitative followed by qualitative (Creswell, 2003).

In this design, a researcher first collects and analyses the quantitative (numeric) data which determine relationships or effects such as prevalence and determinants/predictors of a phenomenon, and followed by the qualitative (text). The qualitative data help to explain the statistical results of the quantitative study by exploring participants' views on vaccine hesitancy in more depth by expanding the quantitative results (Draucker *et al.*, 2020). The rationale for this approach is that the quantitative data and their subsequent analysis provide a general understanding of the research problem (Subedi, 2016). It is used when there is no need to develop a questionnaire for the quantitative phase particularly when an existing validated questionnaire is to be used. The explanatory sequential design strengthens research by offering both numerical precision and rich, detailed narratives which enhances the depth and applicability of findings. Furthermore, the outcome can easily be compared with other studies that used the same questionnaire.

Therefore, the gap identified was that no study has been conducted on vaccine hesitancy in caregivers of under-fives in Akure South LGA, Ondo State, located in the south-western part of Nigeria, using a sequential explanatory mixed-method approach. Predicated on the outcome of this systematic literature review, there is the need to study why some parents/caregivers exhibit vaccine hesitancy in my study location in Southwest, Nigeria, using the previously validated VHS and PACV survey tools, which have not been used before to study vaccine hesitancy in the study location. It is also my conviction that the use of a mixed-method research design will provide new understanding into the vaccine hesitancy paradigm. Therefore, a mixed-methods study employing a validated questionnaire will be conducted in the chosen study location with the aim to determine the predictors of vaccine hesitancy in caregivers of children under five in this community.

Research Questions 1

Sociodemographic characteristics: Are caregivers' sociodemographic statuses associated with parental vaccine hesitancy?

Individual/group influences which encompasses sociodemographic factors (family size, nature of family, maternal age, level of education, socioeconomic status, and employment status leading to vaccination being a low priority for busy parents), were associated with one form of vaccine hesitancy or the other. However, it was not shown how and to what extent a particular variable will be able to influence vaccination behaviour across a population. My primary study will explore this gap through the first research question and seek to determine the role and association of sociodemographic characteristic of caregivers in the study location with vaccine refusal, hesitancy, and vaccination behaviour.

Research Questions 2

Knowledge of vaccine/vaccination: To what extent does a caregiver's knowledge of vaccine-preventable disease (VPD) and vaccination schedule influence their vaccine hesitancy?

Research Questions 3

Attitude/Perception: Are caregivers' attitudes and beliefs about vaccination associated with parental vaccine hesitancy?

The contextual issues are modifiable variables that can be controlled in research. Although many of the articles in the SLR alluded to an association between contextual variables such as parental knowledge about vaccines and vaccination, parental attitude and beliefs about vaccines/vaccination, source of vaccination information, concept of social norms, parental trust in vaccination programme, cultural and faith induced vaccination behaviour, and health system available to deliver the vaccination programme, majority did not establish or test a statistical

relationship between the modifiable variables and vaccine hesitancy. There is the need to test the strength of association between the categorical variables (mostly sociodemographic factors) and the modifiable variables and the impact of the relationship on vaccine hesitancy. Furthermore, it is imperative to explore the effect of existential factors on parental attitude and subsequent vaccination behaviour. These gaps will be addressed in my primary study through the second and third research questions.

Research question 4

Practice: Does caregivers' vaccine hesitancy status determine parental intention to vaccinate and caregivers' vaccination behaviour?

Research question 5

Mediation: Do any of the independent variables mediate the effect of parental vaccine hesitancy on caregivers' vaccination behaviour?

It was observed that none of the reviewed article linked parental intention to vaccinate and caregivers' vaccination behaviour. In addition, there was no attempt to establish a statistical relationship between intention to vaccinate and vaccination behaviour (vaccine uptake or vaccine refusal). Also, none of the articles included in the SLR attempted to explain how and the mechanism through which the independent variable mediates the impact of vaccine hesitancy on vaccination practice. This gap will be addressed through the fourth and fifth research questions.

Insights into the questions will be provided through a research approach that will explore the subject area properly from all angles by not only answering how many or how much but also the reason for framing vaccine hesitancy and refusal behaviour amongst the study population.

Furthermore, considering the context of the research from the viewpoint of my positionality as a clinician who had attended to children that presented with vaccine preventable diseases at children welfare clinic, and the deep social-cultural leanings of the target participants in the study area further provides a compelling need for the research to be carried out at the study location in south western Nigeria.

2.14. Chapter Summary

A preview of existing information on vaccine hesitancy globally and in Nigeria has been carried out through a systematic literature review executed using the PRISMA protocol. The findings from the 32 studies included in the review were arranged under four themes. These were individual/group influences, contextual issues, vaccine- and vaccination-related issues, and existential issues, a domain newly identified by the researcher. The outcome of the SLR was used to streamline the aims and objectives of the subsequent primary study. The research questions were developed in line with the gaps.

In the next chapter (chapter 3), theories, conceptual frameworks, and models that are utilised in shaping health research were explored, and their importance, strength, and limitations were highlighted, focusing on their usefulness in guiding the choice of questionnaires, research design, and discussion of the findings.

Chapter Three: Conceptual Framework on Vaccine Hesitancy.

3.0 Introduction

Theories provide the underlying reason for the occurrence of a phenomenon by explaining the key drivers, and the underlying processes responsible for causing the phenomenon (Beyera, O'Brien and Campbell, 2022). The philosophy of science considers theories as families of models and that they provide a general representation of an entire class of phenomena (Fuhse, 2022). Models on the other hand provide guidance to a research project and assist in visualising the structural framework of causal pathways by showing the different levels of analysis (Beyera, O'Brien and Campbell, 2022). Theoretical models of health beliefs are essential tools for understanding the rationale behind the decision-making process that underpins the adoption of a specific health-related behaviour (Shmueli, 2021). A theory can also be viewed as a big idea that embodies many other ideas or concepts (Collins and Stockton, 2018), and cannot be described as right or wrong and vary in their relevance to inquiries (Beyera, O'Brien and Campbell, 2022). Hence, when a researcher uses multiple models for the study of a phenomenon, the subject is seen from multiple angles that allows a distinct but more complete understanding of the phenomenon or research questions, and thereby enriching the quality of the knowledge produced.

3.1. Overview of the models used in this research.

The discussion of the findings in this study was facilitated using multiple models that were previously deployed for the study of vaccine hesitancy. While a single model or conceptual framework can be used to study a concept, there are several research endeavours in which the research design was framed using multiple theories /models (Romate, Rajkumar and Greeshma, 2022; Aggarwal *et al.*, 2024; Sharma, Awan and Kapukotuwa, 2024). The advantage of using multiple models is that a high predictive power is achieved while facilitating a more

comprehensive understanding of how health behaviours are formed (Romate, Rajkumar and Greeshma, 2022; Fang *et al.*, 2025). In line with this, Lisciandra and Johannes (2021), posit that different models can represent the same target system in different but fundamentally compatible ways. Beyera, O'Brien and Campbell (2022) referred to combination of two or more theories in a given research project as theoretical triangulation and stated that it increases the validity of the study outcomes. In this research, the data collection was framed using the WHO SAGE questionnaires developed based on the constructs of the 3C, 5C and 5A models of vaccine hesitancy. The discussion of findings was done using a number of theories, including the Health Belief Model (HBM), the Capability, Opportunity, and Motivation (COM-B) model, the PEN-3 cultural model, the Social Cohesion Theory (SCT), and the 3C, 5C, and 5A models of vaccine hesitancy. These models were used because of their alignment with specific constructs in the results, ensuring a more nuanced interpretation of the findings. Furthermore, employing an integrative multi-model approach provided a comprehensive analytical framework, thereby mitigating the inherent limitations of any single theoretical model. The narrative description of each model outlines its suitability for appraising the findings in this study.

3.2. The Health Belief Model (HBM)

The health belief model (HBM) is a dynamic framework within the expectancy-value theory (Taflinger and Sattler, 2024) for guiding health promotion and illness prevention initiatives (Devi *et al.*, 2022) and for predicting the behavioural reaction to health interventions (Coulson *et al.*, 2016). It is composed of six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (Alyafei and Easton-Carr, 2025). Each of the individual constructs, or in combination, can theoretically be used to predict the likelihood that a behaviour change will occur (Alhamad and Donyai, 2021).

The HBM revolves round three pivots consisting of individual perceptions, modifying factors, and likelihood of action (Appau *et al.*, 2024). Individual perceptions are factors that affect the perception of illness or disease, including perceived susceptibility and perceived severity. The modifying factors are perceived threat and cues to action. The third category is the likelihood of intended action occurring consisting of perceived benefits and perceived barriers. Finally, the combination of these domains causes a response that often manifests into action. For change to occur, individuals must feel motivated to act based on their perceived susceptibility to and severity of the health treatment, their positive interactions with cues to action, and the understanding that the benefits outweigh the barriers (Alyafei and Easton-Carr, 2025). Figure 3:1 is a schematic representation of the constructs of the Health Belief Model.

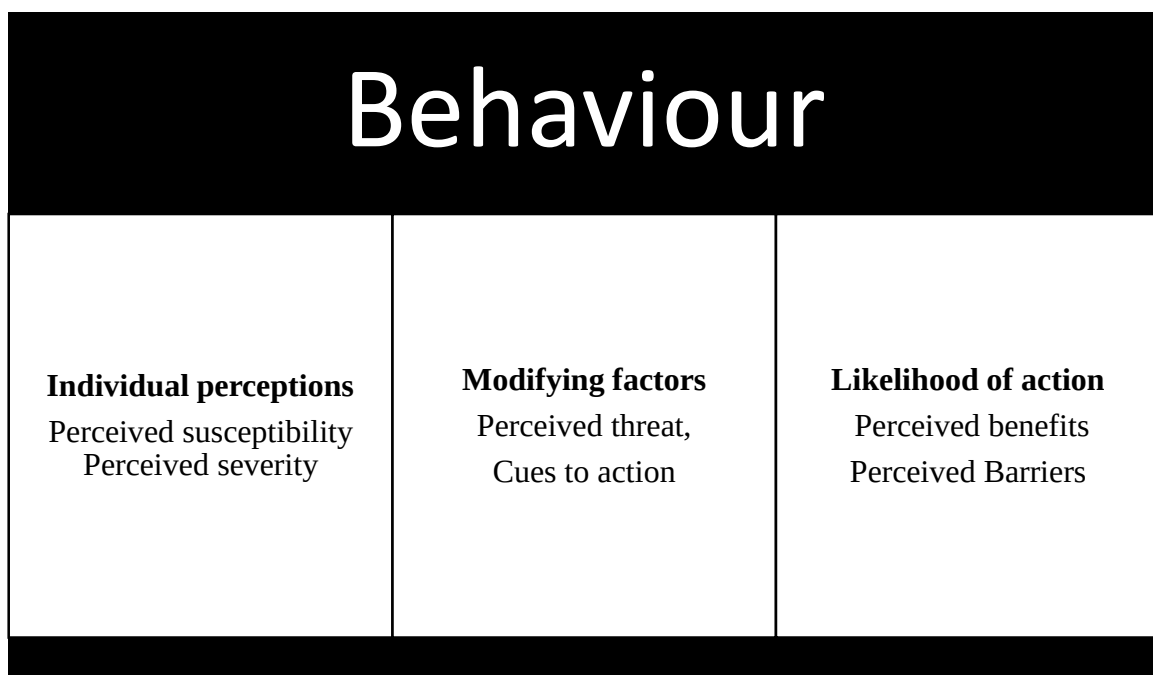


Figure 30.1: Schematic diagram on the constructs of the Health Belief Model.

(Developed by the author)

The weaknesses of the health belief model (HBM) include its weak predictive power and poor construct definition (Alhamad and Donyai, 2021) since the core constructs of the model

(perceived susceptibility, severity, benefits, and barriers) often account for only a small, limited amount of variance (sometimes less than 20–30%) in predicting whether an individual will actually adopt a specific health behaviour and therefore struggles to predict when or if they will act (Carpenter, 2010; Orji, Vassileva and Mandryk, 2012).

The HBM is the most common theoretical model in health research (Fang *et al.*, 2025), and has been widely used in the context of vaccination. The model's versatility is demonstrated by its application in several vaccination studies including the assessment of maternal response to measles vaccinations (Grinberg and Sela, 2021), parents' adherence to childhood immunisation (Hobani and Alhalal, 2022), vaccine hesitancy and routine immunisation (Kiran *et al.*, 2024), and influenza vaccination acceptance (Gu *et al.*, 2023; Peng *et al.*, 2024). Such a broad empirical foundation makes it a desirable model for studying vaccination uptake in children. Consequently, the model will be employed to explain the significance of the findings regarding vaccine knowledge and hesitancy in this study.

3.3. COM-B Model

The Capability, Opportunity, and Motivation (COM-B) model suggests that a specific behaviour or behaviour change is more likely to occur when the capability and opportunity are present and there is some form of motivation to perform that behaviour (Yeo *et al.*, 2022). Capability is defined as an individual's physical (e.g., ability or strength) and psychological (e.g., knowledge, memory) capacity to engage in the behaviour (Pitt *et al.*, 2024), including self-efficacy, and opportunity is the environment that enables the behaviour, such as time, resources, and social nudges. Patterson *et al.* (2023) explained that motivation focuses on perceived benefits and value derived from the behaviour. The COM-B model has a broad perspective and a comprehensive framework for analysis that includes both individual and context determinants of behaviour (Habersaat and Jackson, 2020). The weaknesses of the

COM-B model can be summarised in two main points. Firstly, the COM-B model lacks the predictive power to predict specific outcomes. COM-B can help to diagnose the factors that influence behaviour but cannot provide specific predictions about how or why these factors interact to lead to behaviour change in a given context. Hence, the COM-B model is more of a diagnostic tool than a predictive theory since it can help to determine the level to focus intervention so as to achieve a behavioural change (Boyd *et al.*, 2020). The COM-B model is most effective when practitioners need a flexible and adaptable approach, where the goal is to identify broad drivers of behaviour quickly. For the purposes of this study, the COM-B will be used to explain the behaviour of vaccine refusers in the study area.

3.4. The PEN-3 cultural model

The PEN-3 cultural model is a health promotion model designed to explain the role of culture in health assessment and intervention (Iwelunmor, Newsome and Airhihenbuwa, 2015). Most health promotion models focus on the individual and the psychological determinants of health, while the PEN-3 model emphasises the contextual and socio-cultural factors that define health structures (Opara, Bassendowski and Petrucka, 2024). The PEN-3 model encourages an in-depth exploration of people's cultural settings and how such contexts influence their health beliefs and practices. It has three domains, namely “Cultural Identity”, “Relationships and Expectations”, and “Cultural Empowerment” (Iwelunmor, Newsome and Airhihenbuwa, 2015). Also, each of the domain has three factors corresponding to the “PEN” acronym. With the cultural empowerment domain, health issues are investigated by exploring positive beliefs and practices, evaluating existential values and beliefs, placing emphasis on those without any detrimental health effects, and then identifying negative health practices that serve as obstacles (Iwelunmor, Newsome and Airhihenbuwa, 2015). The PEN-3 cultural model has predictive capability and has been used in the prediction of cervical cancer screening (CCS) behaviour (Dadipoor *et al.*, 2023). Within the context of this study, the relevant domain for the

explanation of the contribution of culture, traditional practices and spirituality to vaccine hesitancy is the Cultural Empowerment domain and its corresponding *Positive, Existential and Negative* constructs. This will be used to explain the influence of culture and religion on vaccine hesitancy in this study. Specifically, cultural and traditional beliefs of caregivers will be framed using the cultural empowerment domain of the PEN-3 cultural model to gain an in-depth understanding of how culturally inclined lived experiences of caregivers may either reinforce vaccine hesitancy or, conversely, provide culturally grounded pathways to improve vaccine uptake.

3.5. Social Cohesion Theory

Social cohesion can be defined as a process of developing well-being, a sense of belonging, and voluntary social participation within a community that promote a multiplicity of values and cultures in an atmosphere where equal rights and opportunities are guaranteed (Fonseca, Lukosch and Brazier, 2019). Social cohesion, according to Larsen *et al.* (2020), is the glue that binds societies, and an essential ingredient to address common societal challenges. The concept is also regarded by Moustakas (2023) as collective attributes and behaviours characterised by positive social relations, a sense of identification or belonging, and an orientation towards the common good.

The concept of social cohesion is complex and influenced by diverse considerations, such as group dynamics, individual traits, and trust in institutions (Sahharon, Bolong and Omar, 2023). For social cohesion to exist, individuals need to have motives to want to belong to a group or a society, which stem from the cognitive beliefs they have (Allen *et al.*, 2022). Though social cohesion is an independent quality of social entities, it is essentially forged by the behaviours and attitudes of individuals (Larsen *et al.*, 2020). Social cohesion theory has three core dimensions consisting of social relations, connectedness, and common good (Larsen *et al.*,

2020; Moustakas, 2023). The social relations domain relates to social networks, trust in people and acceptance of diversity, while connectedness centres on notions of identification, trust in institutions and perception of fairness (Neumann *et al.*, 2023). The third pillar focuses on common good, and it encompasses ideas of solidarity, helpfulness, respect for social rules and civic participation (Moustakas, 2023). Social cohesion can be deployed to galvanise positive population response during societal crises or when there is a need for a collective action such as achieving herd immunity, making it an essential precondition of communal life (Neumann *et al.*, 2023). This theory will be used to explain the findings on how community and social networks influence vaccine hesitancy.

3.6. The 5A model

The 5As model was a systematic taxonomy for the diagnosis of the causes of vaccination coverage gap and a non-socio-demographic template for the design of interventions to promote vaccine uptake (Thomson, Robinson and Vallée-Tourangeau, 2016). The model was developed through the review of forty-three studies and the factors identified were grouped into five dimensions, which consist of accessibility, affordability, awareness, acceptance, and activation. Thomson, Robinson and Vallée-Tourangeau (2016) outlined the five dimensions as follows:

- accessibility as the ability of individuals to be reached by or to reach the recommended vaccines;
- affordability captures the ability of individuals to afford the vaccine, both from financial and non-financial aspects;
- awareness is the degree to which individuals have knowledge of the need for the vaccine and the vaccine's objective benefits and risks;

- acceptance centres on the degree to which individuals accept, question, or refuse the vaccine; and
- activation represents the health system's arrangement to ensure that individuals are nudged toward vaccination uptake through regularity of reminders to individuals, families, and communities to vaccinate (Agboh and Yarney, 2025).

According to Dubé *et al.* (2021), the 5A vaccine hesitancy model can facilitate an understanding of the complex structural, organisational, sociocultural, and individual factors influencing vaccine uptake. The 5A model has been used in a variety of contexts to frame exploration of different dimensions of vaccination programmes. These include, but are not limited to, a qualitative longitudinal study to understand immunisation barriers and optimise uptake of the malaria vaccine pilot implementation in western Kenya (Hoyt *et al.*, 2023); vaccination studies in the ultra-orthodox Jewish population (Jacobson *et al.*, 2023); exploration of factors affecting vaccine uptake within Roma communities across Europe (Cronin and Ibrahim, 2022); and analyses of the barriers and drivers of Ghana's COVID-19 vaccination programme (Agboh and Yarney, 2025). One of the questionnaires (Vaccine Hesitancy Scale, VHS) used for my quantitative study were developed by the WHO SAGE working group based on the 5A constructs and those of the 3C and 5C models. The advantage of the model lies in its simplicity, and it will be used to assess the behavioural enablers of vaccination uptake. Furthermore, it will be used to explain the concept of accessibility and how it contributes to vaccine hesitancy. Furthermore, how acceptance mediates the relationship between availability and uptake will be explored using the 5A model.

3.7. The 3C model

Acceptance of vaccination has been considered by MacDonald (2015) as an outcome behaviour resulting from a complex decision-making process that can be potentially influenced by a wide range of factors. The “3 Cs” model, according to Macdonald (2015) highlights three categories: complacency, convenience, and confidence which collectively influence vaccination behaviour. First, complacency involves perceived risks that vaccine-preventable diseases are low, and vaccination is not deemed a necessary preventive action. Second, vaccination convenience involves perceived benefits of immunisation services in terms of availability, affordability, willingness-to-pay, geographical accessibility, and ability to understand (language and health literacy), and the appeal of the immunisation service affects uptake.” Lastly, vaccination confidence is referred to as trust towards the effectiveness and safety of vaccines and the system that delivers them. Confidence covers three dimensions consisting of trust in the effectiveness and safety of vaccines, in the health system and health professionals, and in institutions and policies that drive vaccine uptake. When caregivers are confident, they exhibit low levels of vaccine hesitancy. The model has previously been used for the study of vaccine hesitancy. For instance, the report by Thompson *et al.* (2023) indicated that factors associated with MMR coverage in England overlap with the 3C (convenience, complacency, and confidence) model of vaccine hesitancy. Also, the domains of the 3Cs model of vaccine hesitancy were used by Ozawa *et al.* (2018) in a study carried out on childhood immunisation uptake in the northern part of Nigeria.

Figure 3.2 shows the interdependent relationship of the components of the 3C model. The questionnaires for the quantitative study were developed by the WHO SAGE working group based on its constructs and that of the 5A and 5C models. Since the 3C model is useful for interpreting vaccination intention and behaviour, the model will be used to explain the findings related to intention to vaccinate.

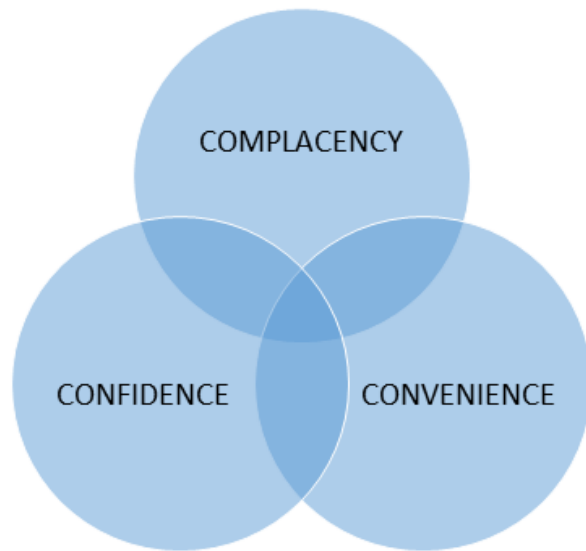


Figure 30.2.: 3C model of vaccine hesitancy Source: (MacDonald, 2015)

3.8. The 5C Psychological Model

The 5C model of vaccine hesitancy proposed in 2018 (Betsch *et al.*, 2018) measures the “psychological antecedents of vaccination.”. It is grounded in established theoretical models of vaccine hesitancy and acceptance and relates them to psychological models to explain health behaviour (Betsch *et al.*, 2018). The model expanded the SAGE WHO’s 3C model to add “calculation” and “collective responsibility” factors, while convenience was replaced with “constraints.”. The concept of collective responses relates to the willingness to vaccinate as a sense of responsibility to protect others and calculation, which has to do with information seeking before deciding to vaccinate. Collective responsibility is considered an individual’s “willingness to protect others by one’s own vaccination by means of herd immunity” (Betsch *et al.*, 2018). Collective responsibility describes the importance and awareness of herd immunity as an achievable goal of vaccination (Davisson and Hoyle, 2023) since individuals with high levels of collective responsibility have a higher tendency to vaccinate. Those who have low levels of collective responsibility, either due to a lack of knowledge about herd immunity or unwillingness to protect others, will have positive correlations with vaccine hesitancy (Tostrud, Thelen and Palatnik, 2022).

The calculation factor captures individuals that seek information, engage in risk-benefit analysis and are assumed to be more risk averse. Due to the wide availability of vaccine misinformation on line and on the social media, individuals with high levels of calculation have positive correlations with perceived vaccination risks and vaccine hesitancy.

The benefit of analysing vaccination behaviour through the 5C model is to better understand the psychological underpinnings behind an individual's vaccine behaviour. In addition to demographic factors and individual characteristics such as chronic illnesses and disability, psychological antecedents can be explored with the 5C model (Eitze *et al.*, 2024). The 5C model has been utilised in diverse contexts to study vaccine hesitancy and vaccination uptake (Adeyanju and Betsch, 2024; Aggarwal *et al.*, 2024; Eitze *et al.*, 2024; Wang *et al.*, 2025). It has also been applied for the development of the maternal influenza vaccine hesitancy of pregnant and postpartum women (Zeng *et al.*, 2025). The model is suitable for use in this study because the questionnaires for the quantitative study were developed by the WHO SAGE working group based on the 5C constructs and that of the 3C and 5A models. The 5C model is also useful for this study because it can help to identify reasons for vaccine hesitancy and focus for targeted interventions (Hussein *et al.*, 2024), design effective communication strategies, and create relevant survey tools to improve vaccination uptake. Figure 3.3 is a schematic diagram depicting the five components of the 5C model.

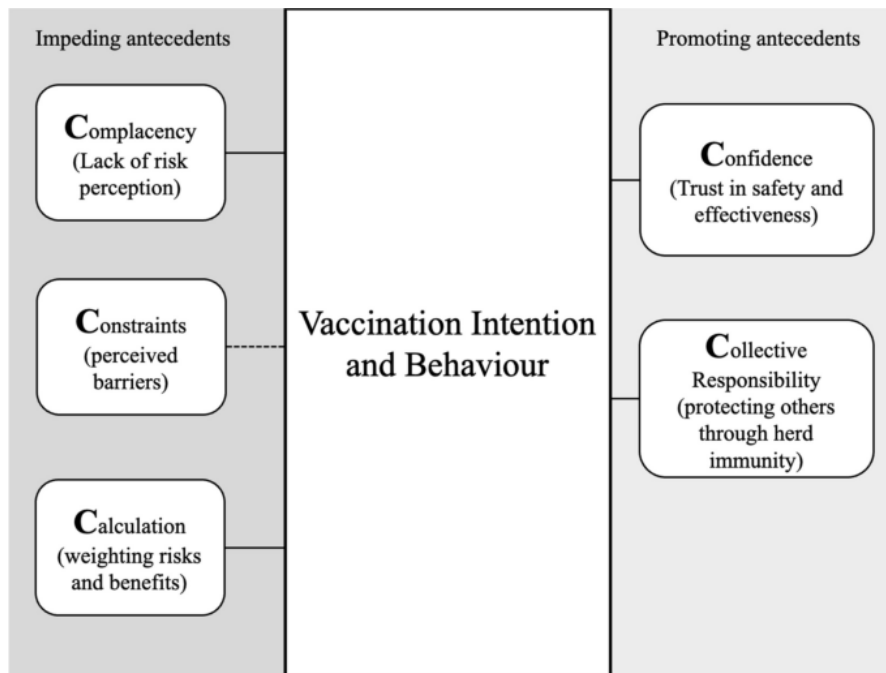


Figure 3.3 : 5C model of factors influencing vaccine hesitancy and vaccine acceptance

Source: (Eitze *et al.*, 2024)

3.9. Overlap of the 3C, 5A and 5C Models of Understanding Vaccine Hesitancy

There is considerable overlap in the utilisation of the 3C, 5A and 5C models for studying and addressing vaccine hesitancy (Tostrud, Thelen and Palatnik, 2022). Acceptance resembles the confidence factor (attitude as a potential linkage), accessibility and affordability match convenience (practical barriers and financial barriers), and awareness is comparable to complacency (perception of diseases' level of risk and that vaccination is necessary).

Furthermore, activation refers to positive subtle and direct cues in the decision space of caregivers which encourage them to take vaccination (otherwise known as nudges in the environment) and can be related to calculation (information searching and processing on vaccination) (Betsch *et al.*, 2018). Finally, the awareness concept aligns with collective responsibility, explained by the fact that due to herd immunity, most vaccinations also protect unvaccinated individuals. The importance of the overlap is that the 5C antecedent and the 5A

model can be used simultaneously to draw meanings from the outcome of the same study consistent with similar applications in other studies (Aggarwal *et al.*, 2024).

3.10. Application of conceptual models in the vaccine hesitancy research.

This study adopts an **integrative multi-model framework** to examine vaccine hesitancy among mothers of under-five children, recognising that no single theoretical model is sufficient to fully capture the complexity of vaccination behaviour. The approach draws together the principles of each of the 7 theoretical models outlined in Sections 3.2–3.8, with each model illuminating specific dimensions of the research problem. Figure 3.4 provides a schematic representation of how these models collectively interact to address the study objectives.

At the individual cognitive level, the Health Belief Model (HBM) is used to explain how caregivers' perceptions of susceptibility to and severity of vaccine-preventable diseases influence their intention to vaccinate. In particular, the HBM provides a lens through which perceived risks, benefits, and barriers to vaccination are interpreted, thereby offering insight into how individual beliefs shape vaccination decisions.

The Capability, Opportunity, and Motivation (COM-B) model extends this analysis by situating behaviour within a broader system of interacting determinants. In this study, COM-B is applied to assess how caregivers' knowledge (psychological capability), environmental conditions such as access to vaccination services (opportunity), and motivational drivers collectively influence vaccine uptake or refusal. This enables a more dynamic understanding of behaviour beyond individual perceptions alone.

To capture the socio-cultural context of vaccine hesitancy, the PEN-3 cultural model is employed, with particular emphasis on the Cultural Empowerment domain. This framework facilitates the categorisation of cultural and religious beliefs into positive, existential, and

negative influences on vaccination behaviour. Through this lens, culturally embedded practices are not merely viewed as barriers but are critically examined for their potential to either hinder or promote vaccine acceptance.

In addition, Social Cohesion Theory (SCT) is used to analyse how community-level factors shape vaccination behaviour. By focusing on social relations, connectedness, and orientation towards the common good, SCT provides insight into how trust in institutions, social norms, and community networks influence caregivers' attitudes towards vaccination. This is particularly relevant for understanding how collective beliefs and peer influences reinforce or mitigate vaccine hesitancy.

From a structural and systems perspective, the 5A model is utilised to assess practical and organisational determinants of vaccine uptake. Specifically, constructs such as accessibility, affordability, awareness, acceptance, and activation are applied to evaluate how health system factors and service delivery influence caregivers' ability and willingness to vaccinate their children. Within this study, particular attention is given to accessibility and acceptance as key mediators between vaccine availability and uptake.

Complementing this, the 3C model (confidence, complacency, and convenience) is used to interpret caregivers' vaccination intentions, particularly in relation to trust in vaccines and the perceived necessity of immunisation. This model provides a concise framework for understanding the core drivers of vaccine hesitancy at the behavioural outcome level.

Finally, the 5C psychological model builds on the 3C framework by incorporating additional constructs -constraints, calculation, and collective responsibility - thereby offering a more nuanced understanding of the psychological antecedents of vaccination behaviour. In this study, the 5C model is used to explore how information-seeking behaviour, perceived barriers, and a sense of social responsibility influence caregivers' vaccination decisions.

Taken together, these seven models operate across multiple levels of analysis—individual, interpersonal, cultural, community, and structural—providing a comprehensive framework for interpreting the study findings. As illustrated in Figure 3.4, the models are not applied in isolation but are integrated to capture the complex interplay between beliefs, social influences, cultural norms, and systemic factors that shape vaccine hesitancy. This integrative approach strengthens the analytical depth of the study and ensures that the research questions are addressed from multiple, complementary perspectives.

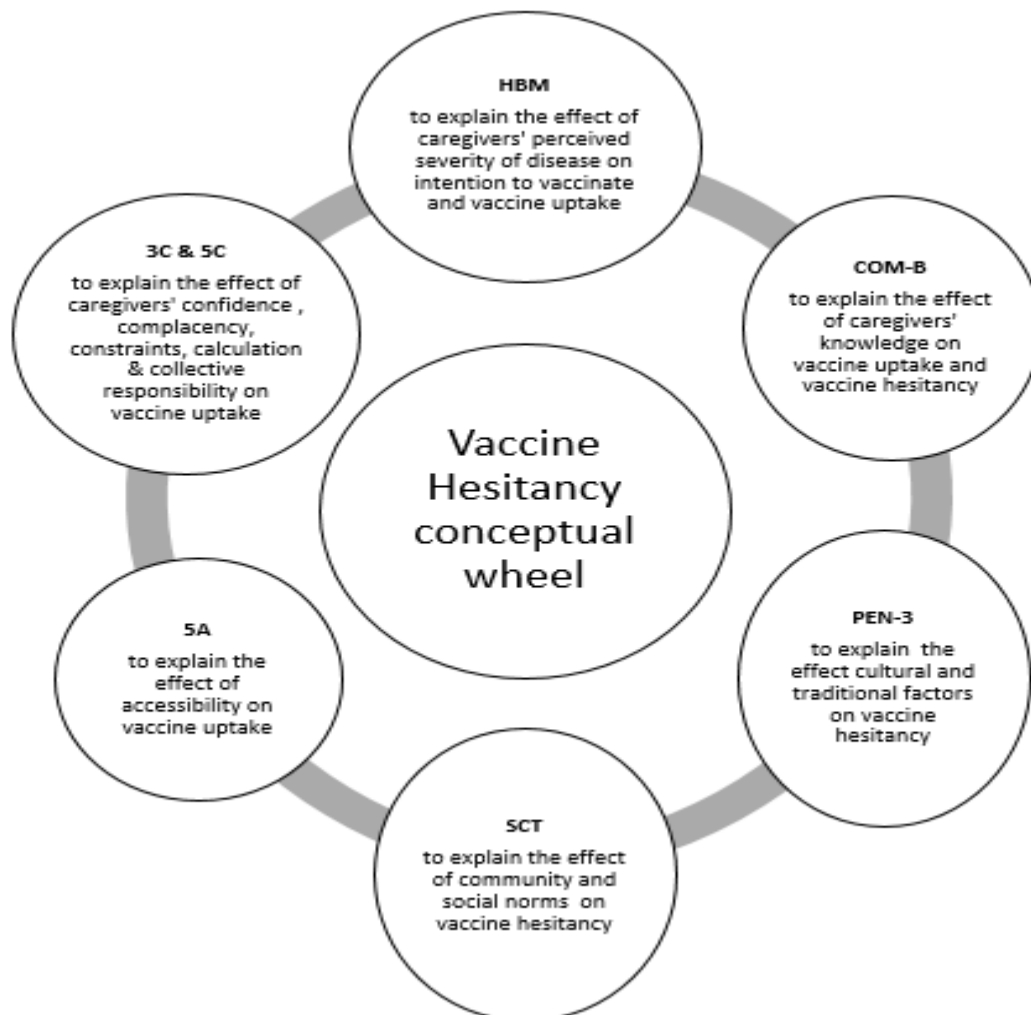


Figure 3.4: A summary of models and their application in the research

(Prepared by the researcher)

3.11. Conclusion and Chapter Summary

This chapter critically appraises various models and theories related to scientific enquiry that are applicable to research on vaccine hesitancy and uptake. Vaccine hesitancy is a phenomenon that has been studied using different models and theories. The choice of theories, concepts and models used for vaccine hesitancy studies has been largely influenced by the research questions and the intended outcomes. In addition, various conceptual frameworks and models can be used to understand vaccine hesitancy, and each model has its strengths and weaknesses. Furthermore, the 5A, 3C and 5C models are useful frameworks for understanding vaccine hesitancy, and the 5C model provides a more comprehensive understanding of the psychological factors influencing vaccine behaviour, including the importance of collective responsibility and calculation.

Ultimately, understanding vaccine hesitancy requires a comprehensive approach and multiple conceptual models can be used simultaneously to draw meaning from the outcome of a single study.

The next chapter will explore the research design and methodology, focusing on the underpinning theoretical framework. The characteristics of the research location and participants will also be described.

Chapter Four: Methodology

4.0. Introduction

The purpose of this study was to investigate the prevalence and predictors of vaccine hesitancy in caregivers of children under five in Akure South LGA, Ondo State, Nigeria, and determine its effect on both caregivers' intentions to vaccinate and actual immunisation uptake.

The research objectives were to:

1. Assess the knowledge of caregivers on vaccine-preventable diseases and vaccination.
2. Assess caregivers' attitude, beliefs, and intention toward vaccination and how this affects immunisation uptake (completing immunisation of children).
3. Describe the practice of caregivers towards vaccination (intention to vaccinate) and its role in immunisation uptake (completing immunisation of children).
4. Assess the determinants of vaccine refusal, hesitancy, and vaccination behaviour.

This study used a mixed methods approach (quantitative and qualitative). The quantitative study is a cross-sectional survey with an interviewer-administered questionnaire. The instrument is a validated questionnaire (Opel *et al.*, 2011; Larson *et al.*, 2015) that collected information on caregivers' sociodemographic status, knowledge of vaccine-preventable diseases and vaccination schedules, and attitude on childhood vaccinations—all of which are necessary to answer the research questions. The qualitative phase utilised a focus group discussion with caregivers of children under-five. An open-ended interview guide was used to explore the caregivers' accounts of factors considered to be important drivers of vaccine behaviours (vaccine hesitancy, refusal, and acceptance).

In this chapter, the following topics were covered: the research design and methodology, the rationale for the underpinning theoretical framework of the study, epistemology, the link

between ontology, epistemology, and methodology, the rationale for using pragmatist epistemology for this study, and the research approach and methods. This chapter covers the details of the study population, sample size determination, sampling procedures, participant recruitment, data collection process, and ethical procedures.

4.1. Methodology

The arrangement of this chapter in this study is predicated on the guidelines provided by Crotty (1998) , which specified four levels of interrelated elements for use in a research study. According to Crotty (1998), these elements include epistemology, theoretical perspective, methodology, and techniques. Based on the foregoing, Creswell and Creswell (2019) conceptualised Crotty's model to address three questions central to the research design:

What are the researcher's knowledge claims, including a theoretical perspective?

What strategies of inquiry will inform the procedures?

What methods of data collection and analysis will be used?

4.2. Rationale for underpinning the theoretical framework of the study.

The underpinning theoretical framework, or the research philosophy, refers to the underlying beliefs, otherwise the worldview, regarding how data about a phenomenon should be gathered, analysed and used (Petersen and Gencel, 2013; Žukauskas, Vveinhardt and Andriukaitienė, 2018). This is also known as paradigms (Cypress, 2017; Žukauskas, Vveinhardt and Andriukaitienė, 2018), philosophical assumptions, epistemologies, and ontologies (Crotty, 1998), or what Creswell and Creswell (2019) referred to as knowledge claims. Creswell and Creswell (2019) mentioned four knowledge claims, and these are post-positivism, constructivism, advocacy/participatory, and pragmatism.

The adoption of a specific epistemological approach in research provides a lens through which knowledge and reality can be viewed or created (Sol and Heng, 2022). With a clear epistemological approach, researchers are guided by a philosophical stance that determines the most appropriate research methodology for a particular study (Creswell and Creswell, 2019; Sol and Heng, 2022; Ylönen and Aven, 2023; Grass, 2024). The research philosophy adopted for this study informed the research design choices. Specifically, the underlying worldview determines how data were collected on vaccine hesitancy in the study population and the process for data analysis and interpretation. It encompasses the chosen paradigm which informs whether data are collected quantitatively, qualitatively or through a mixed methods approach, and the strategies of inquiry employed (Creswell, 2009). For the purpose of this study, pragmatism was adopted as the theoretical philosophy.

4.2.1. Epistemology

Epistemology is the study and explanation of what knowledge is and the logic behind it (Rescher, 2003). It focuses on explaining knowledge, how it can be obtained, and how to reason about its nature and elements (Rescher, 2003; Moon and Blackman, 2014). Epistemology seeks to understand the methods, origins, processes, and limitations involved in observation (Hiller, 2016). Epistemology includes a description of how knowledge impacts the target group of a research which subsequently informs the research design, processes for data collection and analysis employed in the study (Melchior, 2023).

The knowledge production in vaccine hesitancy studies has been diverse, possibly due to its ambiguous notion and uncertain theoretical background (Peretti-Watel *et al.*, 2015). Thus, the application of the different worldviews of epistemology to this study as a theory for knowledge creation determines how data were collected on vaccine hesitancy and the processes for data analysis and interpretation (Sol and Heng, 2022; Melchior, 2023). This study adopted the

pragmatic paradigm, which embraces a plurality of methods (Kaushik and Walsh, 2019) involving the use of a mixed-methods approach. The Systematic Literature Review (SLR) outcome from the previous chapter also informed the choice of mixed methods.

4.2.2. The link between ontology, epistemology, and methodology

Two fundamental philosophical concepts are ontology, consisting of ontological idealism and ontological realism, relating to what reality is, and epistemology concerning epistemological idealism and realism resting on how one can obtain knowledge about that reality (Ylönen and Aven, 2023; Grass, 2024). Ontology defines the research framework, while epistemology determines the research questions to be answered (Al-Saadi, 2014; Kivunja and Kuyini, 2017). Together, ontology, epistemology, and methodology form an all-encompassing system of interrelated practice and thinking that defines the nature of research (Panya and Nyarwath, 2022). This is called the research premise, paradigm, or interpretive framework (Antwi and Hamza, 2015; Guraya *et al.*, 2023). Crotty (1998) argued that epistemological and ontological issues tend to emerge together, and, therefore, ontology as a philosophical stance can be discussed as part of epistemology.

4.2.3. Pragmatism

Pragmatism is one of the knowledge claims (epistemology) specified by Creswell and Creswell (2019). Some scholars (Pihlström, 2009; Moon and Blackman, 2014), however, believe that pragmatism is neither an ontology nor an epistemology, and at best, it is considered to reflect a methodological approach. King (2022) considers the pragmatic theoretical position to be a midpoint between the paradigms of positivism and constructivism. The usefulness and applicability of the pragmatic approach as a methodology in some instances and not an epistemology, however, allows it to encompass both qualitative and quantitative methodology and method (Gobo, 2023). In the case of my study, the pragmatic approach enabled me to (i)

ascertain whether vaccine hesitancy is a significant challenge in the study area, (ii) identify the factors that predispose the study population to vaccine hesitancy, and (iii) determine how the respondents exhibit vaccine hesitancy through a network of actions and factors. The knowledge production process was sequential, starting with the collection of quantitative data using two validated data tools and thereafter a qualitative data collection process.

While acknowledging the diverse nature of pragmatism, Pratt (2016) suggests that one unifying feature is that pragmatism philosophers are committed to presenting pragmatism as epistemology and ontology at the same time. Pragmatist theories of knowledge may be characterised by three ideas: knowledge is fallible, beliefs and theories need to be linked to experience, and philosophical theories and norms should arise from our everyday practices (Choo, 2016). Pragmatists, however, reject the possibility of absolute knowledge (Choo, 2016) and that every proposition concerning truth is hypothetical and provisional since absolute truth is an ideal that cannot be realised (Longoria, 2016). According to Dube, Nkomo and Thokweng (2024), truth is impermanent and dependent on the context of interests. The pragmatism narrative thus suggested that the usefulness of a theory depends on its power to solve problems. The pragmatist is committed to learning as a way of mitigating social problems, and hence pragmatism is a social and normative theory (Iaydjiev, 2013; Ormerod, 2023). The pragmatism philosophy is therefore well suited for this study because it focuses on solving real-world issues like vaccine hesitancy and helps in understanding why caregivers are hesitant about vaccination of their children. Furthermore, studies about vaccine hesitancy revealed that parental response to interventions is a function of their cognitive biases, personal values, and prevailing social contract or norm (Cataldi and O'Leary, 2021)..

4.2.4. Rationale for using the pragmatist epistemology for this study.

Vaccine acceptance is a complex issue at the intersection of individual decisions and societal needs (Martinelli and Veltri, 2022). Reasons behind vaccine hesitancy are still being explored, but researchers have identified an extensive set of factors empirically proven to affect vaccine uptake, including contextual, organisational, and individual ones (Larson *et al.*, 2015). In consonance with the view that the understanding of VH is evolving, Peretti-Watel *et al.* (2015) perceived VH as a set of beliefs, attitudes, or behaviours exhibited by a heterogeneous portion of the population powered by reluctant conformism to societal norms. Also, according to Dubé *et al.* (2016), important gaps exist in the understanding of what factors influence vaccine-hesitant individuals' decisions for or against vaccination since vaccine uptake does not always equal vaccine acceptance. These varied lenses for viewing vaccine hesitancy may be a result of how individuals or groups of individuals sharing similar cognitive characteristics frame their understanding of vaccination (Martinelli and Veltri, 2022) within distinct epistemic boundaries. From the critical appraisal of the papers included in the systematic literature review, inconsistent results were reported for some of the predictors, such as education of parents, socioeconomic status, and family size. Several studies found a negative association between educational level and vaccine hesitancy, while others found a positive association. At the same time, it has been observed that in the past vaccines were mostly refused by people with low education. It is, however, different today, with well-educated people amongst the rank of hesitant individuals and exercising the right to make an "informed" decision about vaccination (Lunderberg, 2019; Cerda and García, 2021). The foregoing contradictions contextualised how beliefs and attitudes on vaccine-related issues are developed by individuals and justifying the need for a context-specific and multi-perspective knowledge production on vaccine hesitancy globally (Galagali, Kinikar and Kumar, 2022; Martinelli and Veltri, 2022). The outlined contradictions and complexities, however, aligns with the way pragmatism

considers knowledge production as an endeavour that is infallible nor absolute (Dube, Nkomo and Thokweng, 2024) and makes vaccine hesitancy a real-life problem for WHO, healthcare professionals, and other stakeholders.

Pragmatism is typically associated with abductive reasoning that moves back and forth between deduction and induction (Kaushik and Walsh, 2019). Researchers using the pragmatist worldview therefore employ a process of abduction, deduction, and induction to gain proper understanding of a problem. The advantage in this is that the problem is tackled from all perspectives, and this is why mixed methods study is often adopted as the preferred methodical approach for inquiry. The advantages of using both qualitative and quantitative research enable the weaknesses of either methodology to be complemented by the strengths of the other (Johnson and Onwuegbuzie, 2004). For a phenomenon like vaccine hesitancy, the process of knowledge production should be robust and dynamic, and this can be achieved effectively using a pragmatic approach.

According to Creswell (2009), pragmatism is not committed to any one system of philosophy and reality, just like mixed methods research in that researchers draw freely from both quantitative and qualitative assumptions when they engage in their research. Hence, the use of mixed methods for this research on vaccine hesitancy aligns with the philosophical underpinnings of a pragmatic worldview. Pragmatists posit that the world is not an absolute unity (Shusterman, 2010), and as such there are many different ways of interpreting the world and undertaking research, which often lead to multiple realities. Creswell and Creswell (2009) reported that mixed methods researchers usually adopt multiple approaches for collecting and analysing data rather than subscribing to only one way. Likewise, pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as different forms of data collection (Creswell, 2009), which is quite suitable for knowledge production with respect to a complex normative phenomenon such as vaccine hesitancy.

Based on the flexibility provided by the pragmatic world view, Johnson (2017) reported that other mixed methods paradigms such as critical realism (Fletcher, 2017), dialecticism (Johnson, 2017), and transformativism (Mertens, 2007), can be used simultaneously or in combination with pragmatism. This is so because pragmatism is a philosophy that is open to creativity as long as it can be shown to work well in practice (Guerra, 2002; Kaushik and Walsh, 2019).

According to Gross (2009), as reported by Ormerod (2023), social mechanisms that shape outcomes of a phenomenon will be dependent on four scenarios, which can be related to the narratives of the vaccine hesitancy problem. Firstly, it is contended that there are habitual ways individual actors understand and respond emotionally to situations in general, resulting from their psychosocial experiences or their biological endowments or propensities (individual cognitive-affective habits). It is the opinion of this researcher that such psychosocial experiences or their biological endowments can be likened to how sociodemographic status, socioeconomic status, history of previous exposure to infection, and vaccination experience affect vaccination behaviour. Secondly, Ormerod (2023) mentioned habits in the form of dispositions, which enact specific behavioural responses or routines when individual actors are faced with particular kinds of problems (individual behavioural habits). This can be explained in terms of cue to action with respect to disposition to accept or reject vaccine (Fadl *et al.*, 2023; Limbu and Gautam, 2023).

The third proposition by Ormerod (2023) captures habits that groups of individuals (including those who comprise collective actors of various kinds) have with respect to working together to solve problems. This can be nested into the framework of how social norms, religions, and ethnic identities function collectively to influence vaccination behaviour either positively or negatively. The fourth and last iteration, according to Ormerod (2023), concerns habits bundled in 'habit sets', which become the reference point for thinking and acting with respect to a set

of problems. Applied to the vaccine hesitancy issue, such habit sets can be framed as actions that characterise small subsets of groups in a population, such as young mothers and mothers in families with small or large family sizes. The import of the foregoing is that the principles of a pragmatic worldview can be adequately applied to the vaccine hesitancy problem for the purpose of knowledge production.

Conclusively, pragmatism offers mixed-method research a logical and practical way of getting things accomplished (Kaushik and Walsh, 2019; Christensen, 2022), a way to listen to and emphasise important epistemological and social values, and a way to produce practical theories that work in particular places (in my study location) and particular contexts (among vaccine-hesitant individuals) with particular people (carers of under-five children) (Johnson, 2017).

4.3. Research Approach

The pragmatism research philosophy used in this study can integrate more than one research approach and research strategy within the same study. Based on the unpredictability (irrationality) and complexity of human behaviour (Lieberman, 2013; Catherine, 2020; Dorina *et al.*, 2024), the research approach employed to study vaccine hesitancy in the study location embodies deduction, abduction, and induction since it was framed through the lenses of a pragmatic epistemology.

The vaccination decision-making process of parents of under-five children is dependent on the parent's environment, which is moderated by individual, contextual, and institutional factors (Damnjanović *et al.*, 2018; Cooper *et al.*, 2021). Under such a situation, any research approach will be targeted towards solving the problem and not arriving at infallible answer since the possibility of ever reaching absolutely certain and final knowledge is thus closed for a pragmatist (Martela, 2015).

This study, therefore, will progress with the assumption that it would not discover any fixed reality about vaccine hesitancy. It is expected that the respondents will provide a more comprehensive perspective on how they perceived vaccine hesitancy and the factors that shape their thought patterns that lead to vaccination decisions. The information provided about their vaccination behaviour would be collected and analysed to help further our understanding of the phenomenon of vaccine hesitancy. Figure 4.1 shows the summary of the research framework for this study.

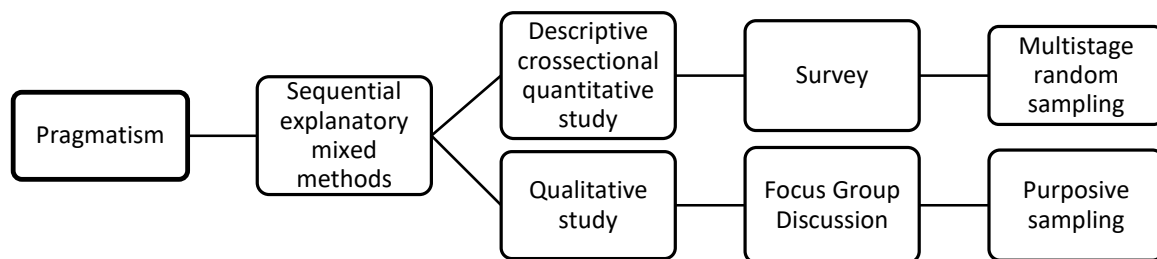


Figure 4.1: Research Framework

4.4. Primary research

4.4.0. Methods

Both methodology and methods are used interchangeably in academic research (Aguiar, 2024), but they actually project and connote different aspects of research. Methodology refers to the process, principles, and procedures by which a researcher approaches problems and seeks answers. Hence, methodology is about research design and the systematic process used in conducting the research (Patel and Patel, 2019; Guraya *et al.*, 2023). Methods, however, describe the approaches, and procedures, which include data collection, participant sampling techniques, instruments used, and data analysis conducted (Guraya *et al.*, 2023). Method is the

specific technique(s) being employed. The selection of appropriate methods is an important step in the research process, influenced by the research questions, objectives, and the underlining methodology (Aguiar, 2024). For this research, the methodology derives from the outcome of the SLR in chapter two and the epistemological preference (pragmatism) for the research. This section of the research method provides the guidelines for conducting the actual research at the study location.

4.4.1. Research design

This study adopted a mixed study approach using a combination of quantitative (survey using a questionnaire) and qualitative methods (using a focus group discussion) in Akure South Local Government Area, Ondo State, Nigeria.

4.4.2. Ethical Approval

Ethical approvals for the study were obtained from the National Health Research Committee of Nigeria (Appendix 4.1) and the University of Essex ethical committee with ethics number ETH2223-1101 (Appendix 4.2). Formal permission to access the primary healthcare centres in Akure South Local government in Ondo State, Nigeria is provided at Appendix 4.3.

4.4.3. Study location

The study was carried out in Akure South Local Government Area, Ondo State, Nigeria. The country is divided into thirty-six states, and each state is made up of a certain number of local government areas (LGAs) depending on the land mass and population of each state. The study was conducted at Akure South Local Government Area, one of the eighteen (18) LGAs in Ondo State, south-western part of Nigeria. This local government area is made up of 11 wards. The map of Nigeria and that of Ondo State are in figure 4.2. and 4.3 respectively. The permission to use the map in Figure 4.2 is at Appendix 4.4A.



Figure 4.2: **Map of Nigeria showing Ondo State**

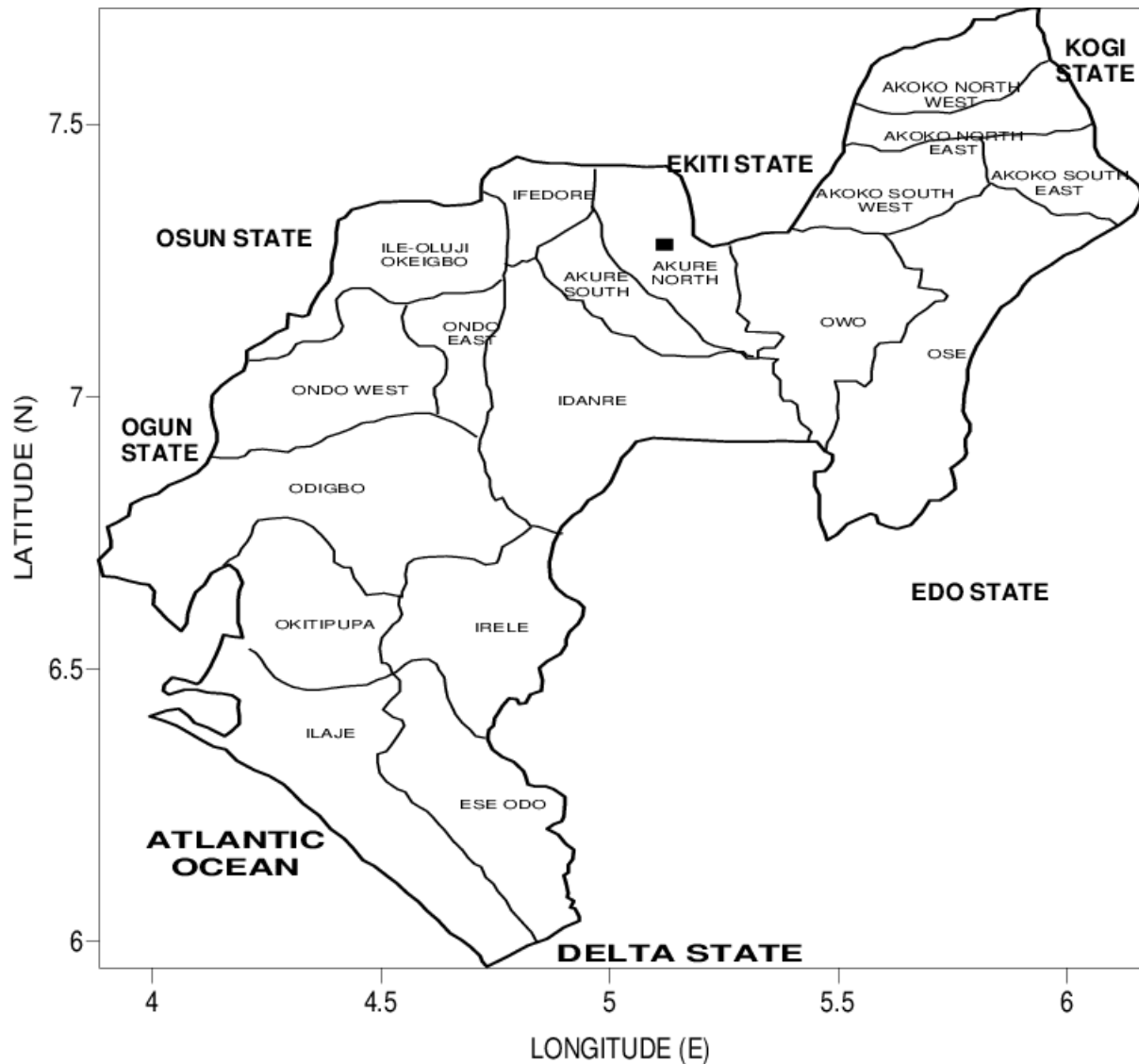


Figure 4.3: Map of Ondo State showing the study location (Akure South LGA)

Source:(Akinbolati *et al.*, 2015)

4.4.4. Study Population

The study population comprised of caregivers of under-five children receiving care in the health facilities in Akure South Local Government Area (AKSLGA) in Ondo State. This local government area was selected for the study because it reflects typical social and cultural groups in Ondo State. This is so because Akure South is the capital city of Ondo State, one of the thirty-six (36) sub-political division in Nigeria. The settlement pattern is for all tribes (both local and migrant) to aggregate around the state capital because of availability of livelihood

opportunities within the urban community and extending to peri-urban and adjoining rural communities. This make the study location a melting point of diverse social and cultural groups. Additionally, being in an urban setting, it provides high exposure to different free childhood vaccination services and communication campaigns. Furthermore, to assess vaccine hesitancy, the availability of vaccination services is a prerequisite for the study, which applies to this locality. 'Caregivers' in this case refers to a person who is in the position to make decisions with regard to vaccination of the child. These individuals may include the father, mother, grandparents, aunts, and uncles. A Local Government Area is an administrative subdivision of a state, and it is the third tier of government in Nigeria. A ward corresponds to an administrative and political unit of a local government area in Nigeria.

4.4.5. Inclusion and Exclusion Criteria

The specification of the inclusion and exclusion criteria for study participants is a standard, required practice when designing high-quality research protocols (Patino and Ferreira, 2018). Inclusion criteria are defined as the key features of the target population which ensure the homogeneity of the study participants and that they adequately represent the target population while exclusion criteria relate to additional characteristics of a potential study participant that may affect the research outcome thereby making such individuals ineligible for the study (Garg, 2016; Patino and Ferreira, 2018).

The inclusion and exclusion criteria for this study is based on the following parameters:

- Age of the index child,
- Attendance at public health facilities
- having vaccination decision authority concerning the index child
- length of domicile of the caregiver in the study area
- Willingness to give inform consent.

Hence caregivers who met the five criteria were included in the study based on the sampling method taking into cognizance the sampling size. The inclusion criteria for this study were (i) respondent must be a caregiver of a child under five years (ii) the index child of the caregiver must be attending public health facilities (iii) the caregiver may be the mother, father, grand parents or anyone that take vaccination decision on behalf of the index child (iv) the caregiver must be domicile at the study location from the birth of the child, and (v) caregiver who gave informed consent.

Caregivers who did not meet the criteria specified above were excluded from the study.

4.4.6. Sample Size Determination for Quantitative Study

The minimum sample size was determined using the formula by Taherdoost (2016).

$$n = Z^2 p(1-p) / d^2$$

n is the required sample size.

P is the percentage occurrence of a state or condition.

D is the maximum percentage error required.

Z is the value corresponding to the level of confidence required.

This study used a confidence interval (margin of error) of $\pm 5\%$ at a 95% confidence level with a standard deviation of 0.5, as utilised by Isezuo and Adamu (2022) in their study in Northern Nigeria. The 95% confidence level implies that if the survey is repeated several times, the results will match those obtained from the population 95% of the time.

$$(1.96^2) (0.5(1-0.5)) / (.05^2)$$

$$(3.8416 * .25) / .0025 = 384.16$$

The sample size will be 385.

In order to cover for possible unresponsive participants, more participants were recruited to complete a total of 425 participants (parents/caregivers), corresponding to roughly 10% additional participants. Hence, the minimum sample size will be 425. For the actual study, 450 questionnaires were administered. This method of augmenting sample size above the calculated sampling size has been done in previous studies in Nigeria and Sudan (Isezuo and Adamu, 2022; Sabahelzain *et al.*, 2022b).

Power calculation for binary logistic regression is typically performed to determine the minimum sample size required to detect a specific effect size with a given level of confidence.

Core Parameters Required

To calculate the sample size, the following inputs were used:

- **Significance Level (α):** The probability of a Type I error, was set at 0.05.
- **Target Power ($1-\beta$):** The probability of correctly rejecting the null hypothesis
- **Effect Size:** Often expressed as an **Odds Ratio (OR)**, which represents the strength of the association between the predictor and the binary outcome.
- **Baseline Probability (P_0):** The probability of the outcome ($Y=1$) when the predictor of interest is at its baseline or mean value.
- **Predictor Distribution:** In this study the main predictor is binary (Bernoulli).

An a priori power analysis was conducted using G*Power 3.1 for binary logistic regression with 7 independent variables. To detect a medium effect, odd ratio was set at 1.72 ($OR = 1.72$) with 95% power ($\alpha=.05$), an expected event rate of 25%, and a primary binary predictor with a 60/40 distribution ($\pi= 0.4$), leading to a minimum sample size of 431 participants.

The 450 questionnaires administered in this study will ensure that there are enough data to detect a medium effect for the primary predictor while maintaining a 5% significance level and 95% statistical power.

The exact procedure for the determination of the sample size with G*Power 3.1 is at appendix 4.4B.

4.4.7. Sampling Technique

The multistage random sampling technique was used. This is a type of probability sampling technique where the researcher randomly selects samples at each stage, narrowing them down through additional random sampling (Acharya *et al.*, 2013). Multistage random sampling can be applied to a research design where the population is too large, and it is impossible to research every individual. Multistage sampling is an extension of cluster sampling in which sampling is done in stages with smaller units being defined and selected at each stage within the units selected at the prior stage (Shimizu, 2014). Information drawn from the small sample can then be used to draw inferences on the entire population. The technique has the advantage of being time- and cost-effective and flexible and helps the researcher to conveniently find the most appropriate survey sample (Enang and Onyishi, 2016; Taherdoost, 2016). The sampling process was as follows:

Stage 1: Selection of wards: All the eleven wards in AKSLGA were selected at the first stage of selection to achieve even representation of the participants.

Stage 2: Selection of Health Facilities: There are thirty-four (34) primary health facilities in AKSLGA, Ondo State, Nigeria. The selection consists of at least one health facility per ward to a maximum of five (5) in some wards. This uneven distribution was due to the population of each ward. According to Olugbamila (2018), the number of health facilities in a given area should be based on the population. At least 50 per cent of the health facilities in each ward

were randomly selected to ensure an even spread of participants in the study. The primary health facilities in each ward in AKSLGA, Ondo State, Nigeria, are in Table 4.1.

Stage 3: Selection of Respondents: There was a proportional allocation of the sample size based on the average number of children seen per week in each facility. The data were collected at the infant welfare clinics. In each facility, the list of children registered every morning was accessed from the attending staff. The caregivers of those under 5 years of age were identified and randomly selected for inclusion in the study. This was done daily till the targeted sample size for each facility was met. The total sample size was divided proportionally among the 20 health facilities and selected as proposed in Table 4.1. The multistage sampling procedure is depicted in Figure 4.4.

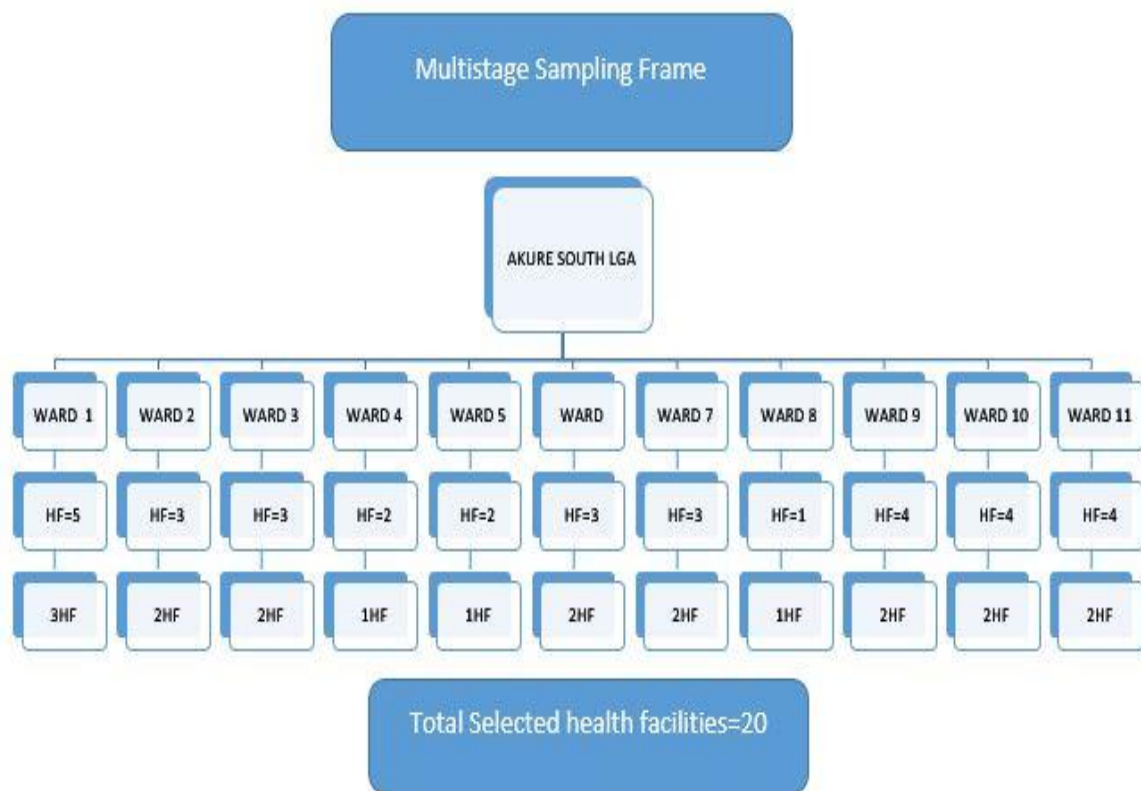


Figure 4.4: **Multistage sampling frame for the study.**

Stage 1: All the eleven Wards in Akure South Local Government Area were selected.

Stage 2: Out of the total of 34 Health facilities in the Local Government Area, 20 were randomly selected for the study ensuring that at least fifty percent of the health facilities in each ward was included.

Stage 3: Participants amounting to the sample size were selected randomly from the 20 selected health facilities. HF: Health facility

Table 4.1.: Names of wards and health facilities per ward in Akure South LGA

SN	Name of Ward	Name of Health Facilities (HF)	Number of HF	Number of Selected HF/Ward
1	Aponmu	1.Ajgunle primary health centre 2.Aponmu primary health centre 3.32 Artillery medical centre 4.Itaoniyan primary health clinic 5.Iwoye basic health centre	5	3
2	Gbogi/Isinkan 1	1.Arakale primary health centre 2. Isikan basic health centre 3.Danjuma primary health clinic	3	2
3	Gbogi/Isinkan 2	1.Aba-oyo primary health centre 2.Awule primary health centre 3.Iyange basic health centre	3	2
4	Ijomu/Obanla	1. Oke Ijebu comprehensive health centre 2.Oke -Ijebu basic health centre	2	1
5.	Ilisa	1.Esure primary health clinic 2.Ijigba primary health clinic	2	1
6.	Irowo	1.Abusoro primary health clinic 2. Igisogba basic health centre 3.Iloro primary health clinic	3	2
7	Oda	1. Ilekun basic health centre 2.Araromi Aje primary health clinic 3. Oda basic health centre	3	2
8	Odopetu	Odopetu basic health centre	1	1
9.	Oke -Aro	1. Oke –Aro basic health centre 2.Familusi primary health clinic 3.Gaga primary health clinic 4.Adofure primary health clinic	4	2
10.	Oshodi/Isolo	1. Kajola basic health centre 2. Millennium basic health centre 3. Shagari basic health Centre 4. Isolo comprehensive health centre	4	2
11.	Owode Imuagun	1.Adegbola primary health clinic 2. Ipinsa basic health centre 3. Orita Obele basic health centre 4.Ilere Primary health Clinic	4	2
		TOTAL	34	20

4.5. Quantitative data collection

The fieldwork commenced with a preliminary visit on 9th November 2023 to the health facilities selected for the study, upon which a research plan was developed. The plan took cognisance of the physical location of the health facilities, their immunisation schedule, clinic operational procedures, size of the health facility and time of operation.

4.5.1. Preliminary visit to the health centres

A preliminary visit was made to the twenty (20) selected healthcare facilities where data will be collected for the primary study. The hospitals were visited to meet with the head of facilities and familiarise my research team with the workings and ethics of the health centres. During each visit, ethical approval for the research and the access letter granted by the Ondo State Primary Healthcare Development Agency were presented to the head of facilities. The study aim, the proposed participants, the details of what participation involved, and any potential risks and benefits to the health facility staff were shared with the officer-in-charge (OIC) of the health facility.

4.5.2. Instruments of data collection for quantitative study

The study instrument for the quantitative study was an interviewer-administered pre-existing validated questionnaire, which was formatted into a Google Form using an Android mobile phone. A paper copy of the questionnaire was also made available. Subsection A and B are generic sociodemographic and knowledge questions while subsection C and D are the validated questionnaires

Information was collected using a semi-structured questionnaire that had four sections:

Section A: The respondents' socio-demographic information was collected. This included age, level of education, occupation, marital status, education, occupation of spouse, family income,

number of family members, religion, number of children, and gender of the child. These were adapted from NDHS records and previous studies (Opel *et al.*, 2013a; Larson *et al.*, 2015; GebreEyesus *et al.*, 2021) and placed in Appendix 4.5A.

Section B: This included questions that were meant to determine the knowledge of respondents on vaccine-preventable diseases (VPD), vaccines, and vaccination. The knowledge status of respondents was measured by 9 knowledge-related questions as adapted from (GebreEyesus *et al.*, 2021) and placed in Appendix 4.5B.

Section C: These were questions meant to determine the vaccine hesitancy status of caregivers. They provided answers to questions proposed by the WHO Strategic Advisory Group of Experts (SAGE) on vaccine hesitancy (Larson *et al.*, 2015). The tool has previously been used by Gentile *et al.* (2021), Wang *et al.* (2022), Thapar *et al.* (2021), and Isezuo and Adamu (2022) in Argentina, China, India, and Nigeria, respectively.

The dichotomous (yes or no) and the Likert scale (strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree) VHS questions were answered by the caregivers. The dichotomous scale VHS tool addresses the concepts in the 5A vaccine hesitancy model, while the Likert scale VHS tool was based on the 3C/5C model of vaccine hesitancy. Both VHS data tools are in Appendix 4.5C.

Section D: The Parental Attitude towards Childhood Vaccines (PACV) instrument, in appendix 4.5D, is a 15-question validated survey tool that assesses the attitude of mothers towards vaccination under three domains: immunisation behaviour, beliefs about vaccine safety and efficacy, and trust. It has been used in previous studies originally by Opel *et al.* (2013), and with slight modification by Napolitano, D'Alessandro and Angelillo (2018) in a study done in Italy, and Sabahelzain *et al.* (2022b) in a study in Sudan.

4.5.3. Recruitment and Training of Research Assistants.

Eight research assistants were recruited to help in the administration of the questionnaires. The research assistants consist of seven (7) community health extension workers and a master's degree holder in project and logistics management.

The research assistants went through a two-day training programme to achieve the following objectives:

1. Understand the basis for the research programme.
2. Understand the key terms of the research.
3. Independently administer questionnaires to respondents.
4. Comply with consent requirements when selecting participants.
5. Be conversant with inclusion and exclusion criteria for respondent selections.
6. Be able to enter data collected into a spreadsheet.

The protocol for the training programme is attached as Appendix 4.6.

4.6. Pilot Study

A pilot test with a small sample of respondents in an adjoining local government area (LGA) that is similar to the target population was carried out. The piloting of the survey instrument helped to check for the clarity, readability, feasibility, and suitability of the survey instrument for the research. The feedback from the pilot participants on the format of the survey instrument was used to improve the questionnaires.

The original PACV questionnaire used the word 'shot' to refer to vaccines. During the pilot study, respondents were confused when asked about shots. For example, the first question on the PACV, *'Have you ever delayed having your child get a **shot** for reasons other than illness*

or allergy?' was not clear to the respondents. Hence, having observed this at the pilot stage, the word 'shot' was replaced with vaccine. This was very valuable in getting the right response from the respondent during the main study.

First visit to the health facility

The research team's first visit to the health centre was on Monday, November 13, 2023. The research team was made up of the Principal Investigator and two Research Assistants (RAs) who were familiar with the terrain of the political ward where the health centre was located. The research assistants were intentionally chosen to facilitate easy access to the facility. The team arrived at the centre around 10 a.m. The day was a booking day for antenatal service in the hospital. Health centres designate specific days for pregnant women to register for antenatal services, known as "antenatal booking day". Upon our arrival, the research team saw some pregnant women who were already waiting to be attended to at the antenatal section close to the head of the facility office. This information, obtained in practice, gave us an indication of how early the service at the clinic commences.

The visit was used to familiarise the research team with the facility's protocol and to meet the Officer-in-Charge, a trained nurse. After confirming the authorisation letter from the Primary Health Care Board that permitted the principal investigator to use the centre for data collection, she took the research team around the clinic, introducing them to the staff. Thereafter, the team met with the Immunisation Focal Officer to discuss the criteria for participant recruitment. The research team left the centre at around 1p.m. after getting all the necessary logistics for the pilot study. This included the details of clinic days for the infant welfare clinic and immunisation sessions, which are held every Tuesday and Thursday.

Second visit to the health facility (first day of data collection)

The research team's second visit to the clinic was on Tuesday, November 14, 2023. The research team got to the clinic around 9:30am. Many of the caregivers had already arrived with their children, waiting at the registration centre and getting ready for the health talk to be delivered by the Health Education Officer of the facility. Registration of clients commences at the clinic after the health talk on days when this session will be held. The research team got this information from the facility head during the first visit and was informed that registration at the clinic will start at 10 a.m. after the health talk. The routine immunisation officer introduced the research team to the caregivers after the health talk and explained to them our purpose at the clinic. The research team stayed at the registration point where the clients were registered and recorded in a booking ledger and recruited every three of the clients registered. 20 caregivers were subsequently recruited, and all the twenty caregivers were interviewed. The research team spent an average of twenty minutes interviewing each caregiver. On average, the respondents spent about an hour extra at the clinic. Each of the RAs interviewed six (6) respondents, while the principal investigator interviewed eight (8) respondents. Fifteen (15) out of the selected mothers were interviewed before their children were immunised. A few (4) were interviewed after they had been attended to at the infant welfare clinic, while a mother who lives in a nearby building to the health centre took permission to go home to attend to her other children who are back from school. This reminded the principal researcher of one of the questions included in the vaccine hesitancy survey about other pressures in the caregivers' lives that prevent them from getting their child immunised. This also depicts the complex nature of caregiving in Nigeria, especially in this part of the country, where most of the responsibilities for childcare lie with the mother. This scenario is an example of the existential issues discussed in my previous systematic literature review as part of the predictors of vaccine hesitancy in the caregivers of under-five children. The woman eventually came back after waiting for her for

about two hours. The principal researcher administered the questionnaire to the woman and thanked her for coming back. After the entire process, the research team did an on-site review of the process, which was completed around 5pm in the evening.

Third visit to the health facility (second day of data collection)

It was a Thursday clinic, on the 16th of November 2023, and the research team arrived at the clinic around 8:30am in the morning. Registration started at 9am because there was no health talk on that day. The research team was at the registration site to commence the caregivers' recruitment for the day and was able to recruit 15 caregivers who gave their consent to participate in the survey.

Suddenly the clinic nutritionist came in to announce the names of some caregivers who were to participate in the food demonstration session for caregivers. At this point, the research team felt disappointed because no prior information on the food demonstration was given by the head of the facility. I had a feeling that it could disrupt our interview sessions for those we have already recruited. The facility head later apologised to our team for her inability to tell us this beforehand, as it became an impromptu programme that they had to fix because the year was already coming to an end. She told us that they needed to fix the food demonstration session as one of the programmes for the last quarter of the year, claiming that this should have come earlier in the month of October.

The foregoing shows that the activities of the health facility take precedence over any other external ones, which became a critical lesson for the team to internalise in planning the data collection exercise. Eventually we realised that three of our recruited caregivers were part of those scheduled to participate in the food demonstration session who later withdrew their consent for the interview since they were already tired. Consequently, the research team administered the questionnaires to 12 out of the 15 participants recruited. The entire incident

served as an important learning experience for how to conduct the main data collection. The research team therefore decided to always put a call through to the head of the facility on the day preceding our visit days to confirm if there were going to be any special clinic activities on such days.

We later joined the food counselling session, where mothers were instructed on how to prepare nutritious local food through a practical session. Mothers were given the already prepared food and were asked to give it to their children. Our decision to join the food counselling session was predicated on the need to identify with the staff and the caregivers. The food demonstration session was also a way of exhibiting the act of living and sharing together at the community level. Hence, not joining the session would have caused the research team to miss the experiential understanding gained with respect to childcare at the community level and how this is reinforced by formal organisations such as the health facility. This is one of the lessons to learn when working in health facilities located in the communities at the ward level. We found this session to be very interesting and asked for permission to take pictures of the event. The team left the clinic at 4.30 pm.

Fourth visit to the facility (third day of data collection)

The fourth visit to the facility was on Tuesday, on the 21st of November 2023. This was the third time the research team was at the facility for participant recruitment and questionnaire administration. On this day, since one of the RAs had a toothache overnight and had gone to see the dentist, the principal researcher arrived at the clinic at 9 am with only one of the RAs. Hence, the team was only able to recruit 6 mothers because the attendance at the clinic was lower than that of the previous week, and all the recruited participants were interviewed.

Fifth visit to the health facility (fourth day of data collection)

The visit on Thursday, 23rd of November, 2023, concluded the data collection process for the pilot study. Only five participants were needed to make up the 43 participants needed for the pilot study. The research team arrived at the facility by 9:00 am. The five participants were recruited after providing their written consent. Questionnaire administration was completed before their infants were due for vaccination. This delay occurred because the vaccine cold chain box was not delivered to the hospital from the central cold chain site on time due to transportation issues. The routine immunisation service is arranged such that vaccine is sent on the immunisation clinic day from a central cold chain site to all the other health facilities in the area to maintain the potency of the vaccines. The scenario above depicts some of the challenges being faced in Nigeria's health centres, which are the access points for under-five immunisations. The questionnaire administration was concluded around 12:00 pm, and followed by a meeting with the immunisation officer for her feedback.

The routine immunisation officer advised the principal researcher to make little incentives available for the caregivers to appreciate them for their time. We also experienced this through subtle requests by some mothers who used the local language to request an incentive by saying, and I quote, "Se oma yo owo," meaning, "Will money be given to us?" The foregoing further underscores the challenges that can be encountered with participants' recruitment in research.

4.6.1. Reflexivity on the pilot study

The pilot study was carried out for two weeks between the 13th of November and the 24th of November 2023. This pilot study was a small-scale research project conducted before the final full-scale study to determine the reliability and the validity of the vaccine hesitancy survey (VHS) tool and the parent attitude to childhood vaccination (PACV) survey tool among the

study population. Through the pilot study, the researcher was able to determine the best way to conduct the final research study.

4.7. Quantitative data collection with use of questionnaires

The main data collection exercise commenced on November 28, 2023, at the designated twenty healthcare centres. Prior to data collection, a spreadsheet (see Appendix 4.4) consisting of the sampling frame, distribution of the research assistants and the principal investigator across the health facility, and the mode of daily questionnaire administration was developed. The spreadsheet was also used for recording the number of participants recruited from each of the twenty health facilities and the number of questionnaires administered. At the end of each day of data collection, the data was transferred to an Excel spreadsheet. The quantitative data collection exercise was concluded on the 5th of March 2024.

4.7.1 Compilation of data, data cleaning, and analysis

The collected data were checked daily by the principal investigator for completeness. The data were then coded and entered into MS-Excel and later exported to Statistical Package for Social Sciences (SPSS) Version 28.0 for data cleaning and analysis.

4.7.2. Data cleaning in SPSS

The data cleaning process in the SPSS involved the following:

1. Duplicate cases were identified and removed.
2. Variables containing excessive missing data were flagged.
3. Extreme values and anomalous cases were identified.

4.7.3. Operationalisation of variables

Outcome variables: In this study, the outcome variable is a parent's vaccine hesitancy status, categorised as non-vaccine hesitant and vaccine hesitant. In this study non-vaccine hesitant was coded as '0' and vaccine hesitant was coded as '1'.

4.8. Qualitative Study

In order to explore the opinions and perceptions that drive vaccine hesitancy among caregivers and to complement the quantitative data, a qualitative approach was used. The qualitative study was useful in capturing and understanding the differences in perspectives among different groups or individuals (Machekanyanga *et al.*, 2017). Qualitative methods are used to answer questions about experience, meaning, and perspective, most often from the participant's standpoint (Hammarberg, Kirkman and de Lacey, 2016). Qualitative data can capture the underlying beliefs, opinions, or motivations of different groups of people and help describe their behaviours while providing a detailed, in-depth understanding of phenomena or experiences (Tuckerman, Kaufman and Danchin, 2022). Consequently, it can answer the 'how', 'why', or 'what' questions rather than simple 'yes' or 'no' questions.

4.8.1. Focus Group Discussions

In line with the outcome of the systematic literature review (SLR), which recommended a mixed methods approach for the study of complex phenomena such as vaccine hesitancy, a qualitative study was carried out using a focus group discussion (FGD) for data collection. This is with the intention to explore the opinions and perceptions that drive vaccine hesitancy among caregivers and to shed more light on the quantitative data.

The focus group discussion (FGD) is a commonly used data-gathering method in qualitative research (Creswell and Creswell, 2009; Braun and Clarke, 2012; Yayeh, 2018). An FGD is

defined by van Eeuwijk and Angehrn (2017) as a qualitative research method and data collection technique in which a selected group of people discusses a given topic or issue in-depth using an external facilitator. Compared with other data collection techniques such as questionnaires and observations, FGDs are a valuable source for exploring the internal views and emotions of individuals (Tümen-Akyildiz and Ahmed, 2021). In addition to this, FGD is an effective way to bring people from similar backgrounds and experiences to discuss a specific topic of interest so as to explore the outcomes that cannot be explained statistically thereby yielding more depth and a lot of information closer to what people are thinking and feeling about the topic (Zacharia, Pai and Paul, 2021).

The importance of the FGD, according to van Eeuwijk and Angehrn (2017), is predicated upon the assumption that the group processes activated during an FGD help to identify and clarify shared knowledge among groups and aggregate individual opinion. Guidance on how to conduct an FGD, including composition and size, has been provided by Mishra (2016) and comprises open-ended questions and probing questions that will help to explore participants' accounts of factors considered to be important drivers of vaccine hesitancy and vaccine acceptance. The discussion lasted for between 60 and 120 minutes at a convenient time and place for the participants, and it was recorded.

4.8.1.1. Recruiting and preparing participants for the focus group discussion

The FGD for this study was made up of three groups. Participant recruitment using the purposive sampling technique was spread around the clinic areas and wards to have a good representation of the population under study. During the quantitative phase at each health facility, participants were informed that a follow-up qualitative phase- involving a moderated group discussion among a few participants to capture their personal views- would be carried

out. Caregivers who indicated their interest in participating were subsequently invited to the focus group discussion.

The advantage of my familiarity with the study location facilitated seamless recruitment of participants for the FGD and I was able to manage the concerns of those who were initially ambivalent about their participation in the FGD.

A total of twenty-four (24) caregivers, consisting of 22 mothers and two grandmothers, gave their consent to participate. The caregivers were divided into 3 groups of eight participants each for ease of conduct of the focus group discussion. The first session of FGD was conducted on Friday, 19th April 2024. All the eight participants invited took part in the discussion. The second FGD session took place on the 3rd of May 2024. Only seven out of the eight participants slated for the FGD were present on the fixed day because the eighth opted out. The last group of eight took part in the 3rd and last session on the 10th of May 2024.

4.8.1.2. Preliminary actions for the FGD

1. An FGD guide was prepared, comprising six (6) open-ended questions derived from the WHO SAGE Working Group's recommended questions (Larson *et al.*, 2015) and probes that helped to explore participants' accounts of factors considered to be important drivers of vaccine hesitancy and vaccine acceptance.

2. Barriers to attending the FGD after selection/volunteering were reduced by offering transportation fare to participants and ensuring that the FGD did not clash with any vaccination schedule for their children.

4.8.1.3. Conducting the Focus Group Discussion

The three sessions of focus group discussion were conducted by a team consisting of a moderator (myself as the principal investigator), an assistant moderator (who served as the

minute taker), and an observer. I facilitated the discussion while the assistant moderator took the notes and operated the mobile device based on the prepared protocol. The observer was the immunisation officer of the health facility whose role was to ensure adherence to the FGD guide. Hence the assistant moderator and the observer did not influence the FGD in anyway. The FGD guide is attached as appendix 4.7.

4.8.1.4. Fieldwork settings and guidelines

Privacy and confidentiality were observed throughout the FGD research period. This was done by ensuring that the sections of the focus group discussion were conducted in a quiet place, away from other people, and that the data collected were not open to anyone other than the researcher and her supervisors. Names of participants were not indicated on the research tools or the audio records. Notes taken during the FGDs were kept secure by the researcher to ensure confidentiality, while the laptop containing the data was password-protected. There were no risks or any challenges during the FGD data collection because the researcher was already familiar with the study location and setting, having worked there as a clinician. At the end of the FGD, all tapes and notes were labelled with the date, time, and name of the group.

Chapter Five: Data Analysis and Methods

5.1. Analysis of quantitative data

This section of the chapter outlines the methods used for the analysis of the quantitative data, based on the research questions. The frequency distribution of the key outcomes of interest, consisting of sociodemographic characteristics of respondents and other correlates of vaccine hesitancy and vaccination decisions, were described using means and ranges for continuous variables and proportions for categorical variables. The associations between sociodemographic characteristics, knowledge status, attitudinal status and vaccine hesitancy were measured. IBM SPSS 28 was used to analyse the data.

5.1.1. Respondents' sociodemographic characteristics and categorization.

The sociodemographic variables were dichotomized by transforming the data and recoding into separate variables. The dichotomised categories of the sociodemographic variables are presented in Appendix 5.1.

The frequency distribution of socio-demographic data was measured while the Pearson's chi-square coefficient was used to determine the test of association between caregivers' sociodemographic characteristics and vaccine hesitancy status. Significant association was determined at 95% confidence interval with a p value less than 0.05. Significant association was determined at 95% confidence interval with a p value less than 0.05.

5.1.2. Prevalence of Vaccine Hesitancy

The dichotomous Vaccine Hesitancy Scale (VHS) data tool (Appendix 4.5D) and the PACV data tool (Appendix 4.5E) were used to determine the vaccine hesitancy status of respondents. The VHS data tool had 10 questions. A hesitant answer was scored zero, while a non-hesitant answer was scored one. The respondents were categorized as hesitant and non-hesitant, using

the mean score threshold. Hesitancy on the PACV tool was determined using the method developed by Opel *et al.* (2013b). Those who scored above 50 were regarded as hesitant, while those who scored below 50 were classified as non-hesitant. The test of association between socio-demographic variables (independent variables) and parental vaccine hesitancy status (dependent variable) was determined using binary logistic regression.

5.1.3. Sociodemographic Determinants of Parental Vaccine Hesitancy

The predictors of parental vaccine hesitancy and the strength of association with the sociodemographic characteristics were determined using binary logistic regression. In a binary logistic regression, the direction and strength of the association between the independent variable and the dependent variable (outcome) is determined by the odds ratio (Harris, 2021; Castro and Ferreira, 2022). The precision of the estimate and statistical significance is measured at a 95% Confidence Interval (CI) of the odds ratio when the *p*-value is less than 0.05. (Castro and Ferreira, 2022).

Three models were tested. In doing this, the sociodemographic variables (all categorical) to be included in the logistic regression were purposively selected according to the process reported by Bursac *et al.* (2008) under the guidance of my supervisor. The criteria for inclusion of a variable in the model involved minimization of variables (two at the beginning in this study) until the most fitting model that describes the data was found while achieving numerical stability and generalizability of the results (Bursac *et al.*, 2008). The dependent variable was the vaccine hesitancy status (VHS) of respondent, and this is binary. Model 1 included the respondent socio-demographic covariates - age and ethnicity, in which 'above 30 years' and 'other ethnic groups' were used as the reference category. In Model 2, the socio-economic covariates – education and employment – were added and thus there were four variables in the second model. 'High education' and 'not working full time' were the reference variables. The

covariates in Model 3 were seven (7) with the addition of the covariates for the index child (sex and age) and number of children of the respondents. The reference categories were ‘Female’, ‘above 24 months’, and ‘above 2 children’ respectively.

The logistic regression equation is depicted as follows:

$$\ln[P/(1-P)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n, \text{ where:}$$

P: This is the probability that the outcome event will happen. This is the probability that the caregiver will be vaccine-hesitant.

1-P: This is the probability of the caregiver non-vaccine hesitant.

P/(1-P): This is the odds that the caregiver will be vaccine-hesitant

$\ln[P/(1-P)]$: This is the log-odds, which is the outcome that the logistic regression directly models.

β_0 : The intercept, or the log-odds, when all predictor variables are zero.

$X_1, X_2, \dots, X_n$: These are the independent variables, which are categorical in this study.

X_1 : Age of caregiver (categorical)

X_2 : Ethnicity (categorical)

X_3 : Education (categorical)

X_4 : Employment (categorical)

X_5 : Age of index child (categorical)

X_6 : Gender of index child (categorical)

X_7 : Number of children (categorical)

$\beta_1, \beta_2, \dots, \beta_n$: These are the regression coefficients for each independent variable.

Model 1

$$\text{Ln (odds that the caregiver will be vaccine hesitant)} = \beta_0 + \beta_1(\text{Age}) + \beta_2(\text{Ethnicity})$$

Model 2

$$\text{Ln (odds that the caregiver will be vaccine hesitant)} = \beta_0 + \beta_1(\text{Age}) + \beta_2(\text{Ethnicity}) + \beta_3(\text{Education}) + \beta_4(\text{Employment})$$

Model 3

$$\text{Ln (odds that the caregiver will be vaccine hesitant)} = \beta_0 + \beta_1(\text{Age}) + \beta_2(\text{Ethnicity}) + \beta_3(\text{Education}) + \beta_4(\text{Employment}) + \beta_5(\text{Age of index child}) + \beta_6(\text{Gender of index child}) + \beta_7(\text{Number of children})$$

5.1.4. Caregivers' Knowledge of Vaccine-Preventable Diseases and Vaccination**Schedule.**

The second research question determines to what extent a caregiver's knowledge of vaccine-preventable disease (VPD) and vaccination schedule influences their vaccine hesitancy. There were nine knowledge questions (Appendix 5.1B), and each right answer was scored one, while a wrong answer was given a score of zero. The mean knowledge score of the respondents was determined. Those who scored above the mean score were classified as having good knowledge, while those who scored below the mean score were regarded as having poor knowledge. The frequency of the scores per variable was determined using simple descriptive statistics.

5.1.5. Knowledge scores based on vaccine hesitancy status and age

An independent *t*-test was used to find the differences in knowledge among parents who were non-hesitant and those who were vaccine hesitant. Also, the differences in knowledge between caregivers whose age was 30 years and below and those whose age was above 30 years were computed. The *p*-value was used to determine if the knowledge difference in the two groups (vaccine hesitant and non-vaccine hesitant) and (caregivers below 30 years and those above 30 years) was significant.

5.1.6. Knowledge as predictors of parental vaccine hesitancy

Logistic regression analysis was used to determine the predictors of parental vaccine hesitancy based on respondents' knowledge of vaccine-preventable diseases and vaccination schedules. The nine items in the knowledge questionnaire were included as independent variables while the dependent variable was the vaccine hesitancy status (as from the VHS tool). The outcomes of the knowledge variables were binary consisting of “wrong answers” and “right answers” to the questions asked.

5.1.7. Measuring parental attitude to childhood vaccination

The parental attitude to childhood vaccination was measured using the PACV scale (see appendix 4.5D), which was developed by Opel et al. (2013). The PACV data tool contains 15 items (questions) under 3 domains (behaviour, safety and efficacy, and general attitudes) according to Opel et al. (2013). Other studies (Abd Halim *et al.*, 2020; ElSayed *et al.*, 2022) had come up with varied classifications for the domains in the PACV. However, the attitude domain has remained unchanged, with only a slight variation in the type of questions to be included in the attitude domain. It has been demonstrated that the PACV data tool can predict childhood immunization status with high reliability (Opel et al., 2013). The utilization of the

PACV tool in this study, therefore, was due to its ability to achieve a robust measure of parental immunization attitudes and beliefs.

Each item on the PACV scale has three response options consisting of “Yes,” “Not sure/don’t know,” and “No,” coded with values of "0," "1," and "2," respectively. The total score per caregiver was the sum of all items, ranging from 0 to 30, with higher scores indicating higher levels of vaccine hesitation. The raw score was then transformed to a 0–100 scale using simple linear transformation. The internal consistency of the scale was determined by Cronbach’s α using the IBM SPSS 28 software.

The focus of this study was not a validation of the PACV data tool; hence, there was no need to carry out exploratory factor analysis (EFA), which was necessary for the identification of potential subscales in the PACV tool. A bivariate analysis, with the PACV status as the dependent variable and selected sociodemographic characteristics, knowledge status, and attitudinal status, as the independent variables, was carried out.

5.1.8. Caregivers’ Attitude on Childhood Vaccination

The attitude and beliefs variables were selected from the Parental Attitude to Childhood Vaccination (PACV) survey tool, and these were Q6, Q7, Q8, Q9, Q10, Q11 and Q12, while the trust variables were Q13, Q14 and Q15, in Appendix 4.5D.

The attitude variables cover respondents’ confidence in vaccines and their perspective on their usefulness, effectiveness, safety and the severity of the diseases they prevent. The items included in this part were also extracted from previous surveys. The attitude and belief scale consisted of 7 items. A 3-point Likert scale consisting of “Yes/Concerned”, “Not sure” and “No/Not Concerned” was used with a score of 0, 1 and 2, respectively. Thereafter, the mean attitude score was calculated, and those who scored above the mean attitude score were

regarded as having a favourable attitude while those who fell below the mean score were considered as having unfavourable attitude.

5.1.9. Attitudinal variables and caregivers' beliefs using the VHS Likert scale.

A Pearson chi-square test was carried out to determine the relationship between the respondents' attitude and socio-demographic characteristics. Thereafter, a binary logistic regression was carried out in which the attitude subscales were used as the independent variables while the PACV status was the dependent variable. The outcome of the regression analysis was used to determine the predictive effect of attitude variables on Parental Attitude to Childhood Vaccination.

5.1.10. Intention to Vaccinate

The "intention to vaccinate" is an outcome variable (vaccination practice) in this study. It is measured by the response to question 4 on the PACV data tool, *"If you have another infant today, would you want him/her to get all the recommended immunization?"* It is a measure of future vaccination behaviour of the respondents. The variable was dichotomised into two categories consisting of those who had the intention to vaccinate and those who had no intention to vaccinate, followed by the determination of the frequency distribution. The predictors of the "intention to vaccinate" by the respondents were determined by conducting a binary logistic regression analysis. The independent variables were knowledge status, attitudinal status, derived hesitancy status, self-reported hesitancy status, and some selected socio-demographic characteristics, and the intention to vaccinate was the dependent variable.

A stepwise binary logistic regression analysis was carried out. The first model contained fourteen (14) variables consisting of knowledge, attitude, past vaccination behaviour, and PACV hesitancy variables. In addition, 10 sociodemographic variables were included, out of which three were child-specific. The model was then tested, and from the output, three

variables with the p-value that has the highest deviation from 0.05 were removed, thereby leaving eleven variables that were tested in Model 2. In the final model, three more variables were removed from the output of Model 2, leaving eight variables that were tested for their predictive effect on future vaccination behaviour of the respondents, which is their intention to vaccinate their children.

The logistic regression assumed the generic equation $\ln[P/(1-P)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_{14} X_{14}$ as previously defined in 5.1.3. The dependent variable is the intention to vaccinate (derived from Q4 of the PACV), with the following as the independent variables in the first model:

X_1 = Knowledge status, X_2 = Derived Hesitancy status, X_3 =Attitudinal status, X_4 = Past vaccination behaviour, X_5 =Age, X_6 = Gender, X_7 = Employment status, X_8 =Religious affiliation, X_9 = Education status X_{10} =Marital status, X_{11} = Ethnicity, X_{12} = Number of children, X_{13} = Child gender, X_{14} = Index child age.

The equation for the final model was:

$\ln(\text{odds that the caregiver will have intention to vaccinate}) = \beta_0 + \beta_1 (\text{Knowledge status}) + \beta_2 (\text{Derived hesitancy status}) + \beta_3 (\text{Attitudinal status}) + \beta_4 (\text{Past vaccination behaviour}) + \beta_5 (\text{Age}) + \beta_6 (\text{Gender}) + \beta_7 (\text{Employment status}) + \beta_8 (\text{Religious affiliation})$

5.1.11. Sources of vaccination information and distribution based on age.

The frequency distribution of caregivers' sources of vaccination information from the 7 sources (Health facilities, health workers, mass media, radio/TV, social media, family and friends and other mothers) was determined using simple statistical measure and thereafter disaggregated according to the age categorisation.

5.1.12. Impact of sources of vaccination information on knowledge status, vaccine hesitancy status and intention to vaccinate.

Three binary logistic regression analyses were carried out in which the source of vaccination information subscale was used as the independent variable while the “intention to vaccinate”, “vaccine hesitancy status” and “knowledge status” were the dependent variable for each model. The importance of this is to determine the effect of the caregivers’ source of information on each of the three dependent variables.

The equations for the three models were as follows:

Model 1

$\text{Ln (odds that the caregiver will have intention to vaccinate)} = \beta_0 + \beta_1(\text{Friends/Family}) + \beta_2(\text{Radio/TV}) + \beta_3(\text{social media}) + \beta_4(\text{Church/Mosque}) + \beta_5(\text{Health workers}) + \beta_6(\text{Health Facilities}) + \beta_7(\text{Other Mothers})$

Model 2

$\text{Ln (odds that the caregiver will be vaccine hesitant)} = \beta_0 + \beta_1(\text{Friends/Family}) + \beta_2(\text{Radio/TV}) + \beta_3(\text{social media}) + \beta_4(\text{Church/Mosque}) + \beta_5(\text{Health workers}) + \beta_6(\text{Health Facilities}) + \beta_7(\text{Other Mothers})$

Model 3

$\text{Ln (odds that the caregiver will have good knowledge)} = \beta_0 + \beta_1(\text{Friends/Family}) + \beta_2(\text{Radio/TV}) + \beta_3(\text{Social Media}) + \beta_4(\text{Church/Mosque}) + \beta_5(\text{Health workers}) + \beta_6(\text{Health Facilities}) + \beta_7(\text{Other Mothers})$

5.1.13. Trust variables’ frequency and relationship with vaccination Practice.

A frequency analysis of the ‘trust’ variables (Questions 13, 14 and 15 on the PACV tool) was carried out using descriptive statistics. Thereafter, two effects were tested using binary logistic

regression analysis involving the trust variables as independent variables and the “PACV” scale and the “intention to vaccinate” as the dependent variables, respectively. The analysis of the effect of the trust variables on the intention to vaccinate involved a stepwise addition of the three variables one after the other, which led to the creation of three models.

The three stepwise models for the intention to vaccinate based on trust variables are represented by the equations below:

$\text{Ln (odds that the caregiver will not have intention to vaccinate)} = \beta_0 + \beta_1 \text{ (I trust the information I receive about immunisation)}$

$\text{Ln (odds that the caregiver will not have intention to vaccinate)} = \beta_0 + \beta_1 \text{ (I trust the information I receive about immunisation,)} + \beta_2 \text{ (Overall, I trust my child's immunisation provider)}$

$\text{Ln (odds that the caregiver will not have intention to vaccinate)} = \beta_0 + \beta_1 \text{ (I trust the information I receive about immunisation)} + \beta_2 \text{ (Overall, I trust my child's immunisation provider)} + \beta_3 \text{ (I am able to openly discuss my concerns about immunisations with my child's doctor)}$

$\text{Ln (odds that the caregiver will be vaccine hesitant on PACV scale)} = \beta_0 + \beta_1 \text{ (I trust the information I receive about immunisation)} + \beta_2 \text{ (Overall, I trust my child's immunisation provider)} + \beta_3 \text{ (I am able to openly discuss my concerns about immunisations with my child's doctor)}$

5.1.13. Vaccination Behaviour

Vaccination behaviour was determined based on a modified version of the procedure used by Ellithorpe, Adams and Aladé (2022). Caregivers were asked, “Have you ever been reluctant or hesitated to get a vaccination for your children?” Those who said “No” to this question were classified as “Willing Acceptors”, while those who responded “Yes” to this question were classified as hesitant. The hesitant group consisted of those who refused completely and those

who eventually accepted vaccines (hesitant acceptors). Those who refused completely (Total Refusers) were the caregivers who said yes when asked, “Have you ever refused a vaccination for your children?” Both questions were from the validated dichotomous data tool for studying vaccine hesitancy.

5.1.14. Mediation Analysis

The effect of PACV status on the vaccination practice via a third variable, known as the mediator or intervening variable, was carried out. This was facilitated through a process macro with 5000 bootstrapping resamples.

Two independent mediation analysis with PACV status (as the independent variable) and vaccination behaviour (as the dependent variable) were conducted using model 4 of Hayes’ Process Macro for SPSS to test the mediation effect of attitude and knowledge in each model. This was based on 5,000 bootstrap samples with 95% confidence intervals (CIs). The PACV, attitude and knowledge scores used for the models were continuous variables, while the vaccination behaviour scale was binary (to accept or to refuse vaccination). Furthermore, since the PACV score is a negative scale, a positive coefficient represents a negative effect on the mediator and the dependent variable. The parameters in each of the mediation model are presented in Table 5.1.

Table5.1: Models for mediation analysis

S/N	Model	Independent Variable (Exposure)	Mediator	Dependent/Practice variable
1	Model 1	Vaccine hesitancy	Attitude	Vaccine behaviour
2	Model 2	Vaccine hesitancy	Knowledge	Vaccine behaviour

The pathways for the two (2) models are presented in figures 5.1 and 5.2.

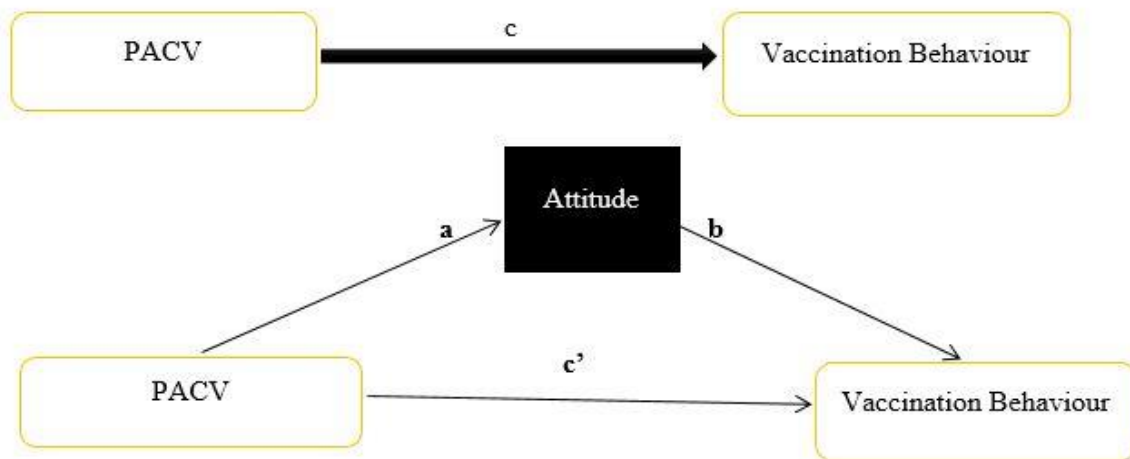


Figure 5.1: The mediation pathway for model 1

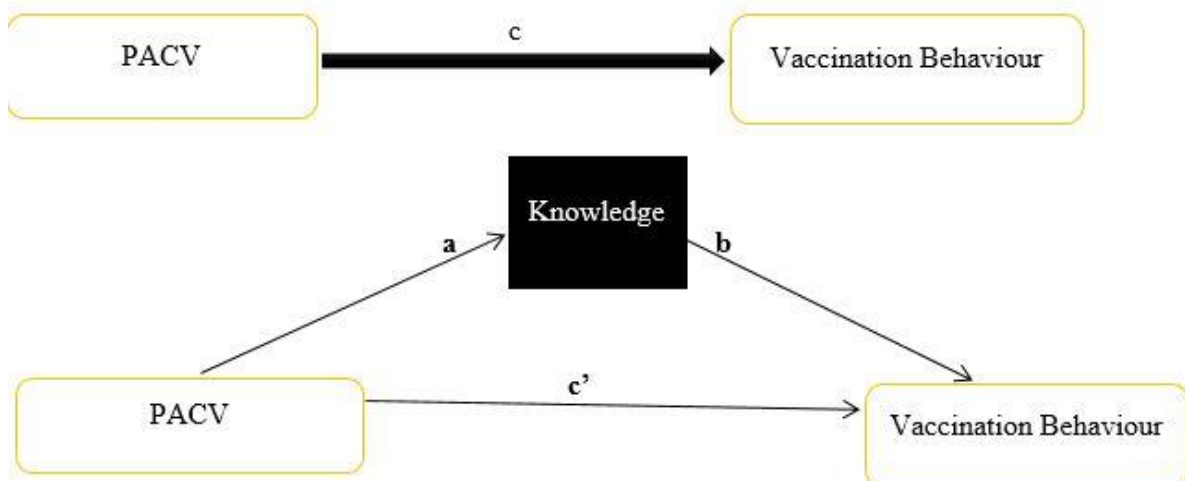


Figure 5.2.: Mediation pathway for Model 2

Three types of effects are measured in mediation analysis to determine the nature of mediation, if any. These are direct, effect, and total effects.

Direct effect is the impact of an independent variable (X) directly on the dependent variable (Y) without passing through the mediator variable (M). It is represented by the path coefficient c' .

Indirect Effect is the effect of PACV (independent variable) on vaccination behaviour (dependent variable) through the mediator (Attitude and knowledge independently). It is

calculated as the product of the path coefficient ($a \times b$) represented as “ ab ” and indicates if the mediator explains the relationship. This means that the indirect effect in this study for Model 1 is the product of the coefficient of the effects of PACV on attitude and the attitude variable on vaccination behaviour. In Model 2, the indirect effect is the product of the coefficient of the effect of PACV on the knowledge variable and the effect of knowledge on vaccination behaviour.

Total Effect is the product of direct effect and the indirect effect, represented as “ $c = c' + ab$ ”.

5.2. Analysis of the qualitative data

This qualitative study employed a pragmatic research approach which utilises a focus group discussion to gather insights on vaccine hesitancy from caregivers of under-fives. The focus group discussions (FGDs) were therefore structured to identify and discuss reasons for vaccine hesitancy, identify terms that caregivers use in discussing their hesitancy, and determine how they group or categorise issues relevant to vaccine hesitancy.

The FGDs' questions were based on the open-ended questions developed by the SAGE Working Group on vaccine hesitancy as reported by Larson *et al.* (2015) and on caregivers' experiences of childhood vaccinations, experiences of vaccination appointments for their children, and decision-making as a parent in accessing childhood vaccination. The participants in the FGD also responded to open-ended questions predicated on the study's research questions, which seek to ascertain the determinants of vaccine hesitancy. The three focus group discussions were audiotaped and transcribed verbatim. The word “audiotaped” refers to audio recording and this was done with the recording function on a mobile device. Thereafter, thematic analysis based on (Braun and Clarke, 2012) guideline was carried out.

The transcripts were examined line by line to generate an initial list of ideas about what is in the data and what is relevant to the research purpose. The initial coding was done which was

sorted into potential themes. The themes were then examined to identify whether they form a coherent pattern or not, identify the vaccine hesitancy factors story that each theme tells, and determine how it fits into the broader overall story.

5.2.1. Colloquial or cultural language and qualitative narrative.

The focus groups were a mix of participants who expressed themselves fluently in English, those who spoke both English and Yoruba language (the popular local dialect in the study area), and those that spoke the Yoruba dialect only. Participants were encouraged to speak whichever of the languages they are comfortable with to allow full participation in the study and to make them feel comfortable. A common ground, however, is the general understanding of pidgin English, a dialectical form of English spoken by virtually all Nigerians. The fluency of the researcher in both languages facilitated the conduct of the FGD in both languages without losing the intended meaning of the participants' responses. The conduct of the FGDs in local dialect in addition to English was consistent with the practice of (Boakye *et al.*, 2021), where a focus group discussion in Kenya was conducted in English and Swahili, the language mainly used by the community members in the study location. Furthermore, this practice aligns with (Alzyood *et al.*, 2020) recommendation that such FGD should be conducted using the local language and that a bilingual lead researcher should be used when there is a bilingual difference in study locations.

The audio recordings were translated and transcribed into contemporary English since some of the participants used expressions that are quite understandable within the local context but may have connote a different meaning to a native English speaker. It also enabled familiarisation or immersion in the data very soon after it was collected. Three (3) transcripts were generated, one for each focus group discussion.

5.2.2. Thematic Analysis Framework

Braun and Clarke's thematic analysis (Braun and Clarke, 2006), involving a six-step process, was carried out. The details of each step as adapted by Campbell *et al.* (2021) with slight modification are presented in table 5.2. These include familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and report production. The researcher used an inductive coding technique in this analysis by allowing the narrative to determine the themes and subthemes (Proudfoot, 2022; Vears and Gillam, 2022). Inductive analysis, according to Nowell *et al.* (2017), is a process of coding the data without trying to fit it into a pre-existing coding frame or the researcher's analytic preconceptions. The codes generated were understood to represent the researcher's interpretations of patterns of meaning across the dataset (Byrne, 2022). While the six phases are organised in a logical sequential order, the analysis was not a linear process of moving forward through the six phases. It, however, involves moving forward and backward between phases many times particularly if dealing with a lot of complex data (Maguire and Delahunt, 2017).

5.2.3. Phase One (Familiarisation with the Transcript)

During the familiarisation phase, each FGD recording was played back involving 'active listening' (Byrne, 2022) to develop an understanding of the primary areas addressed in each FGD prior to transcription without taking any notes. Thereafter, manual transcription of each FGD was done immediately after the active-listen playback. Thereafter, the three datasets (transcripts) were read repeatedly to a saturation point to enable easy recall and identification of key features significant to the research questions. The transcripts were examined line by line to generate an initial list of ideas about the data content.

Table 5.2: Phases of Reflexive Thematic Analysis

Analytic Phase	Description	Actions
<i>Phase One Data familiarization</i>	Immersing in the data to understand depth and breadth of the content Searching for patterns and meaning begins; Guidance by supervisors	Translating and transcribing audio data; Reading and re-reading data set; Note taking Discuss data at supervision meeting
<i>Phase Two Initial code generation</i>	Generating of initial codes to organize the data, with full and equal attention given to each data item	Labelling and organizing data items into meaningful groups
<i>Phase Three Generating (initial) themes</i>	Sorting codes into initial themes Identifying meaning of and relationships between initial codes	Diagramming or mapping Writing themes and their defining properties
<i>Phase Four Theme review</i>	Reviewing the entire data set as a whole; Writing beyond the simple description of the themes; Cycling between the data and the identified themes in order to organize the story	Ensuring there is enough data to support a theme; Collapsing overlapping themes Re-working and refining codes and themes
<i>Phase Five Theme defining and naming</i>	Identifying the story of each of the identified themes; Fitting the broader story of the data to respond to the research questions	Cycling between the data and the identified themes in order to organize the story
<i>Phase Six Report production</i>	Presentation of a concise and interesting account of the story told by the data, both within and across themes	Writing a compelling argument that addresses the research questions Writing beyond the simple description of the themes

Adapted from Campbell *et al.* (2021)

. Having reflected on the data (the content of the transcripts), notes were made on key observations. The initial trends observed in the data and the common opinions, ideas, and use of language were noted. The familiarisation process was critical to transparency and reproducibility of the data since the transcription had to be carried out with a level of rigour (Braun and Clarke, 2006; Roberts, Dowell and Nie, 2019) towards enhancing the depth of research findings (Naeem *et al.*, 2023). In addition, the preliminary ideas noted during the familiarisation with the data were therefore useful in the identification of possible codes and the interpretation of the finalised thematic framework (Neale, 2016). The transcripts were also shared with the researcher's supervisor for the verification of the thematic analysis process and

initial meaning- making of the emerging patterns. Thereafter, after a follow-up meeting to discuss emerging trends, I proceeded to the next stage.

The next stage in the familiarisation phase was the categorisation of the data using a Computer-Aided Qualitative Data Analysis Software (CAQDAS) QSR NVivo14. QSR NVivo was used for data organisation and management and it allows for easy coding of the text on to different themes, subthemes or categories to help in the identification of links and associations within the data. This stage proceeded based on the assertion of Finlay (2021) that researchers who take a more scientifically orientated approach, common with mixed methods study, often adopt a systematic and reliable coding procedures which is facilitated with a software and guided by protocols and set procedures, as conducted in this study.

The process for the coding of the transcript commenced by uploading the transcripts into the NVivo software. Thereafter, a second phase of the familiarisation was also done on the software. The transcripts were read again coupled with note taking and use of annotation while also cross checking by listening to the audiotape to ensure that there was no distortion in the meanings intended by the participants.

5.2.4. Phase Two (development of initial codes)

The second phase of the thematic framework involved the development of an initial coding framework for each set of transcripts and was guided by the research questions, study objectives, and the repeating ideas that came from the raw data. This phase involves highlighting sections of the text (usually phrases or sentences) and coming up with shorthand labels or codes to describe their contents with the aid of field note. Furthermore, particular attention was paid to the meaning of what the participants were expressing, the frequency with which emerging issues were mentioned among the different participants and differences or similarities in views across the participants. In addition, specific examples of personal

experiences given by the participants, majority views, minority views and conflicting arguments were identified. Subsequently, using the research question as a guide, a list of codes was developed based on the reading and rereading of the narrative data with the aid of NVivo software across each data set (transcript of each FGD). The outcomes are at appendices 5.1, 5.2 and 5.3.

5.2.5. Phase Three: Searching for themes.

When all the data had been coded, the set of codes for the three FGD transcripts were brought together to review and harmonise all the different codes into one dataset. Thereafter, the different codes were sorted into potential themes, and all the relevant coded data extracts were organised within the identified themes. Themes are abstract and subtle expressions, patterns, and processes that explain a phenomenon (Mishra and Dey, 2022). This process involved listing all the relevant emerging issues in relation to vaccination and vaccine hesitancy and regrouping them into main themes and sub-themes. Based on the two research questions, four themes were generated for the first research question, while seven themes were generated for the second research question, as presented in table 5.3.

Table 5.3: Preliminary themes developed at Phase Three of the Thematic Analysis

RQ	RESEARCH QUESTION	THEME
1	What are the reasons given by caregivers for accepting vaccines for their children	Perceived efficacy of vaccine in disease prevention
		General wellbeing
		People and Societal influence
		Proper knowledge of vaccination
2	What are the reasons for vaccine hesitancy among caregivers?	Perceived risk and adverse reaction of vaccines
		Traditional practices and Spirituality
		Social Networks and Interaction with Health workers
		Lack of knowledge of vaccination
		Phobia
		Attitude and Cultural beliefs
		Health Facility Characteristics

5.2.6. Phase Four: Reviewing of themes.

This phase involves two levels of reviewing and refining of the themes. The first one involved reviewing the themes at the level of the coded data extracts. This was done by reading all the collated extracts for each theme and considering whether they appeared to form a coherent pattern or not. The essence of this is to determine the adequacy, consistency, transparency and reliability of each theme (Leung, 2015; Noble and Smith, 2015) and whether the themes forms a coherent pattern (Nowell *et al.*, 2017) and accurately reflect the inherent ideas evident in the data set (Braun and Clarke, 2006). The collated extract of a theme consists of the codes brought under the various subthemes of a theme. If a coherent link is established between the codes, the subtheme and theme, then I proceeded to the next level. If not, the composite codes were inspected further to determine whether to rework the theme, create a new theme, reassign into similar theme or discard from the analysis (Braun & Clarke, 2006). This was done in order to capture how each caregiver's experience, through the theme, contribute to the explanation of the why and how of the vaccine hesitancy phenomenon. (Braun and Clarke, 2019) stated that a thematic analysis is considered as a reflection of the researcher's interpretive analysis of the data based on the available dataset, theoretical assumptions of the analysis, and the analytical skills/resources of the researcher and as such no two researchers are expected to give meaning to the three criteria in the same way (Byrne, 2022). Nevertheless, the meaning of the data set was further checked with one of my supervisors through discussion and verification. Hence, once the themes adequately captured the inherent meaning of the coded data and adequately represent the subthemes, I proceeded to the next level. Consequently, the initial themes were reduced from eleven (11) to seven (7). Likewise, some of the sub-themes were merged while a few were reallocated to a different theme. The final themes and subthemes are presented as schematic diagrams in Figure 5.3 and in Figure 5.4. Also, a codebook containing the research

questions, themes, subthemes and respective codes was exported from the NVivo software and presented as Appendix 5.4

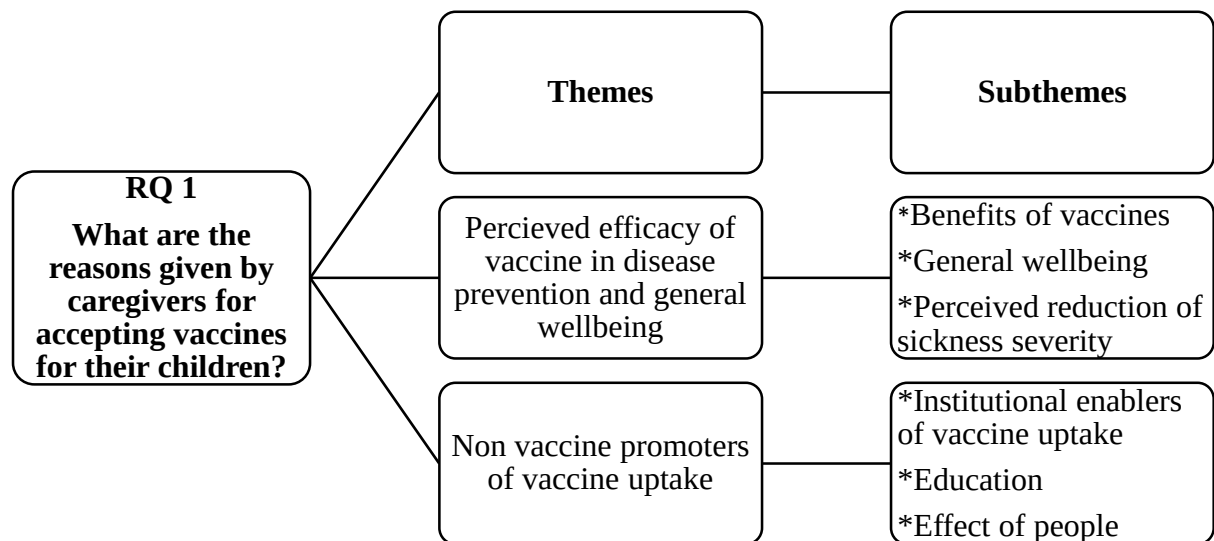


Figure 5.3: Schematic diagram of the themes and subthemes for first research question

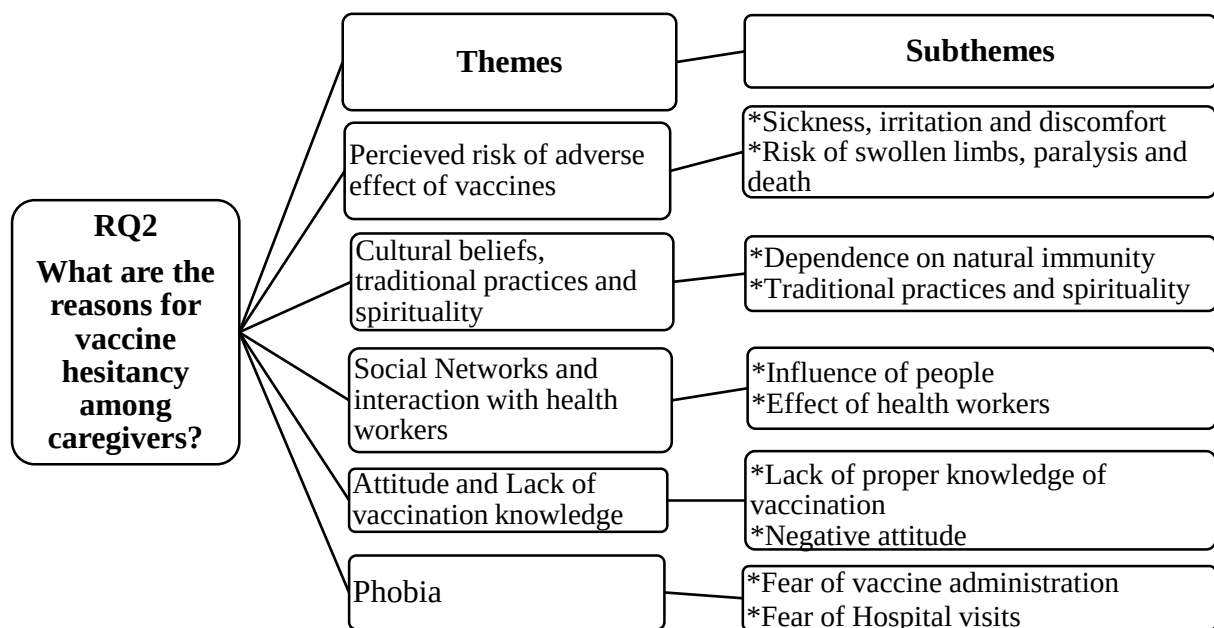


Figure 5.4: Schematic diagram of the themes and subthemes for second research question.

. 5.2.7. Phase Five: Defining and naming themes.

Once the thematic framework of the data has been completed, a detailed analysis for each individual theme was conducted to identify the story that each theme tells in relation to the vaccine hesitancy phenomenon as enunciated by the research questions. This was achieved by identifying the essence of what each theme was about as well as determining what aspect of the data each theme captured. After doing this, the next stage was phase 6 which involved the writing of the thematic analysis report where the significance of each theme was outlined, accompanied with appropriate verbatim quotes.

5.2.8. Significance of the Word Cloud to the research question

Word clouds are a tool which enable qualitative data to be displayed, with the relative importance or frequency of each idea proportional to the size of the word in the cloud (Mowforth *et al.*, 2023). Word clouds are increasingly being used as analytical devices to provide a synopsis of the major themes contained within written material. A word cloud showing a cluster of the most frequent one hundred (100) words associated with the codes in Appendix 5.1, 5.2 and 5.3 is presented as Figure 5.5 while the word summary of 100 most frequent words is at Appendix 5.5.

In this study, there were 6 prominent words and each word was perused for relevance and significance to the two research questions. Subsequently the words were appraised for their inherent meaning and possible contribution to the analysis of the codes. Appraisal was done according to the procedure adopted in the “word cloud analysis of historical changes in the subject matter of public health practice in the United Kingdom” (Atenstaedt, 2021) and in the “word cloud analysis of *BJGP*: a decade on” (Atenstaedt and Jones, 2024).

Chapter Six: Survey Results

6.0. Introduction

This chapter presents the findings of the survey data. A total of 450 caregivers (consisting of mothers, fathers and grandmothers) participated in the quantitative phase of the study. This chapter outlines the research findings related to the following research questions:

1. Are caregivers' sociodemographic/economic status associated with parental vaccine hesitancy?
2. To what extent does a caregiver's knowledge of vaccine-preventable diseases (VPDs) and vaccination schedules influence their vaccine hesitancy?
3. Are caregivers' attitudes and beliefs about vaccination associated with parental vaccine hesitancy?
4. Are caregivers' parental intention to vaccinate and vaccination behaviour determined by their vaccine hesitancy status?
5. Do any of the independent variables mediate the effect of parental vaccine hesitancy on caregivers' vaccination behaviour?

6.1. Sociodemographic characteristics of the caregivers

The results at section 6.1 to 6.4 is framed from the perspective of the health belief model (HBM) which centres on how certain individual factors influence vaccination behaviour. Table 6.1 presents the socio-demographic characteristics of the 450 respondents. The majority (93.1%) of the respondents were females. The mean age of respondents was 31.75 ± 12.14 years, spanning ages from 18 to 55, with 36% under the age of 30. Over 90% of the respondents were married, predominantly Christians (88.2%), and Yoruba (85.6%) by ethnicity, reflecting the profile of the population in the south-western part of Nigeria, where the Yoruba ethnic group constitutes the majority of the population (Onasanya and Achugo, 2023).

More than half of the respondents (54.2%) had tertiary education. Tertiary education, otherwise known as higher education, includes degrees from universities, polytechnics, monotechnics, colleges of education, colleges of agriculture, and other specialised institutions such as schools of health and technology and National Teachers' Institutes (FRN, 2013). A small proportion of the respondents had primary education (3.8%) while 1.3% had no formal education (1.3%). Over 60% of the respondents reported that they were working part- or full-time, while more than a quarter (27.8%) stated that they were unemployed. More than half (51.7%) of the respondents earned between ₦20,000 and ₦100,000 naira monthly, with 4.0% earning a monthly income above ₦100,000 naira. The majority (91%) of the caregivers reported having between 1 and 3 children, and 92.2% were the mothers of the index child. Of the 450 index children, 238 were males and 212 were females, with a mean age of 18.12 ± 9.68 months.

6.2. Prevalence of Vaccine Hesitancy

Out of the 450 respondents, 71.8% (323) were classified as non-hesitant (score above the VHS mean score of 5.9), and 28.2% (127) were classified as hesitant (score below the VHS mean score of 5.9) (Table 6.2).

Table 6.1: Sociodemographic Characteristics of Respondents

		Frequency	Percentage (%)
Age of respondent	18 - 29	162	36.0%
	30 - 39	239	53.1%
	40 - 49	44	9.8%
	50 and above	5	1.1%
Gender of Respondent	Male	31	6.9%
	Female	419	93.1%
Marital status of Respondent	Single	29	6.4%
	Married	418	92.9%
	widow/widower	1	0.2%
	Divorced	2	0.4%
Religion of Respondent	Christian	397	88.2%
	Islam	51	11.3%
	Traditional religion	2	0.4%
Ethnic group of Respondent	Yoruba	386	85.8%
	Igbo	38	8.4%
	Hausa/Fulani	9	2.0%
	Others	17	3.8%
Educational level of Respondent	None	6	1.3%
	Primary	17	3.8%
	Secondary	183	40.7%
	Tertiary	244	54.2%
Employment status of Respondent	Unemployed	125	27.8%
	Working part-time	77	17.1%
	Working full-time	208	46.2%
	Others	40	8.9%
Monthly income in naira	less than ₦20000	199	44.2%
	₦20000 to ₦50000	173	38.4%
	₦50000 to ₦100000	60	13.3%
	above ₦100000	18	4.0%
Number of children	one	138	30.7%
	two	155	34.4%
	three	108	24.0%
	four and above	49	10.9%
Age of Index child	0-12 months	282	62.7%
	above 12 to 24 months	126	28.0%
	above 24 to 36 months	27	6.0%
	above 36 to 48 months	9	2.0%
	above 48 to 60 months	6	1.3%
Relationship with child	Mother	415	92.2%
	Father	31	6.9%
	Grandmother	4	0.9%

Table 6.2: Parental perception of vaccination.

VHS Variables		Frequency	%
Do you believe that vaccines cannot protect children from serious diseases	Yes	1	0.2%
	No	449	99.8%
Do you think that most parents like you do not have their children vaccinated with all the recommended vaccines?	Yes	380	84.4%
	No	70	15.6%
Have you ever been reluctant or hesitated to get a vaccination for your children?	Yes	106	23.6%
	No	344	76.4%
Have you ever refused a vaccination for your children?	Yes	32	7.1%
	No	418	92.9%
Has distance, timing of clinic, time needed to get to clinic or wait at clinic, and/or costs in getting to clinic prevented you from getting your children immunized?	Yes	82	18.2%
	No	368	81.8%
Are there other pressures in your life that prevent you from getting your children immunized on time?	Yes	55	12.2%
	No	395	87.8%
Are there any reasons you can think of why children should not be vaccinated?	Yes	60	13.3%
	No	390	86.7%
Do you think that it is difficult for some ethnic or religious groups in your community/region to get vaccinations for their children?	Yes	128	28.4%
	No	322	71.6%
Have you ever received or heard negative information about vaccinations?	Yes	123	27.3%
	No	327	72.7%
Do leaders (religious or political leaders, teachers, health care workers) in your community oppose vaccinations for infants and children?	Yes	27	6.0%
	No	423	94.0%

6.3. Relationship between socio-demographic variables and vaccine hesitancy

“There was no difference in the degree of hesitancy with respect to age, gender of respondents, ethnicity, religious status, income status, number of children, and gender of index child” (Table 6.3). A significantly lower vaccine hesitancy prevalence was observed among those working fulltime (22.1%) compared to those not working full-time (which included those who are not employed) (33.5%). The age of the index child was significantly associated with the level of vaccine hesitancy with carers of children above the age of 24 months showing higher prevalence of vaccine hesitancy, compared to caregivers of children below the age of 24 months.

6.4. Caregivers’ characteristics and influence on parental vaccine hesitancy

The outcome of the binary logistics regression of sociodemographic covariates with vaccine hesitancy showed that caregivers ‘*not working full time*’ had 1.8 times higher odds of being vaccine hesitant than those working full time. (95% CI: 1.21, 2.90, $p = .005$). While parents of index children whose age was above 24 months had 2.05 times higher odds of being vaccine hesitant than those whose children’s age was 24 months or below (95% CI: 1.06, 3.99, $p = .034$).

Table 6.3: Parental vaccine hesitancy status by sociodemographic factors

Sociodemographic characteristics		VHD Status					
		Non-Hesitant		Hesitant		<i>Test of Association</i>	
		Frequency	%	Frequency	%	Chi-square (χ^2)	p value
Age of Respondent	Below 30	118	72.8%	44	27.2%	.141	.707
	30 and above	205	71.2%	83	28.8%		
Gender of Respondent	Male	20	64.5%	11	35.5%	.867	.352
	Female	303	72.3%	116	27.7%		
Marital Status	Married	301	72.0%	117	28.0%	.156	.693
	Not Married	22	68.8%	10	31.3%		
Ethnicity	Yoruba	277	71.8%	109	28.2%	.000	.985
	Other tribes	46	71.9%	18	28.1%		
Educational Status	Low education	146	70.9%	60	29.1%	.153	.695
	High education	177	72.5%	67	27.5%		
Employment Status	Working full time	162	77.9%	46	22.1%	7.121	.008
	Not working full time	161	66.5%	81	33.5%		
Income Status	Low income	267	71.8%	105	28.2%	.000	.997
	High income	56	71.8%	22	28.2%		
Religious Status	Christianity	284	71.5%	113	28.5%	.097	.956
	Others	39	73.6%	14	26.4%		
Index child Age	24months and below	299	73.3%	109	26.7%	4.898	.027
	Above 24 months	24	57.1%	18	42.9%		
Number of Children	2 and below	211	72.0%	82	28.0%	.023	.879
	above 2	112	71.3%	45	28.7%		
Gender of child	Male	172	72.3%	66	27.7%	.060	.806
	Female	151	71.2%	61	28.8%		
Relationship with child	Mother	301	72.5%	114	27.5%	1.491	.222
	Father or Grandma	22	62.9%	13	37.1%		

Table 6.4: Caregivers' sociodemographic characteristics as determinants of vaccine hesitancy

		MODEL 1		MODEL 2		MODEL 3	
Socio-demographic Characteristics		Exp. B (95 % C.I.) Lower - Upper	<i>p</i>	Exp. B (95 % C.I.) Lower - Upper	<i>p</i>	Exp. B (95 % C.I.) Lower - Upper	<i>p</i>
Age of Respondents	Below 30*						
	Above 30	1.56 (.84-2.90)	.163	1.64 (.87-3.09)	.124	1.54 (.79- 2.97)	.197
Ethnicity	Yoruba*						
	Others	1.02 (.56-1.84)	.947	.91 (.49-1.68)	.770	.88 (.48-1.64)	.692
Education	Low*						
	High			1.43 (.51-4.03)	.498	1.42 (.50-4.03)	.511
Employment	Working full time*						
	Not working full time			1.85 (1.19-2.84)	.005	1.87 (1.21- 2.90)	.005
Index child Age	24months & below*						
	Above 24 months					2.05 (1.06-3.994)	.034
Children number	2 & below*						
	Above 2					.99(.63-1.56)	.978
Gender of index child	Male*						
	Female					1.12(.74-1.72)	.590
Constant		.37		.19		.17	.002

***p* V= *p*Value**

Nagelkerke R^2 is 0.041 accounting for 4.1% of the variation in the model.

6.5. Impact of caregivers' knowledge of vaccination on vaccine hesitancy status.

The second research question was specific to determining the extent to which a caregiver's knowledge of vaccine-preventable disease (VPD) and vaccination schedule influences their vaccine hesitancy. The results at 6.5 to 6.8 are framed from the perspective of the COM-B model which centres on the ability and knowledge of a caregiver to perform a behaviour, which is vaccination uptake in this instance.

Almost half of the respondents (49.8%) scored above the mean score of 6.05 and were classified as having good knowledge, while the remaining 50.2% were classified as having poor knowledge (Table 6.5). The knowledge score ranged from 0 to 9 with a mean of 6.05 ± 1.71 (Table 6.6). Table 6.7 reports the distribution of caregivers based on their knowledge of specific details on vaccine and vaccination schedule. The majority of the participants (87.1%) knew the appropriate age for a child to start immunisation, which is at birth. Nearly 9 out of 10 (88.4%) correctly mentioned at least one vaccine-preventable disease, while 86.4% stated that vaccines are not harmful; 69.3% of the caregivers were able to provide the correct number of sessions needed to complete vaccination (6). A significant association was detected between having correct knowledge of whether vaccines have alternatives and the vaccine hesitancy status ($\chi^2 = 8.552$, $p\text{-value} = .003$). Furthermore, almost all the respondents (94.7%) indicated that it was not necessary to vaccinate a breastfeeding infant, while 36.2% also thought that a child with a fever should not be vaccinated.

6.6. Mean knowledge score based on age categories and vaccine hesitancy status.

There was no significant difference in the mean knowledge score of caregivers who were 30 years and below (6.80) compared to caregivers above 30 years (6.82). However, caregivers who are non-hesitant had a significant ($p = 0.028$; 95% C.I. = .05 - 0.82) higher mean knowledge score (6.94) than parents who are vaccine hesitant (6.51) with a $t\text{-value}$ of 2.217.

Table 6.5: Caregivers' knowledge Status

	Knowledge Status		
Mean Score	Status	Frequency	%
Below 6.05	Poor Knowledge	226	50.2
6.05 & above	Good Knowledge	224	49.8

Table 6.6: Caregivers' knowledge scores and mean score value.

Score	Respondents' Frequency	%	Mean Score	Median Score	Standard deviation
0	7	1.6	6.05	6.00	1.71
1	4	0.9			
2	9	2.0			
3	20	4.4			
4	32	7.1			
5	53	11.8			
6	101	22.4			
7	152	33.8			
8	70	15.6			
9	2	0.4			
Total	450	100.0			

Table 6.7: Caregivers' knowledge of vaccination schedule and vaccine preventable diseases.

Question	Response	Frequency	%
At what age is it appropriate for a child to start immunisation	others	58	12.9%
	At birth	392	87.1%
How many sessions are needed to complete vaccination"	others	138	30.7%
	six	312	69.3%
At what age does a child complete his/her vaccination:	others	149	33.1%
	15 Months	301	66.9%
Mention vaccine preventable disease that you know	wrong VPD	52	11.6%
	correct VPD	398	88.4%
Why do you vaccinate your child	others	107	23.8%
	To protect from diseases	343	76.2%
Is there an Alternative mechanism to prevent infants from vaccine preventable disease?	Yes	175	38.9%
	No	275	61.1%
Are Vaccines Harmful?	Yes	61	13.6%
	No	389	86.4%
Is it necessary to vaccinate a breastfeeding infant?	No	426	94.7%
	Yes	24	5.3%
Can a child with fever be vaccinated?	No	163	36.2%
	Yes	287	63.8%

6.7. Caregivers' knowledge as determinants of parental vaccine hesitancy

Knowledge of 'Why do you vaccinate your child?' and 'Can a child with a fever be vaccinated?' are significant predictors of vaccine hesitancy. The result from the logistic model (Table 6.8) shows that caregivers who do not know why they vaccinate their child have 1.75 higher odds of being vaccine hesitant compared to those who know why they vaccinate their child (95% CI: 1.06, 2.91, $p = .003$). Likewise, those who said a child with fever cannot be vaccinated have 1.78 higher odds of being vaccine hesitant than those who said that children can be vaccinated (95% CI: 1.12, 2.83, $p = .015$).

Table 6.8: Caregivers' knowledge as determinants of parental vaccine hesitancy

Knowledge questions	Responses	95% C.I.			
		<i>Exp(B)</i>	Lower	Upper	<i>p-value</i>
At what age is it appropriate for a child to start immunisation	Wrong answer				
	Right answer (At birth*)	1.61	.78	3.32	.19
How many sessions are needed to complete vaccination	Wrong answer				
	Right answer (Six*)	1.33	.81	2.17	.26
At what age does a child complete his/	Wrong answer				
	Right answer (15 Months*)	.75	.45	1.26	.27
Mention vaccine preventable disease that you know	Wrong answer				
	Right answer (correct VPD*)	.91	.43	1.91	.79
Why do you vaccinate your child	Wrong answer				
	Right answer (To protect from VPD*)	1.75	1.06	2.91	.030*
There is no alternative mechanism to prevent infants from VPD	No				
	Yes*	1.31	.82	2.08	.26
Vaccines are not Harmful	No				
	Yes*	1.56	.83	2.95	.17
Is it necessary to vaccinate a breast-feeding infant	No				
	Yes*	1.29	.48	3.44	.62
Can a child with fever be vaccinated	No				
	Yes*	1.78	1.12	2.83	.015*
Constant	Reference category *	.17			

6.8. Parental attitude to childhood vaccination

The internal consistency reliability, measured by the Cronbach α , was 0.655. Results show that less than a tenth of the respondents (7.3%) had a total PACV score of 50 or higher, classifying them as vaccine-hesitant parents. Almost a third (32.7%) of the caregivers, however, considered themselves to be hesitant while 26.3% reported that they have delayed having their child get immunisation for reasons other than illness or allergy. Additionally, 17.3% had decided not to vaccinate their child at least once even though the child did not have any allergies or illnesses.

More than 70% of respondents believed that children receive more immunisations than necessary, while just under half (42.7%) felt that children should receive fewer vaccines. Less than a third of the respondents (26.9%) were concerned that their child might have a serious side effect from immunisation, 26.2% had safety concerns while 24.4% doubted the efficacy of vaccines (that immunisation might not prevent the disease). Nevertheless, 94.2% of the caregivers trust the information they receive about immunisation, 94.4% revealed that they are able to openly discuss their concerns about immunisation with their child's doctor, while 95.3% trust their child's immunisation provider completely (Table 6.9).

6.9. Respondents' attitude and beliefs on childhood vaccination

The result in table 6.9 is on the third research question “*Are caregivers' attitudes and beliefs about vaccination associated with parental vaccine hesitancy?*”.

Overall, 52.7% of the respondents had unfavourable attitude, while 47.3% of the caregivers has a favourable attitude. Attitude refers to a positive disposition by caregivers towards the acceptance of vaccines for their child.

Table 6.9: Parental attitude to childhood vaccination

	PACV Variables		Frequency	Percentage (%)
Q1	Have you ever delayed having your child get immunisation for reasons other than illness or allergy?	No	325	72.2%
		Not sure	6	1.3%
		Yes	119	26.4%
Q2	Have you ever decided not to have your child get immunisation for reasons other than illness or allergy?	No	366	81.3%
		Not sure	6	1.3%
		Yes	78	17.3%
Q3	How sure are you that following the recommended immunisation schedule is a good idea for your child?	Completely sure	421	93.6%
		Not sure	0	0.0%
		Not at all sure	29	6.4%
Q4	If you had another infant today, would you want him/her to get all the recommended immunisation?	Yes	411	91.3%
		Not sure	19	4.2%
		No	20	4.4%
Q5	Overall, how hesitant about childhood immunisation would you consider yourself to be?	Not hesitant	182	40.4%
		Not sure	121	26.9%
		Hesitant	147	32.7%
Q6	Children get more immunisation than are good for them.	No	90	20.0%
		Not sure	44	9.8%
		Yes	316	70.2%
Q7	I believe that many of the illnesses immunisation prevent are severe.	No	327	72.7%
		I don't know	75	16.7%
		Yes	48	10.7%
Q8	It is better for my child to develop immunity by getting sick than to get immunisation.	No	264	58.7%
		Not sure	99	22.0%
		Yes	87	19.3%
Q9	It is better for children to get fewer vaccines at the same time.	No	196	43.6%
		Not sure	62	13.8%
		Yes	192	42.7%
Q10	How concerned are you that your child might have a serious side effect from immunisation?	Not concerned	164	36.4%
		Not sure	165	36.7%
		Concerned	121	26.9%
Q11	How concerned are you that any one of the childhood immunisations might not be safe?	Not concerned	144	32.0%
		Not sure	188	41.8%
		Concerned	118	26.2%
Q12	How concerned are you that immunisation might not prevent the disease?	Not concerned	190	42.2%
		Not sure	150	33.3%
		Concerned	110	24.4 %
Q13	I trust the information I receive about immunisation."	Yes	424	94.2%
		Not sure	13	2.9%
		No	13	2.9%
Q14	I am able to openly discuss my concerns about immunisations with my child's doctor.	Yes	425	94.4%
		Not sure	13	2.9%
		No	12	2.7%
Q15	Overall, how much do you trust your child's immunisation provider	Complete Trust	429	95.3%
		Not sure	0	0.0%
		Complete distrust	21	4.7%

6.10. Attitude and belief variables as determinants of PACV status

The result of the logistic regression model exploring the association between attitude variables (Q6-Q12 in Table 6.9) and PACV status (derived at section 5.1.7) shows that those caregivers who believed that many of the illnesses immunisation prevent were not severe have 18.6 higher odds of being vaccine-hesitant (95% CI 4.4–77.8; $p < 0.001$) than those who believed that illnesses immunisation prevents were severe. Furthermore, those who believe it is better for children to develop immunity by getting sick than to get immunisation have 7.93 higher odds of being vaccine-hesitant (95% CI 2.5–25.4; $p = 0.01$) when compared to those who do not believe in this.

Likewise, respondents that believe that it is better for children to get fewer vaccines at the same time have 10.4 higher odds of being vaccine-hesitant (95% CI 2.4–45.5; $p = 0.02$) than those who have no objection to the number of vaccines taken at a time. In addition, those who were concerned that their child might have a serious side effect from immunisation have 11.5 higher odds of being vaccine-hesitant (95% CI 1.9–67.3; $p = 0.07$) when compared to those who do not worry about the potential side effects of vaccines. The outcome is presented in table 6.10.

6.11. Caregiver's belief about childhood vaccination based on the VHS Likert Scale

Almost all the caregivers (99.6%), as presented in table 6.11, believed that vaccines were important, while 87.3% had confidence in the effectiveness of vaccines. However, about 60% have doubts about the risk quotient of new vaccines while up to 40% are of the opinion that children do not need vaccines for diseases that are not common anymore. Interestingly, only 22% were not concerned about serious adverse effects of vaccines. The result is presented in table 6.11.

Table 6.10: Effect of the attitude variables (derived from Q6-Q12 of the PACV) on Hesitancy Status derived from the Parental Attitude to Childhood Vaccines (PACV) Scale

		Exp. B (95% C.I.)	
		Lower - Upper	<i>p</i> -value
Children get more immunisation than are good for them.	No*		.300
	Not sure	4.75(0.62- 36.52)	.135
	Yes	3.75(0.62 - 22.6)	.150
I believe that many of the illnesses immunisation prevent are not severe.	No*		.000
	I don't know	6.26(2.05 -19.13)	.001
	Yes	18.58(4.44 -77.81)	.000
It is better for my child to develop immunity by getting sick than to get immunisation.	No*		.002
	Not sure	3.16(.96 -10.45)	.059
	Yes	7.93(2.47 - 25.44)	.001
It is better for children to get fewer vaccines at the same time	No*		.007
	Not sure	9.61(1.84 -50.16)	.007
	Yes	10.35(2.35-45.54)	.002
How concerned are you that your child might have a serious side effect from immunisation?	Not concerned*		.005
	Not sure	2.95(.498 – 17.53)	.233
	Concerned	11.46(1.96 -67.03)	.007
How concerned are you that any one of the childhood immunisations might not be safe?	Not concerned*		.383
	Not sure	1.64(0.28-9.61)	.586
	Concerned	2.95(0.52-16.64)	.220
Constant		.000	.000

*= Reference Category

Table 6.11: Caregivers beliefs on childhood vaccination based on VHS Likert scale.

		Frequency	Column N %
Childhood vaccines are important for my child's health	Yes	448	99.6%
	No	2	0.4%
	I don't know	0	0.0%
Childhood vaccines are effective	Yes	393	87.3%
	No	36	8.0%
	I don't know	21	4.7%
Having my child vaccinated is important for the health of others in my community"	Yes	409	90.9%
	No	16	3.6%
	I don't know	25	5.6%
All childhood vaccines offered by the government programme in my community are beneficial	Yes	439	97.6%
	No	9	2.0%
	I don't know	2	0.4%
New vaccines carry more risks than older vaccines	No	194	43.1%
	Yes	144	32.0%
	I don't know	112	24.9%
The information I receive about vaccines from the vaccine program is reliable and trustworthy	Yes	434	96.4%
	No	11	2.4%
	I don't know	5	1.1%
Getting vaccines is a good way to protect my child/children from disease"	Yes	439	97.6%
	No	8	1.8%
	I don't know	3	0.7%
Generally, I do what my doctor or health care provider recommends about vaccines for my child/children	Yes	440	97.8%
	No	7	1.6%
	I don't know	3	0.7%
I am concerned about serious adverse effects of vaccines	No	102	22.7%
	Yes	74	16.4%
	neither agree nor disagree	274	60.9%
My child/children do or do not need vaccines for diseases that are not common anymore	No	282	62.7%
	Yes	73	16.2%
	I don't know	95	21.1%

6.12. Intention to Vaccinate

Intention to vaccinate (based on PACV Q4) is one of the outcome variables in this study. 91.3% of the caregivers expressed intention to vaccinate, while 8.7% said “No” or “Not Sure” with respect to intention to vaccinate. Table 6.12 presents three logistic models showing the association between several independent variables and the intention to vaccinate as the dependent variable. Four (4) independent variables consisting of knowledge and PACV hesitancy status, in addition to two (2) caregivers’ sociodemographic variables (employment and gender), were significant predictors of intention to vaccinate by the caregivers. Caregivers’ attitudinal status ($p=0.085$), religious affiliation ($p=0.063$), past vaccination practice and age had no significant association with their “future vaccination behaviour” (same as intention to vaccinate). Caregivers with poor knowledge have 3.1 ($p=0.007$) higher odds of not vaccinating their child in the future than those with good knowledge, while those who were hesitant had 10.5 ($p < 0.001$) higher odds of declining vaccination for their child than those who were classified as non-hesitant (95% CI: 3.37, 32.39). Likewise, those working fulltime had 2.3 ($p=.027$) higher odds of not vaccinating their child in the future (95% CI: 1.09, 4.9) (reduced intention to vaccinate) compared to those not working full time. It should be noted that the “intention to vaccinate” outcome (measured by PACVQ4) for caregivers working full time is different from the “actual vaccination outcome” (using the derived hesitancy obtained from VHS data tool) reported in section 6.3 and 6.4. This is so because those working full time are discouraged by the situations they often meet at the vaccination centres. Hence they are reluctant to go for vaccination but in actual practice, they vaccinate their children more than those not working full time because of the institutional arrangement by their employers to facilitate vaccination. Finally, male caregivers had 3.3 ($p=.036$; 95% CI: 1.08, 10.78) higher odds of not vaccinating their child compared to female caregivers. The past vaccination behaviour

(practice) of caregivers in this study did not have a significant effect on their intention to vaccinate their children.

Table 6.12: Association between selected variables and the future vaccination behaviour (intention to vaccinate measured by PACVQ4) of caregivers

		Model 1		Model 2		Model 3	
	Variable Categories	Exp(B) 95% C.I.	pValue	Exp(B) 95% C.I.	pValue	Exp(B) 95% C.I.	pValue
Knowledge	Poor Knowledge	3.13 (1.36 -7.19)	.007	3.23(1.41-7.40)	.005	3.09(1.367-7.02)	.007
	Good Knowledge						
PACV Status	Hesitant	9.84(3.17-30.53)	.000	9.86(3.19-30.39)	.000	10.45(3.37-32.39)	.000
	Non-hesitant						
Attitudinal Status	Unfavourable attitude	.49(.10-1.15)	.100	.48(.21-1.10)	.083	.48(.21-1.11)	.085
	Good attitude						
Practice	Accepted Vaccine	1.29(.43-3.82)	.651	1.29(.44-3.83)	.645	1.43(.49-4.21)	.515
	Refused Vaccine						
AgeD30	30 and below	.73(.31-1.73)	.473	.71(.31-1.67)	.438	.80(.36-1.78)	.586
	Above 30						
Gender of Respondents	Male	3.39(1.07-10.76)	.039	3.23(1.03-10.11)	.044	3.32(1.08-10.18)	.036
	Female						
Employment status	Working full time	2.23(1.02 -4.85)	.043	2.33(1.09-5.0)	.030	2.34(1.09- 4.99)	.027
	Not working full time						
Religious affiliation	Christianity	4.47(.88-22.63)	.070	4.63(.92-23.35)	.063	4.66(.92-23.67)	.063
	Others						
Education status	Low Education	1.72(.31-9.74)	.539	1.68(.29-9.39)	.557		
	High Education						
Number of children	2 and below	1.26(.55-2.89)	.583	1.261(.553-2.879)	.581		
	Above 2						
Child Gender	Male	1.18(.55-2.50)	.672	1.175(.559-2.470)	.671		
	Female						
Marital status	Married	1.01(.24-4.31)	.986				
	Not married						
Ethnicity	Yoruba	1.53(.39-5.90)	.535				
	Other tribes						
Index child age	24 months and below	.84(.27-2.58)	.762				
	Above 24 months						
Constant		.003	.000	.004	.000	.005	.000

6.13. Sources of vaccination information based on caregivers' preference and age

Health workers (55.1%) and health facilities (36%) were the highest sources of vaccination information (SVI) among caregivers while others got their vaccination information (VI) from mass media channels, that is radio/TV (22.7%) and social media (10.4%). Some of them also accessed vaccination information from family and friends (16.7%) and other mothers (8.9%). Caregivers under 30 years that got SVI from family/friends (18.5%) were more than those above 30 years (15.6%). There was no difference in the proportion of caregivers in both age categories that got VI from social media, while a higher percentage of caregiver above 30 years (24.7%) when compared to those under 30 years (19.1%) got SVI from radio/TV. No difference was observed in the proportion of caregivers in each age category that got VI from health workers but there was a higher proportional difference between caregivers under 30 years (42%) and those above 30 years (32.6%) who got VI from health facilities. The distribution of sources of vaccination information is presented on Table 6.13.

6.14. Determinants of intention to vaccinate based on source of vaccination information.

Those who got vaccination information from Radio/TV, health workers and health facilities had 4.41 (C.I. 1.22-16.00), 4.36 (C.I. 1.55-12.20) and 3.89 (C.I. 1.31-11.64) higher odds of vaccinating their children than those who did not get vaccination information from these sources. The outcome is presented in Table 6.14.

6.15: Hesitancy and knowledge status based on sources of vaccination information (VI)

Results show (Table 6.15) that caregivers who did not get VI from health workers and health facilities had 1.6 (CI, 1.02-2.43) and 1.8 (CI, 1.09-2.83) higher odds of being vaccine hesitant compared to those who got their VI from these sources. Also, caregivers who got VI from health workers and health facilities were reported to have 2.1 (CI, 1.39-3.16) and 1.8 (CI, 1.16-2.75) higher odds of having good knowledge compared to those who got VI from other sources.

Table 6.13: Sources of vaccination information based on preference and age

	SVI Preference	SVI based on Age		
SVI	Percentage (%)		Below 30	30 and above
Friends/Family	16.7	No	81.50%	84.40%
		Yes	18.50%	15.60%
Radio/TV	22.7	No	80.90%	75.30%
		Yes	19.10%	24.70%
Social media	10.4	No	89.50%	89.60%
		Yes	10.50%	10.40%
Church/Mosque	12.0	No	87.00%	88.50%
		Yes	13.00%	11.50%
Health Worker	55.1	No	44.40%	45.10%
		Yes	55.60%	54.90%
Health Facilities	36.0	No	58.00%	67.40%
		Yes	42.00%	32.60%
Other Mothers	8.9	No	87.70%	93.10%
		Yes	12.30%	6.90%
Others	4.0	No	93.80%	97.20%
		Yes	6.20%	2.80%

Table 6.14: Sources of vaccination information as determinants of intention to vaccinate (measured by PACVQ4).

Variable	Category	ExpB (95% C.I., Lower-Upper)	p-value
Friends/Family	No	2.47(.67-9.04)	.173
	Yes		
Radio/TV	No	4.41(1.22-16.00)	.024
	Yes		
Social media	No	.734(.157-3.44)	.695
	Yes		
Church/Mosque	No	4.69(.56-39.28)	.153
	Yes		
Health Workers	No	4.36(1.55-12.20)	.005
	Yes		
Health Facilities	No	3.89(1.31-11.64)	.015
	Yes		
Other Mothers	No	1.121(.24-5.22)	.885
	Yes		
Constant		2.45	.068

Reference Category: No Outcome: Intention to vaccinate

Table 6.15: Sources of vaccination information as determinants of vaccine hesitancy and knowledge status.

Information source	Vaccine hesitancy based on SVI		Knowledge status based on SVI	
	ExpB (95% C.I., Lower-Upper)	p-value	ExpB (95% C.I., Lower-Upper)	p-value
Friends/Family No	.75(.41-1.37)	.345	1.16(.63-2.12)	.638
Yes				
Health Worker (No)	1.57(1.02-2.43)	.042	2.09(1.39-3.16)	.000
Yes				
Health Facilities (No)	1.76(1.09-2.83)	.021	1.79(1.16-2.75)	.009
Yes				
Others (No)	.42(.12-1.44)	.165	2.88(.69-12.11)	.148
Yes				
Social media (No)	1.06(.44-2.56)	.904	1.54(.60-3.96)	.367
Yes				
Other Mothers (No)	.83(.35-1.97)	.670	1.20(.51-2.82)	.671
Yes				
Radio/TV(No)	.99(.58-1.97)	.987	.62(.36-1.06)	.083
Yes				
Constant	.74	.54	.53	.001

6.16. Trust of caregivers concerning childhood vaccination

The level of trust as measured by the three ‘trust’ variables on the PACV data tool in Table 6.9, consisting of “*I trust the information I receive about immunisation*”, “*I am able to openly discuss my concerns about immunisations with my child's doctor*”, and “*Overall, how much do you trust your child's immunisation provider?*” was 94.2%, 94.4%, and 95.3%, respectively. 2.9% did not trust the information they receive on immunisation, 2.7% cannot openly discuss their concerns about immunisation with their child’s doctor, while 4.7% do not trust their child’s immunisation provider.

The result of the test of association of the trust level of caregivers and parental attitude to childhood vaccination presented in Table 6.16 shows that respondents that did not trust the information they received about immunisation had 7.60 higher odds of being vaccine hesitant

than those who trust the information they receive about immunisation (95% CI: 2.60, 21.88, $p < .001$). With respect to intention to vaccinate, the three trust variables were added stepwise to create three models. This was done to identify the variables that were relevant to predict the final model. The result showed that those who did not trust the information they received about immunisation had 3.55 higher odds not to vaccinate their children than those who trust the information they receive about immunisation ($p\text{-value} = .011$, 95% CI: 1.34-9.46). When the variable “Overall, I do not trust my child’s immunisation provider” was added, a significant relationship ($p\text{-value} = 0.019$) was also observed. However, the addition of the third variable (I am able to openly discuss my concerns about immunisations with my child's doctor) made the effect of the variable insignificant on the intention to vaccinate. This scenario is a common phenomenon in binary logistic regression and it arises due to confounding or the result of high multi-collinearity, that is correlated independent variables (Graham, 2003; Midi, Sarkar and Rana, 2010). When an independent variable (IV_1) has a significant effect on the dependent variable (DV) alone but becomes insignificant when another independent variable (IV_2) is added, it indicates that IV_2 explains the relationship previously attributed to IV_1 . Furthermore, the outcome may have been due to small sample size.

The variables, “Overall, I do not trust my child’s immunisation provider” and “I am able to openly discuss my concerns about immunizations with my child's doctor”, had no significant effect on the PACV and the intention to vaccinate.

Table 6.16: Trust level of caregivers as determinants of PACV hesitancy and intention to vaccinate. *= Reference Category

Intention to Vaccinate								PACV hesitancy
		Model 1		Model 2		Model 3		
Trust Variables		Exp(B) 95% C.I.	p	Exp(B) 95% C.I.	p	Exp(B) 95% C.I.	p.	Exp(B) 95% C.I. p
I trust the information I receive about immunisation	Yes*	3.56		3.39		2.77		7.60
	No	(1.34-9.46)	.011	(1.22-9.42)	.019	(.87-8.85)	.085	(2.64-21.89) <.001
Overall, I trust my child's immunisation provider	Yes*			1.25		1.010		2.67
	No			(.33 - 4.84)	.743	(.23-4.46)	.989	(.75-9.46) 0.13
I am able to openly discuss my concerns about immunisations with my child's doctor.	Yes*							
	No.					1.70		2.19
						(.45-6.54)	.435	(.56-8.56) 0.26
Constant		.084	.000	.084	.000	.083	.000	.050

p = pValue

6.17. Vaccination Behaviour

Caregivers that has never been reluctant or hesitated to get a vaccination for their children were 76.4 % and classified as “willing acceptors”. The remaining caregivers (23.6%) admitted that they have been reluctant or hesitated to get vaccination for their children and were classified as hesitant. The hesitant group consisted of those who refused vaccination completely (complete refusers), and caregivers who were initially hesitant, but later accepted vaccination (hesitant or delayed acceptors). The proportion of willing acceptors and hesitant acceptors that received vaccination was 92.9%. The distribution of caregivers according to vaccination behaviour is presented in Table 6.17. The unadjusted odd ratio showed that “intention to vaccinate”, “non-hesitancy on PACV scale”, “non-hesitancy on VHS scale” and “good knowledge” were significant predictors of positive vaccination behaviour. However, only intention to vaccinate (OR 2.93, 95% C.I:1.03 -8.28), non-hesitancy on PACV scale (OR 4.02,

95% C.I.: 1.22 -13.23), and non-hesitancy on VHS scale (OR 8.399, 95% C.I.: 3.65 – 19.33) significantly predicted positive vaccination behaviour. The binary logistic output is in table 6.18.

Table 6.17: Distribution of caregivers based on vaccination behaviour (PACV Q1)

Vaccination Behaviour	Category		Frequency	%
Have you ever been reluctant or hesitated to get a vaccination for your children?(VHS Q3)	Hesitant	Yes	106	23.6%
	Willing Acceptors	No	344	76.4%
Have you ever refused a vaccination for your children? (VHS Q4)	Outright Refusers	Yes	32	7.1%
	Total Acceptors	No	418	92.9%
Hesitant Acceptors (Difference between Hesitant Caregivers and Outright Refusers)	Hesitant Acceptors		74	16.5%

Table 6.18: Effect of key variables on caregivers' vaccination behaviour (PACV Q1)

Variables	Categories	Unadjusted odd ratio		Adjusted odd ratio	
		Exp(B) 95% C.I.	pValue	Exp(B) 95% C.I.	pValue
Intention to vaccinate	Yes*	4.16	.001	2.93	.043
	No	(1.72 -10.03)		(1.03 -8.28)	
PACV Hesitancy	Non-hesitant*	4.22	.002	4.02	.022
	Hesitant	(1.67 – 10.67)		(1.22 -13.23)	
VHS Hesitancy	Non-hesitant*	7.72	<0.001	8.399	.000
	Hesitant	(3.46 -17.20)		(3.65 –19.33)	
Attitudinal status	favourable attitude*	.779	.497	1.48	.373
	unfavourable attitude	(0.38 -1.60)		(.63 – 3.47)	
Knowledge status	Good knowledge*	2.71	.041		
	Poor Knowledge	(1.22 – 5.99)			
Constant				.427	.254

6.18. Characteristics of caregivers that were vaccine refusers.

Results show that 7.1% (32/450) of the caregivers were outright refusers of vaccination. The analysis showed that majority of the refusers have poor knowledge (71.9%), above 30 years (62.5%), not working full time (62.5%) and predominantly low-income earners (87.5%). Conversely, caregivers with unfavourable attitude and those with favourable attitude were

almost equally represented among vaccine refusers (46.9%;53.1%) while both categories of education status had equal proportion among vaccine refusals. Attitude was measured by variables Q6 to Q12 on PACV data tool. These are presented in table 6.19.

Table 6.19: Characteristics of caregivers that were vaccine refusers

Variable	Category	Frequency	N %
Knowledge Status	Poor Knowledge	23	71.9%
	Good Knowledge	9	28.1%
Attitudinal Status	Unfavourable Attitude	15	46.9%
	Good Attitude	17	53.1%
Age Category	Below 30	12	37.5%
	30 and above	20	62.5%
Educational Status	Low education	16	50.0%
	High education	16	50.0%
Employment Status	Working full time	12	37.5%
	Not working full time	20	62.5%
Income Status	Low income	28	87.5%
	High income	4	12.5%

6.19. Mediation analysis of the effect of PACV on vaccination behaviour

The R square of the mediation path between PACV and attitude was .795 and therefore attitude accounted for 79.5% of the variance in the PACV. In the second mediation analysis, the R square of the mediation path between PACV and caregivers' knowledge was .0267 which shows that knowledge accounted for only 2.07% of the variance in PACV. The path coefficients for the PACV-Attitude path ($b = .1716, p < .0001$) and PACV-Knowledge path ($b = -.0192, p < .0001$) were both significant and presented in Table 6.20. However, while the path coefficient for the “attitude-vaccination behaviour path” ($b = -1.071, p < 0.001, -1.4184, -.7217$) was significant, the path coefficient for the “knowledge-vaccination behaviour path” ($b = .1246, p = .1667, C.I. -.0524, .3016$) was not significant as presented in table 6.21 and 6.22 respectively. In the model mediated by attitude, the direct effect of PACV on vaccination behaviour ($B = .3367, LLCI .2598, ULCI .4136, p < 0.001$) and the indirect effect ($B = -.1836, SE = 0.0398, 95\% \text{ Boot CI: } -.2769, -.1223$) were both significant. Also, the direct effect (B

=.1566, LLCI .1229, ULCI .1903, $p < 0.001$) and the indirect effect ($B = -0.0024$, $SE = -0.0020$, 95% Boot CI: -.0070, -.0009) were significant for the model mediated by knowledge with the indirect effect very negligible and negative. The summary of the mediation analysis is presented at Figure 6.1.

Table 6.20: Mediation paths between the independent variable and the mediator variables.

Model Outcome Variables: Attitude(M)

	Coeff.	SE	<i>t</i>	<i>p</i>	LLCI	ULCI
constant	1.2895	.1312	9.8263	.0000	1.0316	1.5474
PACV	.1716	.0041	41.6192	.0000	.1635	.1797

Model Outcome Variables: Knowledge (M)

	Coeff.	SE	<i>t</i>	<i>p</i>	LLCI	ULCI
constant	6.5940	.1739	37.9129	.0000	6.2522	6.9358
PACV	-.0192	.0055	-3.5083	.00005	-.0299	-.0084

Table 6.21: Mediation path between the independent and dependent variables with mediator (Attitude)

Model Outcome Variable: Vaccination behaviour (Y)

	Coeff.	se	Z	<i>p</i>	LLCI	ULCI
constant	-5.7462	.6921	-8.3024	.0000	-7.1027	-4.3897
PACV (X)	.3367	.0393	8.5777	.0000	.2598	.4136
ATS (M)	-1.0701	.1777	-6.0207	.0000	-1.4184	-.7217

Table 6.22: Mediation path between the independent and dependent variables with mediator (Knowledge)

Model Outcome Variable: Vaccination behaviour (Y)

	Coeff.	se	Z	p	LLCI	ULCI
constant	-7.7980	.9407	-8.2899	.0000	-9.6417	-5.9543
PACV (X)	.1566	.0172	9.1106	.0000	.1229	.1903
Knowledge (M)	.1246	.0903	1.3796	.1677	-.0524	.3016

Table 6.23: Direct and indirect effects of X (PACV) on Y (Vaccination Behaviour)

	Effect	SE	Z	p	LLCI	ULCI
Direct effect of PACV on VB on Y	.3367	.0393	8.5777	.0000	.2598	.4136
	Effect	BootSE	BootLLCI	BootULCI		
Indirect effect(s) of PACV on VB through Attitude	-.1836	.0398	-.2769	-.1223		

Table 6.24: Direct and indirect effects of X (PACV) on Y (Vaccination Behaviour)

	Effect	SE	Z	p	LLCI	ULCI
Direct effect of PACV on VB	.1566	.0172	9.1106	.0000	.1229	.1903
	Effect	BootSE	BootLLCI	BootULCI		
Indirect effect(s) of PACV on VB through Knowledge	-.0024	.0020	-.0070	-.0009		

PACV: Parents attitude about childhood vaccines; VB: Vaccination Behaviour

ATS: Attitude; LLCI: Lower Limit Confidence Interval; ULCI: Upper Limit Confidence

Interval; BootLLCI: Bootstrap Lower Limit Confidence Interval

BootULCI: Bootstrap Upper Limit Confidence Interval

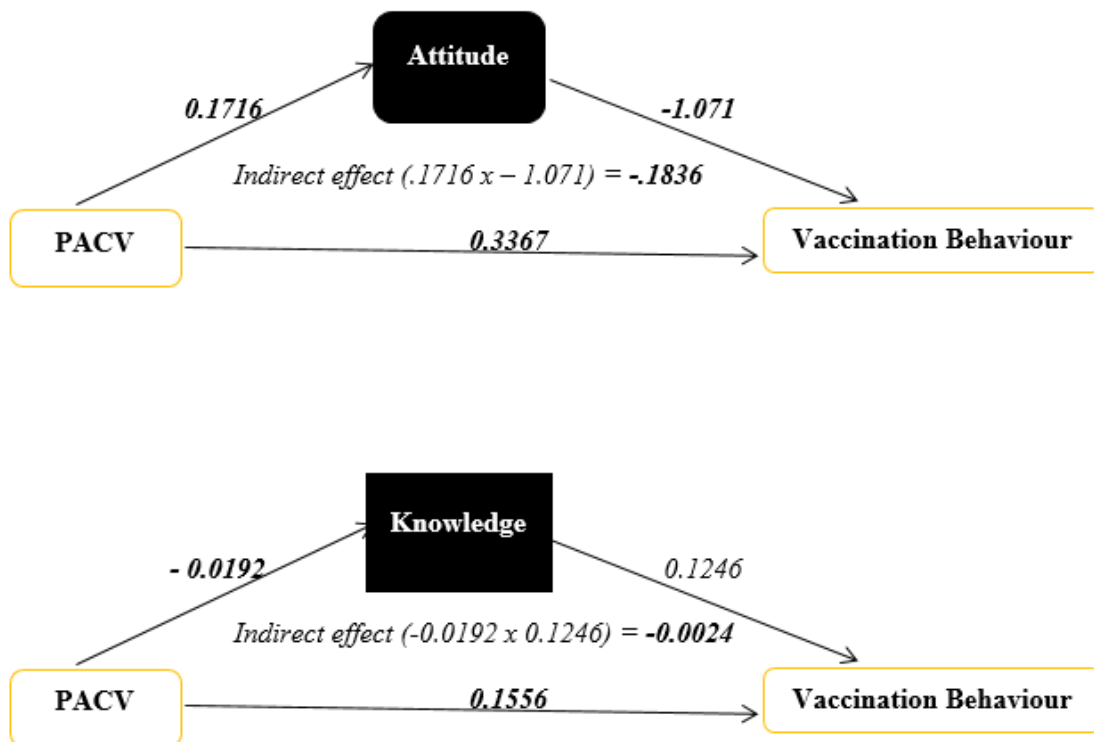


Figure 6.1: Summary of the path coefficient of the mediation analysis

The coefficient in **bold** indicates significant pathway

Chapter Seven: Findings of the qualitative study

7.0. Introduction

This chapter presents the outcome of the thematic analysis of the narrative data from the three focus group discussions. The themes and interrelated sub-themes created were described in detail, laying emphasis on the enablers and barriers of vaccination through the lenses of the lived experiences of the caregivers. The vaccination stories of the caregivers were distilled to reveal how vaccine hesitancy develops and is exhibited by caregivers. The analysis thus offers an in-depth understanding of vaccine hesitancy.

7.1. My Positionality as a Researcher

The analysis of the collated data commenced with a rigorous inductive analysis using the thematic analysis (TA) approach of Braun and Clarke (2012) after returning to the UK from my immersive fieldwork in Nigeria. Though an inductive approach was used, the outcome of the systematic literature review (SLR) carried out earlier, coupled with my background and work experience in the Infant welfare clinic as a clinician, introduced an element of deduction into the theme development in consonance with the overall research question. The background knowledge helped in making sense of the narrative data within the context of the research question without introducing bias to the process of analysis. This approach aligned with Olmos-Vega *et al.* (2023), who averred that it was essential that qualitative researchers carefully consider their paradigmatic stance and use reflexive practices as a means to embrace and value researchers' subjectivity. This position helped as a researcher to relate with the narratives of each caregiver with insights into their inherent meaning. It was also quite useful in determining the themes and the choice of narrative expression for depicting each theme and subtheme.

7.2. Demographics: Background information about participants.

In total, 3 focus group discussion sessions were held over a period of two months (May-June 2024). Of the 3 groups, 2 consisted of eight participants, while one had seven participants. The focus groups all consisted of women, and the sociodemographic characteristics of all the participants are presented in Appendix 7.1. Five (5) women completed secondary education, 10 had a National/Higher National Diploma, and 1 had a National Certificate of Education, while the rest (7) were educated to degree level. Four (4) of the participants were tailors/fashion designers, 4 worked as health attendants/pharmacy assistants, 3 were teachers, 3 worked with the government, 4 were self-employed/ entrepreneurs, 2 were into trading, while 3 were unemployed.

7.3. Presentation and Organisation of the Findings

Each theme and sub-theme is presented based on the study's research questions. The distinction in the themes did not blur their relative connection, thereby depicting the intertwined nature of the vaccine hesitancy phenomenon as highlighted by the responses of the participants. The identified themes are presented in table 7.1, and consist of two (2) and five (5) themes for the first and second research questions, respectively. The seven main themes and their sub-themes are outlined below with relevant quotes from the participants.

7.4. Thematic presentation of results

This section presents the outcomes based on the first research question:

What are the reasons given by caregivers for accepting vaccines for their children?

The themes and subthemes were as follows:

7.4.1. Theme One: Perceived efficacy of vaccine in disease prevention and general wellbeing.

In theme one, caregivers outlined the reasons for vaccinating their children. Three subthemes emerged from the codes identified under the theme. The caregivers' primary desire of parents to keep their children healthy and free of diseases and thus achieving a level of wellbeing. There was a common thread through the three (3) subthemes which depicted an understanding and appreciation of the fact that acceptance of vaccine will give their children a desirable level of wellness.

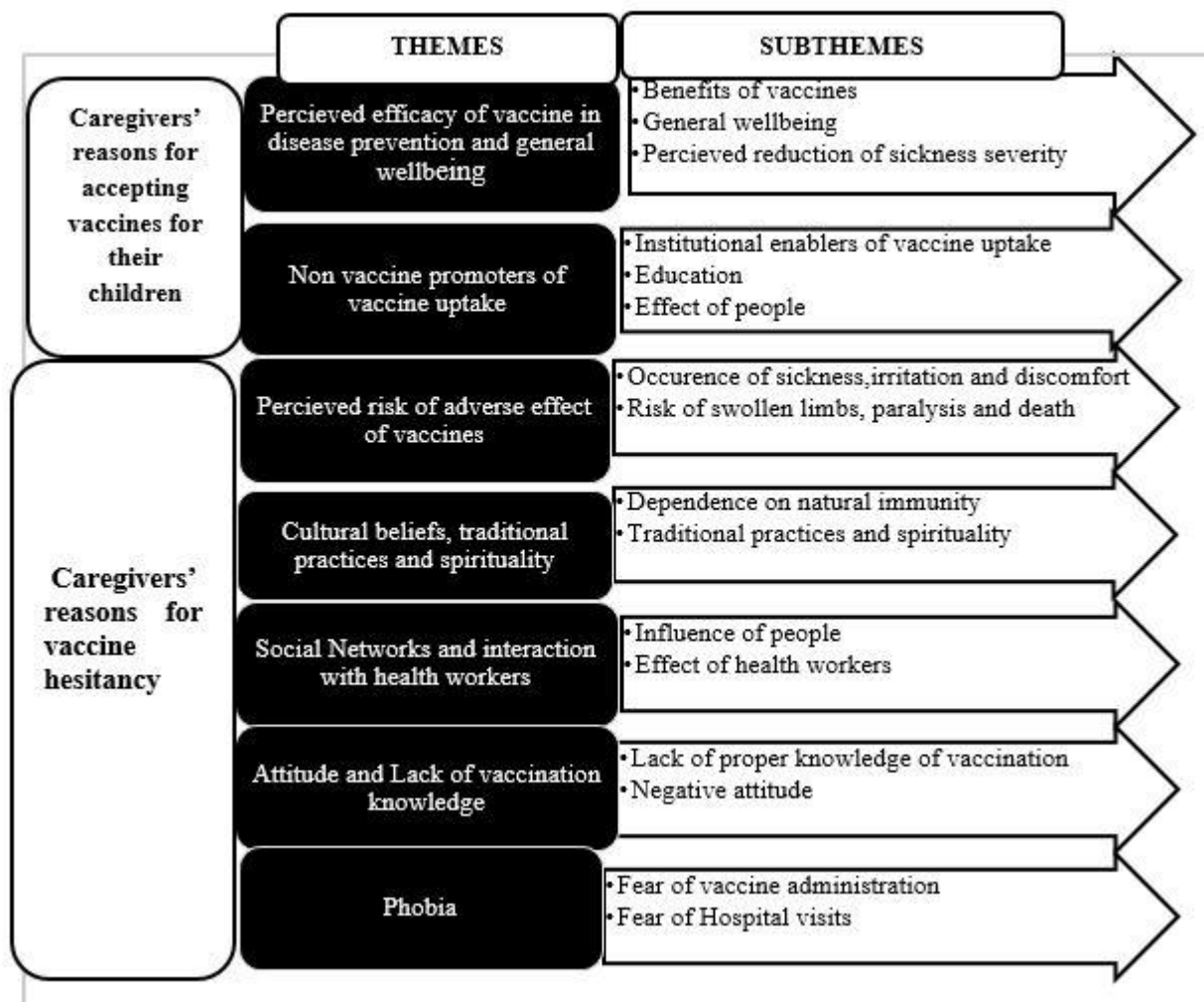


Figure 7.1: Schematic diagram showing the themes and the subthemes

7.4.1.1. Sub-theme One: Benefits of Vaccines.

Central to the vaccination practice of respondents is the belief that vaccination is beneficial by protecting their children from diseases. There were twenty-six (26) codes in this category across the 3 FGDs.

A respondent from the second FGD was emphatic about this reason by saying:

“My own view about immunisation is that it prevents sicknesses from entering the body of my child. In the olden days when there was no immunisation, children get sick, and they go to the hospital often, but immunisation has put a limit to the frequency of hospital visits for children” (PA2).

This quote also suggested that they accept immunisation to reduce the number of times they have to visit the hospital because immunisation will prevent their children from falling ill. Some were specific about the type of vaccine-preventable diseases that immunisation prevents. Diseases mentioned were polio, measles, diarrhoea and whooping cough. “...

“The reason for vaccinating my child is to prevent diseases like polio, diarrhoea and hepatitis.” (PF1)

The reasons given by some of the respondents were that immunisation reduces the rate at which their children fall sick, in addition to disease prevention:

“Immunisation has reduced the incidence of diarrhoea and other diseases.” (PA2)

7.4.1.2. Sub-theme 2: General wellbeing.

This sub-theme highlights the perception that vaccine uptake can promote and sustain the wellbeing of their children and make them healthy. The participants’ ideas of wellbeing were very diverse. These included being at peace, reduced hospital visits, and being active, strong

and healthy. Anatomical advantage (proper brain development) and physiological considerations, such as boosting the immunity of the child, were part of the benefits mentioned under general wellbeing.

A respondent put the idea of general wellbeing in perspective by saying:

“...I am really interested in immunising my child. I usually try to immunise my children so that my mind will be at peace, and I will be confident that nothing bad will happen to them in future.” (PG3).

One of the participants, while commenting on the usefulness of vaccines in preventing frequent hospital visits by children, adopted a historical approach:

“...in the olden days when there was no immunisation, children get sick, and they go to the hospital often, but immunisation has put a limit to the frequency of hospital visits for children” (PA2).

Another respondent opined that:

“...there will be no tuberculosis, there will be no polio, and the child will not have to be taken to the hospital for treatment all the time. (PE2).

Some of the respondents declared that immunisation makes their child active, strong and healthy. According to one of them.... *The reason why I vaccinate my child is for her to be very active...(PG1)* while another respondent stressed that: *the health would be strong; my baby will be strong (PC1).* Also, a respondent said.... *I choose to vaccinate or to give my son vaccination because it is healthy for him. To stay healthy. I give my son erm vaccination for him to be healthy (PB1).*

Those who gave an anatomical reason stated that they have a positive disposition to childhood vaccination because it helps with brain development. One respondent stated that *‘it will also make my child’s brain to develop very well.....’*.

There was a consensus among many of the participants across all 3 FGDs that immunisation will build the immune system and boost the child’s immunity. A participant said....

"The reason why I give immunisation to my children is to build up their immunity.... The reason why I immunise my children is, like she said, so their immune system can fight against any diseases." (PF2).

The participants in the FGDs gave some other reasons, which, though they were not directly an outcome of vaccination uptake, promoted positive vaccination behaviour. For instance, a respondent revealed that vaccines make children to grow well.....*It also helps them to grow very well.... Immunisation allows a child to grow well. (PG1)*

Another similar reason which had no cause-and-effect relationship with vaccination was the perceived effect of immunisation on the ingestion of dirty things by children. A respondent stated that:

“..... some children eat dirty things from the ground; immunisation will help to prevent the bad effect this will have in their body” (PG1).

7.4.1.3. Sub-theme 3: Perceived reduction of sickness severity

This subtheme centres on the perceived ability of vaccines to reduce the severity of diseases and the likely side effects. Though vaccines basically are for disease prevention, they can also reduce the severity of the disease in situations where the child eventually develops the disease despite being immunised. A typical example of such a situation can be seen in cases of measles infection (Bullen, Heriot and Jamrozik, 2023), which is a vaccine-preventable disease. While

the subtheme does not explore whether vaccines can achieve this, some of the participants had listed this as the reason why they accept vaccines for their children. A participant said.... *'It would reduce the side effect of sicknesses.'* (PC1)

On the severity of diseases, a participant declared that...*"Even if a child falls sick, immunisation will prevent the disease from becoming severe."* (PG2). Another participant further reasserted as follows:

"Sickness that will come in the future at least, even though the sickness will come, it won't be as strong as it's supposed to be." (PB1)

7.4.2. Theme Two: Non-vaccine related promoters of vaccine uptake

This theme centres on the direct and indirect factors that nudge caregivers towards vaccination acceptance, even when there are dissenting voices and opinions from people such as co-workers, neighbours, etc. around them. These factors include the educational status of caregivers and their spouse, institutional enablers for vaccine acceptance, and the role of people.

7.4.2.1. Sub-themes 1: Education

Education and vaccination knowledge are known to affect vaccination practices of individuals. In this study, one of the participants attributed her inclination to vaccinate her child to the fact that she and her spouse were educated.

"..... As a learned people, my husband and I are learned, we know too well that even since pregnancy level, at different point we were given injection for different things so we were told beforehand that by the time you have this child, you will have to vaccinate this child at different point in time....." (PB2)

7.4.2.2. Sub-theme 2: Institutional enablers of vaccine uptake

This sub-theme centres on the impact of the institutional initiatives put in place in vaccination centres to encourage and promote vaccination uptake. Such initiatives, which are implemented by health workers, include pre- immunisation health talks, songs, drama presentations, and house-to-house immunisation advocacy outreach.

“The people that usually encourage me to vaccinate my child include the health workers in the clinic where I delivered my child.” (PE1)

A participant, buttressing the positive roles of health workers as promoters of vaccination uptake, declared that since when she was young, she had been hearing health workers singing on the street, inviting mothers to come and take vaccines for their children so that they will not be infected with diseases:

“Right from when I was young, I used to hear some health workers with megaphones moving from street to street singing the song as follows:

Come and immunise your child (2xce)

So, no disease will enter into the body of your child.

Then come and immunise your child.” (PE2)

7.4.2.3. Sub-theme 3: Effect of people

This subtheme captures the different categories of individuals that serve as promoters of the positive ideals of vaccination towards ensuring positive vaccination behaviour. Among all the persons mentioned, their spouses (husbands) were the predominant encouragers and promoters of vaccine uptake. A participant revealed that her husband helps track the immunisation date and ensures that no scheduled immunisation is missed. This was captured by several quotes.....and my husband always keep the dates in mind and reminds me when it is getting

to the time (PE2). Another participant also revealed that her husband facilitates her attendance at immunisation clinic by giving her money for transportation:

“Then the number two person that encourage me is my husband, my husband will keep giving me money for transportation to take our child for immunisation.” (PD2)

Mothers and mother in-law were revealed by some participants as their main supporter to access vaccine for their children. According to a participant and similar to how husband promote vaccination uptake, a participant revealed that her mother helps her to keep vaccination dates.... *My mother always encourages me that I should keep to the dates of immunisation appointment. (PE2)* while another participant stated that: *.....the person that usually encourage me to immunize my child is my mother-in-law because she knows I usually have a carefree attitude. (PG2)*

“I have so many people around me that are encouraging me. like my mother, she also took us for immunisation when we were young, I as a person even have some of the scars of the immunisation in my arm.” (PF2)

Personal motivation was also mentioned as a means of promoting positive vaccination behaviour: *‘I still encourage myself to take my child for the immunisation because I know it is compulsory’(PA1)*. A participant hinged her motivation on the desirability of vaccines: *I usually encourage myself to do so because I know it is good for my child.... (PE2)*

A participant attributed her positive vaccination behaviour to the fact that she was also vaccinated when she was young, and hence it was proper for her to do the same for her children. *“.... I personally was immunised too so I don’t have any regrets, my parents don’t have any regret, I think that’s the number one factor that has really encouraged me on immunisation”. (PB2)*

Another participant explained her positive vaccination behaviour as a function of her tenacity on issues:

“.....In my own case, I noticed that whatever I want to do for my child, I don't allow anyone to discourage me. I usually hear people saying that immunisation can cause a child leg to be paralysed but me I usually pray to God if there is anything I want to do for my child. I usually pray that the immunisation will not have any adverse effect on him.” (PA2)

Other promoters of vaccine uptake were grandmothers and siblings. “Grandma” in this case refers to the grandmother of the participant:

“.....but my grandma now encouraged me that the immunisation has a lot of benefits for children, and I was encouraged by what she said and started taking the immunisation for my children. So that is it (PC2). Sisters were also mentioned as positive influences on vaccine acceptance.... My people around me, my husband and my sisters always encourage me too.” (PE1)

7.5. Themes based on the second research question.

This section presents the outcomes based on the second research question:

What are the reasons for vaccine hesitancy among participants?

The themes and subthemes are as follows:

7.5.1. Theme One: Perceived risk and adverse reaction of vaccines

This theme is on the research question that seeks to explain the various reasons why caregivers exhibit hesitancy despite the availability of free childhood vaccines. The majority of the participants in this study expressed concerns about potential adverse effects of vaccines. Hence, the theme has more codes than other themes in this study. Experiences of fever, swollen limbs and general discomfort were the most reported reasons for parents' apprehension concerning

vaccination. The codes under this theme were categorised into two subthemes - *fever, irritation and discomfort, and risk of swollen limbs, paralysis and death.*

7.5.1.1. Sub-theme One: “Fever, irritation and discomfort”

This sub-theme focused on how adverse vaccination reactions experienced by children affect caregivers’ decisions on vaccine uptake. There were 130 references cited by caregivers during the FGD, which cuts across all three focus group discussions. Fever was the most frequent adverse effect mentioned by the participants in the three focus group discussions. Other adverse effects included been irritable, excessive crying, inactiveness, and swollen vaccination site.

“We couldn’t sleep in the night because he was running fever (PD3).”

The majority of the participants believed that post-immunisation fever was a key adverse effect that may prevent them from going back to complete the immunisation scheduled for their children despite knowing the importance of vaccines. A mother said:

‘I know I have every reason to immunise my child because it prevents diseases. But the reason for my hesitation is that when we had the second immunisation, she started running a fever and became very irritable’ (PD2).

Additionally, the distress caused by the excessive crying of the children due to fever, pain and swollen limbs was reported as the reason why they may discontinue immunisation for their children. One caregiver said:

“He cried throughout the day and even in the night and refused sucking to the extent that our neighbours had to come to our house because of his persistent crying. I started blaming myself for taking him to take the immunisation” (PG2).

Another one remarked:

“...She was very irritable and cried all the time. I was now very scared and started thinking that maybe they have injected her in the wrong place, and I was praying that she will not get paralysed” (PC2).

A participant revealed that her child was not active after immunisation while some said their baby refused to suck breast.

“.... The child was not active.... She had a fever, and she became very irritable and inactive to the extent that I became very scared....” (PE2)

Furthermore, a participant related a first-hand experience about the effect of vaccines as follows:

“.....and on that Wednesday that they collected the injection, he was running a temperature throughout the night despite the paracetamol he was given. We could not sleep throughout the night, and I was now asking myself, “What type of immunisation is this?” (PB1)

7.5.1.2. Sub-theme Two: Risk of swollen limbs, paralysis and death

Some of the respondents also mentioned fear of side effects of vaccines administration, such as leg paralysis and swollen injection sites, as reasons why they may not take vaccines:

“..... The reason why I hesitate to take immunisation is because before I gave birth to my child, I saw a child in my church who was paralysed because of the injection he was given.” (PC2)

The remark of one of the participants outlined a key reason for incomplete vaccination and reinforces the notion that vaccine hesitancy is a continuum.

“As for me ..., when I gave birth to my second born, her leg got swollen as a result of the injection she took to the extent that they had to incise it and bring out the pus, and the injury lasted for three months before it healed up. Since then, I stopped giving her vaccine since for

9 months she didn't collect it completely; even for the 9months I didn't think she collected it. With this child now, I just take the step of faith again to collect it. She's two years now; she's not even up to 9 months then when the issue happened." (PB3)

The narrative above captures the fate of *hesitant compliers*.

A negative experience with childhood vaccination can influence the decision-making of caregivers. Some caregivers were influenced by a negative story heard from people in their workplace, church and social circles. Two participants related their individual experiences as follows:

"After that someone came to my shop again and said that they gave a child an immunisation, and the child became paralysed, so I became very scared again. and I said "I will not be able to give this child immunisation again." (PE2)

The other one said:

"When we took the one we took last, before we took it in February, we took it in January. My child's leg was swollen; even his daddy said that I should not bring him for immunisation again, but Grandma insisted that we should continue to take him for the immunisation". (PA1)

In addition, the most extreme narrative on adverse vaccination effects was when a participant said a child died after receiving a vaccination:

"When I was still single, one of my neighbours took her second child for immunisation and the child died, and people said that the injection was administered on the child's vein. So, she said she can never give immunisation to her child any longer." (PF1).

The foregoing sums up how vaccine hesitancy behaviours of caregivers are driven by adverse experiences.

7.5.2. Theme Two: Cultural beliefs, traditional practices and spirituality

Theme two centred on how the interplay of cultural beliefs, traditional practices and religious inclinations of caregivers determines hesitant behaviour or otherwise.

7.5.2.1. Sub-theme One: Cultural belief and dependence on natural immunity

This subtheme explores the effect of parental cultural inclination, and belief in the adequacy of natural immunity in protecting a child against diseases, on uptake of childhood vaccines. Parental culture was reported as a reason why immunisation was not giving to some children, according to a caregiver:

“.... there are people who do not give their children immunisation because of their culture.”

(PF2)

Likewise, some of the participants expressed a preference for natural immunity over vaccinations. For instance, a 24-year-old female participant said:

“I believe that the natural immunity of the child is enough for him to fight against diseases.”

(PF2)

In the same vein, another caregiver revealed that her mother was advised not to accept vaccines for her grandchild because the child has natural immunity.....*The woman told my mum that the baby already has a natural immunity, so don't use drugs or anything for her... (PC2)*

This viewpoint aligns with the opinion of those who felt that vaccines should not be given to a child that does not have any ailment or sickness..... *the child does not have any issue and so may not need the vaccine.*

7.5.2.2. Sub-theme Two: Traditional Practices and Spirituality

Some parents believe that herbal concoctions will work better than vaccines. In the study area, care of children consists of the use of orthodox medicine as well as local herbs. For instance,

some women sell local herbs in the market and help mothers to select ingredients for herbal concoctions for treating different ailments. It is interesting that they even believe that some of these herbs can cure vaccine-preventable diseases (VPD) better than the regular orthodox medicines. However, the efficacy of the herbs may be questionable, and the right quantity to avoid toxicity is unknown. When such local treatment fails, some of the caregivers will visit the health facilities as their last choice for health seeking. This may perhaps be responsible for the opinion expressed by one of the participants:

“.... they prefer to prepare an herbal concoction and give it to the child because they believe that this will help the child, and these things eventually work against the child by causing another ailment...The grandma said that when they have an herbal concoction, the child does not need immunisation”. (PB2)

Another aspect of traditional practices in this study area is the naming of new-borns within a specific time frame after birth. This practice may prevent a child from taking the necessary vaccination scheduled for the first week of life. In addition, some mothers have to take their new-born baby to their own birthplace immediately after delivery for traditional rites and naming ceremonies. This was evident in the response of a young mother who said:

“I travelled to my hometown after I had my baby, and I spent a long time there. So, I couldn't give him the normal hospital immunisation.” (PD3)

The impact of caregivers' spiritual beliefs and spiritual practices was not profound in this study. For some, however, religious convictions and their faith in God were significant in determining their hesitancy status. They believed that it is God that protects children.

A participant expressed this viewpoint by saying:

‘They feel like it is God that protects children, so just leave them; they don't immunize the children’. (PA3)

The doctrine of the church they attend also affects their vaccination behaviour and hence their hesitancy. Some churches do not believe in using medications but rather in holy water.

“There are some churches that do not believe in anything drugs at all; they believe in holy water they’re giving that once a person takes their holy water, there will be nothing like sickness”. (PC3)

Some even believe that if a child is immunised, it can worsen the child’s spiritual problems:

“....and then another person that I know is my neighbour; she said she can never take a child for immunisation, and I noticed that all her children are not healthy at all. During the time they were doing house-to-house immunization for hepatitis, they came to our street, but this woman refused to allow her children to be vaccinated because of the previous experience she claimed to have. She said the problem of the child is spiritual, which is associated with battles from his father’s family, and the immunisation can worsen it.....” (PF1)

7.5.3. Theme 3: Social networks and interaction with health workers

Family and community members were influential in caregivers’ perceptions of vaccination. These were critical stakeholders that influence caregivers’ vaccination perceptions, as this is essential to developing strategies to promote vaccine acceptance and improve uptake (Dhaliwal *et al.*, 2021). Furthermore, Ulmido *et al.* (2024) stated that fostering a good relationship between healthcare workers and caregivers through communication techniques such as motivational interviewing could help bridge the gap created by mistrust in vaccinations.

7.5.3.1. Sub-theme One: Community influence

This sub-theme outlined how the vaccination behaviour of caregivers is influenced by different categories of individuals in their social network. As such, it draws on the participants’

experiences and perspectives on how social interaction and connection determine the choices made by caregivers on the uptake of vaccines for their children. In this study, it was discovered that the choice of caregivers on vaccine acceptance or otherwise was influenced by their friends or family members:

“But there is a particular woman staying very close to my shop that usually discourages me whenever I tell her that I want to take my child for immunisation. She tells me that she doesn’t like immunisation because it can cause the child’s leg to be paralysed.” (PE2)

Another participant mentioned those in her workplace and said:

“But what gets me discouraged are the people living very close to my shop in Lafe. There is a child who cannot walk properly with his legs, and people said that it was the immunisation he took that caused it.” (PC1)

Another category of people who constituted a barrier to vaccine uptake were members of the same household. For instance, a participant said:

“When I gave birth to my child, the people we are living together with in the same house told me that I should not take him for immunisation that if he takes it, he will be running a temperature, he will not be able to sleep, the injection site will be swollen.” (PD3)

The quote above summarises how the social network of an individual exerts influence on parental vaccination decisions using non-evidence-based adverse outcomes to profile the entire childhood immunisation programme negatively.

7.5.3.2. Sub-theme Two: Effect of health workers

This subtheme captures the actions of health workers at vaccination centres and how their behaviours affect the desires of mothers to vaccinate their children. Some caregivers expressed

displeasure at the treatment meted out to them at vaccination centres by health workers. They alleged that the health workers do not address them with courtesy and empathy.

“The nurses don’t feel the way we feel about this, and if you frown your face anyhow to show any negative feeling, they will be angry with you, telling you, “Do you think we want to do anything bad to your child?” (PE1)

In addition, a participant said:

The thing that discourages me most sometimes when I come for immunisation like this is that the nurses will be talking to you as if you are nobody. So, the way they normally talk to us, the way they normally shout at us will make you feel as if you are nobody, or is it because me too, I’m not a nurse or I am not in the position where they are?” (PB1)

Some caregivers revealed that some of them do not take vaccination for their children because of the long period of time often spent at the vaccination centres. Furthermore, they often prioritise other livelihood activities over attending the clinic for vaccination. A participant gave insight into her mother in-law decision not to vaccinate two of her children:

“One person that I know that hesitated and refused to take vaccination for her child is my mother-in-law. She said she did not take immunisation for her first and second born. She said they usually waste time in the clinic. She said the day could clash with the day she needed to go to her farm market to purchase the commodities she will need to resell, and she cannot afford to go to any clinic where they will waste her time, and she will end up not being able to go to where she is supposed to go.” (PE1)

Another participant, a school teacher, revealed that whenever her child is to be vaccinated, she cannot go to work on such days because they will not attend to her in time.

“Another thing I want to say concerning this immunisation is the consumption of time anytime we come to the clinic. For a person like me I take my child for immunisation at Oloyun clinic at Lefe junction and I work at St louis’ grammar school so any day my child is due for immunisation I don’t always go to work. Because it can be as late as 2 or 3 o’clock before I can leave the clinic.” (PC1)

This same participant also faulted the pace of work at the vaccination centres and concluded that the workers were too slow:

“Moreover, the workers at the clinic do not do their work very fast, and they usually brag for us. They will not start the immunisation on time when it is still morning time, and by the time they start it will be getting to the noon time when it is already hot, and the child’s body will be hot.” (PC1)

7.5.4. Theme Four: Attitude and lack of Vaccination Knowledge.

The importance of having a proper attitude and knowledge about vaccination was the focus in theme four. It emphasised the importance of readily available vaccination information in the moderation of vaccination decision-making of care-givers. The concept of *if it is not broken, you don’t need to fix it* was a driver for vaccine hesitancy under this theme.

7.5.4.1. Subtheme One: Lack of proper knowledge of vaccination

The opinions of the participants challenged the mainstream vaccine mandate, a principle which prescribed compulsory vaccination for all (Lantos *et al.*, 2010), regardless of contrary opinion or state of health.

Echoing this sentiment, a participant said:

“..... child does not have any issue and so may not need the vaccine, as we take them to be, so there is no need to make her child suffer for nothing.” (PC1)

This participant also expressed the belief that the diseases vaccines prevent were not serious, and hence there was no need for vaccination:

“...I even think that the sicknesses the children take vaccines for are not even all that serious.”
(PC1)

Another participant was of the opinion that if a child is not sick, there is no need to immunise the child:

“... if a child is not sick, there is no reason for taking such a child to be immunised”

Some participant hesitancy was largely due to the negative information they heard about vaccination:

“..... the way I hear some people talking about the effect of immunisation on their children usually gets me discouraged as a person.” (PH1)

“What I just discovered is that some people are less informed; it is not everyone that has the right understanding of this immunisation, so we need to keep providing the right information.” (PG2)

7.5.4.2. Subtheme Two: Negative Attitude

From the three FGDs, participants revealed that attitudes such as non-prioritisation of vaccination, dislike for vaccination and complacency about immunisation predisposed some parents to vaccine hesitancy.

“.. Then I realised that the woman is a very lazy person. Maybe she doesn't want to go out since Lagos is a very rowdy city. Because in my own case anytime I'm taking my child for immunisation, I would have left the house since around 6am in the morning so that I can go and pick a tally for my appointment because you can get there and they will say they are just

attending to fifty children on that day. So, the lady may be thinking of the distance, and this may be the reason why she has decided not to take her child for the immunisation.” (PB3)

Furthermore, a participant unwittingly declared that she had not accepted a vaccine for her child before: *“I have not immunized my child before.” (PD3)*

Another attitude that fuels vaccine hesitancy was a dislike for vaccination without any stated reason, as revealed by a participant concerning her neighbour:

“I have a neighbour whose child was always sick. All sorts of rashes often appear on the child’s body. So, I called her one day and enquired whether she had not taken vaccination for her child. She said I just don’t like it.” (PA2)

7.5.5. Theme Five: Phobia

This subtheme summarises how fear, founded or unfounded, serves as a contributor to parental vaccine hesitancy. Different types of fears that have the potential to fuel negative vaccination behaviour were expressed by the participants.

7.5.5.1. Subtheme One: Fear of vaccine administration

Some participants revealed that they have a phobia for injections. They also expressed fear about how the health workers give the injection and have the morbid fear that something bad can happen to their child. According to a few participants:

“.....and another thing is that I do use to be afraid of the way they give the injection, and I will be wondering if it will not touch the bone of the child because I’ve seen many occasions where the children legs will be paralysed as a result of the injection given.” (PB1)

“What usually makes me fear the injection is the way the legs of the children usually swell up.”

Some participants' fears stem from their personal hatred for injection, and that the delivery of the injection can be painful.

"Personally, I don't like to take injections. I am very scared of going to the hospital even as old as I am"

"Why I am personally discouraged is because I have phobia for injection, so I am always scared anytime they want to give my child an injection." (PF1)

7.5.5.2. Subtheme 2: "Fear of hospital visits"

Other types of fear exhibited by participants were the fear of hospital visits and nurses' white dresses.

"It is only antenatal service during pregnancy and child's immunization that makes me visit the hospital. You know when you get to the hospital. I am always scared of the white uniform of the nurses and the way they give injections to people." (PC1)

7.6. Conclusion

In summary, caregivers' views and experiences on promoters of vaccine uptake and reasons for vaccine hesitancy and refusals were presented in this chapter. The findings have revealed that caregivers have great concerns about vaccine risks and adverse effects, although the majority were favourably predisposed to the uptake of vaccines. A network of persons (spouses, family members and self) influences vaccine uptake positively and was highlighted. The contributory role of community networks and interaction with health workers to vaccine hesitant behaviour was also explored. It is important to note that culture, traditional beliefs and spirituality were mentioned as barriers to vaccination uptake in the study location. It is therefore desirable that this network of factors be considered when developing initiatives and

interventions aimed at promoting full vaccination for children in the study location. The next chapter will explore the integration of the quantitative and qualitative results.

Chapter Eight: Integration of Research Findings

8.0. Introduction

The strategy used to process the findings was to integrate the quantitative and qualitative findings. Integration is a mechanism for managing mixed methods research (Bazeley, 2024). It is the explicit conversation between the quantitative and qualitative components and the central defining feature of mixed methods research (Plano Clark, 2019). In this study, the goal is to provide answers to why caregivers exhibit vaccine hesitancy in the study location using the findings of the survey analysis and the outcomes of the narratives of the focus group discussions.

The term 'integration' is used to describe an intentional process whereby researchers use quantitative and qualitative data or findings interdependently to address a common goal (Plano Clark, 2019; Richards *et al.*, 2019; Skamagki *et al.*, 2024). Mixed methods integration, as explained by Guetterman, Plano Clark and Molina-Azorin (2024) combines quantitative and qualitative aspects of a study and can occur at the level of philosophy, research design, methods, data, or results. The intention is to gain a greater understanding of how complex interventions work and their implications for practice, research, and policymaking (Noyes *et al.*, 2019). Integration helps to develop instruments, merge findings and draw meta-inferences that give a more comprehensive understanding (Guetterman, Plano Clark and Molina-Azorin, 2024). This is useful in designing interventions to address complex phenomena (Richards *et al.*, 2019), such as the vaccine hesitancy challenge. According to Guetterman, Fetters and Creswell (2015), integration of mixed methods data in the discussion phase can be achieved in four ways, which include explaining quantitative results with a qualitative approach, building from qualitative results to a quantitative component, merging quantitative and qualitative

results, or embedding one approach within another. (Nessle *et al.*, 2023) define a joint display as the visual representation of integrated data.

8.1. Joint Display

Joint displays are visual frameworks for depicting the integration of qualitative and quantitative research during data collection, analysis, and interpretation (Guetterman, Fàbregues and Sakakibara, 2021; McCrudden, Marchand and Schutz, 2021). According to Younas, Pedersen and Durante (2020), joint displays are structured frameworks used for the integration and synthesis of qualitative and quantitative data at the analysis and interpretation levels. The advantage is that a joint display facilitates the comparisons between quantitative and qualitative results (Creswell and Hirose, 2019).

8.2. Types of joint display

The most common type of joint display is a side-by-side display that places qualitative results with related quantitative results and resulting meta-inferences (Guetterman, Fàbregues and Sakakibara, 2021; Skamagki *et al.*, 2024). The side-by-side display process, which is peculiar to sequential explanatory design, begins with the reporting of the quantitative results in the first column, and the qualitative results that help explain the quantitative results appear in a second column (Creswell and Hirose, 2019; Skamagki *et al.*, 2024). Thereafter, the significant results from the two columns containing the qualitative results can be mixed, and the outcome of the integration can be presented in a separate column on the initial table (Skamagki *et al.*, 2024) or on a new table (Othman, Steen and Fleet, 2020). The outcome of the integration process can be convergent (confirmation), which describes the agreement between the two sets of findings; complementary when the findings illustrate different but non-contradictory interpretations; expansion, which occurs when some findings overlap but also provide space for further interpretation; and divergent (discordance), which is when the quantitative and the qualitative

findings demonstrate conflicting interpretations. The overall conclusions drawn from the merging of qualitative and quantitative inferences reveal unique insights which could not be achieved by either approach alone and which produces an integrated understandings called meta-inferences (Younas *et al.*, 2025), which result in new insights that address the study's aim and objectives. The major types of joint displays are presented in Table 8.1.

Table 8.1: Major types of joint displays

Types	Side-by-side joint displays (Integrated results matrix)	Statistics-by-themes	Interview questions	Participant selection	Instrument development
Features	Represent merging by arraying qualitative and quantitative results next to each other, based on research questions, results, or a theoretical model	Array statistical results by qualitative themes with one as rows and the other as columns, similar to a cross-tabulation	Link the results of a quantitative strand of research to specific interview or focus group questions	Link the results of a quantitative strand of research to a specific purposeful qualitative sample of participants	Link the results of a qualitative strand to build specific scales, variables, and items for quantitative survey instrument
Benefits	Facilitates comparison and complementarity at the discussion phase	Facilitates relating qualitative and quantitative results to look for patterns at the discussion phase	Useful for explanation of results	Useful for purposive sampling at the qualitative phase of a mixed-method research	Use at the instrument development phase of an exploratory sequential mixed-method research

Adapted from Guetterman, Fàbregues and Sakakibara. (2021) and McCrudden, Marchand and Schutz. (2021)

8.3. Processes for the integration of quantitative and qualitative findings

According to Skamagki *et al.* (2024), there are four phases of integration. These are the creation of joint displays, linking activity, establishing relationships, and interpreting and reporting. The process commences with the selection of the type of joint display that the researcher intends to

create. The joint display will give a dashboard view of the findings. This is followed by the ‘linking activity’ phase. Linkages are established between the quantitative findings (descriptive statistics) and qualitative findings (illustrative quotes/memos/coding/categories) using a mapping exercise to compare and contrast the different component findings. In this phase, each contributing category was searched for related quantitative findings, and one or more appropriate qualitative participant quotes were chosen to illustrate these. Arrows with different colours will be used to link the survey findings with relevant quotes. The third phase involves the establishment of relationships between the quantitative and qualitative findings. This is the integrative process continued by looking for inconsistencies, alignments, or conflicting findings in order to establish relationships between the qualitative and quantitative data. The relationships are interpreted as the level of ‘fit’ between the findings. These are indicated with the labels ‘convergence’, ‘complementary’, ‘expansion’, and ‘divergence’ and are reflected in a new column in the narrative table. The last stage is the generation of meta-inferences.

8.4. Method of Integration

The side-by-side joint display has been adopted for the integration of the quantitative and qualitative findings in this study. The green lines show convergence between the quantitative and qualitative findings. When the amber line is used, it indicates that, though there was no exact convergence, the qualitative findings further expanded on the quantitative findings by providing deeper insight, a different but complementary perspective or an entirely new meaning. The red lines show divergence in the quantitative and qualitative findings. The broken line is utilised when both findings are neither divergence nor convergence but are not strong enough to be classified under either of the two. The joint displays and the linkage tables for all the themes are in table 8.2 to table 8.7

Table 8.2: Joint display of Theme One (Boosting childhood vaccination)

Overarching Theme/Categories	Quantitative findings	Qualitative findings
Boosting childhood vaccination Category 1 Reasons for vaccination	99.8% believe vaccines can protect children from serious diseases 86.4% believe vaccination is not harmful 93.6% are completely sure that following the recommended immunization schedule is good for their child	"My own view about immunisation is that it prevents sicknesses from entering the body of my child....." "The reason for vaccinating my child is to prevent diseases like polio, diarrhoea and hepatitis". "..... but immunisation has put a limit to the frequency of hospital visits for children" "I believe that if they give a child immunisation, the child will be healthy....." The reason why I vaccinate my child is for her to be very active..... the health would be strong; my baby will be strong it will also make my child brain to develop very well..... "The reason why I give immunisation to my children is to build up their immunity.....so their immune system can fight against any diseases" ".....It also helps them to grow very well...." "Even if a child falls sick, immunisation will prevent the disease from becoming severe". "sickness that will come in the future at least even though the sickness would come it won't be as strong as it's supposed to be"
Category 2 Enablers of vaccination (education, family members and health workers)	94% of community leaders (religious or political leaders, teachers, health care workers) supports vaccination Education does not have a significant association with neither vaccine hesitancy nor intention to vaccinate	"..... As a learned people, my husband and I are learned, we know too well that even since pregnancy level.... that by the time you have this child, you will have to vaccinate this child at different point in time....." "I already know that it's my duty, but my husband must not hear that I did not come for immunisation" "Then the number two person that encourage me is my husband, my husband will keep giving me money for transportation to take our child for immunisation." "as for me o erm my mum usually encourages me a lot to take the vaccination and my mother-in-law." "My own parents and my mother-in-law do encourage me on immunisation as well and.....because she knows I usually have a carefree attitude." "I have erm so many people around me that are encouraging me" (PF2) "My mother always encourages me that I should keep to the dates of immunisation appointment". 'I still encourage myself to take my child for immunization because I know it is compulsory' ".... I personally was immunized too so I don't have any regrets, my parents don't have any regret, I think that's the number one factor that has really encouraged me on immunisation". ".....but my grandma now encouraged me that the immunisation has a lot of benefits for children, and I was encouraged by what she said and started taking the immunisation for my children. So that is it ".... My people around, my husband and my sisters always encourage me too" "The people that usually encourage me to vaccinate my child include the health workers in the clinic where I delivered my child." "Right from when I was young, I used to hear some health workers with megaphone moving from street to street singing the song.....come and immunise your child....."

Table 8.3: Joint display of Theme Two (Intention to vaccinate)

Overarching Theme/Categories	Quantitative findings	Qualitative findings
Intention to vaccinate unfavourable attitude in caregivers reduces intention to vaccinate	70% believe that children receive more immunisations than are necessary. 42.7% felt that children should receive fewer vaccines while 43.6% on the PACV scale also opined that it is better for children to get fewer vaccines at the same time. 52.7% of caregivers had unfavourable attitude. 25.44 higher odds not to vaccinate (for caregivers who believe it is better for their child to develop immunity by getting sick than to get immunisation) on PACV scale	Caregivers have protective instinct towards their children “..... the injections they give to them are too many. I was telling my friend that do they want to kill them, two at once in the thigh, two in the arm, this is too much for a small child even me as an adult it takes a lot for me to take a single injection”
		Some caregivers are lazy “. Then I realized that the woman is a very lazy person... So, the lady may be thinking of the distance, and this may be the reason why she has decided not to take her child for the immunisation.”
		Some caregivers are complacent “I have a neighbour whose child was always sick. All sorts of rashes often appear on the child’s body. So, I called her one day and inquired whether she had not been taken vaccination for her child. She said I just don’t like it” “I have not immunised my child before”
Belief in the non-severity of Vaccine Preventable Diseases	72.7% believe that many of the illnesses immunisation prevent are not severe. 18.58 higher odds to be vaccine hesitant (those who believe that many of the illnesses immunisation prevent are not severe)	“..... child does not have any issue and so may not need the vaccine, as we take them to be so there is no need to make her child suffer for nothing.” “... if a child is not sick, there is no reason for taking such a child to be immunised”
Poor access to vaccination centre reduces intention to vaccinate	82(18.2%) of the caregivers revealed that distance, timing of clinic, time needed to get to clinic or wait at clinic, and/or costs in getting to clinic prevented them from getting their children immunised	“..... Because in my own case anytime I am taking my child for immunisation, I would have left the house since around 6am in the morning so that I can go and pick tally for my appointment because you can get there and they will say they are just attending to fifty children on that day.....” “..... Maybe she doesn’t want to go out So, the lady may be thinking of the distance, and this may be the reason why she has decided not to take her child for the immunization.”
Knowledge deficit in caregivers reduces vaccination	Half (50.2%) of the caregivers have poor knowledge. Those who have poor knowledge have higher odds (3.098) not to vaccinate their child	“‘What I just discover is that some people are less informed, it is not everyone that has the right understanding of this immunization, so we need to keep providing the right information.”
Caregiver’s level of trust promotes intention to vaccinate	94.2% and 95.3% respectively expressed trust in the information they receive about immunization”, and the level of trust for their child’s immunisation provider. 3.55 higher odds not to vaccinate their child for caregivers that do not trust the information they receive about immunization 96.4% reported that the information they receive about vaccines from the vaccine program is reliable and trustworthy	“...Some people told me that if I give it to my child, that my child will be running temperature. So, I am afraid that something bad may happen to him if I allow him to be immunized”. “I don’t really know much about immunization but when I gave birth, I was advised to take my baby for immunisation and I did my baby has not been sick”. “Naturally even as an adult when you’re having catarrh and cough.....it will even disorganize your system, so when my children are having catarrh and cough, I don’t give them immunisation. Even though the doctor says I should give them, at that stage I won’t give them because it will be as if I am fighting two things at the same time”

Table 8.4: Linkages of Key Findings in Theme One and Two

THEME	QUANTITATIVE FINDINGS	QUALITATIVE FINDINGS
BOOSTING OF VACCINATION UPTAKE	99.8% believed vaccines can protect children from serious diseases. 86.4% believe vaccination is not harmful. 93.6% are completely sure that following the recommended immunisation schedule is good for their child 94% of community leaders (religious or political leaders, teachers, health care workers) supports vaccination. Education does not have a significant association with neither vaccine hesitancy nor intention to vaccinate	Caregivers reported that vaccines prevent diseases like polio, diarrhoea and hepatitis" immunisation has put a limit to the frequency of hospital visits for children. Caregivers believed that an immunised child would grow well, be healthy, active and strong with a well-developed brain and immunity. Caregivers reported that it was their duty to vaccinate their child but that they were supported by their husband (who facilitates their access to vaccination centres), grandmother, mother-in-law, mother (helping to keep the dates of immunisation), sisters, health workers in the clinic, Caregiver stated that they vaccinate their child because her and her spouse were educated
CAREGIVERS' INTENTION TO VACCINATE	70% believe that children receive more immunisations than are necessary. 42.7% and 43.6% felt that children should receive fewer vaccines on VHS and PACV scale respectively. 52.7% of caregivers had unfavourable attitude. Caregivers who believed it is better for their child to develop immunity by getting sick than to get immunisation has significant higher odds not to vaccinate (on PACV scale). Caregivers who believed that most of the illnesses immunisation prevent are not severe has significant higher odds to be vaccine hesitant. Half of the caregivers have poor knowledge while those who had poor knowledge have higher odds not to vaccinate their child in the future. Caregivers have overwhelming trust in the information they receive about immunisation, and the level of trust for their child's immunization provider with Caregivers that do not trust the information they receive about immunisation having almost four-fold higher odds not to vaccinate their child.	Caregivers have protective instinct towards their children by opining that the injections they give to children are too many and that a child that is not sick does not have to be vaccinated. Some caregivers are complacent revealing that they just do not like vaccination. Some of them lack the right understanding of immunisation. Negative information about immunisation discourages some caregivers Fear that something bad may happen to their children prevent some from immunising their children. Caregivers said she will not give immunisation when her child has common cold even if she is advised by immunisation provider to do so

Table 8.5: Joint display of Theme Three (Vaccine Hesitancy)

Themes	Quantitative findings	Qualitative findings
Prevalence and determinants	28.2% were vaccine hesitant on VHS scale. 7.1% hesitant based on the PACV data tool. 7.602 higher odds to be vaccine hesitant (those who do not trust the immunisation information)	"I have not immunised my child before" "I have a neighbour whose child was always sick. All sorts of rashes often appear on the child's body. So, I called her one day and inquired whether she had not been taken vaccination for her child. She said I just don't like it"
Caregivers' sociodemographic characteristics influences vaccine hesitancy	Employment status and index child (IC) age has significant association with VHS Caregivers 'not working full time' and those with IC with age above 24 months had 1.8 and 2.05 times higher odds to be vaccine hesitant. Caregivers above 30 have slightly higher (28.8%) VH compared to those below the age of 30 (27.2%).	"Another thing I want to say concerning this immunization is the consumption of time anytime we come to the clinic. For a person like me and I work at St louis' grammar school so any day my child is due for immunisation I don't always go to work. Because it can be as late as 2 or 3 o'clock before I can leave the clinic."
Poor knowledge in caregivers promote vaccine hesitancy	Mean knowledge score (MKS) of non-hesitant caregivers (6.9) & hesitant caregivers (6.5). Those who said a child with fever should not be vaccinated (36.2 %) has 1.77 higher odds to be hesitant 12.9% and 30.7% of the caregivers does not know when to start vaccination and number of session necessary, respectively. Those who don't know why they vaccinate their child (23.8%) has 1.75 higher odds to be vaccine hesitant	"..... child does not have any issue and so may not need the vaccine, as we take them to be so there is no need to make her child suffer for nothing." ".../I even think that the sicknesses the children take vaccines for are not even all that serious". "... if a child is not sick, there is no reason for taking such a child, so we need to keep providing the right information."
Caregivers perceived risk and adverse reaction of vaccines	63.5% were concerned and doubted that their child might have a serious side effect 58.2% doubted safety of childhood immunisations 54.7% doubted the efficacy of immunisation Those concerned that their child might have a serious side effect from immunisation has 67.03 higher odd to be vaccine hesitant.	"We couldn't sleep in the night because he was running fever" "She reacted badly to the one she took this last Wednesday; she started running fever and could not stretch out her legs properly" ".... child was not active.... she had fever and she became very irritable and inactive to the extent that I became very scared...." "When I was still single, one of my neighbours took her second child for immunisation and the child died and people said that the injection was administered on the child's vein. So, she said she can never give immunisation to her child any longer".
Community and Social network contribute to vaccine hesitancy	Only 6% of community leaders (religious, political leaders, teachers, health care workers) opposes vaccination "	"But there is a particular woman staying very close to my shop whenever I tell her that I want to take my child for immunisation. She tells me that she doesn't like immunisation because it can cause the child's leg to be paralysed." "But what gets me discouraged are the people living very close to my shop in Lafe. There is a child who cannot

		walk properly with his legs and people said that it was the immunisation he took that caused it". "When I gave birth to my child, the people we are living together in the same house told me that I should not take him for immunisation that if he takes it, he will be running temperature, he will not be able to sleep, the injection site will be swollen".
Health system characteristics, health workers' attitude to caregivers, and fear of vaccine administration	18.2% prevented by distance, timing of clinic, time needed to get to clinic or wait at clinic, and/or costs in getting to clinic from immunising their child	"One person that I know, my mother-in-law, she did not take immunisation for her first and second born. She said they usually waste time in the clinic..." "The nurses don't feel the way we feel about this and if you frown your face anyhow to show any negative feeling, they will be angry with you telling you that do you think we want to do anything bad to your child." "the thing that discourages me most when I come for immunisation like this is that the nurses will be talking to you as if you are nobody". "...and another thing is that I used to be afraid of the way they give the injection, and I will be wondering if it will not touch the bone of the child" "What usually makes me to fear the injection is the way the legs of the children usually swell up" "Why I am personally discouraged is because I have phobia for injection, so I am always scared anytime they want to give my child an injection."
Caregivers' cultural belief and dependence on natural immunity	Ethnicity has no significant relationship with neither vaccine hesitancy nor intention to vaccinate	".... there are people who do not give their children immunisation because of their culture". "I believe that the natural immunity of the child is enough for him to fight against diseases". ".....The woman told my mum that the baby is already having a natural immunity, so don't use drug or anything for her..."
Caregivers' traditional practices and spirituality	38.9% (175/450) believes there is an alternative to vaccines Caregivers are predominantly Christians (88.2%). No association between their faith and vaccine hesitancy.	".... they prefer to prepare herbal concoction and give to the child.... the grandma said that when they have herbal concoction, the child does not need immunisation". "They feel like it is God that protects children so just leave them, they don't immunise the children".) "There are some churches that do not believe in anything drugs at all, they believe in holy water..."

Table 8.6: Joint display of Theme Four (Vaccination Behaviour)

Themes	Quantitative findings	Qualitative findings
Parental Vaccination Behaviour	92.9% (418/450) have never refused vaccination before. 7.1% reported out right refusal of vaccination Caregivers with good knowledge & non-hesitant has 2.7 OR and 6.86/7.71 OR/AOR not to refuse vaccination. Willing Acceptors: 76.4% Hesitant Acceptors: 16.5%	"I have no reason to refuse vaccination" "I know I have every reason to immunise my child because it prevents illnesses. But my hesitation comes from the fact that when we had the second immunisation, she started running a fever and became very irritable". "When we took the one, we took last, before we took it in February, we took it in January. My child's leg was swollen, even though his daddy said that I should not bring him for immunisation again, but grandma insisted that we should continue to take him for the immunisation".

Table 8.7: Linkages of Key Findings in Theme Three and Four

THEME	QUANTITATIVE FINDINGS	QUALITATIVE FINDINGS
VACCINE HESITANCY	Slightly above a quarter of the caregivers were vaccine hesitant on VHS. Employment status and index child (IC) age has significant association with VHS. Caregivers not working full time and having IC aged above 24 months were significant factors for vaccine hesitant. Mean knowledge score (MKS) of non-hesitant caregivers was higher than that of hesitant caregivers. Almost a third of the caregivers does not know when to start vaccination and number of session necessary. Those who don't know why they vaccinate their children and those who said a child with fever should not be vaccinated had almost two-fold higher odds to be hesitant. More than half doubted the efficacy and safety of vaccines and were concerned that their child might have a serious side effect. Ethnicity has no significant relationship with VH while more than a third believes there is an alternative to vaccines. Religion had no association between their faith and vaccine hesitancy, although caregivers were majorly Christians. 18.2% prevented by distance, timing of clinic, time needed to get to clinic or wait at clinic, and/or costs in getting to clinic from immunising their child	Caregivers gave primary and secondary narratives of adverse effect following immunisation (AEFI) such as fever, swollen limbs, paralysis and even death. Unfriendly behaviour of nurses and perceived lack of respect for caregivers. Poor time management at vaccination clinics Negative counsel from social networks fuels VH. Some caregivers had phobia for injection and exercise fear concerning how injection is given to children. Preference for natural immunity to vaccines. Cultural inclinations to abstain and dependence on herbal concoction reasoning that a child does not need vaccines when herbal concoction is available. Caregivers profess a belief in the protection by God and mentioned the use of holy water instead of drugs. Caregivers demonstrated lack of knowledge on importance of vaccination
VACCINATION BEHAVIOUR	Over 90% of the caregivers accepted vaccines consisting of willing acceptor and hesitant acceptors. 7.1% refused vaccines out rightly. Two-third of outright refuser had poor knowledge and predominantly not working full time. Many of outright refusers believed in vaccine importance and safety. 65% of vaccine refusers believed vaccines were important 92.9% (418/450) have never refused vaccination before. Caregivers with good knowledge & non-hesitant has 2.707 OR (p=0.014) and 6.857/7.706 OR/AOR (p<0.001) not to refuse vaccination.	Some caregivers said they had no reason to refuse. Caregivers, despite the fact that they believe vaccines was important, refused vaccines when their child was ill and after experiencing of AEFI Caregivers transit from vaccine acceptor to vaccine refusal after AEFI and back to reluctant acceptor after intervention by grandmother.

8.5. Integration of the findings in this study

For the purpose of the integration and the drawing of meta-inference from the findings, the procedures in two studies (Guetterman, Feters and Creswell, 2015; Othman, Steen and Fleet, 2020) were utilised with a slight modification. Meta-inference was drawn from each of the key findings in three steps involving a narrative summary of the quantitative and qualitative findings under each theme, followed by highlighting the corresponding outcomes and implications.

8.5.1. Boosting Childhood Vaccination: Reason for Vaccination

Quantitative: 99.8% believe vaccines can protect children from serious diseases. 86.4% believe vaccination is not harmful. 93.6% are completely sure that following the recommended immunisation schedule is good for their children.

Qualitative: Caregivers reported that vaccines prevent diseases like polio, diarrhoea and hepatitis and that immunisation has put a limit on the frequency of hospital visits for children. They believed that an immunised child would grow well and be healthy, active and strong with a well-developed brain and immunity.

Outcome: The integration results in a convergence. The quantitative data showed that the majority of the caregivers believed vaccines can protect children from serious diseases, are not harmful, and are completely sure that following the recommended immunisation schedule is good for their children. The qualitative data confirmed these findings and provided specific details about what vaccines can do, such as making their children healthy and preventing sickness and diseases such as polio, diarrhoea, and hepatitis; building up the child's immunity; and making the child active and strong for proper brain development.

Implications: Vaccines are important and essential for disease prevention, proper development, and reducing the incidence of hospital visits. Provide health literacy for caregivers on the importance and usefulness of vaccines. Support caregivers to adhere to vaccination schedules for their children.

8.5.2. Boosting Childhood Vaccination: Reason for Vaccination

Quantitative: 94% of community leaders (religious or political leaders, teachers, and healthcare workers) support vaccination. Education does not have a significant association with either vaccine hesitancy or intention to vaccinate.

Qualitative: Caregivers reported that it was their duty to vaccinate their child but that they were supported by their husband (who facilitates their access to vaccination centres), grandmother, mother-in-law, mother (helping to keep the dates of immunisation), sisters, health workers in the clinic,

Outcome: There was a positive convergence of the findings. The quantitative data showed that the majority of the relevant stakeholders supported vaccination, while the qualitative findings showed how each category of stakeholders facilitated vaccination.

Implication: Enablers of vaccination are nuclear family members and networks of relations. Influential community and faith leaders are also not in opposition to vaccination. Such individuals should be used to create a formidable support system for vaccination programmes.

8.5.3. Caregivers' Intention to Vaccinate

Parental intention to vaccinate precedes successful vaccination, and it is attitudinal and dependent on knowledge and trust: Caregivers who choose to refuse or accept immunisation for their children first develop an intention to do so or otherwise. This intention is dependent on the attitude and trust quotient of the caregiver. Unfavourable attitude in caregivers, belief in

the non-severity of vaccine-preventable diseases (VPD) and poor access to vaccination centres reduce intention to vaccinate.

Quantitative: 70% believe that children receive more immunisations than necessary. 42.7% and 43.6% felt that children should receive fewer vaccines on the VHS and PACV scales, respectively. 52.7% of caregivers had an unfavourable attitude. Caregivers who believe it is better for their child to develop immunity by getting sick than to get immunisation have significantly higher odds not to vaccinate (on the PACV scale). Many who believed that most of the illnesses immunisation prevents are not severe had significantly higher odds of being vaccine hesitant. Half of the caregivers have poor knowledge, while those who have poor knowledge have higher odds of not vaccinating their child in the future. They have overwhelming *trust* in the information they receive about immunisation, and the level of trust for their child's immunisation provider with caregivers that do not trust the information they receive about immunisation having almost four-fold higher odds not to vaccinate their child.

Qualitative: Caregivers have protective instincts towards their children by opining that the injections they give to children are too many and that a child that is not sick does not have to be vaccinated. Some caregivers are unaware of vaccination benefits and complacent, revealing that they just do not like vaccination. Some of them lack a proper understanding of immunisation. Negative information about immunisation discourages some caregivers and the fear that something bad may happen to their children prevents some from immunising their children.

Outcome: The quantitative data showed that almost half of the caregivers were not comfortable with the quantity of injections given to their children, and such caregivers has a significantly higher odd to be hesitant. There was a convergence between both sets of findings since a similar preference for reduced or no vaccination was revealed in the qualitative findings, where

some caregivers felt that natural immunity is adequate enough to replace vaccines. However, despite the fact that they trust their immunisation providers and the information they provide, some were still negatively influenced by their social networks.

Implication: Intention to vaccinate can only be positive if caregivers have a positive disposition to vaccination and have appropriate knowledge about vaccination. The reason why children have to take the number of vaccines they take must be explained to caregivers. Since about half lack the right understanding of immunisation, HCP will need to keep providing the right information to them.

8.5.4. Vaccine hesitancy

Vaccine hesitancy prevalence influences vaccination outcomes. This research has demonstrated that vaccine hesitancy exists in the study area and that the prevalence is contextual and due to certain determinants that significantly affect intention to vaccinate and vaccine uptake.

Quantitative: Slightly above a quarter of the caregivers were vaccine hesitant on VHS. Employment status and index child (IC) age have significant associations with VHS. Caregivers not working full time and having IC aged above 24 months were significant factors for vaccine hesitancy. The mean knowledge score (MKS) of non-hesitant caregivers was higher than that of hesitant caregivers. Almost a third of the caregivers does not know when to start vaccination and the number of sessions necessary. Those who don't know why they vaccinate their children and those who said a child with fever should not be vaccinated had almost two-fold higher odds of being hesitant. More than half doubted the efficacy and safety of vaccines and were concerned that their child might have a serious side effect. Ethnicity has no significant relationship with VH, probably due to the dominance (90%) of Christianity in the sample population while more than a third believe there is an alternative to vaccines. Caregivers,

although predominantly Christians, had no association between their faith and vaccine hesitancy.

Qualitative: Caregivers gave primary and secondary narratives of adverse effects following immunisation (AEFI), such as fever, swollen limbs, paralysis and even death. Unfriendly behaviour of nurses and perceived lack of respect for caregivers. Poor time management at vaccination clinics and negative counsel from social networks fuel VH. Some caregivers had a phobia of injection and exercised fear concerning how injection is given to children. Preference for natural immunity over vaccines. Cultural inclinations to abstain and dependence on herbal concoction reasoning that a child does not need vaccines when herbal concoctions are available. They also profess a belief in the protection by God and mentioned the use of holy water instead of drugs.

Outcome: The quantitative data showed that less than half of the caregivers had confidence in vaccines, and only two sociodemographic factors influence vaccination decisions. Knowledge of vaccination and vaccination schedules is important for vaccination uptake. The qualitative data expanded and provided more details on why caregivers were vaccine hesitant. The effect of social networks, culture and religion was shown to be negative. Administration of vaccines and health workers' attitude were a source of concern to caregivers.

Implication: Poor knowledge fosters vaccine hesitancy, and hence a health literacy programme involving all relevant stakeholders will be vital to address vaccine hesitancy in the study location. Health workers should be trained on work-based human relations, and a strict adherence to good work ethics will remove some of the issues raised by the caregivers.

8.5.5. Vaccination Behaviour

This document the final vaccination behaviour of the caregivers and details how it is influenced by specific determinants, with the parental vaccine hesitancy index acting as a mediator.

Quantitative: Over 90% of the caregivers accepted vaccines, consisting of willing acceptors and hesitant acceptors. Hesitant caregivers almost a quarter of the population. 7.1% refused vaccines outright. Two-thirds of outright refusers had poor knowledge and predominantly worked part-time or were unemployed. Many of the outright refusers believed in vaccine importance and safety.

Qualitative: Some caregivers said they had no reason to refuse. Caregivers refused vaccines when the child was ill and after experiencing AEFI.

Outcome: The quantitative data showed that caregivers with positive attitudes and beliefs refused vaccines. The qualitative findings revealed the context that can lead to vaccine refusal despite positive attitudes and beliefs.

Implication: Vaccination behaviour is not dependent absolutely on knowledge and attitude but mediated by the context under which the decision is to be taken. The typology of beliefs and context determines vaccination behaviour.

8.6. Conclusion and chapter summary

The integration of the quantitative and qualitative findings reveals that most caregivers believe vaccines protect children from serious illnesses and are not harmful. Key enablers of vaccination include immediate family members and broader social networks. However, nearly half feel uneasy about the number of injections administered to their children, and some believe natural immunity is sufficient to replace vaccines. Despite trust in immunisation providers and information, less than half have confidence in vaccines.

Social networks, culture, and religion negatively impact vaccine hesitancy, with concerns about vaccine administration and health workers' attitudes being significant sources of worry. Healthcare professionals must continue to provide accurate information to combat vaccine hesitancy. Health workers should receive training on workplace human relations and adhere to

ethical work practices. Vaccination behaviour is not solely determined by knowledge and attitude but is influenced by the context in which the decision is made. The foregoing will set the foundation for the discussion of the key outcomes in the subsequent chapter.

Chapter Nine: Discussion

9.1. Introduction

This chapter starts with a summary of findings and the discussion of the four themes obtained from the integration of the quantitative and qualitative results highlighting areas of convergence with other researchers while providing reasons for divergent and novel results. The first theme in section 9.3 explored caregivers' reasons for accepting vaccination and factors necessary for boosting childhood vaccination in the study area while outlining the role of diverse stakeholders in enabling vaccination among caregivers. The chapter continues in Section 9.4 by assessing the impact of key variables—including knowledge, gender, accessibility and belief in VPD severity—on caregivers' vaccination intentions and their subsequent effect on overall vaccine uptake. Section 9.5 begins with a characterisation of vaccine hesitancy and a contextual analysis of its prevalence in the study location. The implication of some sociodemographic characteristics, vaccination knowledge, caregivers' adverse reaction risk perception, normative framework, health systems and trado-cultural practices, for the vaccine hesitancy status of caregivers were evaluated.

Section 9.6 examined the findings obtained through the self-reported vaccination behaviour of the caregivers. The demographic indices and vaccination beliefs of caregivers were used to characterise vaccine refusers. The impact of caregivers' vaccination attitudes and beliefs on vaccination behaviour was discussed using the explicit and implicit attitudes framework and the belief-behaviour inference model. Section 9.7 provides a critical examination of how vaccination behaviour predictors, identified through mediation analysis, impact the promotion of vaccination programmes. The chapter conclude with discussion of the strengths and limitations of the study in section 9.8.

9.2. Summary of key findings

The findings of this research work were integrated and aggregated based on the purpose and objectives of the study. Figure 9.1 presents the synthesis of the key findings as a theoretical pathway. The pathway is a schematic diagram that depicts the influence of barriers and boosters of vaccine uptake on “intention to vaccinate” and the subsequent impact on vaccination outcome. The contributors to vaccine uptake, consisting of “perceived benefits” and “enablers” were indicated in the theoretical model.

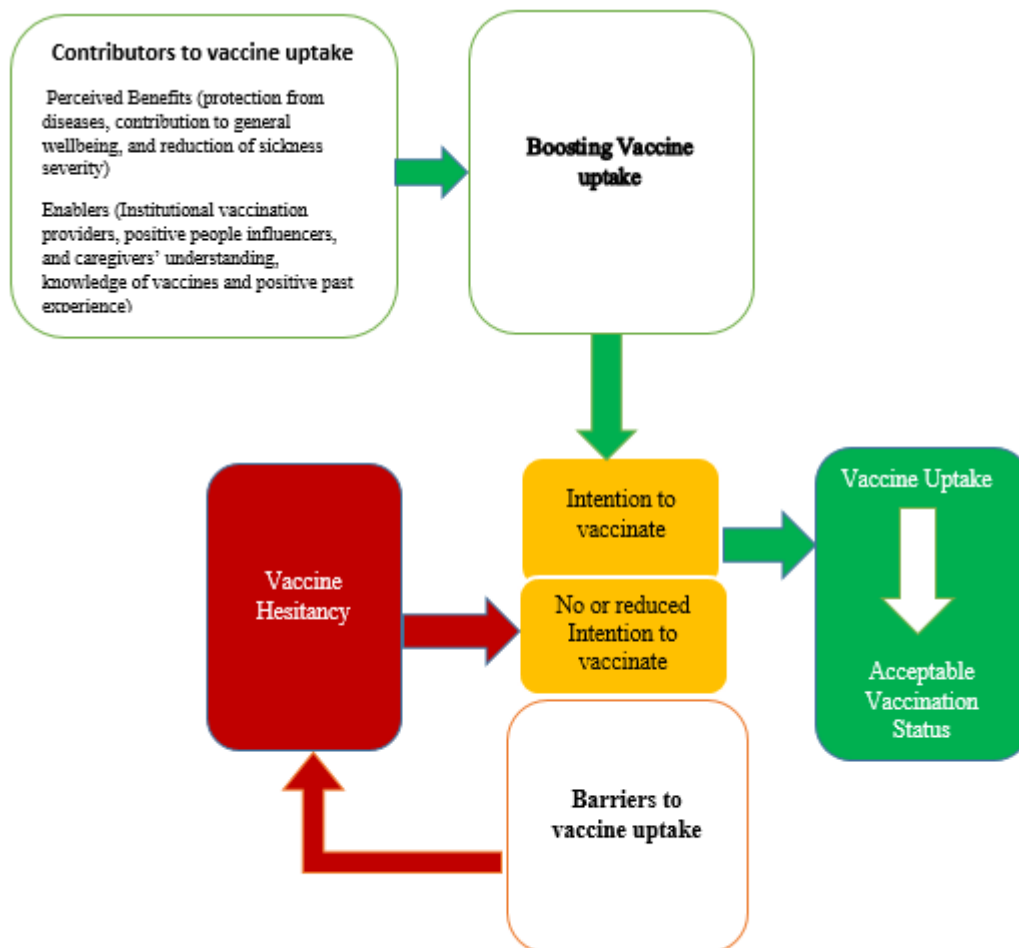


Figure 9.1: Theoretical pathway between vaccine hesitancy and vaccine uptake

(Developed by the researcher)

The key outcomes of the mixed methods studies were structured as follows:

(i) Boosting childhood vaccination is contingent on caregivers' confidence in vaccine importance and the influence of positive enablers: Caregivers in the study area showed a lot of faith in the importance of vaccination, as evident in the survey outcomes. This viewpoint was given further credence by the themes and subthemes on promoters of vaccination uptake that emerged in the thematic analysis of narrative data.

ii) Parental intention to vaccinate precedes successful vaccination, and it is attitudinal and dependent on knowledge and trust: Caregivers who choose to refuse or accept immunisation for their children first develop an intention to do so or otherwise. This intention is dependent on the attitude and trust quotient of the caregiver.

iii) Vaccine hesitancy prevalence influences vaccination outcomes: contexts, factors and determinants: This research demonstrates that vaccine hesitancy is prevalent in the study area; its influence is contextual and driven by specific factors that significantly affect both vaccination intention and uptake.

iv) Vaccination behaviour

This finding documents the vaccination practice of caregivers and details how vaccine hesitancy affects the vaccination decision while acting through specific determinants as the mediator.

The main findings with respect to the research questions are highlighted and discussed under the four themes presented above as the summary of key findings of the study. The implication and inherent meaning of each finding and congruence with (or deviation from) the outcome of other researchers is examined while novel outcomes are noted as original contribution to knowledge.

9.3. Boosting Childhood Vaccination

9.3.1. Caregivers' reasons for vaccination

The main findings why caregivers accept vaccination for their children were caregivers' beliefs in the benefits, importance, safety and effectiveness of vaccines.

The benefits and importance centre on the ability of vaccines to protect children from diseases, enable healthy growth and provide immunity against diseases. The integration of the quantitative and qualitative findings on 'reasons for vaccination' showed a convergence of both results and an alignment that vaccines can protect children from serious diseases. Almost all caregivers (99.8%) believed that vaccines can protect children from serious diseases, and 93.6% were completely sure that following the recommended immunisation schedule was a good idea for their child. Many of the caregivers in the focus group discussion (FGD) confirmed the quantitative findings by declaring that acceptance of vaccines makes their children healthy. One of the FGD participants (PA, FGD1) stated, "*My own view about immunisation is that it prevents sicknesses from entering the body of my child....*" Similar convergence between quantitative and qualitative findings with respect to benefits of vaccination has been reported in other mixed methods studies (Akwataghibe *et al.*, 2019). Also, a study in Ghana by Danso *et al.* (2023) found that 94.2% of the respondents believed that childhood immunisations protected their children from diseases and additionally will make their child strong. While the quantitative part of this study did not report on whether vaccination makes a child strong, nevertheless one of the caregivers in the FGD declared that she vaccinates her child because it makes the child active and strong, saying, "*.... The reason why I vaccinate my child is for her to be very active.... The health would be strong; my baby will be strong*" (PF, FGD1). Hence, this narrative data provides additional insight into the reasons why caregivers accept vaccines for their child and constitutes an expansion on the quantitative

findings. Therefore, caregivers' beliefs that vaccines can prevent diseases in children, their knowledge of the names of these diseases, and their conviction that vaccines reduce the frequency of illness and hospital visits while boosting a child's immunity all fall under the protection paradigm. On the other hand, the three-narrative quotes: *"It will also make my child brain develop very well..."* (PF FGD2), *"... The reason why I vaccinate my child is for her to be very active..."* ... *the health would be strong; my baby will be strong*" (PF, FGD1) and *"... It also helps them to grow very well..."* (PF FGD2) can all be categorised together under growth.

The reasons given by caregivers for accepting vaccination in this study – protection and growth – were explained by Alfano and Ercolano (2022) as "individual gain", which are benefits associated with getting vaccinated contrasted to "collective benefits" of a community due to getting vaccinated. A similar benefit-driven acceptance of vaccines was reported in a scoping review by Mohammed *et al.* (2024) that explored the landscape of routine immunisation in Nigeria. The study documented that perceived vaccine benefits and fear of the consequences of non-immunisation were facilitators of vaccine uptake in the northwest part of the country. The thought of never forgiving oneself if something were to happen to a child due to a decision not to vaccinate, captured as a "fear of anticipated regrets" by Hamama-Raz, Ginossar-David and Ben-Ezra (2016), was a strong motivator to act (vaccinate) and positively aligns with the benefit-driven acceptance behaviour identified in this study.

The perception of caregivers on vaccine safety was also a key determinant of vaccine uptake. In this study, 86.4% of caregivers believed that vaccines were not harmful, and this was similar to the 85.0% reported for parents in the UK (UKHSA, 2025) and globally, where eight in ten people (79%) somewhat or strongly agree that vaccines are safe. Furthermore, the qualitative findings expanded the quantitative result where an FGD participant stated categorically that:

“I believe that if they administer a child immunisation, the child will be healthy. so they can be, they can look healthy” (PH FGD1).

Despite the narrative on vaccine safety enunciated above, very contentious discussions surrounded this issue in the past and until now. Previous controversies, such as the concern on polio vaccine safety fuelled by rumours and religious considerations, resulted in hesitancy to the polio vaccine in Northern Nigeria, which presented a significant challenge to global polio eradication efforts (Adili-George and Chilaka, 2025). Also, the Wakefield scientific report, which falsely linked childhood vaccines to autism in children (DeStefano and Chen, 1999; Davidson, 2017; Novilla *et al.*, 2023), continues to provide anti-vaxxers (Evrony and Caplan, 2017; Carpiano *et al.*, 2023) leeway to create doubts about the safety of vaccines and thereby discrediting the entire vaccination programme. This group have made social media their habitat and portend great risk to vaccination programmes. One of the participants (PB FGD2) spoke unequivocally on this:

“... then we are in a world of social media; when you go online you see things, you see different deformities in children that are so alarming, sometimes you are scared, and I kept wondering what went wrong, although I don't have access to these people; all I see are pictures online. I don't have access to, and I don't know their stories...”

This issue is particularly significant for Nigeria, with a population of 36.8 million social media users (World Population Review, 2025). Vaccine safety is shown to be important to the study population since those who believed vaccines were harmful were significantly more likely to be vaccine hesitant than those who believed vaccines were safe.

A further iteration of the integrated findings of this study also brought to the fore the issue of vaccine confidence, which has been described as one of the key reasons why most caregivers accept vaccines for their children. According to Rimal *et al.* (2024), caregivers' confidence in

vaccines is viewed from the perspective of their confidence in the importance of vaccines, their safety and efficacy. For instance, an empirical study by De Figueiredo *et al.* (2020) reported that confidence in the importance of vaccines (rather than in their safety or effectiveness) had the strongest association with vaccine uptake when compared with other determinants. Furthermore, the statement from one caregiver, “*The reason for vaccinating my child is to prevent diseases like polio, diarrhoea and hepatitis*” (P1, FGD 1), is one borne out of her conviction that vaccines are effective enough to protect her child from the diseases.

A key contribution to knowledge is that when caregivers have a definitive understanding of the perceived benefits of vaccines, it leads to a high level of confidence in vaccines, and they are more likely to vaccinate their children.

9.3.2. Caregivers’ enablers of vaccination

The empirical and narrative findings from this study showed that human factors-classified as personal and interpersonal enablers, and health system factors were associated with positive childhood vaccination uptake. Enablers of vaccination are a network of factors that facilitate and motivate caregivers to access and receive vaccines for their children. These factors include humans (health workers, family members, and community leaders), health system processes, and vaccine administration policies. Jalloh *et al.* (2022) further classified enablers of childhood vaccination as either emotional or practical enablers, where emotional enablers capture caregivers’ demonstration of parental obligation to their children driven by a desire to make the right decision concerning their health, while practical enablers cover actions or activities associated with positive vaccination behaviour.

The quantitative study revealed an overwhelming support for vaccination (94%) by community leaders consisting of religious or political leaders, teachers, and healthcare workers, while 55.1% of caregivers claimed that they get their vaccination information from health workers.

Furthermore, caregivers who obtain vaccination information from health workers have 4.36 higher odds of vaccinating their child than those who did not get their vaccination information from a health worker. This was also corroborated by the qualitative findings, where a caregiver in the FGD stated as follows:

“The people who usually encourage me to vaccinate my child include the health workers in the clinic where I delivered my child (PE FGD2).”

This convergence of the quantitative and qualitative findings further confirmed the importance of health professionals in promoting positive vaccination behaviour and, hence, vaccination uptake. In a study in Kenya by Moucheraud *et al.*(2024), which reviewed childhood vaccination uptake over a five-year period between 2017 and 2022, trust in health workers was one of the strongest factors associated with vaccination. Similarly, Kulkarni *et al.* (2022), in a cross-sectional household survey in Sierra Leone, established that health workers and faith leaders are important sources of information to deliver vaccination messages, given their strong association with vaccination confidence and uptake. The high level of trust in health workers may be attributed to the confidence with which they disseminate vaccination information, as well as the consistency and usefulness of that information over time.

Immunisation activities at the health facilities typically begin with a health talk for pregnant women who came to register for and receive antenatal care, and mothers who brought their children for immunisation. The dos and don'ts during pregnancy and the benefits and importance of vaccines are communicated to the caregivers with a candour borne out of experience. This perhaps creates in the caregivers a high sense of trust in health workers, which Essa-Hadad *et al.* (2024) in a study in Israel construed to be due to health workers' pleasant disposition at work and on caregivers' assumption that health professionals were most knowledgeable regarding vaccination. Hence, in order for health workers in the study location

to continue to render valuable knowledge-based advice to caregivers towards enhancing vaccination uptake, they must be properly and regularly trained on contemporary issues on vaccines and vaccinations. This position resonates with the recommendations of Aguilar Perez, Satherley and Dixon (2024) and Moucheraud *et al.* (2024) that public health workforce must be upskilled through regular training and updates to better address vaccine safety concerns and support parents.

In addition to the foregoing, the human enablers in this study can be classified as individual and interpersonal in consonance with the categorisation by Ali, Bell and Mounier-Jack (2025) in a qualitative study that explored the enablers of high childhood vaccination uptake in East London's Bangladeshi community. The individual category was revealed in the narrative of some of the caregivers in the FGDs who declared that they were responsible for encouraging themselves to accept vaccination.

I still encourage myself to take my child for the immunisation because I know it is compulsory (PAFGD1).

In the concluding part of the narrative, the caregiver said that she knew it was compulsory. The implication of this is that a caregiver's self-motivation to accept vaccination for her child is dependent on a personal conviction about the importance of vaccination for the child, and this is a key finding in this research. The concept of being compulsory may also have been derived from the information received on vaccination. This view may also be linked to the practice in some homes or communities where mothers are responsible for vaccinating their children. Furthermore, Anyabolu (2016), in an unpublished PhD thesis titled "Understanding Caregivers' Perceptions of Childhood Immunisation", projected immunisation as the mother's responsibility. This assertion was confirmed by the quantitative findings, which revealed that the majority (93.6%) of the caregivers were female.

The following perspective and mind-set may impose “a duty of care” on the mothers, framing them as the sole decision-makers and placing the burden of compulsory uptake of vaccination entirely on their shoulders. This depicts a common household scenario where mothers are thrust to the forefront of childhood vaccination while their husbands are reduced to mere ‘cheerleaders’ or providers of passive support. However, when a spouse actively participates in the child's care, they share the responsibility and potentially improving the child’s health outcomes.

Furthermore, one caregiver noted that she motivates herself to accept vaccination out of a conviction that it was beneficial for her child. Another attributed her positive vaccination behaviour to her own childhood vaccination history, and that it was proper for her to do the same for her children. These actions can be explained in terms of positive parenting and a belief in the importance of vaccines.

The foregoing narratives revealed that personal motivation for positive vaccination behaviour was contingent on caregivers’ belief that vaccines are compulsory, their understanding of vaccine benefits, their personal conviction and tenacity coupled with intergenerational commitment to vaccination. This amalgam of reasons, that drives caregivers’ motivation to vaccinate their children, is novel and constitute an original contribution to knowledge.

Furthermore, the commitment to doing the right thing (accepting vaccination for the child) was an existential action that involved supplication to God to avert risks. Besides, a sense of collective responsibility could be deduced from their intergenerational commitment to their child's vaccination.

The interpersonal enablers capture the different categories of individuals that serve as promoters of the positive ideals of vaccination towards ensuring positive vaccination behaviour. They include husbands, parents (particularly mothers of caregivers), grandmothers

and siblings. The majority (92.9%) of the caregivers were married, while 97.4% and 96.6% were married in similar studies in Northern Nigeria and Ethiopia (Masters *et al.*, 2018; Isezuo and Adamu, 2022). Among all the individuals mentioned, caregivers' spouses (husbands) were predominantly positioned to encourage and promote vaccination uptake by helping their spouse to keep records of vaccination schedule. This conclusion was captured and confirmed in several quotes: “.....*the first person to encourage me is my husband*” (PC FGD1)

Emerging from the various quotes was the fact that husbands enable vaccination by working together with their wives, keeping track of immunisation schedules, facilitating access to immunisation centres by giving transport fare to their wives, and acting as an enforcer so that caregivers attend immunisation clinics according to schedule. If the couple lives together, the roles performed by the husband are critical to vaccination uptake. This is particularly significant because health system accessibility (Ekezie *et al.*, 2022), intention to vaccinate (Siena *et al.*, 2022; Knijff *et al.*, 2023) and knowledge of vaccination schedule (Essoh *et al.*, 2023) have been established in several studies as determinants of vaccination (Galagali, Kinikar and Kumar, 2022).

It is interesting to note that the analysis of the sociodemographic variables in this study revealed no association between maternal education and either vaccine hesitancy or intention to vaccinate. However, one of the caregivers in the FGD declared that her child was vaccinated because she and her husband were both educated, and that was why the couple exhibited a positive disposition to vaccination.

“..... *As a learned people, my husband and I are learned, we know too well that even since pregnancy period.... we were told beforehand that by the time you have this child, you will have to vaccinate this child at different points in time.....* (PB FGD2)”

Studies (Khan, Zaheer and Shafique, 2017; Alotaibi *et al.*, 2024; Gebreyesus and Tesfay, 2024) have shown that maternal education had a positive association with the level of vaccination uptake. Furthermore, (Sako, Gilano and Hailegebreal, 2023), in a study in Ethiopia, reported that education is an independent predictor of full or partial vaccination. The narrative quotes above nevertheless raise the fact that the final vaccination decision may not depend only on whether the caregiver is educated but on the education status of both parents and their level of awareness of vaccination. Furthermore, being educated may not be enough to guarantee acceptance of vaccination since there were instances when education constituted a barrier to vaccine uptake as revealed in section 2.10.1.4 of the systematic literature review (SLR) in chapter two. Education becomes a positive factor, however, when module on vaccination is mainstreamed early into the school's curriculum. This will encourage the development of positive disposition to vaccination early in life.

Several studies (Mavundza, Cooper and Wiysonge, 2023; Ali, Bell and Mounier-Jack, 2025) have documented the positive impact of family and household members on vaccination uptake. This study had also, through various narrative quotes, captured the positive role of grandmothers, sisters, and mothers-in-law. Some revealed that their mother, mother-in-law, grandma, and sisters, encouraged them to pay attention to the dates of vaccination appointments since she has a carefree attitude.

“.....but my grandma encouraged me that the immunisation has a lot of benefits for children, and I ...started taking the immunisation for my children.” (PE FGD1)

The network of enablers (caregiver's mother, mother-in-law, grandmothers and sisters) identified in this study can exert a net positive pressure on the vaccination decision of caregivers. This positive net pressure can be construed as a social normative framework, which has been reported in various studies (Campbell *et al.*, 2023; Rimal *et al.*, 2024) as a key

determinant of vaccination uptake. Also, the quantitative finding that 90.9% of the caregivers believed that having their child vaccinated was important for the health of others in their community further expanded the application of the social norm theory in framing vaccine uptake in the study area. This is so because people perceive social norms through expectations about the behaviour of others (Gross and Vostroknutov, 2022; Dannals and Li, 2024). Norms prescribe how to make decisions in social situations and influence choices which are conditional on what others do or believe (Gross and Vostroknutov, 2022) or say, as obtainable in this study. The quantitative finding where 84.4% of caregivers said that they thought that most parents like them have their children vaccinated with all the recommended vaccines is consistent with the social norm theory and complementary to the qualitative outcomes. This vaccination behaviour can also be explained in terms of commitment to collective responsibility based on the 5C psychological antecedent of vaccination (Betsch *et al.*, 2018). A similar report was made by Mavundza, Cooper, and Wiysonge (2023) in a study in Burkina Faso, where some parents were more accepting of childhood vaccinations because they took them as a community-wide social practice.

A key outcome of this study, consistent with the findings of other researchers as outlined above, is that health care decision-making in African communities is not an individual effort but shared with others in the household (Haskins *et al.*, 2017), and hence the increase of vaccine uptake in the study area can be achieved through the implementation of public health interventions that will leverage the advantages of social norms (Rabb *et al.*, 2022).

9.4. Parental intention to vaccinate precedes every successful vaccine uptake.

9.4.0. Introduction

The intention to vaccinate is a key parameter that determines eventual vaccine uptake in this study. Intention to vaccinate is a state of mind that is developed in response to certain

modifiable factors and a positive commitment to childhood vaccination. It is the self-expressed future vaccination behaviour of the caregivers and the most proximal psychological determinant of behaviour (Fishman *et al.*, 2024). This is so because the attitude of the parents to vaccination is an important marker of the intention to have the child vaccinated (Demir Pervane *et al.*, 2025).

The intention to vaccinate prevalence of 91.3% in the study area is remarkable when compared with vaccination intention rates of 76.3% and 83.4%, respectively, obtained in two communities in China with different policies of self-paid vaccination and free vaccination (Zeng *et al.*, 2019). Likewise, Knijff30 *et al.* (2023) reported a vaccination intention rate of 83.1% for the Netherlands in 2022, as determined from the Dutch National Immunisation Programme (DNIP). Although, intention to vaccinate does not directly translate into vaccination uptake, it is a significant predictor of vaccination uptake. This position was affirmed by Jwa *et al.* (2025), who posited that vaccination intention and behaviour are strongly associated; they noted that while changing intention is necessary for vaccine uptake, it is not sufficient to change behaviour on its own. The development of a positive intention by a caregiver is dependent on certain variables. To understand the mechanism of these factors, and their association with intention to vaccinate — the proposed future vaccination behaviour of caregivers — three models were fitted using a backward elimination regression. The findings showed that caregivers who had poor knowledge, were hesitant on the PACV scale, worked full-time, or were male were significantly associated with an intention not to vaccinate. This indicates that “blanket” public health interventions might be less effective than focused ones. In furtherance of the need for customised initiatives, Knijff *et al.* (2023) advised that monitoring these determinants and developing appropriate interventions could help sustain high vaccine uptake.

9.4.1. Caregivers have a protective instinct towards their children.

Attitudes toward vaccination are an important determinant of public health (Alfano and Ercolano, 2022). Unfavourable attitudes towards vaccines are a major public health concern in the UK (Paul, Steptoe and Fancourt, 2021), and globally, significantly influencing vaccine acceptance and uptake (Cheng *et al.*, 2024). A frequency analysis revealed that 52.7% held unfavourable attitude, compared to 47.3% who held favourable one. The results of the qualitative study provided complementary insights into the importance of positive attitudes in achieving successful vaccination outcomes.

From the quantitative and qualitative findings, it is evident that caregivers' vaccination choices are influenced by the desire to avoid pain for their children. This is because distressing experiences may demotivate them from developing parental intention to vaccinate (Taddio *et al.*, 2010, 2022). This position is rooted in the opinion of Damnjanović *et al.* (2018) that for a child to be vaccinated, the parent may have to witness the child's discomfort and the potential adverse effects. Further credence is given to the assertion as almost three-quarters (70%) of the caregivers in this study believed that children receive more immunisations than are necessary while 42.7% felt that children should receive fewer vaccines. This statement is complemented by the narrative quote (PE FGD1),

“..... the injections they give to them are too many. I was telling my friend, “Do they want to kill them? Two at once in the thigh, two in the arm? This is too much for a small child, even me as an adult; it takes a lot for me to take a single injection.”

Therefore, a key finding in this study is that the attitude of caregivers is regarded as spontaneously protective towards their children and hence individualistic. A demonstration of the protective instinct of caregivers towards their children in this study was their concern about the number of doses of vaccines taken by children. The opinion that the number of

immunisations taken by children should be reduced, however, does not consider the purpose of the vaccines because each vaccine is meant to combat a specific VPD. However, this concern was not exclusive to the study location. A qualitative study by Chiem *et al.* (2022) revealed that a major concern raised by parents in Northern Alberta, Canada, was the number of vaccines that are given to children. Chiem *et al.* (2022) substantiated these findings with a verbatim quote.

“Yeah, I-I, like, it scared me because this one time she had given him four needles in a day, and I wasn’t sure if it was safe or not, so I was kind of scared.”

Several studies (Boyle *et al.*, 2020; Demir Pervane *et al.*, 2025) have also reported caregivers’ preference for fewer vaccines. Reducing the number of doses is increasingly possible since there is continuous research on the combination of multiple vaccines so that they can be administered in one single dose. An example is the measles, mumps, and rubella (MMR) vaccine. Although controversies are associated with its safety, the vaccine is desirable when weighed against the risk which mumps, measles and rubella (MMR) portend for the health and wellbeing of children, including potential to cause severe illness, disability and death (Kauffmann *et al.*, 2021; Kuter *et al.*, 2021).

The reality of current immunisation programmes across the globe is the challenge of coping with the practicalities of accommodating the ever-increasing number of vaccines within the confines of a limited number of health-care visits and restricted budgets (Hausdorff *et al.*, 2024). The way out is either to increase vaccines given to children, which the caregivers are against, or to deploy combination vaccines. The combination of vaccines results in fewer injections and decreased incidence of pain, which invariably leads to higher compliance (Fatima and Hong, 2025). This is particularly beneficial for caregivers with needle phobia since pain and needle fear contribute to vaccination non-compliance across the lifespan (Taddio *et*

al., 2022). In resource-limited countries such as the study location, which has poor health systems (Al-Worafi, 2023) and low vaccination coverage (Stoop, Hirvonen and Maystadt, 2021), the use of combination vaccines can promote widespread vaccination, which helps in attaining herd immunity. This position is congruent with the suggestions of Jelly *et al.* (2023) that combination vaccines have an advantage over multiple-dose vaccines. Furthermore, the use of combination vaccines can simplify vaccination schedules, thereby reducing the logistic challenges at healthcare facilities; this will result in optimisation of immunisation programmes (Fatima and Hong, 2025). Among the 194 World Health Organization (WHO) member nations, He *et al.* (2025) revealed that over 120 have introduced the hexavalent vaccine, while 63 had incorporated it into their National Immunisation Programs (NIPs). An example of the combination vaccine use in routine childhood immunisation in Nigeria is the pentavalent vaccine (the 5-in-1 vaccine). This kind of vaccination protects the child against diphtheria, tetanus, whooping cough (pertussis), hepatitis B, and Hib disease (*Haemophilus influenzae* type b). However, in the UK this regimen has been replaced by the 6-in-1 vaccine for all babies born on or after 1st August 2017. The 5-in-1 and 6-in-1 vaccines, being combination vaccines, require only a single injection to protect against multiple diseases. Such scientific advancements are vital for Nigeria to significantly improve vaccination coverage, provided appropriate safeguards are in place to prevent "missed opportunities for vaccination."

While aligning with the position that the vaccines taken at once by children were too much, De Souza Amorim Matos *et al.* (2024) reported that caregivers in Brazil also questioned the rationale behind the age of commencement of vaccination, with some opining that they would give their children the vaccine without hesitating if it were given at an older age: "*I would give them all without hesitating.*" Within this context, however, caregivers must know that all the vaccines that are part of the National Immunisation Programme (NIP) are important for the

protection of the child against vaccine-preventable diseases, necessary for the child to achieve full immunisation, and needed for the attainment of population herd immunity.

Another disposition that drives negative “intention to vaccinate” is that mothers, because of their emotional connection and love for their children, may prefer to spare the child from immediate pain associated with vaccination at the expense of long-term benefits of vaccination. The love for the child may have a negative or positive effect on vaccination uptake. This may propel acceptance by caregivers who understand that vaccinations are beneficial to children, while causing caregivers with a wrong perception to hesitate with no intention to immunise their child (Olaniyan, Isiguzo and Hawk, 2021).

Since caregivers’ emotional competence significantly predicts the formation of parents’ intentions of childhood vaccinations (Li *et al.*, 2021), it was proposed by Gavaruzzi *et al.* (2021) that caregivers should be able to identify and manage their own emotions. The comment of one of the caregivers (PE FGD1) in the qualitative study, “..... *the injections they give to them are too many. I was telling my friend that do they want to kill them...*” underscored why it was necessary for mothers in the study location to manage their emotions so that they can develop the intention that will lead to vaccine acceptance. Hence, the role of caregivers’ emotions (Cintulová, 2019) - a key contribution to knowledge - must be integrated with other modifiable and non-modifiable factors for the promotion of positive “intention to vaccinate” and eventual uptake of vaccines.

Complacency is an attitude by caregivers that can reduce intention to vaccinate (Marzo *et al.*, 2023). According to the 3C model (MacDonald, 2015), factors like complacency, convenience, and confidence influence vaccine hesitancy. Complacency, according to Houle and Andrew (2024), occurs when the perceived risk of vaccine-preventable diseases is considered low and vaccination is not deemed a necessary preventive action. For example, 38.9% of the caregivers

believed there are alternatives to vaccination, while 42.7% prefer that children take fewer vaccines. The narrative quotes of some of the caregivers from the three FGDs revealed complacent attitudes such as care-free attitude and dislike for vaccination about immunisation. A caregiver revealed that her neighbour expressed dislike for vaccination without any stated reason. This showed the level of complacency in some caregivers, even when the child was manifesting some health challenges. These attitudes ultimately will prevent the caregivers from taking the right vaccination decision and thus lead to poor vaccination outcomes.

I have a neighbour whose child is always sick. All sorts of rashes often appear on the child's body. So, I called her one day and enquired whether she had not been taken vaccination for her child. She said, "I just don't like it." (PA FGD2)

Furthermore, a caregiver declared that she had not accepted a vaccine for her child before: *"I have not immunised my child before." (PB FGD3)*

Thus, it is critical that complacency among caregivers in the study area be addressed through a behavioural change strategy that will target the attitude of such caregivers to immunisation.

9.4.2. Belief in the non-severity of Vaccine Preventable Diseases (VPD)

A key argument in favour of vaccines is that the diseases they prevent are very severe, with the potential to cause permanent disability and death in children (Nandi and Shet, 2020; Di Pietrantonj *et al.*, 2021). Hence, caregivers in the study area who do not perceive vaccine preventable diseases (VPDs) as a significant threat are more likely to hesitate to accept vaccines for their children and thus have reduced intention to vaccinate. According to Goje and Kapoor (2024), perceptions of risk posed by VPDs compared to the perceived risks of vaccination can influence vaccination decisions since a caregiver may not be able to correctly assess the severity of VPDs. Also, a qualitative study in Shanghai, China (Sun *et al.*, 2018),

reported that parents' decision to get a vaccine for their child is influenced mainly by the perceived severity of a disease, measured in terms of its potential to cause long-term disability.

The findings in this study reveal intriguing aspects of the vaccination paradigm. For instance, the quantitative study revealed that 72.7% of the caregivers believed that many vaccine-preventable diseases (VPDs) are severe. Conversely, some of the participants in the qualitative study opined that VPDs are not severe enough for a child to be immunised. In one of the FGD, a caregiver remarked: “...*I even think that the sicknesses the children take vaccines for are not even all that serious (PC FGD1).*” This qualitative sentiment aligns with the findings that there was no statistical relationship between the perceived severity of diseases and intention to vaccinate. This outcome agrees with a similar finding in a study conducted in South Korea which reported no significant relationship between the severity of diseases and caregivers' intention to vaccinate (Paek, Shin and Park, 2015). Conversely, some other studies have found the severity of diseases as a key determinant of vaccination. (Sun *et al.*, 2018; Goje and Kapoor, 2024). This finding is significant because, while the perceived severity of a disease may influence vaccination behaviour, the actual uptake of vaccination results from a complex process in which the final decision relies on a network of context-specific factors that interact during the decision-making process.

9.4.3. Poor access to vaccination centres reduces intentions to vaccinate.

Accessibility is one of the 5As in the 5A model (Thomson, Robinson and Vallée-Tourangeau, 2016) used for the study of vaccine hesitancy. The quantitative and qualitative findings in this study were complementary with respect to the effect of accessibility on intention to vaccinate. Eighteen percent (18%) of the caregivers in the quantitative survey revealed that distance, the timing of the clinic, the time needed to get to the clinic or wait at the clinic, and/or the costs of getting to the clinic prevented them from immunising their children. Correspondingly, the

narrative quote provided a complementary viewpoint on the impact of accessibility on vaccination behaviour.

“..... Because in my own case anytime I am taking my child for immunisation, I would have left the house since around 6am in the morning so that I can go and pick a tally for my appointment because you can get there and they will say they are just attending to fifty children on that day.....” (PB FGD3).

The above narrative underscores the accessibility barriers to vaccination centres confronting caregivers. The quote also revealed that the child might remain unvaccinated, even on their vaccination appointment day. This narrative raised a number of issues that are contextually challenging. When a child is brought for immunisation and ends up not being immunised as a result of an ineffective health system arrangement, the implication is that the child runs the risk of incomplete vaccination and the attendant risk of contracting vaccine-preventable diseases. Such experiences may decrease the intention to vaccinate.

Another aspect of accessibility raised in the narrative quote below is distance to vaccination centre.

“..... Maybe she doesn't want to go out since Lagos is a very rowdy city.... So, the lady may be thinking of the distance, and this may be the reason why she has decided not to take her child for the immunisation” (PB FGD3).

The above quote introduced the concept of motivation for childhood vaccination. If the caregiver perceived that the barrier to immunisation is greater than the personal motivation to vaccinate, the caregiver may not develop an actionable intention to vaccinate. An intention becomes actionable when the caregiver, in spite of challenges, proceeds to take the child for vaccination. In one of the narrative quotes, a caregiver reported that her husband gives her transport fare anytime she needs to go to the immunisation centre. This amounted to increasing

the motivation for vaccination by removing the barrier. However, accessibility goes beyond distance from vaccination centres but also includes diverse issues such as accessibility to vaccination information and being able to afford the cost of transportation to vaccination centres. The findings from this study further highlight the importance of accessibility with regard to vaccine uptake, which, as such, should be given proper relevance and appropriately conceptualised (Chisnall *et al.*, 2024) when designing empirical research.

9.4.4. Caregivers' knowledge deficit reduces intention to vaccinate

Knowledge is a critical asset in health-seeking behaviour and uptake of critical health commodities. Knowledge is acquired through personal, deliberate information-seeking by individuals (Ruppel, Kahlow and Pu, 2020) and through formal education. It is also transmitted through deliberate and specific awareness-creation programmes facilitated by influential community leaders and official government channels. In this study, over half (50.2%) of the caregivers were classified as having poor knowledge. Although the study population was predominantly educated, their academic qualifications do not necessarily translate to vaccination knowledge or health literacy. Danso *et al.* (2023), in a study in a community in Ghana with a similar demography to the study location, reported that 58% of the respondents had poor knowledge and that poor maternal knowledge was the main contributory factor to vaccine hesitancy. The binary logistic regression model between selected variables and intention to vaccinate identified knowledge as a significant predictor of behavioural intention regarding child vaccination in this study. Caregivers with good knowledge have higher odds (3.098, $p < 0.007$) of vaccinating their children in the future. This position aligns with the finding of Paek, Shin, and Park (2015) and is strongly supported by the qualitative narrative quote in this study:

“What I just discovered is that some people are less informed; it is not everyone who has the right understanding of this immunisation, so we need to keep providing the right information.”

(PG FGD2)

The narrative above further highlights the importance of parental vaccination knowledge to childhood vaccine uptake. Reports from previous studies (Atnafu Gebeyehu *et al.*, 2023; Tsegaw *et al.*, 2024) indicate that lack of knowledge and maternal illiteracy (lack of education) were significantly associated with incomplete vaccination, which is in conformity with the outcome in this study.

Poor knowledge often leads to poor adherence to vaccination schedules. In this study, 12.9% of participants were unaware that vaccination begins at birth; consequently, they did not vaccinate their child before leaving the hospital. Furthermore, children born at home are at a greater risk of missing the initial vaccine doses. This suggests that giving birth outside a health facility significantly increase the probability of non-compliance with the vaccination schedule. Hence, there is a need to put in place a mechanism that ensures every child delivered in the hospital is vaccinated before discharge. In addition, since most caregivers' information about vaccination comes from health workers (55.1%), it is pertinent that processes for effective dissemination to caregivers be put in place.

The fact that 31.7% of the caregivers were not able to provide the correct number of sessions needed to complete vaccination for their child is also a cause for concern. This may be one of the reasons for incomplete vaccination. According to the National Immunisation Schedule (NIS) produced by the National Primary Health Care Development Agency (NPHCDA), a child immunisation status is classified as incomplete in Nigeria if the child fail to receive at least one of the recommended childhood vaccinations. This set of recommendations consists of *Bacillus Calmette–Guérin* (BCG), three doses of the pentavalent vaccine, three doses of the

Pneumococcal Conjugate Vaccine (PCV), two doses of the rotavirus vaccine, three doses of the oral polio vaccine, and measles vaccine by the age of 12 months.

When a caregiver has just given birth, the intention to vaccinate is boosted since new-borns are expected to receive three (3) vaccines: BCG, Oral Polio Vaccine (OPV), and Hepatitis B Vaccine (HBV), according to the NIS, before leaving the hospital. Studies have shown that the children of mothers who attended antenatal clinics, were delivered to a health facility, and lived in urban areas were more likely to be fully immunised (Adedokun *et al.*, 2017; Atnafu Gebeyehu *et al.*, 2023). Although this current study did not collect data on place of birth and attendance at the antenatal clinic, the caregivers were drawn from urban and peri-urban communities in the study location. Furthermore, an independent *t*-test in this study showed no significant difference in knowledge between caregivers aged 30 and below and those above 30, with higher mean knowledge scores of 6.81 and 6.83, respectively. Hence, since there was no significant variance in knowledge, both age categories were expected to have similar disposition and intention to vaccinate, which was the result of the binary logistic analysis. It is also important to note that some of the caregivers who were under 30 were not first-time mothers, and many had higher education. Hence, they made up for their lack of vaccination experience with the knowledge they have and their level of education. Conversely, Adedokun *et al.* (2017) reported that about 83% of children whose mothers were under the age of 24 failed to receive full immunisation, which they attributed to their lack of childcare experience. However, this reason seems speculative in light of the study's outcome, as young mothers are generally tech-savvy and have access to a wealth of information on various issues, some of which may either encourage or hinder their intention to vaccinate.

9.4.5. Caregivers' level of trust promotes intention to vaccinate

Trust is a key determinant for vaccination decision-making (Larson *et al.*, 2018; Adhikari, Yeong Cheah and Von Seidlein, 2022). It is a psychological state that a caregiver reaches after having summed up and considered the pros and cons of vaccination. Trust plays a crucial role in determining whether or not individuals choose to get vaccinated, and the object of trust can be the vaccine, government, health institutions or healthcare professionals (Freiman, 2023). The dimension of trust that leads to positive intention to vaccinate is multilevel and multidimensional (Lohmann and Albarracín, 2022). The ingredients for building trust include personal experience, influences of social network, religion, ethnicity and cultural affiliations, government policies, health workers, and health system architecture (Souvatzi *et al.*, 2024). Trust is, therefore, a key variable that determines intention to vaccinate and vaccine hesitancy in this study.

The dimension of trust determined in this study is the caregivers' level of trust for their child's immunisation provider, which was 95.3%. This result is similar (94%) to the level reported for caregivers in England (Campbell *et al.*, 2023) in a study titled "Vaccination, information and parental confidence in the digital age in England". However, one of the narrative quotes provided insight into an instance when a caregiver vaccination decision may be contrary to the advice of the immunisation provider.

"Naturally, even as an adult, when you're having catarrh and cough...it will even disorganise your system, so when my children are having catarrh and cough, I don't give them immunisation. Even though the doctor says I should give them, at that stage, I won't give them because it will be as if I am fighting two things at the same time." (PC FGD3)

Based on the foregoing, it is obvious that the primary concern of caregivers is that their child is not affected negatively by vaccination, regardless of the benefit, as seen in the narrative

above. This paradigm drives the choice between ‘hesitating to accept’ and ‘intention to vaccinate’. Caregivers may not prioritise vaccination for their children due to their experiences of social exclusion (Cooper *et al.*, 2021) arising from economic hardship, social instability, social displacement, and feelings of loneliness and isolation. This scenario further highlights the complexity of vaccine hesitancy.

The caregivers in this study reported an overwhelming trust in the provider of vaccination services, where 96.4% reported that the information they receive about vaccines from the vaccine programme is reliable and trustworthy. The idea of trust in health institutions was also addressed by Campbell *et al.* (2023) when they reported that 93.3% of the parents trusted the NHS and its advice on vaccines as disseminated mainly through NHS-branded leaflets. In the study area, the mechanism of dissemination of vaccination information is through the radio, television and by health workers in all vaccination centres. The government offices responsible for this are the Ministry of Health and the Primary Healthcare Development Agency.

The empirical evidence from this study showed that 94.2% expressed trust in the information they received about immunisation, but the qualitative findings have been ambivalent. The two narrative quotes below illustrate the foregoing assertion. The first was positive, while the second statement was negative with respect to intention to vaccinate:

“I don’t really know much about immunisation, but when I gave birth, I was advised to take my baby for immunisation, and I did so; since then, my baby has not been sick” (PE FGD3).

“I have not immunised my child before. Some people told me that if I give it to my child, my child will run a temperature. So, I am afraid that something bad may happen to him if I allow him to be immunised.” (PB FGD3)

In the two narrative quotes, the caregivers were advised by people in their social networks who fell into two groups: vaccine supporters and vaccine opponents. The above narratives from the

two caregivers depicted the different ways information received about vaccination can affect their intention to vaccinate and subsequent vaccination practice. Bearing this in mind, caregivers with low trust in immunisation information had 3.55 times higher odds (95% CI: 1.335-9.46) of not vaccinating their child than those who trusted the information they received. Considering the importance of trust to the vaccination programme, Nurmi and Jaakola (2023) identified two paths to losing trust in vaccination as ‘*mistrust*’, which is a cumulative suspicion about vaccines, and ‘*distrust*’, regarded as a sudden loss of trust. Expanding on this, Sondagar *et al.* (2020) proposed a four-point approach for the sustenance of trust in vaccine programmes. These include understanding and addressing vaccine concerns, presenting vaccines as a social norm, and putting in place a robust plan that will foster resilience among vaccination actors.

9.4.6. Caregivers’ gender plays a role in intention to vaccinate.

This study revealed that male respondents, compared to female, had 3.32 higher odds not to vaccinate their child, which contradicted the findings by Zheng *et al.* (2022) that fathers were more willing than mothers to vaccinate their children in a survey in China. They based their result on the idea that fathers exhibit different risk-taking behaviours compared to mothers. The outcome in this study, therefore, aligns with the practice which culturally and traditionally situates mothers as caregivers to children, including taking health-seeking decisions such as vaccination uptake. This position aligns with the assertion of Muraya *et al.*, (2021) that mothers play the key role in caring for their children and in health decision-making. Hence, interventions that are meant to promote vaccination acceptability must be specifically designed to address both parents using an evidence-based communication strategy delivered through a presumptive format (O’Leary *et al.*, 2024). Although mothers have greater intention to vaccinate their children in this study, probably based on the strong emotional connection between a child and caregiver that develops during the first few years of the child’s life

(Zaidman-Mograbi, le Roux and Hall, 2020), it has, however, been established that a practical enabler of vaccination is by getting fathers more involved in the process (Jalloh *et al.*, 2022).

9.5. Prevalence of Vaccine Hesitancy: Contexts, Determinants, and Predictors

“Herd immunity is not a slogan – it is a shield we build together.”

Statement by Lesley Miller, UNICEF Representative on the European Immunisation Week

9.5.1. Prevalence and determinants of vaccine hesitancy

The VH prevalence will be discussed from the perspective of previous studies, contextualising it from model and research design perspectives while exploring its association with caregivers' sociodemographic characteristics, vaccination knowledge, community and sociological variables (including religious, spiritual, herbal, and natural immunity), and the implications for herd immunity in the study area.

The findings in this study highlighted a high degree of heterogeneity in vaccine hesitancy, and caregivers are therefore classified based on the cause of their hesitancy as livelihood-induced hesitancy, knowledge-induced hesitancy, attitudinal hesitancy, adverse reaction-induced hesitancy, and accessibility-induced hesitancy. This classification fulfilled the expectation of Hample (2018) that research should investigate whether vaccine-hesitant parents can be categorised into "types". Identification such a typology allows for more effective interventions by tailoring messages to parents' specific beliefs. Furthermore, the classification reflected the assertion that vaccine-hesitant parents (VHPs) are heterogeneous and can be categorised based on their specific beliefs or levels of vaccine hesitancy (Hu *et al.*, 2019; Fernández-Basanta, Lagoa-Millarengo and Movilla-Fernández, 2021).

In this study, the caregivers' vaccine hesitancy prevalence based on the Vaccine Hesitancy Scale (VHS) was 28.2%, while 7.1% refused vaccination. The level of prevalence observed is

the same as that reported for caregivers in Andhra Pradesh, India (28.1%) (Goruntla *et al.*, 2023) and slightly higher than the 27.0% reported for the Netherlands (Bussink-Voorend *et al.*, 2025) and 25.9% for Cameroon (Yakum *et al.*, 2022). Conversely, lower prevalence rates of 19.7% and 11.0% were recorded in Turkey and Malaysia, respectively (Azizi, Kew and Moy, 2017; Soysal and Akdur, 2022), and a point prevalence of 6.7% in Cork, Ireland (Marshall *et al.*, 2021). When compared to other studies on vaccine hesitancy in Nigeria, the prevalence of VH (28.2%) observed in this study area in southwest Nigeria was lower than the 31.5% and 37.7% reported for Enugu State in the southeast and Sokoto State in northern Nigeria, respectively (Ogbuabor and Chime, 2021; Isezuo and Adamu, 2022).

The differences in vaccine hesitancy prevalence within Nigeria, especially the high rate of 37.7% in Northern Nigeria, are primarily attributed to cultural inclinations that oppose social norms and practices originating from Western countries (Agbede *et al.*, 2024; Etim *et al.*, 2024), as well as religious biases, conspiracy theories related to adverse effects (Yusuf *et al.*, 2024; Adili-George and Chilaka, 2025), and variations in research methodology (Bussink-Voorend *et al.*, 2022; Oduwole *et al.*, 2022). Within Africa, the prevalence of vaccine hesitancy in this study is lower than the 33% obtained for Africa but higher than the global cumulative average, ranging from 21.1% to 25%, reported in two different systematic reviews and meta-analyses in 2023 and 2024 (Abenova *et al.*, 2023; Maamor *et al.*, 2024). Vaccine hesitancy was attributed to religious sentiments, personal beliefs, perceived safety concerns, and a desire for more information from healthcare providers (Maamor *et al.*, 2024).

More than a quarter of the caregivers in my study were vaccine hesitant. If this translates to outright refusal, the overall vaccine rate would not achieve herd immunity. Global data for immunisation coverage in 2023, as published by the World Health Organisation (WHO, 2024b), shows that infants who have not received the first dose of the diphtheria, tetanus, and pertussis vaccine (DTP1) by the end of their first year of life (zero-dose children) numbered

fourteen million, five hundred globally. It should be noted that fifteen per cent (15%) of these zero-dose children, corresponding to over two million children, are in Nigeria. The data collection for this study was conducted in 2023, providing ample opportunity to investigate the role of vaccine hesitancy in driving non-vaccination in the southwest part of Nigeria.

The differences in prevalence across studies in different countries further attest to the contextual dimension of vaccine hesitancy. This is because VH in each country is dependent on country-specific historical, sociocultural, economic, and political factors, which vary across time, place, and vaccines (Olson, Berry and Kumar, 2020; Galagali, Kinikar and Kumar, 2022). Although a range of similar reasons are responsible for vaccine hesitancy across studies and regions, location specificity still exists. Therefore, the following sections of the chapter critically examine the significance and implications of the factors responsible for vaccine hesitancy in the Ondo State study area, emphasising how they differ from other studies and the unique process through which they influence caregivers' vaccination decisions.

9.5.2. Caregivers' sociodemographic characteristics influence vaccine hesitancy.

While age has been reported as a determinant of vaccine hesitancy in some other studies (Ogbuabor and Chime, 2021), no such statistical association existed between age and vaccine hesitancy in this study. Although there was a minimal variation in the proportion of those above 30 years who were hesitant (28.8%) compared to those below the age of 30 (27.2%), there was no statistical evidence to support the position that the population tends to be more vaccine hesitant as the age of caregivers increases. According to Moschese *et al.* (2023) in a study in Italy, the observed difference in vaccine hesitancy is due to the differences in level of knowledge, where those above 30 years had poorer knowledge of vaccination than caregivers under 30 years. This reason, however, does not apply to this study, as there was no significant

difference in the mean knowledge score of caregivers above 30 years (6.51) and those below 30 years (6.50).

Hence, the trend in this study, rather than being influenced by the disparity in knowledge across age categories, is that older caregivers may become complacent due to having cared for children for many years. Some caregivers may become vaccine averse due to their previous experiences with vaccination, or they may become too busy with various parenting tasks and caring for other children if they have more than one child (Ulmido *et al.*, 2024). Additionally, some caregivers may feel burdened by their jobs or other vocational responsibilities (Hakim *et al.*, 2025). There are instances when caregivers may hesitate to accept vaccination, as they observe that the children of some caregivers who have refused vaccines appear to be healthy (Cooper *et al.*, 2021). This situation is captured succinctly in the quote of one of the caregivers in this study:

"But what surprised me most is that the child is doing very well even without the immunisation; she reached all the necessary milestones at the right time." She is my neighbour; the baby walked at 9 months. The child is one year older than my child. Presently, he already has about 12 teeth in his mouth, and he is looking very healthy" (PCFGD1).

De Souza Amorim Matos *et al.* (2024) advanced a similar reason in a study in Brazil, where one of the caregivers explained that she was influenced not to vaccinate her children by friends who already had older children who were healthy and not vaccinated. As caregivers become experienced in caregiving, they tend to rationalise vaccination, involving much calculation and balancing the benefits of taking the vaccine against the risks of not accepting it. Although the proportion of caregivers below 30 years who received their vaccination information from health workers (55.6%) was not significantly different from those above 30 years (54.9%), a greater proportion (42.0%) of caregivers under 30 years obtained their vaccination information

from health facilities than those above 30 years (32.6%) and are therefore more likely to be less hesitant. A key contribution to knowledge is that since caregivers in the study tend to be more vaccine hesitant as they advance in age, public health interventions designed to address vaccine hesitancy should target older caregivers, among other strategies.

No significant relationship between marital status and vaccine hesitancy was found. However, the qualitative data revealed that caregivers' spouses play a positive role in the uptake of vaccination (where a caregiver declared, "*.....the first person to encourage me is my husband*"). This expression further reinforces that husbands must be integrated into strategies designed to combat vaccine hesitancy. Furthermore, in line with several previous recommendations (Gkentzi *et al.*, 2021; Cagnotta *et al.*, 2025), public health interventions to address vaccine hesitancy must target specific populations, particularly single parents.

Results also showed how male caregivers were more hesitant (35.5%) compared to female caregivers (27.7%). The findings by (Soysal and Akdur, 2022) and Saitoh and Shobugawa (2024), in studies conducted in Turkey and Japan, were similar to those obtained in this study. Women are more likely than men to receive positive vaccination information due to their frequent hospital visits for antenatal care prior to delivery.

The proportion of those working full-time (22.1%) who were hesitant in this study was significantly lower when compared to those not working full-time (33.5%). In addition, the employment status of caregivers in the study significantly predicted their vaccine hesitancy status. Caregivers '*not working full-time*' had 1.8 times higher odds of being vaccine-hesitant than those working full time. This outcome in vaccine hesitancy status is divergent to the intention to vaccinate status (PACVQ4) of caregivers working full-time as mentioned in page 221. The ambivalent behaviour of those full-time workers may be driven by negative experiences at vaccination centres. Compared to a study in Malaysia, vaccine hesitancy was

also associated with unemployment, with parents in this group having 1.97 higher odds of being vaccine hesitant. This outcome may be because unemployed caregivers lack the positive peer influences found in workplaces. Although the quantitative findings reported greater hesitancy among those not working full-time, the qualitative findings, however, reported a divergent view.

"Another thing I want to say concerning this immunisation is the consumption of time anytime we come to the clinic. For a person like me I work at St Louis Grammar School, so any day my child is due for immunisation, I do not always go to work. Because it can be as late as 2 or 3 o'clock before I can leave the clinic."

Those who work full-time, due to the time spent at vaccination centres, may become discouraged and, therefore, hesitant. Vaccine hesitancy of this nature may be referred to as “livelihood-induced hesitancy”.

Education is a significant determinant of vaccine hesitancy, as noted in various studies. The effect, however, has been multidimensional, with some studies (Gebreyesus and Tesfay, 2024; Ta'an *et al.*, 2024) reporting that no or low education significantly predisposes caregivers to vaccine hesitancy, while higher levels of education were associated with higher adherence to children's vaccinations (Bussink-Voorend *et al.*, 2025). Conversely, other studies (Du *et al.*, 2020; Gentile *et al.*, 2021) have found a significant relationship between higher education among caregivers and a tendency to be vaccine hesitant.

However, this study found no significant association between education and vaccine hesitancy. Nevertheless, there was a marked difference in the proportion of caregivers that were vaccine-hesitant in each category of education level, with caregivers with “no education” being more compliant with childhood vaccination. When using the “Calculation prism” in the 5C vaccine hesitancy model, there is a tendency for educated caregivers to rationalise vaccine information

based on their understanding, and most of the time, this may lead to indecision and possibly total refusal to accept the vaccine. The narrative quote, relevant to education in this study, posits that the caregiver's non-hesitant behaviour was because she and her husband were both educated.

Index child characteristics were found to influence parental vaccine hesitancy. For instance, caregivers with a female child (28.8%) were more hesitant than those with a male child (27.7%). This result resonates with the findings by Hanifi *et al.* (2018) that female children have a lower rate of vaccination than males. This situation may arise due to cultural preference for sons in some communities. This form of gender discrimination is rooted in the belief that daughters are less valuable than sons, resulting in biased attitudes and harmful practices toward female children, including non-vaccination (Bashir and Ayeni, 2025). Furthermore, the age of the index child was significantly associated with the level of vaccine hesitancy, with caregivers of children above 24 months showing a higher prevalence of vaccine hesitancy than those with younger children. Caregivers of children older than 24 months had 2.05 times higher odds of being vaccine hesitant. This trend may be due to “vaccine fatigue” or “vaccine exhaustion” where perceived burden and burnout manifest as inertia or inaction towards vaccine instructions (Su *et al.*, 2022).

9.5.3. Lack of appropriate knowledge by caregivers promotes vaccine hesitancy.

This section explores the extent to which a caregiver's knowledge of vaccine-preventable diseases (VPD) and vaccination schedules influences their vaccine hesitancy. Lack of knowledge is a critical factor that determines hesitant behaviour in caregivers (Maamor *et al.*, 2024), and any form of hesitant behaviour related to knowledge can be classified as "knowledge-induced vaccine hesitancy". The outcome of an independent t-test conducted in this study revealed that the mean knowledge score (MKS) of caregivers who were non-hesitant

(6.9) was significantly higher than that of caregivers who were hesitant (6.5). Various studies (Voo *et al.*, 2021; Kılınç and Işık, 2025) have reported that non-hesitant caregivers tend to be more knowledgeable than hesitant caregivers. Furthermore, the level of hesitancy among those with poor knowledge (36.7%) was almost twice the rate of hesitancy among those with good knowledge (19.6%).

A key finding in this study is that caregivers' knowledge quotient is dependent on three dimensions of knowledge. These are:

- knowledge of immunisation schedule
- knowledge of vaccine importance (Are there alternatives to vaccines? The diseases vaccines protect are not severe), and
- knowledge leading to vaccine confidence (vaccine safety and efficacy)

The knowledge of immunisation schedules, which is a key factor in vaccination uptake (Barry, Aljammaz and Alrashed, 2020; Eze *et al.*, 2021) entails knowing the age for the commencement of immunisation and the number of sessions necessary to complete immunisation. When caregivers have good knowledge of the immunisation schedule and adhere to it strictly, and barring other barriers, their children will have complete immunisation (Jelly *et al.*, 2023). However, any deviation from the schedule, likely due to forgetfulness, can lead to missed vaccination opportunities and, subsequently, incomplete immunisations (Danso *et al.*, 2023). In this study, 12.9% and 30.7% of the caregivers do not know when a child is expected to start vaccination and the number of sessions necessary, respectively. If a mother gives birth at the hospital, it is assumed that the vaccination for the child starts at birth (Chaudhari, 2021) before the mother is discharged. Hence, caregivers who did not know that the vaccination commences at birth may not have delivered at the hospital. In the qualitative narratives, a caregiver said, and I quote:

"I travelled to my hometown after I had my baby, and I spent a long time there. Consequently, I could not give him the normal hospital immunisation" (PDFGD3).

This pro-hesitancy behaviour is a product of a lack of knowledge about the vaccination schedule. Additionally, caregivers who obtained vaccination information from health workers and health facilities had 2.09- and 1.09-times higher odds, respectively, of having good knowledge of vaccination compared to those who did not receive vaccination information from the same source. In a previous study by Ellithorpe, Adams and Aladé (2022) in the US, individuals who had never been vaccinated were found to rely more on friends and family for vaccination information. The implication of this is that vaccination messages must target the entire community so that vaccination information gotten from non-official sources thereafter is pro-vaccination.

Caregivers' understanding and knowledge of vaccine importance is the basis for the second dimension of knowledge critical for vaccine uptake (Ameen *et al.*, 2023). When caregivers lack understanding of the importance of vaccines, they are prone to hesitant behaviours and indecision, which hampers high vaccination coverage (Eskola *et al.*, 2015). For instance, 23.8% of the caregivers do not know the reason for vaccinating a child in this study, and such caregivers have 1.75 higher odds of being vaccine hesitant compared to those who know why they vaccinate their child. These quantitative results converged with the qualitative findings as expressed by some of the caregivers in the following quotes:

"... if a child is not sick, there is no reason for taking such a child to be immunised."

"The child does not have any issue and so may not need the vaccine, as we take them to be, so there is no need to make her child suffer for nothing." (PCFGD1)

These statements express the inability of the caregivers to have a total overview of the importance of vaccination and the complex relationship between disease risks and severity and

the protection provided by vaccines. Using the Health Belief Model (HBM), it is evident that caregivers often underestimate their children perceived susceptibility, erroneously believing that since a child had no current ailment and hence not at risk. This depicted a lack of understanding of why a child should be vaccinated and the importance of vaccines. The capability gap is also evident in the narrative quote that questions the severity of the diseases prevented by vaccines.

“...I even think that the sicknesses the children take vaccines for are not even all that serious”
(PCFGD1).

It is interesting to note that 38.9% of the respondents believe there are alternatives to vaccines. This mind-set may predispose this category of respondents to vaccine hesitancy. The behaviour of the caregiver can be explained the Health Belief Model (HBM). When a caregiver believes in alternatives to vaccines, their perception of the perceived benefits of vaccines and the perceived severity of vaccine-preventable diseases (VPD) is low. Obviously, such a caregiver lacks the appropriate knowledge on vaccination. This is supported by the significant association between having correct knowledge of whether vaccines have alternatives and vaccine hesitancy status. Similarly, significantly higher vaccine hesitancy has been reported among parents who use alternative medicine practices in Turkey and semi-urban area in India (Yörük and Güler, 2021; Patel, Chauhan and Patel, 2025).

The third type of knowledge necessary to prevent vaccine hesitancy is the understanding that build the confidence of caregivers regarding vaccination. These include belief in vaccine safety and effectiveness (Houle and Andrew, 2024), trust in the competence of health services and professionals that delivers them, and the motivations of policymakers who determine which vaccines are needed. When this understanding is strong, the likelihood of vaccine hesitancy decreases (Cagnotta *et al.*, 2025). The quantitative and qualitative findings in this study were

divergent. While 86.4% of caregivers expressed confidence in vaccine safety by agreeing that vaccines are not harmful, some caregivers in the FGDs exhibited behaviours that did not reflect this confidence.

"I have a neighbour whose child was always sick. All sorts of rashes often appear on the child's body. So, I called her one day and enquired whether she had not taken vaccination for her child. She said, "I just do not like it." (PAFGD2)

9.5.4. Caregivers' perceived risk and adverse reaction to vaccines

The majority of the participants in this study expressed concerns about the potential adverse effects of vaccines. An adverse event following immunisation (AEFI) is an observable change in a child's well-being after the administration of a vaccine. Such events may occur as mild transient discomfort, although there are instances when vaccines have caused permanent disability (Nath, 2023) and even death (Miller *et al.*, 2015). Caregivers may hesitate to vaccinate when they experience adverse events or hear reports about AEFI through formal or informal sources (Gauna *et al.*, 2025). Such experiences can have consequences for an individual's future vaccination decision-making (Christou-Ergos, Wiley and Leask, 2023). According to Cagnotta *et al.* (2025), the fear of AEFIs is the primary cause of vaccine hesitancy. Those who use social media networks as sources of information for childhood immunisations and those who follow anti-vaccination groups on social media are more likely to hesitate before accepting vaccinations for their children (Yörük and Güler, 2021; Cag *et al.*, 2022). In this study, 26.2% of the caregivers believed immunisations might not be safe, while 24.4% thought that immunisation might not prevent the disease. In addition, based on the VHS dichotomous data tool, those who were concerned that their children might have a serious side effect from immunisation have 11.45 higher odds of being vaccine-hesitant when compared to those who do not worry about the potential side effects of vaccines. There was alignment in

the outcomes of the VHS and PACV data tools. Based on the PACV scale, 63.5% of caregivers were concerned and uncertain that their children might experience a serious side effect from immunisation, and 58.2% of caregivers doubted the safety of childhood immunisations. A similar finding was reported in a study where individuals became vaccine-hesitant because their children experienced a mild adverse reaction to a previous vaccination (Ellithorpe, Adams, and Aladé, 2022). This study's quantitative and qualitative results thus confirmed a strong association between caregivers' concerns about safety and efficacy and vaccine hesitancy.

In this study, the most commonly reported reasons for parents' apprehension about vaccination were fever, swollen limbs, and general discomfort. Fever was the most frequently mentioned adverse effect by the participants in the three focus group discussions. Ogundele *et al.* (2023) also identified fever as the most common adverse event in a study conducted in Ile-Ife, southwest, Nigeria. The majority of participants believed that post-immunisation fever might prevent them from completing the immunisation schedule for their children, even though they understood the importance of vaccines. A mother said:

"She reacted badly to the one she took this last Wednesday; she started running a fever and could not stretch out her legs properly" (PC FGD2), while another one revealed that 'I know I have every reason to immunise my child because it prevents diseases. But the reason for my hesitation is that when we had the second immunisation, she started running a fever and became very irritable' (PDFGD2).

The quote above highlights that vaccination uptake is not guaranteed solely by understanding the importance of vaccines; rather, all other prevailing factors must be in place to facilitate willing acceptance. Furthermore, when caregivers decline vaccination because the child has a fever or minor illnesses, they can miss the opportunity to be fully vaccinated. In a mixed-

methods study on missed opportunities for vaccination (MOV) among children aged 0–23 months visiting health facilities in three local government areas in Ondo State, the prevalence of MOV was 32.8% (Fatiregun *et al.*, 2021). The implication of this scenario is that the child's vaccination status will be affected, which invariably negatively impacts the population's herd immunity. In Nigeria, such caregivers are often monitored, and a follow-up mechanism, which includes outreach visits and phone calls to the caregivers, is implemented. The monitoring is designed to prevent a missed vaccination opportunity. The practice is necessary because monitoring and follow-up can promote vaccine uptake in these groups of individuals.

Caregivers also reported that their children experienced various forms of discomfort after immunisation. These ranged from inability to suck very well to persistent crying, irritability, and restlessness. The source of discomfort in children is the pain associated with immunisation, since vaccine injections are the most common painful needle procedure experienced throughout the lifespan (McMurtry *et al.*, 2015). It is well documented that children experience pain and distress during and after immunisation (Southern *et al.*, 2017; Taddio *et al.*, 2022; Watyaba *et al.*, 2025).

A caregiver related a first-hand experience of AEFI as follows:

"...and on that Wednesday that they collected the injection, he was running a temperature throughout the night despite the paracetamol he was given. We could not sleep throughout the night, and I was now asking myself, "What type of immunisation is this?" (PBFGD1)

In light of this, caregivers should be taught how to apply pain management therapy for elimination or reduction of vaccination-related pain, such as comfort positioning, sucrose or breastfeeding for infants, and age-appropriate distraction (Friedrichsdorf and Goubert, 2020; Mabbott and Bedford, 2023). Although the highlighted strategies have been proven to have an analgesic effect and reduce child distress, the extent and success of the pain management

strategies with respect to childhood immunisation are mixed, as observed in this study. This is so because some caregivers revealed that the distress experienced by their children as a result of immunisation was the reason why they may discontinue immunisation for their children (McMurtry, 2020).

"He cried throughout the day and even at night and refused to suck, to the extent that our neighbours had to come to our house because of her persistent crying." "I started blaming myself for taking him to get the immunisation" (PGFDG2).

The narrative above comes from a caregiver who was initially willing to accept vaccines but later became hesitant and eventually refused them. Therefore, policymakers must prioritise establishing protocols to manage caregivers' experiences of AEFI to prevent a gradual shift towards vaccine hesitancy among those who were previously pro-vaccination. As recommended by Slater *et al.* (2025), effective pain management for infants and children can significantly promote vaccination uptake and positively influence future attitudes towards pain. Some of the caregivers also mentioned fear of side effects, such as leg paralysis and swollen injection sites, as reasons why they may not take the vaccine:

".... The reason why I hesitate to take immunisation is because before I gave birth to my child, I saw a child in my church then who got paralysed because of the injection he was given" (PCPGD2).

Narratives of this nature must be examined critically by experts to determine whether the limb paralysis was due to the vaccine administered to the child or somewhat attributable to the non-acceptance of necessary vaccines. For instance, poliomyelitis could cause limb paralysis in a child who had not received the polio vaccine. Hasty assumptions by people unfamiliar with the cause-and-effect relationships between health actions and physical manifestations can further exacerbate the issue of vaccine hesitancy. The implication of these findings is that public health

managers must envision scenarios of this nature and implement a communication strategy to counter misinformation. According to McMurtry (2020), a variety of AEFIs have been reported that have no confirmed relationship with immunisation; these include type 1 complex regional pain syndrome (CRPS), chronic fatigue syndrome, postural orthostatic tachycardia syndrome (POTS) and dissociative neurological symptom disorders. In addition, palpitations, headache, dizziness, and faintness are examples of vaccination-related anxiety reactions introduced in 2012 by WHO as a new category of AEFI referred to as psychogenic AEFIs (Pan *et al.*, 2025). Psychogenic and minor AEFIs, in addition to AEFIs experienced by others, can cause vaccine hesitancy (Christou-Ergos, Wiley and Leask, 2023; Gopalan *et al.*, 2025; Pan *et al.*, 2025).

The remark of one of the participants also outlined a key reason for incomplete vaccination and reinforced the notion that vaccine hesitancy is a continuum.

“As for me ..., when I gave birth to my second-born, her leg got swollen because of the injection she took, to the extent that they had to incise it and bring out the pus, and the injury lasted for three months before it healed up. Since then, I stopped giving her the vaccine; for 9 months, she did not collect it completely, not even the one for 9 months. I did not think she collected it. With this child now, I take the step of faith again to collect it. She is two years old now. She was not even up to 9 months then when the issue happened.” (PBFGD3)

The narrative above captures the fate of a *hesitant compiler* who ultimately chooses to accept the vaccine after initially refusing it due to personal experience with AEFI. Additionally, the narrative below suggests that a transition from “outright rejection” to “willing acceptance” across the hesitation spectrum is possible if influential people who can positively influence caregivers are part of their social network.

"When we took the one we took last before we took in February, we took in January; my child's leg was swollen. Even his daddy said that I should not bring him for immunisation again, but Grandma insisted that we should continue to take him for the immunisation." (PAFGD1)

One of the participants in the FGD gave the most extreme narrative on adverse effects by saying that a child died after receiving vaccination:

"When I was still single, one of my neighbours took her second child for immunisation, and the child died." People said that the injection was administered into the child's vein. So, she said she can never give immunisation to her child any longer." (PFFGD1).

The foregoing sums up the adverse experiences that drive caregivers' vaccine hesitancy behaviours in the study area. The practice in Canada is to prepare caregivers' minds for a possible AEFI by informing them of the possibility and ways to mitigate the pains, swelling and discomfort (MacDonald, Desai and Gerstein, 2018). In the UK, PHE provides guidance on childhood vaccinations, and practitioners are responsible for ensuring that parents are informed and prepared, as well as knowing how to seek help if circumstances change. Unfortunately, Nigeria does not prioritise or emphasise this practice enough. The experience in Nigeria is similar to what is available in Ghana, where HCPs support infant pain management during vaccination but rarely deploy evidence-based pain intervention protocols (Annan, Ramukumba and Stevens, 2023). This information gap notwithstanding, any semblance of an adverse event or reaction will push many caregivers in the study area into vaccine hesitancy. Vaccine hesitancy based on AEFI is therefore designated as Adverse Reaction-induced Hesitancy.

9.5.5. Community and social network influences vaccine hesitancy

This factor focuses on the mechanism through which community and social interactions determine why caregivers hesitate to vaccinate their children. The interplay of the influence of different categories of individuals on the vaccination behaviour of the caregivers is explored

using the social cohesion theory (SCT). It draws on the participants' experiences and perspectives on how social interaction and connection influence the choices made by caregivers regarding uptake of vaccines. This study indicated that friends or family members influenced caregivers' decisions regarding vaccination refusal.

(Morrison *et al.*, 2021) averred that there are several reasons why the community is important in mass vaccination strategies, health engagement, and public health strategies. Social cohesion within communities can influence carers' vaccination behaviour, as local communities are the sites of knowledge and action, as well as the physical locations where interventions are introduced (Morrison *et al.*, 2021). This value can be harnessed through proper community engagement that acts on the caregiver's vaccination behaviour. Polonsky *et al.* (2025) found a positive correlation between community engagement and improved vaccine acceptance, reduced hesitancy, and increased coverage. When the vaccination choices of caregivers are framed from the lenses of the three core dimensions of social cohesion theory – social relations, connectedness, and a focus on the common good (Moustakas, 2023), the capability of community networks to drive positive vaccination behaviour is appreciated.

The quantitative and qualitative findings in this study align with the core essence of social cohesion that can be explained by the 5C model of vaccine hesitancy. The social networks construct of social cohesion aligns with constraints/complacency since over reliance on the dominant idea in the social network can breed complacency; trust in people and institutions can be nested in the confidence domain, while the concepts of ideas of solidarity, respect for social rules, and civic participation fit into the collective responsibility domain, which are essential for social well-being and vaccination uptake (Moustakas, 2023; Fowler Davis and Davies, 2025). In alignment with collective responsibility, 94% of the caregivers declared that they believe that other caregivers like them accept vaccines, thus reinforcing the positive role which social cohesion can play in enabling vaccination. A study in Nigeria by Adetunji *et al.*

(2023) which explored the role of social cohesion in community capacity strengthening found that social cohesion can promote improved health outcomes by fostering a sense of belonging, which is facilitated by social and behavioural change. When social cohesion in communities is not harnessed by individuals with a positive disposition towards vaccination, it may result in vaccine hesitancy, felt not only at the individual caregiver's level but also at a community scale. Although only 6% of community leaders (religious and political leaders, teachers, and healthcare workers) opposed vaccination in this study, with 94% in support, the qualitative findings still revealed that some caregivers were negatively impacted by the community's cohesive force, which made them hesitant to accept the vaccine for their children.

"... after that, someone came to my shop again and said that they gave a child immunisation, and the child became paralysed, so I became very scared again. And I said, "I will not be able to give this child immunisation again." (PEFGD2)

"But there is a particular woman staying very close to my shop... whenever I tell her that I want to take my child for immunisation. She tells me that she does not like immunisation because it can cause the child's legs to be paralysed." (PEFGD2)

The following quotes show what can happen when those who oppose and are less informed of vaccination's benefits lead community engagement. Conversely, when community engagement is led by "community champions", defined by Public Health England as community members who volunteer to promote health and wellbeing or improve conditions in their local community (Vanderslott *et al.*, 2024), vaccine hesitancy is reduced.

A key finding therefore is that the use of respected figures in the community (Karras *et al.*, 2024) and trusted local actors (Polonsky *et al.*, 2025), such as religious leaders and doctors, to help disseminate accurate information on vaccination, will be effective in addressing misinformation and fostering trust in the study location. Furthermore, the creation of an

engagement space where open discussions about vaccines and concerns can be addressed (Karras *et al.*, 2024) will be a viable and pivotal means of promoting vaccine uptake in Akure South LGA, Ondo State, Nigeria. Such engagement spaces, as observed in this study, can be workplaces, worship centres, neighbourhoods, and even within households. Again, if individuals lacking knowledge about vaccines and vaccinations dominate the space, vaccine hesitancy may flourish.

“But what gets me discouraged are the people living very close to my shop in Lafe. There is a child who cannot walk properly with his legs, and people said that it was the immunisation he took that caused it.” (PCFGD1)

“When I gave birth to my child, the people we were living with in the same house told me that I should not take him for immunisation and that if he took it, he would be running a temperature, would not be able to sleep, and the injection site would be swollen.” (PDFGD3)

The quotes above summarise how the social network of an individual exerts influence on parental vaccination decisions, using non-evidence-based adverse outcomes to negatively profile the entire childhood immunisation program. The social network theory provides a platform for theories that focus on individuals and the web of interpersonal relationships that both constrain and enable human action within social systems (Nimmon, Artino and Varpio, 2019). The conclusions and subsequent behaviour of the caregivers quoted above stemmed from the dominant idea projected within their social network. The dominant idea can either constrain or enable positive vaccination behaviours.

Since people are embedded in relationships and cannot be viewed in isolation from their social environment (Gamper, 2022), the type of decision made by the caregiver on the basis of what she heard from her social networks is more normative than an aberration. Thus, the vaccination behaviour exhibited by the caregiver was shaped by her social network. When the influence of

the social network is positive, vaccines are accepted willingly, but vaccine hesitancy sets in when the social network exerts a negative effect. In addition, many caregivers' vaccination ideas and practices are influenced by the vaccination ideas and practices of the people they mix with socially (Cooper *et al.*, 2021), which further reinforces their views and practices around vaccination. Therefore, to achieve attitudinal or behavioural change, it is crucial to understand the interplay between social networks and health beliefs (Mukoka *et al.*, 2025). This knowledge can be deployed for the development of effective health interventions and promotion of positive health outcomes.

The effect of social networks can be managed using a community engagement model that integrates local knowledge in designing interventions aimed at addressing vaccine hesitancy (Morrison *et al.*, 2021). Additionally, community champions must be situated within the intervention loop, as they have the potential to promote health and well-being or improve conditions in their local community (Vanderslott *et al.*, 2024). The European Commission (EC) also recommended that planned interventions to address vaccine hesitancy be combined with opportunities for dialogue with vaccine-hesitant groups using participatory approaches (European Commission. Directorate General for Health and Food Safety. and Expert Panel on effective ways of investing in Health (EXPH)., 2018).

9.5.6. Health systems, health workers' attitudes, and vaccine administration

Health system governance refers to the processes, structures, and institutions in place to oversee and manage a country's healthcare system (WHO, 2025). It coordinates the interaction between different actors and stakeholders involved in healthcare, including government agencies, healthcare providers, patients, and their families (WHO, 2025). The health system's architecture for managing and administering vaccination programs in a country significantly influences their success. Effective health system governance is essential for ensuring that

healthcare services that support vaccination programs are accessible, equitable, efficient, affordable, and of high quality for all.

Health system characteristics such as location of vaccination centres, ease of accessing vaccines at vaccination centres, personal experience at the vaccination centres, and vaccination policies and processes are central to caregivers' attitudes about vaccines. When the caregivers' perception of the outlined characteristics is negative, it predisposes them to vaccine hesitancy. In addressing this, the government of Ondo State has a policy that ensures the even distribution of health facilities across all 18 local government areas and 203 political wards in the State (Olugbamila, 2018). The intention of this is to facilitate easy commuting by caregivers to vaccination centres, and this measure has significantly improved access to vaccination centres and increased uptake of vaccination. Access to vaccination centres is important to caregivers in the study area, as 18.2% admitted that they were prevented by distance, the timing of the clinic, the time needed to get to the clinic or wait, and/or the costs of getting to the clinic to immunise their children. This observation was in tandem with the findings of (Ameen *et al.*, 2023) that accessibility to vaccination centres was a factor in incomplete vaccination, as vaccination sites were often too far from residential homes. There was a convergence in the quantitative and qualitative findings, as seen in the narrative quote of one of the caregivers *"One person I know, my mother-in-law, did not receive immunisation for her first and second children." born. She said they usually waste time in the clinic. She said the day could clash with the day she needed to go to her farm market to purchase the commodities she will need to resell, and she cannot afford to go to any clinic where they will waste her time...."*

The significance of accessibility to vaccination centres concerning hesitant behaviour was also reflected in the narrative quote, *"...my husband always gives me transport fare..."* The foregoing iteration highlighted the importance of the physical locations of vaccination centres. One of the As in the 5A vaccine hesitancy model is "Accessibility". According to Mazar *et al.*

(2023), a longer distance to vaccine sites reduces vaccine uptake, thereby posing a significant barrier to vaccination. Considering the benefits of vaccines as revealed by the caregivers in both the quantitative and qualitative research, the cost of attending vaccination clinics is insignificant compared to the protective benefits of vaccines. Furthermore, it has been revealed in a systematic review that parents' vaccination ideas and practices may be influenced by their access to and experiences of vaccination services and their frontline healthcare workers (Cooper *et al.*, 2021).

The successful vaccination of a child in a health clinic marks the culmination of a complex journey that encompasses a sequence of essential steps, the sustenance of which depends on establishing appropriate health systems (Gavi, the Vaccine Alliance, 2025). Hence, strong health systems, which encompass workforce availability, quality data systems and use, innovative leadership and management, and integrated monitoring of vaccine coverage, among others (Blanc *et al.*, 2024), are vital to delivering vaccines to those who need them. In the context of the study area, strengthening the health system in the study location will be a valuable strategy for ensuring that vaccination is not hindered by vaccine hesitation. Another positive aspect of health system management in Ondo State, Nigeria, is that the immunisation service point and the infant welfare clinic are located in the same place. Hence, caregivers can achieve more in one single visit since they can access relevant medical care along with vaccination service.

Another issue vital to the health systems driving vaccinations is caregivers' experiences at the vaccination centres. This is contingent on how the engagement of health workers with caregivers at vaccination centres influences the desire of the caregivers to vaccinate their children. Some of the caregivers expressed their displeasure at the way they were treated at the vaccination centres by health workers. The caregivers in this study alleged that the health workers do not empathise with them and that they talk to them without courtesy. The provision

of healthcare services that respect and meet patients' and their caregivers' needs is essential in promoting positive care outcomes and perceptions of quality of care (Kwame and Petrucka, 2021). This arrangement means that patients need to be treated as full partners when receiving care, and their experiences, knowledge, values, preferences, and needs must be acknowledged and respected (Edgman-Levitan and Schoenbaum, 2021; Kwame and Petrucka, 2021). When this concept is applied to the vaccination of children, it implies that caregivers' opinions must be considered and doubts about the vaccination programme must be dispelled through active engagement. In this study, health workers were perceived as being unapproachable, which foreclosed any opportunity for discussing the caregiver's doubts and anxiety concerning immunisation. Most caregivers visit vaccination centres with a lot of confusion and unresolved issues in their minds, which require person-centred attention to manage rather than the general mechanism often employed to pass information across to mothers who had come to vaccinate their children. The quantitative findings revealed that 12.2% of the caregivers indicated that other pressures in their lives could prevent them from getting their children immunised on time. Additionally, 13.3% of the caregivers knew of reasons why children should not be vaccinated, while 27.3% had received or heard negative information about vaccinations. The quantitative results were corroborated by the narrative quotes, further confirming that some caregivers indeed have doubts that may prompt them to hesitate in vaccinating their children.

The convergence of the quantitative and qualitative findings is evident in the quote below:

"The nurses do not feel the way we feel about this, and if you frown your face anyhow to show any negative feeling, they will be angry with you, telling you that you think we want to do anything bad to your child." (PEFDG1)

This situation can be frustrating, particularly when health workers are unable to provide answers to caregivers' questions and put up a dismissive attitude (Landicho-Guevarra *et al.*,

2021). These challenges can, however, be prevented from degenerating into vaccine hesitancy if health workers can proactively address such doubts using a communication strategy that acknowledges the needs of caregivers and respects their opinions.

Caregivers also reported a power imbalance between them and health workers (De Souza Amorim Matos *et al.*, 2024), where the latter held more power over them. They are helpless when confronted with the unchallenging authority of the government and its agents, which the health workers represent. They feel humiliated by the health workers' disrespectful actions, which (Essoh *et al.*, 2023) presume may serve as a barrier to their willingness to return for subsequent vaccine doses. The narrative quote below captures the caregivers' feelings:

".....the thing that discourages me most sometimes when I come for immunisation like this is that the nurses will be talking to you as if you are nobody. So, the way they normally talk to us, the way they normally shout at us, will make you feel as if you are nobody or is it because me, too, I am not a nurse or I am not in the position where they are?" (PBFDG1)

The narrative above from one of the caregivers in this study succinctly aligns with the experience referred to as equity-limiting power dynamics (Shearer *et al.*, 2023), where health workers were considered to have wielded power from relative privilege over caregivers and that such victimised caregivers had the least likelihood of returning to the vaccination facility. The seemingly powerful tension between the health practitioner and the caregiver can be explained in terms of the white coat syndrome, which is characterised by raised blood pressure as a result of feelings of anxiety when in the presence of health workers in a hospital environment (Pioli *et al.*, 2018). Hence, rather than blame health workers, it is necessary to create a system that reassures the caregivers of their importance in the health system designed for maintaining population health.

Health workers were also alleged to handle their work with levity, and caregivers questioned the pace of work at vaccination centres. Several caregivers revealed that some people do not take their children for vaccinations because of the long periods often spent at vaccination centres, often due to poor work ethics among health workers. A participant provided insight into her mother-in-law's decision not to vaccinate two of her children:

"One person that I know that hesitated and refused to take vaccination for her child is my mother-in-law. She said she did not take immunisation for her first and second born. She said they usually waste time in the clinic..."

Another participant, a schoolteacher, revealed that whenever her child is to be vaccinated, she cannot go to work on such days because the clinic's service is slow.

"Another thing I want to say concerning this immunisation is the consumption of time anytime we come to the clinic. For a person like me, I take my child for immunisation at a clinic near Lafe junction, and I work at St Louis Grammar School. So, on any day my child is due for immunisation, I do not always go to work. Because it can be as late as 2 or 3 o'clock before I can leave the clinic." (PC1)

However, considering the negative narratives about health workers, it is worth noting that some of their observations may not be attitudinal but rather occupational. According to (Paterson *et al.*, 2016), healthcare professionals are often stretched as they face time constraints, increased workload, and limited resources and frequently lack adequate information or training support to address parents' questions. The way forward is to recruit more health workers and continue to build their capacity through ongoing training to address the controversies surrounding vaccine hesitancy effectively.

Furthermore, the fear associated with vaccine administration was identified in this study as one of the issues that needed to be addressed within the purview of health system strengthening.

Since immunisation can be accompanied with a short-term pain, and the fear of needles can serve as a barrier to vaccination uptake (Taddio *et al.*, 2022), a mechanism for mitigating the effect is necessary. A study by the Oxford Vaccination Group reported that a quarter of the UK adult population screens positive for a potential injection phobia. At the same time, fear of needles is a significant factor in up to 10% of people who are vaccine-hesitant (University of Oxford, 2021). The significance of caregivers' perception of vaccination pain was further emphasised in that strategy for managing immunisation pain was one of the five (5) evidence-based pieces of guidance to clinicians on how to work with vaccine-hesitant parents (MacDonald, Desai and Gerstein, 2018). Furthermore, needle fear was confirmed as a determinant of vaccine hesitancy in Bologna, Italy (De Gioia *et al.*, 2022), and a different method of administration may increase caregivers' compliance rate.

Although this study did not provide direct quantitative evidence of needle pain, 13.3% of carers indicated that they had reasons for believing children should not be vaccinated. In contrast, the qualitative study revealed that carers' fears regarding needles and injections stemmed from concerns about the potential harm to their immunised child and their own personal phobia of injections. The two quotes below illustrate the extent of needle fear.

"...and another thing is that I do use to be afraid of the way they give the injection, and I will be wondering if it will not touch the bone of the child because I have seen many occasions where the child's leg was paralysed as a result of injection given."

"Why I am personally discouraged is because I have a phobia of injections, so I am always scared anytime they want to give my child an injection."

The Canadian Paediatric Society considers that healthcare providers often overlook the fear of immunisation pain and distress felt by many parents and admonishes that caregivers' perceptions of pain must be addressed head-on (MacDonald, Desai and Gerstein, 2018). Based

on the narrative quotes in this study, it was evident that needle phobia for some caregivers, otherwise known as trypanophobia (Jha *et al.*, 2023), is very real, and the impact on caregivers should be considered a serious variable in vaccination hesitancy (Berube, 2024). It is therefore important to counsel such parents that the transient pain of vaccinating their child is less significant than the risk of not vaccinating them. Caregivers must be supported to overcome the phobia associated with vaccine administration for the benefit of the child and the overall good of the community.

9.5.7. Cultural beliefs and traditional practices

Vaccine hesitancy is conceived by De Souza Amorim Matos *et al.* (2024) to be temporal and dependent on the history and culture of a given place. This theme centres on how the interplay of cultural beliefs, traditional practices, and spirituality determines hesitant behaviour or otherwise. These can be framed through the lenses of the PEN-3 cultural model.

In some instances, cultural beliefs may influence healthcare behaviours. It is manifested through the rejection of Western medicine or by the utilisation of specific non-formal processes and materials that are not documented by Western medicine. In Africa, these practices, which fall under complementary and alternative medicine (CAM), have been practised for centuries (Ezekwesili-Ofili and Ogbonna, 2022) and consist of a diverse group of healthcare practices not generally considered part of the conventional medical curriculum (Wardle *et al.*, 2016) but strongly implicated as a driver of vaccine hesitancy. Within the context of routine immunisation, vaccine-hesitant parents considered vaccines as toxic and embraced CAM as a harm-free protective strategy for immune systems in place of vaccines (Attwell *et al.*, 2018). Those who use CAM and its practitioners consider that the human body should be protected from risks such as vaccines, which are thought to be far more dangerous than infectious diseases (Malo *et al.*, 2023).

This study intertwines cultural beliefs and traditional practices. Though a majority of the mothers were Christians and educated, some still expressed a preference for the use of herbal concoctions dictated by culture and tradition. Resting on this, a participant revealed that some caregivers refused to give their children immunisation because of their culture:

"... there are people who do not give their children immunisation because of their culture."
(PFFGD2)

The quantitative findings also showed that 38.9% thought there was a vaccine alternative, which made them more likely to take other steps to protect their kids from illness. In light of this, some caregivers believe that herbal concoctions will work better than vaccines. In the study area, the care of children involves the use of both orthodox medicine and local herbs. For instance, some women sell local herbs at the market, and they are called "agbomola," which means "child's saviour" or "child's protector." Mothers who believe in herbal medicine purchase herbal materials from dedicated stores to create remedies for a wide range of childhood ailments. They believe, just like any believer in CAM, that herbal concoctions offer their children better protection from vaccine-preventable diseases (VPD) than orthodox medicines (vaccines) and that they will also cure the diseases if the child is infected. However, the efficacy of these herbs may be questionable, and the correct quantity to avoid toxicity is unknown. When such local treatment fails, some caregivers will visit health facilities as their last choice for health-seeking. This may perhaps be responsible for the opinion expressed by one of the participants:

".... They prefer to prepare herbal concoctions and give them to the child because they believe that this will help the child, and these things eventually work against the child by causing another ailment...." The grandma said that when they have herbal concoctions, the child does not need immunisation." (PBFGD2)

This is a practice that has been going on for a long time. Applying the PEN-3 cultural model to assess and explain the behaviour of caregivers as depicted in the preferences above will involve the use of the Cultural Empowerment domain constructs of Positive, Existential and Negative. The use of herbal concoctions instead of vaccines is neither positive nor existential but a negative cultural practice which facilitates vaccine hesitancy. The framing of the herb as an alternative to vaccines will lead to vaccine hesitancy. However, if caregivers accept vaccines, these traditional practices become less significant and do not impact the health system. The intervention is not to stop caregivers from using herbal concoctions but to inform them that herbal concoctions are not an alternative for vaccines.

Another aspect of traditional-cultural practices in this study area is the naming of new-borns within a specific time frame after birth. This practice may prevent a child from taking the necessary vaccination scheduled for the first week of life, leading to missed opportunity for vaccination (MOV), though some may get vaccinated eventually. Additionally, some mothers must take their new-born baby to their birthplace immediately after delivery for traditional rites and naming ceremonies. This practice is evident in the response of a young mother who said:

"I travelled to my hometown after I had my baby, and I spent a long time there. So, I could not give him the normal hospital immunisation" (PDFGD3).

Although some of these caregivers eventually vaccinated their children, such children, however, became victims of delayed vaccination, while others had incomplete vaccination with the attendant risks.

In a mixed methods study by (Akwataghibe *et al.*, 2019), some of the reasons that influenced the levels of utilisation of immunisation services in the community included ethnicity and culture. Caregivers reported hesitation due to cultural festivals and traditional rituals that restrict women's movement. The choices made by the caregivers, based on the above narratives,

were existential, having no positive or negative impact on vaccination. However, the risk of incomplete vaccination is real, and we must manage these cultural practices without compromising the child's full vaccination. Policymakers must make a conscious effort to have information on the details and schedule of the cultural events and make alternative arrangements on other days for caregivers to receive vaccines for their children.

Furthermore, the foregoing narratives depict CAM as being in opposition to biomedicine and vaccination (Brosnan, Vuolanto and Danell, 2018). In light of the growing interest and patronage of CAM, even in Western societies, and its relationship to vaccine hesitancy, it becomes imperative to open up a channel of communication that will seek to engage CAM users and providers (Deml *et al.*, 2019) by taking time to understand hesitant parents' wishes, involving them in vaccination decisions, and taking their concerns seriously.

9.5.8. Dependence on natural immunity and spirituality

This section examines how parental belief in the adequacy of natural immunity in protecting a child against diseases hinders the uptake of childhood vaccines. Natural immunity, as attractive as the proposition might be, is not sufficient to protect a child adequately from existing and emerging vaccine-preventable diseases. A primary aim of vaccination programs is herd immunity, which occurs when a critical portion of a community is immunised against a contagious disease; the only way herd immunity can be achieved is through mass vaccination (Pierik, 2020). Supporting the preference of mass vaccination over natural immunity, Biggs and Littlejohn (2022) argued that building public health policy around vaccines is the safest option compared to natural immunity. This position was predicated on the fact that mass vaccination gives a better outcome when the risk of exposure, coverage reliability and sustainment through booster doses are considered.

Hence, the dependence on natural immunity by some of the caregivers poses a significant challenge to the immunisation programme. The belief that a child born with natural immunity does not need to be immunised endangers both the child and the community. In this study, a participant averred that some people fail to give their children immunisation because they assume that children are born with natural immunity and that there is no need to boost the child's immunity. For instance, a 24-year-old female participant expressed a preference for natural immunity over vaccinations:

"I believe that the natural immunity of the child is enough for him to fight against diseases."
(PFFGD2)

In the same vein, another participant revealed that her mother was advised not to accept vaccines for her grandchild because the child has natural immunity. *The woman told my mum that the baby already has natural immunity, so do not use drugs or anything for her."*
(PCFGD2)

This viewpoint aligns with the opinion of those who feel that vaccines should only be given to a child who has an ailment or sickness. *"The child does not have any issue and so may not need the vaccine."* The actions of such caregivers are negative, and their viewpoint can be corrected by knowledge dissemination carefully conveyed to the caregivers through trusted channels such as health workers and respected community leaders.

This study's participants held spiritual beliefs and engaged in diverse spiritual practices, which significantly influenced their vaccination behaviour. The relationship between spirituality, religion, and medicine has been recognised for ages, and there is a shared global consensus that spirituality and religion play an important role in the healing of diseases (Romeo, Gallo and Tagarelli, 2015). Although most caregivers in this study were predominantly Christians (88.2%), no association was found between their faith and vaccine hesitancy in the quantitative

study. Contrarily, a study on vaccine hesitancy among Dutch parents of newborn children and its associated characteristics found that parents who reported VH were more likely to have a religious or anthroposophical life philosophy and were less certain about their vaccination intentions (Bussink-Voorend *et al.*, 2025). However, the qualitative findings in my study revealed that the religious convictions and faith of some caregivers in God were significant in determining their hesitancy status. They believe in the protective ability of God as an existential expression of faith with no harm intended. This outlook may become negative if such a belief serves as a barrier to childhood vaccination. A participant expressed this viewpoint by saying: *'They feel like it is God that protects children, so just leave them; they do not immunise the children.'* (PAFGD3)

The opinion expressed in the quote above is similar to the report by (Jinarong *et al.*, 2023), which states that "God is a power of attorney and protector," in a qualitative study investigating the beliefs of Muslim parents and the factors influencing the complete immunisation of children. The two key expressions, *"It is God that protects children"* and *"God is a power of attorney and protector"*, are religious expressions of faith in the ability of God to protect.

The doctrine of the church they attended also influenced their vaccination behaviour and, consequently, their hesitancy. Some churches do not believe in using medication but rather in the use of holy water. This phenomenon therefore poses a barrier to vaccination uptake.

"There are some churches that do not believe in anything drugs at all; they believe in holy water. They are giving that once a person takes their holy water, there will be nothing like sickness." (PCFGD3)

The use of holy water for protection against diseases and healing is widespread among Christians (Orogun, 2024), which is practised by over 88% of the caregivers in this study. This practice is expected to be existential, but the effect can be negative if it fuels vaccine hesitancy.

Hence, healthcare professionals must be able to convey to caregivers that the importance and benefits of vaccines cannot be replaced with holy water.

Some people even hold the belief that immunising a child can exacerbate their spiritual issues.

"... And then another person that I know is my neighbour; she said she can never take a child for immunisation, and I noticed that all her children are not healthy at all. During the time they were doing house-to-house immunisation for hepatitis, they came to our street. However, this woman refused to allow her children to be vaccinated because of a previous experience she claimed to have had. She said the problem of the child is spiritual, which is associated with battles from his father's family, and the immunisation can worsen it...." (PFFGD1)

The foregoing expression presented the picture of a caregiver who vowed not to take her child for immunisation because of her previous experience: *"...but this woman refused to allow her children to be vaccinated because of the previous experience she claimed to have."*

The completing part of the comment, however, introduced another layer of complexity to the discourse when the caregiver attributed her child's state of health to spiritual battles which immunisation can worsen:

"... She said the problem of the child is spiritual, which is associated with battles from his father's family, and the immunisation can worsen it..."

The question, therefore, is, what is the connection between immunisation and spiritual battles? This situation further highlights the complexity surrounding immunisation and the need for a comprehensive deconstruction of the myths and prejudices that affect decision-making on vaccination by caregivers. Addressing this complexity, Martens and Rutjens (2022) argued that spirituality and religiosity working together foster vaccine hesitancy and negatively impact vaccination programs. Working on COVID-19, Zarieczna *et al.* (2023) reported that spirituality directly predicted a lower likelihood of vaccination. The framing of spirituality as

an individualised set of beliefs characterised by a strong dependence on subjective experience (Martens and Rutjens, 2022) coincides with the mindsets of caregivers in this study, where faith in the protective ability of God (DiGregorio, Corcoran and Scheitle, 2022; Tiwana and Smith, 2024) is considered by a few to be more effective than vaccines. Therefore, when designing programmes to address vaccine hesitancy in individuals and among religious groups, it is advised that appropriate consideration should be given to spiritual beliefs. Health care professionals must be trained on how to engage spiritual leaders and navigate the quagmires of religious doctrines so that they can successfully steer hesitant caregivers towards acceptance of vaccination. Furthermore, through adequate sensitisation and mobilisation of religious leaders, religion could positively promote vaccination uptake and dispel several misconceptions about vaccination (Garfield, Ali and Murdan, 2025).

9.6. Vaccination Behaviour

9.6.0. Introduction

This section explores how caregivers' vaccination decisions are shaped from a behavioural perspective. In practice, the decision-making process guides caregivers through a path mediated by a range of both psychological and demographic factors until they reach a point—either accepting or refusing the vaccine. Therefore, a caregiver's ultimate vaccination choice reflects their actual vaccination behaviour. Several studies (Gkentzi *et al.*, 2021; Yeskendir, Gusmanov and Zhussupov, 2023; Zastawna *et al.*, 2023) have shown that attitudes and beliefs influence parental vaccination choices, although the exact process remains unclear. For instance, Gkentzi *et al.* (2021), in the study in Greece, reported that Greek parents have a positive attitude toward vaccines and believe that vaccines are important and effective, without explaining how the attitude translates to behaviour. In another study where parental beliefs and attitudes towards vaccination were reviewed, Lima *et al.* (2024) presented factors that shape

beliefs as presumptive determinants of vaccination decisions but did not explain the “how and mechanism” behind how these beliefs influence vaccination behaviour. Although the authors attempted to use the Health Belief Model (HBM) as a theoretical framework to understand caregivers’ behaviour (whether they accept vaccines or not), the constructs of HBM—perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action (Alyafei and Easton-Carr, 2025)—only predicted “intention” and not actual practice (behaviour).

Hence, the relationship between vaccination attitudes and beliefs and vaccination behaviour in this section of the thesis is discussed from a perspective that explores how the eventual vaccination behaviour of caregivers is shaped, particularly in cases of vaccine refusal. The process reveals the behavioural pathway leading to vaccine acceptance or refusal. More significantly, the “psychological frame that influences how attitudes and beliefs affect vaccination choices” is examined, focusing on why caregivers may possess favourable views regarding vaccination yet still decline to vaccinate their children.

9.6.1. Self-reported vaccination behaviour.

Caregivers’ vaccination practices result in a binary outcome: either acceptance or refusal of routine immunisation, without considering the spectrum of vaccine hesitancy. The vaccination practice refers to whether the caregiver accepted or refused routine immunisation for the child. Hence, caregivers can be vaccine acceptors or vaccine refusers.

The caregivers who refused vaccines in this study accounted for 7.1% of the total caregivers. This figure is slightly lower than the Africa continental average of 8.4% (Bobo *et al.*, 2022) but similar to the 7.8% reported in Kazakhstan (Yeskendir, Gusmanov and Zhussupov, 2023) and much lower than the 22.0% noted in a study in Peshawar, Pakistan (Hakim *et al.*, 2025). Pakistan and Nigeria are two countries that are often grouped together with respect to zero

vaccination and poor vaccination outcomes (Hussain *et al.*, 2023). Compared to high-income countries, 5.0% and 16.8% were reported for the Netherlands (Bussink-Voorend *et al.*, 2025) and Canada (Schellenberg *et al.*, 2023), respectively.

Among those who accepted vaccines, comprising 92.9% of the population in this study, 76.4% accepted vaccines without hesitancy (Willing Acceptors), whereas 16.5% exhibited hesitation prior to vaccinating their children (Hesitant Acceptors). Those who initially showed hesitation constituted 23.6% of the study population, and the hesitant acceptors (16.5%) accounted for 69.9% of individuals who were initially hesitant but subsequently vaccinated their children. This figure is lower than the 90.05% of hesitant mothers who later administered all recommended vaccines to their children, as reported in a study concerning parental behaviour towards childhood vaccination in Romania (Iova *et al.*, 2025). In the Dutch study, 81.5% of hesitant caregivers ultimately accepted vaccination, with only 5.0% refusing vaccination out of the 27% who initially expressed hesitancy. According to Bussink-Voorend *et al.* (2025), a significant number of parents in the Dutch population expressed hesitancy regarding vaccination decisions; however, the majority (81.5%) of those who were hesitant intended to and ultimately did vaccinate, even while still harbouring doubts about their choice.

Hence, the proportion of hesitant acceptors among those who initially hesitated in vaccination studies, as observed in my study, is a vital statistic because it quantifies caregivers' transition from hesitant refusers to acceptors. The positive change in vaccination decisions by 69.9% of hesitant caregivers in this study further confirms that vaccine hesitancy is not a fixed reality but rather a fluid and dynamic phenomenon situated on a spectrum between two extremes of vaccine acceptance and vaccine refusal.

Hence a key finding from this study is that it is imperative for practitioners and policy makers to take cognizance of the details of hesitant acceptors and identify the reasons why a hesitant

caregiver can transition to an acceptor since the information can be used to design behavioural change interventions for hesitant caregivers.

One of the caregivers in the qualitative study provided deeper insight into the behaviour of hesitant acceptors through an account of how she moved across the spectrum from “willing acceptor” to “hesitant refuser”, propelled by vaccine hesitancy due to AEFI, and then back to “hesitant acceptor”, facilitated through the influence of an enabler of vaccination.

“When we took the one we took last, before we took it in February, we took it in January. My child's leg was swollen; even his daddy said that I should not bring him for immunisation again, but Grandma insisted that we should continue to take him for the immunisation.” (PAFGD1)

The positive transition experienced by Participant A in FGD1 was facilitated through a positive vaccination influencer, the grandmother. Furthermore, the ease with which caregivers can change from being vaccine acceptors to vaccine refusers due to a single experience of AEFI is quite worrisome, particularly when AEFI is a common feature of vaccination. It is, therefore, essential that caregivers receive constant dissemination of positive messages both before and after immunisation to reinforce the importance of making informed vaccination decisions. Such engagement, targeted at both vaccine acceptors and vaccine refusers, must be dialogic, encouraging caregivers to reveal their fears and concerns about vaccination. Family and community influencers with a positive disposition towards vaccination, as revealed in the FGD, will help achieve this target.

In addition, there must be the deployment of trained immunisation extension officers who will have the responsibility of going into the communities, not only with a megaphone, but also taking the time to sit, engage, and discuss with caregivers the factors that can sustain acceptance among acceptors and facilitate a transition from vaccine refusals to vaccine acceptance. This strategy is a viable recommendation and constitute a vital contribution to knowledge.

Figure 9.2 is a visual representation of the vaccination spectrum concerning vaccination behaviour.

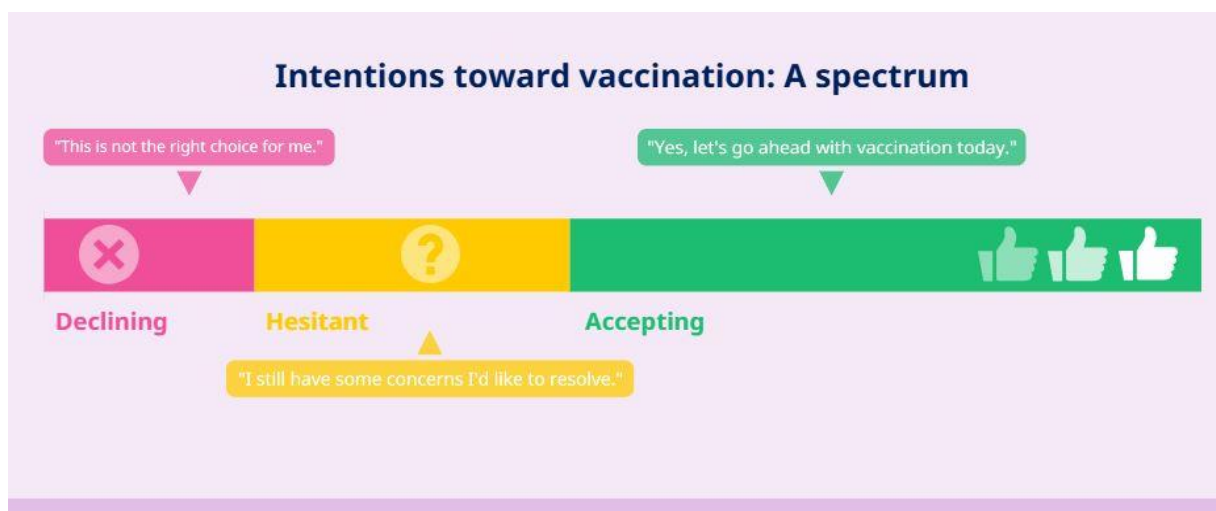


Figure 9.2: Intention towards vaccination across a spectrum

Source:(Pan American Health Organization (PAHO) and WHO, n.d)

9.6.2. Characteristics and vaccination beliefs (attitude) of vaccine refusers.

To tailor interventions for vaccine refusers, it is also essential to understand their specific sociodemographic characteristics and beliefs about vaccination. This is because parents' beliefs about vaccines are a key factor associated with vaccination refusal (Howell *et al.*, 2022). This study revealed that out of the 7.1% (n=32) of total caregivers who were “outright refusers” of vaccination, the majority had poor knowledge (71.9%). Various studies have demonstrated the crucial role of knowledge in shaping caregivers' perceptions about vaccination. (Alves, 2024) asserts that knowledge and attitudes significantly impact health behaviour. The individuals' knowledge about health information, their attitudes towards a specific issue, and the practices they adopt can be measured using the knowledge, attitude, and practice (KAP) model, a common theoretical framework for explaining the health-seeking behaviour of individuals (Andrade *et al.*, 2020).

Knowledge empowers caregivers to adopt positive vaccination behaviour, which is reflected in the capability pillar of the COM-B model. The Capability, Opportunity, and Motivation (COM-B) model suggests that a specific behaviour or behaviour change is more likely to occur when the capability and opportunity are present and there is some form of motivation to perform that behaviour ((Yeo *et al.*, 2022). Capability refers to knowledge and self-efficacy; opportunity is the environment that enables the behaviour, such as time, resources, and social nudges; motivation focusses on perceived benefits and value derived from the behaviour (Patterson *et al.*, 2023). Based on the COM-B model, “outright refusers” of vaccines are more likely to change their behaviour and accept vaccines only if their knowledge improves from poor to good. Therefore, any intervention aimed at changing the vaccination behaviour of this group of caregivers must be based on increasing knowledge.

Furthermore, nearly two-thirds (62.5%) of the "outright refusers" were over 30 years old, which aligns with the pattern seen among hesitant parents in this study, where those who were older than 30 tend to be more vaccine hesitant. Therefore, when designing behaviour change initiatives, the characteristics of this demography must be considered. Additionally, the economic status of “outright refusers” of vaccination revealed that most were not working full-time (62.5%) and were low-income earners (87.5%). This result aligns with findings from other studies. For example, Bertoncello *et al.* (2020), in a study conducted in Italy, reported that economic hardship was a factor in hesitancy, while lower education predicted outright refusal. For many individuals going through hardship, immunisation does not offer a direct, immediate benefit compared to using their time to eke out existence. Conversely, Vlasak, Dinero and Roitman (2023) argued that systemic advantages, such as wealth and easy access to quality healthcare, might lead some individuals to refuse vaccines due to a perceived lower risk of disease. The influence of income status on vaccine refusal, however, depends on the context. At the study location, low-income individuals frequently participate in temporary income-

generating activities that require long hours for minimal compensation. This employment, usually as casual labour or for small firms in the informal sector, leaves little time for childcare, including vaccinating their children (Zimba *et al.*, 2024). In addition, since they are casual workers, they do not get paid when they miss work. Therefore, these caregivers' main concern is to provide essentials for their families, placing vaccinations lower on their priority list. As revealed in the FGD, immunisation is always the “foregone alternative”. On the other hand, caregivers working in formal settings, which acknowledge the importance of vaccination, tend to be more conscious of their children's health and have the economic means to travel to vaccination centres compared to the unemployed and manual labourers (Zafar *et al.*, 2023). The insight on age and income pattern of caregivers in the study area helps in determining which section of the population is to be targeted with specific information on vaccination. This makes the behavioural change initiative to be smart and efficient.

9.6.3. Caregivers' Vaccination Attitudes and Beliefs on Vaccination Behaviour

Caregivers' attitudes and beliefs refer to the feelings people have, coupled with the predetermined ideas they harbour towards vaccination (Walker *et al.*, 2021), and both are often measured together in childhood vaccination studies (Makarić *et al.*, 2018; Boyle *et al.*, 2020). In determining the attitudes and beliefs of vaccine refusers regarding vaccination, the set of variables measured in this study, which reflects the beliefs, also depicts the attitudes of the specific population. According to Samayoa and Albarracín (2025), belief determines attitudes, norms, and perceived behavioural controls. This aspect of the chapter is concerned with the attitude dimension of belief and how it shapes vaccination behaviours.

The beliefs of caregivers who refused vaccines in this study did not follow a typical pattern that could predict their vaccination behaviour, whether they accepted or refused vaccines. These findings further complicate understanding the mechanisms behind vaccine refusal and

acceptance. The analysis showed that 78.1% of caregivers who refused vaccination believed vaccines are effective (vaccine efficacy), 68.7% felt they are not harmful (vaccine safety), and 75% thought many of the illnesses immunisation prevents are severe. Typically, this type of belief profile should lead many refusers to develop a positive attitude towards vaccination and accept vaccines. However, contrary to expectations, their belief profiles did not align with their behaviours. Interestingly, 62.5% of the same caregivers also believed there is an alternative method to prevent infants from vaccine-preventable diseases, and 59.4% thought it was better for their children to develop immunity by getting sick rather than through immunisation. Samayoa and Albarracín (2025) explained that it is common to hold certain beliefs without acting on them. Therefore, even though caregivers perceived vaccines as safe and beneficial, they still refused vaccination because these beliefs did not influence their actions. This apparent contradiction between belief and behaviour was further explored in terms of explicit and implicit attitudes in studies by Howell et al. (2022).

9.6.4. Explicit and Implicit Attitudes and Vaccination behaviours.

Explicit attitudes (beliefs) are defined as conscious attitudes that are formed deliberately and can be measured using self-reporting data tools, such as questionnaires or other similar data-gathering tools (Muschalik *et al.*, 2019). Conversely, implicit attitudes are conceived as unconscious mental associations between a concept, object, or product—for example, vaccines and a favourable or unfavourable evaluation or viewpoint (Khalili and Kazemi, 2025). A favourable review may convey the notion that vaccines are important, while a negative assessment may suggest they are harmful. Explicit attitudes are better at predicting deliberate behaviour, whereas implicit attitudes appear to better predict quick or spontaneous decision-making (Martinussen, Petranca and Sømhovd, 2018; Muschalik *et al.*, 2019). Although the sets of beliefs in this study were measured using a self-reporting tool (a questionnaire), they potentially reflect different behavioural tendencies. While beliefs about vaccine benefits,

safety, and efficacy are often spontaneous opinions, another group of beliefs results from rational thinking by caregivers before making a concrete decision about whether to accept vaccines or use an alternative and whether to opt for natural immunity instead.

Yuan *et al.* (2023) reported that researchers' efforts to determine the predictive power of attitudes towards behaviour have shown that individuals often express their attitudes but do not act in accordance with them. Among the caregivers who refused vaccination in this study, 68.7% stated that vaccines are not harmful, yet still chose to refuse vaccination. Furthermore, Howell *et al.* (2022) explained that a caregiver can hold competing cognitions, which demonstrate inconsistency between vaccination beliefs and vaccination behaviour. As a result, one set of attitudes aligns with positive vaccination behaviours, while the other diverges. This inconsistency, known as attitude-behaviour inconsistency (Yuan *et al.*, 2023), is observed in parents who refuse vaccination despite believing that vaccines are essential for their children. This situation is also reflected in this study, as illustrated by the statement of one caregiver in the FGD.

“I know I have every reason to immunise my child because it prevents illnesses. But my hesitation comes from the fact that when we had the second immunisation, she started running a fever and became very irritable” (PDFGD2).”

The caregiver above attached disease prevention and benefits, which are positive beliefs, to vaccination. At the same time, they also attached pain, risk, and illness, which are negative consequences of immunisation due to the AEFI experience. Therefore, the vaccination behaviour of the caregiver will depend on which factors exert the highest effect on the caregiver and the context. Based on this, the study has shown that caregivers may hold competing beliefs about vaccination, which can manifest as hesitancy or refusal, even when they believe that vaccines are important and not harmful to their children (Howell *et al.*, 2022). To deepen this

understanding, we can draw on the model of *belief-to-behaviour inference* (Samayoa and Albarracín, 2025), which states that beliefs must exert causal impacts on behaviour before behaviour can be attributed to a belief.

Furthermore, this study has shown that caregivers have the ability to form attitudes based on changes in context, thus depicting individual behaviour as a product of the interaction between attitudes and their perceived context. This position aligns with Samayoa and Albarracín's (2025) postulation that context, people, and types of beliefs are essential for the development of belief-to-behaviour inferences. Since vaccination behaviour is context-specific (Reñosa *et al.*, 2021; Tuckerman, Kaufman and Danchin, 2022), the impact of context on caregivers' perceptions may account for the ambivalence in the beliefs' variables among vaccine refusers, as observed in this study (Yuan *et al.*, 2023). The acceptance of vaccination by the caregiver (*PDFGD2*) initially occurred in a context dominated by positive enablers, such as knowledge, normative factors, and trust in the benefits of vaccines. This context was free from barriers such as AEFI. However, when the child had a fever and was in distress, the AEFI introduced risk, fear, and doubts concerning vaccine safety, thereby changing the context for further vaccination and subsequent behaviour. The importance of these factors, which is a key finding and constitute a contribution to knowledge is that when designing a behavioural change intervention for those who refuse vaccinations, the context underlying the refusal must be established and addressed for the intervention to be successful.

9.6.5. Belief-behaviour inference model and vaccination behaviour of caregivers

Samayoa and Albarracín (2025) proposed that beliefs have a causal influence on behaviours when people make a belief-to-behaviour *inference*. They postulated that beliefs affect behaviour when people consider the implications of a belief for behaviour and develop a belief-to-behaviour inference. Belief-to-behaviour inference is defined as the reasoning that connects

beliefs to behavioural attitudes (evaluating behaviour as positive or negative), thus driving behaviour. To explain this concept, Samayoa and Albarracín (2025) classified possible beliefs into existence, descriptive, and outcome subtypes. Existence beliefs are beliefs that predict the existence of an entity. Examples include: “I believe in God” and “Vaccines are important”. Descriptive beliefs centre on the qualities of an entity, such as “Vaccines are safe.” Outcome beliefs predict that a particular outcome will occur — thus dealing with causality — such as “Vaccines save lives”. These belief subtypes connect vaccines to a specific outcome. In the context of this research, caregivers express the belief that “vaccines are important”, which is an existential belief, while caregivers’ opinion that “vaccines are safe” is a descriptive belief. Finally, caregivers hold outcome beliefs “vaccines prevent diseases” and “there is an alternative to vaccines”. When the outcome beliefs are positive (“vaccines prevent diseases”), the resulting behaviour is the acceptance of vaccinations. However, if the dominant outcome belief is negative regarding vaccination (for example, “vaccines cause AEFI” or “natural immunity is better than vaccination”), caregivers tend to refuse vaccination.

9.6.6. Determinants and Implications of Vaccine Refusal

This study has shown that inadequate knowledge, vaccine hesitancy and lack of intention to vaccinate are the determinants of outright refusal of vaccines by caregivers. These caregivers exhibited significantly higher odds of vaccine refusal compared to those with high vaccination literacy, with a firm intention to vaccinate, or a non-hesitant profile. The essence of this finding is that when a caregiver is hesitant, the likelihood of refusing vaccines is greater. Furthermore, caregivers who are unable to openly discuss their concerns about immunisations with their child’s doctor (or immunisation provider) have higher odds of refusing vaccines. A study that explored UK parents’ reasons for not vaccinating their children (Skirrow *et al.*, 2024) reported a similar finding: parents' vaccination behaviour is contingent on their ability to speak to trusted and known health professionals about their children's vaccines. This experience is universal

and applicable to caregivers globally. For instance, a positive vaccination behaviour is associated with trust in health care providers (HCP) in the USA (Katzman and Christiano, 2022), Ireland (Marron *et al.*, 2023), Israel (Tal *et al.*, 2021), Ethiopia (Woudneh and Shiferaw, 2024), India (Moucheraud *et al.*, 2024), Cameroun (Yakum *et al.*, 2022), and in this research.

This study, consistent with previous research, has demonstrated that vaccine hesitancy is different from vaccine refusal (Bednarczyk *et al.*, 2023; Mesa *et al.*, 2023; Iova *et al.*, 2025). Understanding the clear distinction between these two vaccination behaviours is vital, as it will guide the development of appropriate interventions for management (Schwartz and Caplan, 2011).

In conclusion, caregivers who refuse vaccines are seen as a risk to their children and the community, since VPD outbreaks often start within their group before spreading to others (Omer and Orenstein, 2009). The negative effects of vaccine refusals are, however, mitigated by herd immunity provided by the pro-vaccination population, especially when caregivers supporting vaccination outnumber those opposing in a specific community (Mesa *et al.*, 2023). Ironically, those who refuse vaccination place a greater burden on the vaccinated while benefiting from the herd immunity created by the vaccine through the interruption of pathogen transmission (Doherty *et al.*, 2016; Mesa *et al.*, 2023).

A low rate of vaccine refusal — even lesser than the 7.1% reported in this study — can have widespread societal consequences. These impacts undermine health service utilisation, overall health and well-being, cognitive development, and ultimately, the economic productivity of the population (Doherty *et al.*, 2016). Since caregivers' acceptance of vaccination contributes to community well-being (Adeyanju and Betsch, 2024), investments in interventions that challenge and reduce vaccine hesitancy and refusal should be prioritised (Mesa *et al.*, 2023).

9.7. Prediction of Vaccination Behaviour through Mediation Analysis

Mediation analysis allows researchers to decompose the total effect of an exposure into two parts: a direct effect and an indirect effect that operates through a mediating variable. In vaccination research, it is well-established that vaccine hesitancy negatively impacts vaccination behaviour. By identifying mediators, researchers can understand the specific processes or mechanisms through which an intervention can control the effect of vaccine hesitancy by mitigating the outcome.

The result of the mediation analysis as presented in chapter 6 showed that the effect of PACV on vaccination attitude, though with a positive and significant coefficient, has a negative effect on attitude ($b = .1716$, $SE = 0.041$, $p < 0.001$). This is because the PACV score is a negative scale, and vaccine hesitancy increases from 50 to 100 and decreases from 50 to 0 (Opel *et al.*, 2013b). Hence, a positive coefficient represents a negative effect on the mediator and the dependent variable. The path from attitude to vaccination behaviour (vaccine refusal) is negative and significant ($b = -1.071$, $SE = 0.1777$, $p < 0.001$). This shows that good vaccination attitude is contrary to refusal of vaccination and therefore positively predicts vaccination uptake. This result is consistent with the findings of (Capasso, Caso and Zimet, 2022), who found that attitude towards vaccination positively predicted vaccination intention. Furthermore, the direct effect of PACV ($B = .3367$, $SE = .0393$, $p < 0.001$) on vaccination behaviour was positive and significant in the model. This conclusion means that vaccine hesitancy, in the absence of the mediator, promotes the outcome, which is vaccine refusal. The indirect effects of PACV ($B = -.1836$, $SE = 0.0398$, 95% Boot CI: $-.2769$, $-.1223$), however, on vaccination behaviour in the presence of the mediator (vaccination attitude) were negative. This means that vaccine refusal is suppressed, and vaccine uptake is promoted when the attitude is right. When the three paths in the mediation model are significant, as observed in this study, it implies that vaccination attitudes partially mediate 18% of the link between PACV and

vaccination behaviour (MacKinnon, 2011; O'Rourke and MacKinnon, 2018). Furthermore, the results provided evidence for the mediating role of vaccination attitudes in the relationship between PACV and vaccination behaviour by showing significant indirect effects. These results align with findings from similar mediation studies on vaccination outcomes, vaccination intentions (Lei *et al.*, 2024), and vaccination behaviour (Assante and Candel, 2022). The results of the present study could assist in shaping future interventions meant to promote childhood vaccination by focusing on social change initiatives designed to change vaccination attitudes.

The mediation analysis involving knowledge showed that the indirect effect of the independent variable (PACV) on the dependent variable (vaccination behaviour) via the mediator (knowledge) was negative (-.0024) and not significant. This negative value implies that increasing knowledge will suppress vaccine refusal but the effect is very minimal. Additionally, the significant direct effects of PACV on vaccine behaviour may obscure any indirect effects that knowledge might have. Nevertheless, to ensure clinically and epidemiologically sound decisions, (Twisk, 2024) advised that the clinical relevance of mediation, rather than statistical significance, should be used to evaluate the importance of indirect effects in mediation analyses. The implication of the findings for practice is that any intervention aimed at promoting vaccine acceptance in the study area should prioritise attitudinal changes over knowledge issues to be successful.

9.8. Strengths and Limitations of the Study.

A number of strengths and limitations to this research were identified. The conduct of a systematic literature review (SLR) before the primary research provided background information on the subject and revealed areas for further study. This subsequently reduced bias and increased the reliability of the study. Therefore, the knowledge gaps were given direct attention, leading to resource optimisation. Furthermore, the multiple validated data tools used

created the opportunity for data triangulation, integration, and meta-inference of findings, leading to trustworthiness and reliability of the study. The use of a mixed methods sequential explanatory research design, which employed multiple methodologies, provided ample opportunity for knowledge production consistent with the pragmatic research method used in this study. The adequacy of the sample size ($n=450$) for the quantitative study and the number of participants for the three focus group discussions (FGD) also increased the overall output of the research. Finally, the researcher's positionality as a clinician was beneficial to the research, and the opportunity to conduct certain aspects of it in the local language was also an advantage.

The limitations observed in the research include the collection of data based on parental self-reported responses to the questionnaire. This may introduce recall bias and normative conformity, thereby distorting responses and subsequent research outcomes. The participants in the FGD phase were only female because all the male caregivers approached did not give their consent to participate in the FGD. Hence, the opinions of the caregivers in the qualitative study were framed from a female perspective. The author's background as a clinician could also introduce bias into this research. This, rather than being a disadvantage, was a benefit because the researcher's reflexivity and positionality enabled the researcher to accurately interpret and present the information provided by caregivers and clear any ambiguities when such arose in the research.

Chapter Summary

This chapter presented a critical discussion of the study's findings. This chapter presents an analysis of the factors that contribute to increasing childhood vaccination rates, taking into account the reasons for vaccination among carers and the factors that facilitate vaccination. The integration of the quantitative and qualitative findings on 'reasons for vaccination' yielded a mixed meta-inference, converging for some factors while expanding for others. Conclusively,

three paradigms—protection, growth, and belief in vaccine safety—were identified as reasons for vaccine uptake in the study area. Furthermore, a definitive understanding of the perceived benefits of vaccines and positive perception of vaccine safety by caregivers leads to a high level of confidence in vaccines and increased vaccine uptake for their children.

The caregivers' enablers of vaccination were a network of factors that facilitate and motivate caregivers to access and receive vaccines for their children. They included health workers, the caregiver, her spouse, and a network of family members and social acquaintances. It was established that a caregiver's self-motivation to accept vaccination for her child is dependent on a personal motivation that is contingent on the belief that the vaccine is compulsory and beneficial, personal tenacity, and intergenerational commitment to vaccination. A public health intervention that will leverage the key outcomes of the study to boost vaccination in the study area was proposed.

The intention to vaccinate is a key parameter that determines eventual vaccine uptake in this study. Although intention to vaccinate does not directly translate into vaccination uptake, it is, however, a significant predictor. The development of a positive intention by a caregiver, however, is dependent on certain factors which include perceived severity of VPDs, knowledge, hesitancy status, employment status, caregivers' gender and trust. The findings from the study further established the significance of accessibility to vaccination centres and prompt attention to caregivers, their gender and trust were shown to impact intention to vaccinate, and interventions meant to promote vaccination acceptability must address both parents using an evidence-based communication strategy. The prevalence of vaccine hesitancy among caregivers was lower than the in-country values in Nigeria and the average for Africa but higher than the global cumulative average. In this study, vaccine hesitancy can be classified into several categories based on its causes: livelihood-induced hesitancy, knowledge-induced hesitancy, adverse reaction-induced hesitancy, accessibility-induced hesitancy, and attitudinal

hesitancy. Three knowledge dimensions were identified as strategic to vaccine hesitancy: knowledge of immunisation schedules, knowledge of vaccine importance, and knowledge about vaccine confidence.

The findings have revealed that while many of the participants were favourably predisposed to the uptake of vaccines, they still have significant concerns about vaccine risks and adverse effects. The interpretation of the mediation analysis was done, highlighting its implications for controlling vaccine hesitancy in the study area. Some of the determinants of vaccine hesitancy were tested to ascertain their predictive capability. The next chapter will summarise the thesis and outline the implications of its findings for practice, education, policy and research.

Chapter 10: Recommendations and Conclusion

10.1. Introduction

This chapter provides an overview of the study purpose, objectives, and summary of the research process. A synthesis of the main findings, the contribution to knowledge, and the impact of research was presented. Finally, seventeen recommendations were made on how to address vaccine hesitancy and promote vaccine uptake in the study location.

10.2. Summary of Key Findings, Impact of Research, and Contribution to Knowledge

This thesis provides insights into the determinants and the predictors of vaccine hesitancy among caregivers of under-5 children in Ondo State, Nigeria. It contributes to the existing body of knowledge by offering a deeper understanding of vaccine hesitancy among caregivers in the study area that will benefit vaccination programmes in Ondo State, Nigeria. The study key outcomes were integrated and aggregated according to the research objectives and are categorised under four primary themes. The main findings for each theme are as follows:

(I) Boosting childhood vaccination is contingent on caregivers' confidence in vaccine importance and the influence of positive enablers.

The relevant findings on this theme are as follows:

- i. the concept of importance (benefits), safety and effectiveness, which are key ingredients for vaccine confidence, were demonstrated as key facilitators of vaccine uptake in this study. A key contribution to knowledge is that when caregivers have a definitive understanding of the perceived benefits of vaccines, their confidence in vaccines increases, making them more likely to vaccinate their children.
- ii. This study has revealed that personal motivation for positive vaccination behaviour is contingent on four factors: belief that vaccines are compulsory, perceived benefits of vaccines based on past positive experiences, personal conviction and tenacity, and

intergenerational commitment to vaccination. This amalgam of reasons, that drives caregivers' motivation to vaccinate their children, is novel and constitute an original contribution to knowledge.

- iii. A key outcome of this study, consistent with the findings of other researchers, is that health care decision-making in African communities is not an individual effort but shared with others in the household, and hence the increase of vaccine uptake in the study area can be achieved through the implementation of public health interventions that will leverage the advantages of social norms.

II) Parental intention to vaccinate precedes successful vaccination, and it is attitudinal and dependent on knowledge and trust.

The corresponding findings under this theme are as follows:

- i. From the quantitative and qualitative findings, it was observed that caregivers will only make decisions that cause no pain to their children, and that any distressful action may demotivate them from developing the intention to vaccinate. This falls within the existential paradigm of vaccination uptake and reaffirms the relevance of the existential theme identified in the systematic literature review (SLR) conducted in chapter two.
- ii. This study highlights the potential of combination vaccines (5-in-1 and 6-in-1 vaccines) to significantly improve vaccination coverage in Nigeria by providing protection against multiple diseases simultaneously.
- iii. The findings from the study revealed that accessibility with respect to vaccination is diverse and not limited only to spatial accessibility but also includes diverse issues such as accessibility to vaccination information, engagement in employment that create opportunities to visit vaccination centre, and being able to afford the cost of transportation to vaccination centres.

- iv. A key finding in this study is that caregivers' knowledge quotient is dependent on three dimensions of knowledge which consist of knowledge of immunisation schedule, knowledge of vaccine importance, and knowledge leading to vaccine confidence (vaccine safety and efficacy).
- v. This study revealed that a key health systems factor that determines caregivers' desire to vaccinate their children is their engagement with health workers and experiences at vaccination centres. When such engagement is negative, driven by equity-limiting power dynamics where health workers wielded power from their relative privilege, it reduces caregivers' intention to vaccinate and the likelihood of aggrieved caregivers returning to the vaccination facility for subsequent vaccine doses.
- vi. A positive aspect of health system management in Ondo State, Nigeria, revealed by this study, is the location of the immunisation service point and the infant welfare clinic in the same place. Hence, caregivers can achieve more in one single visit since they can access relevant medical care along with vaccination service.

III) Vaccine hesitancy prevalence influences vaccination outcomes and it is contextual and dependent on certain factors. The relevant findings on this theme are as follows:

- i. The findings of the mediation analysis indicated that vaccine hesitancy, in the absence of the mediator, promotes vaccine refusal. Also, attitude was found to have a positive significant effect on vaccination behaviour which implies that good vaccination attitude is contrary to refusal of vaccination and therefore positively predicts vaccination uptake. Furthermore, the findings provided evidence for the mediating role of vaccination attitudes (18%) when compared to knowledge (2.4%) in the relationship between PACV and vaccination behaviour.

- ii. This study provided evidence that immunisation can be accompanied with a short-term pain, and that the fear of needles can lead to vaccine hesitancy and a barrier to vaccination uptake.

IV) Vaccination behaviour documents the vaccination practice of caregivers and details how vaccine hesitancy affects the vaccination decision while acting through specific determinants as the mediator. The findings are as follows:

- i. This study has shown that the sociodemographic details of hesitant acceptors and the reasons why they can transition to an acceptor are vital for the design of behavioural change interventions for hesitant caregivers. Furthermore, it was revealed that the proportion of caregivers who changed from hesitant refusers to hesitant acceptors was a key metric that indicated the level of success of interventions meant to drive transition from vaccine refusal to vaccine acceptance.
- ii. It was established in this study that caregiver vaccine acceptance is dependent on a context dominated by positive enablers, vaccination-related knowledge, normative factors, and trust in the benefits of vaccines. Conversely, hesitancy and refusal are exhibited when the context is compromised by negative experiences-particularly Adverse Events Following Immunisation (AEFI)-which introduce perceived risks and erode confidence in vaccine safety.
- iii. Caregivers doubts about vaccination, driven by diverse reasons, ultimately affect their vaccination behaviour. The mechanism and strategies for dispelling the doubts were identified in this study.

Importantly, the findings above led to the crafting of a set of recommendations meant to mitigate the effects of vaccine hesitancy and reduce barriers to full childhood immunisation in the population. The recommendations will be of great benefit to multiple stakeholders, such as

policymakers, healthcare practitioners (doctors, nurses, and community health extension workers), social networks, and caregivers. This study is the first to assess the determinants of vaccine hesitancy of caregivers of under-five children in Ondo State, Nigeria, using multiple data tools and a sequential explanatory mixed method.

10.3. Recommendations

This section outlines the strategic recommendations for mitigate the identified drivers of vaccine hesitancy and refusal, so as to promote vaccine uptake. Furthermore, this thesis identified that actors (family members, social networks, and health workers) in the decision space of caregivers encouraged and nudged them to take vaccination (activation). Although, the caregivers did not actively search for vaccination information, they were passively impacted through the intrusive nature of the social media. Hence, they exhibited an element of calculation, and a significant proportion of them believed that other caregivers like them accept vaccination (collective responsibility). In this regard, the recommendations were centred on the themes of service and practice improvement, education, policy development, health system strengthening, and research while taking cognisance of the 5A and 5C psychological antecedents of vaccination as presented in sections 3.6 and 3.7. However, the implementation of each recommendation can involve diverse stakeholders such as policy makers, staff of Ministry of Health, staff of Primary Health Care Development Agency (PHCDA), frontline health workers, community leaders, caregivers and researchers drawn from multiple fields such as government, development partners, academia, faith based and community organisations, and health sector, acting complementarily.

The recommendations are as follows:

10.3.1. Service and Practice Improvement.

Basis for recommendations: Some caregivers were not aware of the importance of vaccines while some exhibited vaccine hesitancy because of concerns about vaccine safety and fear due to past adverse effect of vaccine as depicted in section 9.4.1. There were also concerns about the engagement of health workers with caregivers which discouraged some from visiting vaccination centres as discussed in section 9.5.6. The foregoing findings are to be addressed by the following recommendations:

1. Caregivers should be informed of the importance of immunisation during antenatal visits since immunisation starts from birth, and a robust information package laying emphasis on the imperative of childhood immunisation, the schedule, and mitigation of possible AEFIs should be developed and published.
2. Information on vaccine safety and importance must be displayed on the government's websites, social media pages, and physical infrastructure so that parents can accurately consider the risks and benefits of immunisation. Such messages must be clear, easily understood, and attractive.
3. Health workers in the study location must be kept abreast of the latest vaccination information through regular training on contemporary issues on vaccines and vaccinations. Such training will serve as continuous professional development, particularly on how to address safety concerns about vaccines and enable them to provide valuable knowledge-based advice to caregivers on a continuous basis. The process will build trust in the healthcare system and health workers and must be a priority for enhancing vaccination uptake.
4. A protocol for engaging with caregivers, which draws largely from the health workers' service charter and professional manual, must be developed and enforced. Such a protocol must stress that health workers should relate with caregivers with respect, compassion, and

understanding of their vulnerabilities, doubts, and concerns. This protocol is to be co-created with inputs from health workers and caregivers, and should be reviewed regularly.

10.3.2. Education.

Basis for recommendations: This study revealed that when both parents are educated, there is the likelihood to embrace vaccination. However, there are other instances when education constitute a barrier to vaccination and hence education is not a guarantee for vaccine acceptance. It was discussed at section 9.3.2 that the provision of a vaccination education, targeting school children and students in higher education undertaking health sector courses, should be embedded within the country's education system to achieve a societal-wide positive disposition to vaccination. The proposal is consistent with the suggestion of Du *et al.* (2025) that “regions in Africa with low immunisation coverage should continue to enhance vaccination education and improve vaccination readiness to reduce hesitancy” to promote vaccination uptake. The recommendations on the viewpoint are as follows:

1. An enhanced syllabus on immunisation education should be developed to support community health extension workers and nursing, midwifery, and medicine undergraduates in schools in Nigeria, particularly in Ondo State. The syllabus should incorporate counselling skills and objection-handling techniques, as well as an overview of the factors causing vaccine hesitancy and aversion. Furthermore, it should also be extended to physicians in the family medicine specialty and those in general practice training.
2. Immunisation education must be part of the school's programme starting from the primary school phase, and positive stories about immunisation must be told in the science textbooks.

10.3.3. Policy

Basis for recommendations: Through this research work, issues pertaining to the affordability and accessibility of caregivers to vaccination information and location were brought to the fore

and discussed at section 9.4.3. In addition, individual, societal, and institutional factors that impact vaccination programmes, were identified and discussed in sections 9.5.5 and 9.5.7. Also, in section 9.3.2, it was reiterated that health care decision-making in African communities is not an individual effort but shared with others in the household, and that social norms can exert positive net value on vaccination behaviour. Furthermore, the concerns of caregivers on the frequency and number of doses of vaccines given to children were discussed in section 9.4.1. In order to utilise the aforementioned findings to improve vaccination programme in the study area, the following recommendations are proposed:

1. A national policy on child immunisation should be developed with set guidelines for postnatal care by caregivers. The guidelines will contain protocols for informing new parents on the importance and safety of immunisation in the first week of life. It will also provide safeguards for the vaccination of every child born in the hospital.
2. Community-led programmes that leverage the power of social norms must be designed and implemented regularly in the study area. These initiatives, designed to promote awareness of childhood immunisation, could include the designation of some mothers who have fully completed the immunisation schedule as the "immunisation mom of the month." Their immunisation stories can be shared with other mothers online and on social media.
3. The creation of "vaccination engagement spaces" for open discussions on immunisation, is recommended. These engagement spaces include physical workplaces, worship centres, neighbourhoods, dedicated websites, interactive blogs, and households.
4. The Nigerian government should accelerate the adoption of 6-in-1 combination vaccines to promote widespread vaccination and significantly improve the country's vaccination coverage. It will also reduce the logistic challenges at health facilities and accessibility problems of caregivers.

5. A policy promoting easy accessibility of caregivers to vaccination centres should be prioritised in Ondo State, Nigeria. In the absence of a formal organised public transport system, caregivers could be given a transport subsidy every time they attend vaccination clinics.

6. Immunisation awareness messages and intervention programmes must be addressed to both parents and be designed using an evidence-based communication strategy.

10.3.4. Health System Strengthening.

Basis for recommendations: The strengthening of the health system that support vaccination in the study area was identified as a priority for improved vaccination uptake. Caregivers responses to the side effect of vaccination as discussed in section 9.4.1 is spontaneously protective and the need to build the competencies of health workers in vaccine administration is very important. Perceived conflict between health workers and caregivers was attributed to the fact that health system may be understaffed and not an attitudinal problem as shown in section 9.5.6. Hence the outlined recommendations:

1. A responsive health system must be put in place to ensure that caregivers who decline immunisation because of AEFI or other reasons are monitored and followed up through outreach and phone calls. This is to prevent a missed opportunity for vaccination. The monitoring and follow-up will promote vaccine uptake in this group of individuals.

2. The system responsible for managing immunisation services must be strengthened by the recruitment and training of adequate health workers, enhanced data administration, and integrated monitoring of vaccine coverage driven by purposeful leadership so that the vaccination programme is not hindered.

3. There must be constant dissemination of positive vaccination messages to caregivers pre- and post-immunisation to reinforce positive vaccination behaviour. Such engagement, targeted

at both vaccine acceptors and vaccine refusers, must be dialogic, encouraging caregivers to reveal their fears and concerns about vaccination.

10.3.5. Research.

Basis for recommendations: A significant knowledge gap concerning childhood immunisation protocols and vaccine efficacy was identified among caregivers, as discussed in sections 9.4.4 and 9.5.3. Specifically, three knowledge deficits exist: inability to independently track immunisation schedule- since the study revealed that some caregivers depend on third parties to help them track their children immunisation schedule; a lack of understanding of vaccine importance relative to perceived alternatives; and reliance on natural immunity discussed in section 9.5.8. In addition, the study revealed a contextual nature of vaccine refusal and that inadequate knowledge, vaccine hesitancy and lack of intention to vaccinate are the determinants of outright refusal of vaccines by caregivers as discussed in sections 9.6.2 and 9.6.6. Also, the mechanism through which context impact vaccination uptake is not well understood. Therefore, the dimension of these gaps and the processes to mitigate impact on vaccination uptake must be determined. Hence it is recommended that:

1. Trained immunisation extension officers should be sent to the communities for the purpose of data gathering for evidence-based intervention and should involve active engagement and discussion with caregivers on factors that can sustain acceptance for acceptors and a transition from vaccine refusals to vaccine acceptance for caregivers who refused vaccination.
2. The context of vaccination refusal must be established and addressed when designing behavioural change intervention for those who refused vaccines to encourage a transition from vaccine refusal to vaccine acceptance. This is a joint responsibility that transcends research, education, and practice.

10.4. Conclusion

The vaccine programme in Ondo State, Nigeria, is characterised by the availability of free childhood vaccines at all centres across all political wards. Despite the availability of free vaccines, the 2023-2024 NDHS survey reported that up to 39% of children in Nigeria miss out on receiving lifesaving vaccines either partially or completely due to a multiplicity of factors. Vaccine hesitancy has been established as a major cause of poor vaccination coverage in the study area. Furthermore, the research findings demonstrate that perceptions of importance, safety, and efficacy constitute the primary determinants for vaccine confidence, a major facilitator of vaccine uptake. Consequently, it is concluded that a definitive understanding of the perceived benefits of vaccines correlates with a high level of confidence in vaccines, thereby increasing caregivers' willingness to vaccinate their children.

This study established that the mechanism for boosting childhood vaccination depends on caregivers' perceptions of vaccine importance anchored on their belief that vaccination was a means of protection against childhood illness and subsequent hospitalisation, necessary for growth and maintenance of optimal health, and that vaccines were safe. The study also established that positive vaccination behaviour is enabled by actors which include the caregivers, spouses, parents, family members, health workers, community leaders, institutions and policies. Caregivers who choose to refuse or accept immunisation for their children first develop an intention to do so or otherwise. This intention is dependent on the attitude and dimension of trust of the caregiver. The development of a good attitude towards vaccination is often determined by the caregiver's knowledge of vaccines and the vaccination schedule. This research has demonstrated that the prevalence of vaccine hesitancy was significant in the study area and dependent on specific context and certain factors that influence the intention to vaccinate and eventual vaccine uptake. In the study location, a high degree of heterogeneity in vaccine hesitancy was observed, and it was classified based on its causes: livelihood-induced

hesitancy, knowledge-induced hesitancy, adverse reaction-induced hesitancy, accessibility-induced hesitancy, and attitudinal hesitancy.

The study also revealed that the vaccination behaviour of caregivers oscillates between vaccine acceptance and vaccine refusal, with a fluid spectrum in between referred to as vaccine hesitancy. The vaccination action is either to accept or refuse vaccines, and the decision is influenced by vaccine hesitancy. Negative attitudes and beliefs contribute to vaccine hesitancy; however, they do not directly predict vaccination behaviour. The mechanism of action operates through a behavioural pathway explained by the belief-behaviour inference model. The significance of transitioning from vaccine hesitancy to vaccine acceptance is highlighted, along with the processes that can facilitate this transition. This study has shown that poor knowledge, vaccine hesitancy, and lack of intention to vaccinate are the determinants of outright refusal of vaccines by caregivers. The essence of this finding is that when a caregiver is hesitant, the likelihood of refusing vaccines is greater. This study, consistent with previous research, has demonstrated that vaccine hesitancy is different from vaccine refusal. The outcome of the study has shown a progressive link between vaccine hesitancy, intention to vaccinate, and vaccine uptake. Finally, a set of recommendations were made to address the vaccination problems identified in this study.

The recommendations, focusing on service improvement, health system strengthening, policy development, deliberate subject-specific health literacy for stakeholders, strategic communication training, educational improvement, and research, will increase vaccine confidence and uptake in the study area.

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Appendix

Appendix 2.1: Protocol specification for the SLR.

ITEM	SECTION /TOPIC	CHECKLIST ITEM (Moher, <i>et al.</i> , 2015)	SLR ON THE PREDICTORS OF VACCINE HESITANCY AND REFUSAL IN CARERS OF UNDER-5 CHILDREN AND IMPACT ON CHILDHOOD VACCINATION STATUS
1a	Identification	Identify the report as a protocol of a systematic review	This table containing these guidelines is the protocol of a systematic review titled
1b	Update	If the protocol is for an update of a previous systematic review, identify as such	This protocol is not for an update of a previous systematic review
2	Registration	If registered, provide the name of the registry (e.g., PROSPERO) and registration number	This protocol has not been registered and hence has no registration number
3a	Authors Contact	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author.	To be filled after vetting by my supervisors
3b	Contributions	Describe contributions of protocol authors and identify the guarantor of the review.	To be filled after vetting by my supervisors
4	Amendments	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments.	The protocol is not an amendment of a previously completed or published protocol
5a	Sources	Indicate sources of financial or other support for the review	The review has no financial or other support from any source.
5b	Sponsor/funder	Provide name for the review funder and/or sponsor	The review has no funder and/or sponsor.
5c	Role of Sponsor/funder	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	There is no funder
6	Rationale	Describe the rationale for the review in the context of what is already known	The rationale is to highlight factors identified to be responsible for vaccine hesitancy in each study and methodological rigor consisting of source and quality of questionnaire, key findings and individual study limitations with the intention to categorize parental attitudes on childhood vaccination into domains and themes for proper deconstruction of the phenomenon while projecting existing gaps in studies that can be the basis for further studies.
7	Objective	Objectives 7 Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	1.What are the determinants of vaccine hesitancy, rejection and full completion of childhood immunization 2.What is the impact and relationship of the determinants on childhood immunization status 3.To what extent does a care giver knowledge of vaccination schedule and vaccine preventable diseases, attitude /perception, socioeconomic status and vaccination service characteristics affect their practice and their child uptake of immunization?
8	Eligibility criteria	Specify the study characteristics (e.g., PICO, study design, setting,	This has to do with the inclusion and exclusion criteria. Date range limited to 12 years from 2010 to

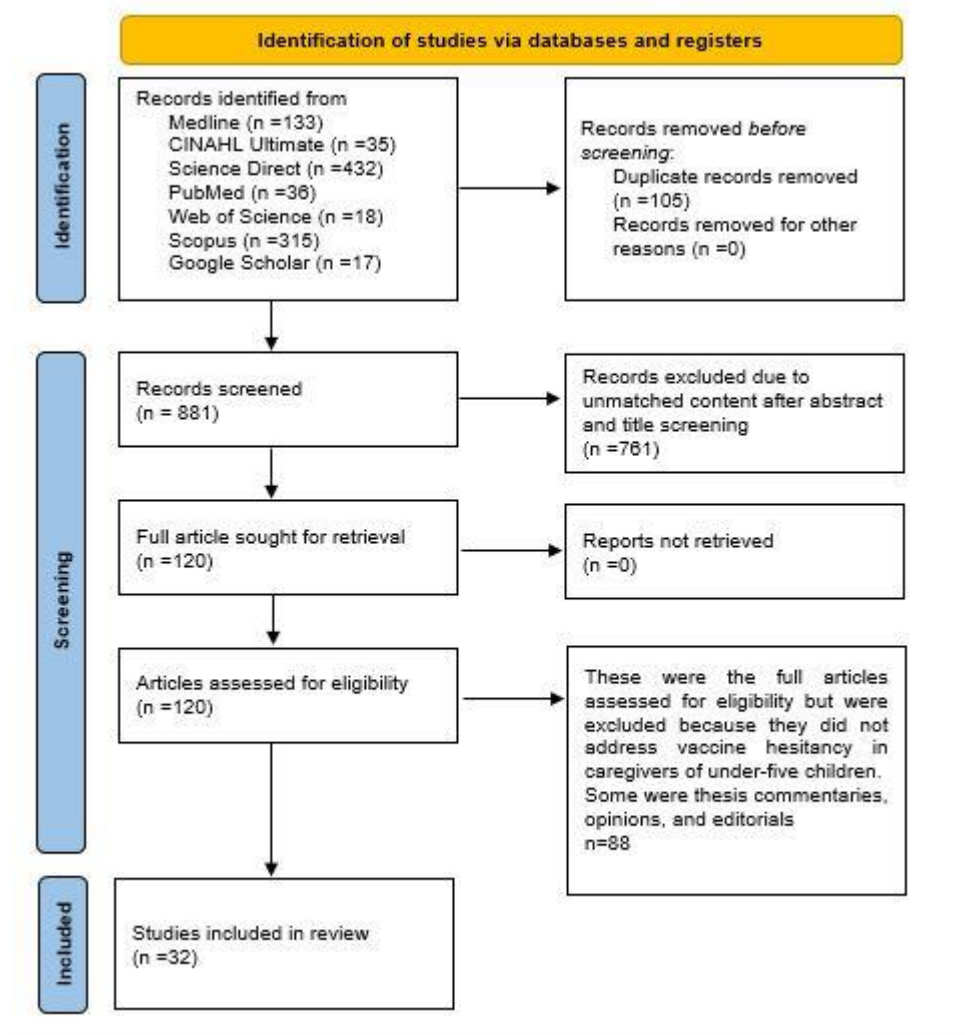
		time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for eligibility for the review.	2023.Only articles written in English, on childhood immunization, published in peer reviewed journal, and on primary research study will be included. Covid-19 vaccine hesitancy articles and grey literature will be excluded
9	Information sources	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	Scopus, Science Direct, Web of science, EBSCO Host, PubMed, Medline, CINAHL Ultimate, Google scholar
10	Search strategy	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated.	One of the databases searched is PubMed. Search terms such as ‘Vaccine hesitancy, vaccination status, knowledge of vaccine, Predictors of childhood vaccination, determinants of childhood vaccine hesitancy, predictors of vaccine hesitancy, vaccine refusals in children, Vaccines rejection, vaccine acceptance, childhood vaccinations and childhood immunization Childhood vaccination and vaccine hesitancy These were used with relevant associated text terms. The searches were limited to items published from 2010 to 2023. The last search was conducted on 20 th February,2023. All titles and abstracts or executive summaries found through the search strategy were screened to determine if they were relevant to the review. The full text of those articles that appeared to meet the inclusion criteria were retrieved and reviewed for relevance. The reference lists of all included items were searched to identify any additional items for inclusion.
11a	Data management	Describe the mechanism(s) that will be used to manage records and data throughout the review	Selected articles were exported to Zotero, and relevant data extracted to a table where synthesis will take place.
11b	Selection process	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	To be filled after vetting by my supervisors
11c	Data collection process	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	For each study information extracted from the articles included study title, year, study location, study design, , number of participants, methodology, sampling technique used, findings, limitations, study design, the method of recruitment and the location and type of participants, the number of participants recruited (and completing the study, where appropriate), relevance to the study, and details of the tools used to measure vaccine hesitancy, attitudes and belief about vaccination, mentioning of model use for the design of the questionnaire and use of validated questionnaire. Data extracted from each study were tabulated and grouped by study type and study characteristics including sample size, recruitment method, and location.

12	Data items	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications Outcomes and prioritization.	Vaccine hesitancy, vaccine acceptance, vaccine refusal, vaccine delay, vaccine knowledge, knowledge of importance of vaccines and vaccines preventable diseases
13	Outcomes and prioritization	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale Risk of bias in individual studies	Vaccine hesitancy, vaccination status, knowledge of vaccine, Predictors of childhood vaccination, determinants of childhood vaccine hesitancy, predictors of vaccine hesitancy, vaccine refusals in children, Vaccines rejection, vaccine acceptance, childhood vaccinations and childhood immunization Childhood vaccination and vaccine hesitancy
14	Risk of bias in Individual studies	14 Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis.	The risk of bias of individual studies will be assessed and this will be done at the outcome of study level. Details of questionnaire (source and validation status), number of study participants, clarity of methodology, the method of recruitment and the location and type of participants, the number of participants recruited (and completing the study, where appropriate)
15	Data Synthesis	15a Describe criteria under which study data will be quantitatively synthesized. 15b If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I ² , Kendall's tau) 15c Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression) 15d If quantitative synthesis is not appropriate, describe the type of summary planned	The study data were qualitatively synthesized into domains consistent with the content domain of the PACV model and the template reported by Jarret et al (2015)
16	Meta-biases	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	This is not applicable
17	Confidence in cumulative evidence	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	

Appendix 2.2: Summary of searches from various databases

DATA BASE	KEY SEARCH ITEMS	NUMBER OF HITS
Medline	PREDICTORS OR INDICATORS OR FACTORS OR DETERMINANTS AND VACCINE HESITANCY OR VACCINE REFUSAL AND CHILDHOOD VACCINATION OR IMMUNIZATION NOT COVID 19 VACCINE HESITANCY	133
CINAHL	PREDICTORS OR INDICATORS OR FACTORS OR DETERMINANTS AND VACCINE HESITANCY OR VACCINE REFUSAL AND CHILDHOOD VACCINATION OR IMMUNIZATION NOT COVID 19 VACCINE HESITANCY	35
Science direct	UNDER FIVE CHILDHOOD VACCINATION AND VACCINE HESITANCY	432
PubMed	PREDICTORS OF CHILDHOOD VACCINE HESITANCY	36
Web of science collection	UNDER FIVE CHILDHOOD VACCINATION AND VACCINE HESITANCY	18
Google Scholar	ADVANCE SEARCH WITH ONLY CHILDHOOD VACCINATION AND VACCINE HESITANCY TO SHOW IN TITLE	17
Scopus	VACCINE AND HESITANCY AND CHILDHOOD AND VACCINATION	315

Appendix 2.3: PRISMA Flowchart showing the article search strategy
(PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses)



	Ethiopia									can affect timeliness was not captured
Ngandjon et al., 2022)	Insights into Predictors of Vaccine Hesitancy and Promoting Factors in Childhood Immunization Programs Cameroun	To identify predictors associated with vaccine acceptance in the context of the Expanded Program on Immunization.	160 mothers of 12 to 23 months old children.	Quantitative & Community based	simple random sampling technique	Descriptive cross-sectional study Questionnaires	Yes	Yes	Result shows 60% vaccine Acceptance, 40% vaccine hesitancy. Factors such as age-appropriate vaccination. knowledge of vaccine preventable diseases and religion are associated with vaccine acceptance.	Cross-sectional study, and the sampling method is susceptible to selection bias.
Touray et al (2021)	Childhood vaccination uptake and associated factors among children 12–23 months in	To assess vaccination uptake and contextual-associated factors among children aged 12 to	200 care givers of children aged 12-23 months	Quantitative & Community based	Multi-Stage	Descriptive cross-sectional study Questionnaires	Yes	Yes	The proportion of children who received all the required vaccines was 66%,88.5%received BCG, 71% received OPV,82.5% received Penta 3, while 72 and 71% received measles-rubella and yellow fever respectively, Farmers,(occupation) those who have primary, secondary education and	Respondents without Infant Welfare Cards were excluded from the sample, which may have resulted in distorted sampling.

	rural settings of the Gambia. Gambia	23 months in rural Gambia							above(education) and children from more than 20 members family (family size) are less likely to complete their immunization schedule	
4 Musa et al, 2019	Vaccine hesitancy among parents in Kuala Lumpur Malaysia	To determine the prevalence of vaccine hesitancy (VH) among parents in Kuala Lumpur (KL), To identify the predictors associated with a vaccine hesitant attitude	380 caregivers of under five children	Quantitative & Health facility	Convenience sampling	Cross sectional study design Questionnaires	Yes	Yes	The study found a prevalence of VH of 14.5% among parents based on the 15-item PACV scale. Univariate analysis found no link between sociodemographic factors and VH in parents. predictors of VH among parents in Kuala Lumpur were introduction to a new vaccine, negative past experiences of vaccinations, distrust of the pharmaceutical industry, distrust of health systems and providers and being a male.	1.The study design precludes the possibility of causality between the factors tested with VH. 2.The findings from the study are also based on the self-perception of the parent at one particular time. This could potentially change over time, place and context. 3.As the participants were given a choice of whether to answer each question, there was several missing

										values which could not be accounted for in the study.	
5	Ghosh et al 2022	Demography and determinants of incomplete immunization in children aged 1-5 years and vaccine hesitancy among caregivers: An Eastern Indian perspective India	To assess the prevalence of incomplete immunization in children and parental vaccine hesitancy 2.To explore the socio-demographic determinants and delineate their interconnections	Mothers of 2100 under 5 children	Quantitative & Health facility based	Systematic random sampling	Cross sectional study Questionnaires	Yes	Yes	The prevalence of incomplete vaccination and vaccine hesitancy were 18.9% and 41.6% respectively. Significant predictors of incomplete immunization were maternal education, socio economic status, gender and place of delivery. Most responders believed vaccines are effective (99%) Important for their child's health (98%) and most vaccines offered by government are beneficial (95%) but were also concerned about serious adverse effects (41%) and fear about new vaccines carrying more risks than old vaccines (16%) Maternal education and family type were significant determinants of vaccine hesitancy. Incomplete immunization	Recall bias which can lead to overestimation of the vaccination coverage. Limited data were collected on socio-demographic information and this could have resulted to missing other important variables affecting immunization status and Vaccine hesitancy. WHO-SAGE survey tool could not be tested due to participants' time constraints, and for the same, relevant information from the non-responders

									was significantly prevalent among children with vaccine hesitant caregivers, though it was not found to be an independent predictor.	could not be obtained to perform a comparative analysis
Azizi et al 2017 6	Vaccine hesitancy among parents in a multi-ethnic country, Malaysia	To determine the prevalence of vaccine hesitancy among parents and its association with parents socio-demographic characteristics To assess the test-retest reliability of the PACV questionnaire in Malay language	650 mothers of under five	Quantitative & Health facility based	Convenience sampling	Cross sectional Questionnaires	Yes	Yes	7,9% of the respondents agreed to have ever delayed vaccinating their children,3,2% of them had refused vaccines for their children. The parents' greatest concerns on vaccination were mainly side effects (40%), and the efficiency of and safety of the vaccine (22.2% 88.8% were aware of the severity of vaccine preventable diseases. Most parents (85%) agreed that they could trust the information they receive about vaccination, The internet was the most popular source of information, followed by the brochure and then	The survey was cross sectional and therefore inference about temporal association between variables is limited.

									health care workers. Unemployed parents, parents from younger age group, non –Muslims and mothers expecting their first child were significantly more vaccine hesitant. Other socio demographic characteristic such as ethnicity, educational level household income and gender did not have any significant association with vaccine hesitancy	
Vrdelja et al 2018 7	The growing vaccine hesitancy; exploring the influence of the internet Slovenia	To explain ways of communicating about vaccination to mothers of young children using the situational theory of public (STOP)	1704 mothers of under five children	Quantitative & Community based	Convenient sampling	Descriptive cross-sectional study Questionnaires	Yes	Yes	The study shows that mothers react passively to information about vaccination no matter whether they come across it coincidentally or intentionally. Most often they seek information about vaccination from friends or online. The more concerned mothers are about the safety of vaccine the more they search	Mothers who did not take up a position regarding three key statements and represent the non-public group according to Situational theory of problem solving (STOP) were excluded.

									for information about vaccination and their communication is more active. Mothers that see safety as a problem and are afraid of adverse effect of vaccines are more likely to seek for alternative actions	
8	Chung-Delgado et al 2021 Vaccine hesitancy; characteristics of the refusal of childhood vaccination in a peruvian population Peru	To explore the characteristics of the vaccination decision –making process that may result in the refusal of childhood immunization in Peru	552 care givers of under five	Quantitative & Telephone interview	Convenience sampling	Descriptive cross-sectional study questionnaire	Yes	Yes	9.8% of the participants were considered vaccine hesitant, 70.3% had purposively denied vaccination, 88.4% thought fewer vaccines were better, 52.2% were concerned about vaccine safety, Level of vaccine hesitancy was inversely proportional to the level of education and the number of children at home. Mothers aged less than 29yrs showed a greater level of vaccine hesitancy. Vaccine safety and the number of vaccines to administer are important determinants of vaccine hesitancy	The statistical analysis was designed to show descriptive, non-inferential data representative only of the selected population. The convenience purposive sampling and telephone interview method are prone to selection and response bias. There is a possible confounding factor of the

										ongoing SARS-CoV-2 pandemic during the execution of this study.	
9	Taylor et al (2017)	Understanding vaccine hesitancy in polio eradication in northern Nigeria	To understand factors at household and community level associated with propensity to refuse polio vaccine	3306 carers of under five children	Quantitative & Community based	Purposive sampling	Descriptive cross-sectional study	Yes	Yes	Those who are wealthier. More educated females those who have more knowledge about vaccines and those residing in urban part are more likely to refuse vaccination than the poor, non-educated females those who have less knowledge of vaccine and those residing in the rural parts. Ethnic and religious identity did not appear to be associated with the risk of OPV refusal.	Survey was cross sectional and therefore inference about temporal association between variables is limited.
	Isezuo & Adamu2022	Vaccine Hesitancy and Refusal among parents of under-fives attending health facilities in	To assess the prevalence of vaccine hesitancy and refusal among parents of children aged 6months to	406 parents of under five children	Quantitative & Health facility based	Multi-Stage	Descriptive cross-sectional study	Yes	Yes	The proportion of those who refused vaccines increased along the immunization schedule. The commonest reason provided was that vaccine was not necessary to protect from diseases followed by family refusal	The study is a health facility-based study unlike a community based which maybe more reflective as those who attend health facilities are more likely to

10	Sokoto metropolis, Nigeria using the WHO vaccine hesitancy tool Nigeria	60months (about 5 years) in Sokoto metropolis 2. To identified factors associated with vaccine hesitancy and refusal among respondents 3.To determine the perceptions of study respondents regarding childhood vaccinations.				Questionnaires			and concern for safety from negative information gotten which include perceived handicap from vaccine and infertility. Predictors of vaccine hesitancy were tertiary educated fathers and young mothers	accept interventions provided so the study can be at risk of bias
Sabahelza in et al.,(2021)	Determinants of Measles Vaccine Hesitancy among Sudanese Parents	This study aimed to assess measles vaccine hesitancy and characterize its determinants	500 parents/caregivers of children	Quantitative & Community based	stratified sampling technique	Descriptive cross-sectional study	Yes	Yes	1 in 5 parents has hesitation towards measles vaccine. Significant predictors of parental vaccine hesitancy were parental exposure to anti-vaccination information or materials, the parent's	Most of the participants were females. This may be attributed to the time when the interviews were conducted (i.e., men at

11	in Khartoum State Sudan	among Sudanese parents in Omdurman in Khartoum State	aged 2-3years			Questionnaire.			perception of the effectiveness of measles vaccine, the age of the mother, the birth rank of the child and the total number of the children in the family. Vaccination access issue were the common justification for parental vaccination hesitancy	work). Thus, the perceptions, perspectives, and role of fathers in making decisions about vaccination was not properly captured.
(Dasgupta et al., 2018)	Vaccine Hesitancy for Childhood Vaccinations in Slum Areas of Siliguri, India	To find out the proportion and factors contributing to vaccine hesitancy for childhood vaccinations in slums of Siliguri, India.	194 Mothers/p rimary care givers of 0-59months old children	Quantitative & Community based study	cluster sampling	Descriptive cross-sectional study Questionnaires	Yes	Yes	Majority (83%) of the families were vaccine hesitant and only 17% were not hesitant. Nuclear families and mothers of lower educational status had significantly higher odds of vaccine hesitancy. Reluctance to vaccinate and to be unaware or having no reliable information were the major reasons cited for vaccine hesitancy	1.Inherent limitation of cross-sectional studies 2.Vaccine –specific causes of hesitancy could not be elicited properly because of likely incorporation of recall bias
Cherian et al 2021	Prevalence and predictors of vaccine hesitancy in an urbanized	To determine the prevalence of vaccine hesitancy in an urban	350 caregivers of under five	Quantitative & Community based	Purposive sampling	Descriptive cross – sectional study	Yes	Yes	The prevalence of vaccine hesitancy was 28,9% Fears of needle, concern about pain during vaccination, lack of family	A temporal association could not be established between vaccine hesitancy and its predictors because

13	agglomeration of New Delhi, India	agglomerate of New Delhi 2.To establish the factors that contribute to vaccine hesitancy				Questionnaires			support, and apprehension regarding side effects were ascertained as reasons for vaccine hesitancy. Type of family, time taken to reach the health facility and antenatal care received by mother were significant predictors of vaccine hesitancy.	the study was cross-sectional in nature.
Du et al (2021) 14	Access to Vaccination Information and Confidence/Hesitancy towards Childhood Vaccination: A Cross-Sectional Survey in China	To investigate the number and types of primary sources of vaccination-related information the public accesses, and estimate associations between the reported primary information sources and vaccine	2122 caregivers of children under 6yrs	Quantitative & Health facility based	Two stage cluster-sampling method	Descriptive cross-sectional study. Questionnaires	Yes	Yes	majority (72%) of caregivers had multiple sources of vaccination-related information. The proportions of caregivers reporting professional sources, media, and peers as primary information sources were 81%, 63%, and 26%. Internal migrants were less likely to get information from professional sources; more educated and wealthier caregivers reported more information sources and were more likely to get information from media and peers. Caregivers who reported	1.There may be a recall bias as information were collected on past childhood vaccination behavior. 2.Participants may misunderstand some questions in the self-administered questionnaires, 3. The sampling methodology may lead to

		increase vaccine uptake.							had fully vaccinated their children, Marital status and Greek nationality were found to be major determinant of vaccine uptake	
Costa-pinto et al (2016)	Parental immunization needs and attitudes survey in pediatrics hospital clinics and community maternal and child health centers in Melbourne, Australia	To determine the prevalence of vaccine concerns, resources and healthcare providers (HCPs) accessed and satisfaction with these resources in two different settings. 2. To identify relationships between the level of vaccine concern, socio-economic	1,301 parents of under 5 children attending general pediatric clinic 2,311 parents of under 19months (about 1 and a half years) attending	Quantitative & Health facility/community based	Convenience sampling	Descriptive cross-sectional study Questionnaires	Yes	Yes	43% of parents reported vaccine concern such as the number of vaccines given in the first 2 years (25%), vaccine ingredients (22%), allergies (18%), weakening immunity (17%) and autism (11%). They identified health care providers as the most commonly accessed and trusted information source. 23% of parents reported insufficient knowledge to make good vaccination decisions. There was little evidence of an association between parental vaccine acceptance or socio-economic status and vaccination status	Exclusion of non-English speaking mothers

		status and vaccine uptake.	community maternal Childs health nurse								
17	Bertoncello et al (2020)	Socioeconomic determinants in vaccine hesitancy and vaccine refusal in Italy	To explore socioeconomic inequalities in vaccine hesitancy and outright refusal	3865 families of 3months-5years old	Quantitative & Online	Convenience sampling method	Descriptive cross-sectional study Questionnaires	Yes	Yes	64% of families were pro vaccine, 32.4% were hesitant, 3.6% were anti vaccine. Rising level of perceived economic hardship were associated with vaccine hesitancy while lower parental education was a predictor of outright refusal without affecting hesitancy.	Families with no internet access or computer literacy could not take part in the survey
18	(Napolitano et al., 2018)	Investigating Italian parents' vaccine hesitancy. Italy	To assess the prevalence of vaccine hesitancy and to identify factors associated with vaccine	727 parents/ caregivers of 2yrs to 6yrs old children	Quantitative & Community based (Pre-school setting)	simple random sampling	Descriptive cross-sectional study Questionnaires	Yes	Yes	34.7% were defined as being hesitant of childhood vaccines. Vaccine hesitancy was significantly more common among those who were concerned and among those who were not sure that anyone of the childhood shots is safe, among those who were concerned that their child can	Cross sectional studies applied, and this causes a limitation on making any conclusion on causal relationship between the factors.

		hesitancy among parents							develop serious side effects, among those who were concerned that a shot might not prevent the disease, among those who delayed or refused a shot of vaccine for their children and in those who are not sure and uncertain in the pediatrician More than half of parents expressed the desire to receive additional information about the vaccine	2.Risk of potential recall bias Majority of the samples was represented by the mothers
Gornal 2020 19	Comparing vaccination hesitancy in Polish migrants' parents who accept or refuse nasal flu	To investigate the background to low uptake of influenza vaccination in polish pupils in Edinburgh Scotland	365 mothers of school children	Quantitative & Community based	Convenient sampling	Cross-sectional study Questionnaires	Yes	Yes	almost half of the parents interviewed expressed concern about potential side effect of vaccines, this increased to 77,8% in vaccine refusers and 16.7% in vaccine accepters. 15.8% of the respondent are of the opinion that children do not need vaccines for uncommon diseases.	consent form was written in English, and the consent form guidance translations available online was inaccessible or unfit for purpose.

	vaccination for their children UK								Polish migrants in the UK still retains their Norm and perspectives on vaccination.	
Author (Year)	Title & Country	Aims	Sample	Methodology & Study Settings	Sampling method	Research design & Data Collection tool			Findings/Result	Limitation
Blaisdell et al, 2016 20	Unknown risk: Parental hesitation about vaccination USA	To explore perceived and constructed personal judgments about the risks and uncertainties associated with vaccines and vaccine preventable	42 parents of under five children	Qualitative & Community based.	Convenience sampling	Inductive grounded theory approach Semi structured focal group	Yes	Yes	Vaccine hesitant parents engage in various reasoning processes and tend to perceive risks of vaccination as greater than the risks of Vaccine preventable diseases. At the same time, VHPs engage in other reasoning processes that lead them to perceive ambiguity in information about the harms of vaccination—citing concerns about the	1. The sample was racially and ethnically homogeneous and limited to parents in a single US state. 2.Information on specific age or birth order of

		diseases (VPDs) and how these subjective risk judgments influence parents' decisions about childhood vaccination. Methods.				discussion guide			missing, conflicting, changing, or otherwise unreliable nature of information. . Vaccine hesitant parents' refusal of vaccination may reflect their aversion to both the risk and ambiguity they perceive to be associated with vaccination	participants' children was not collected 3. comparative data from vaccine-accepting parents was not obtained
Price et al (2020) 21	Barriers and facilitators of childhood flu vaccination: the views of parents in Northeast England UK	To complete a descriptive qualitative investigation of parents' perceptions of the barriers and facilitators to flu vaccination for pre-school children	12mothers of children age 2-3years	Qualitative & Online video conferencing platform	purposive sampling method	Exploratory qualitative research design Semi structured interview guide	Yes	Yes	Participants whose children were not vaccinated against flu nonetheless generally held favorable views of vaccination and reported low concern about side-effects. Barriers involved a combination of internal and external factors, mainly a lack of convenient access to vaccination opportunities and flu vaccination being a low priority for busy parents.	The study involved a relatively small sample of parents from one English region and the findings may not be generalizable to other contexts. 2. The study did not collect information on participants' ethnic background, so it is not clear whether the findings

[illegible]

23	hesitancy towards early childhood vaccination Turkey	perceptions, and beliefs underlying these decisions				research studies) In-depth interview Data analysis done by thematic analysis			The most important factor that affect their decision is trust	
Peretti Watei et al (2019) 24	Vaccine hesitancy, commitment and trust among parents of young children France	To assess the level of trust towards physicians and commitment to vaccination issues.	25 parents of 3-5yrs old children	Qualitative & Community based	Purposive sampling	Grounded theory approach In depth interview using a semi structured guide	. Yes	Yes	Parents with higher socio-economic status were able to engage more resources and use a wider repertoire of action called vaccine inertia whereby despite their doubts they make vaccine decision due to social pressure. and anticipated regrets or routine duplication of previous vaccination related decision made for an elder sibling	Recall bias and social desirability bias

									they also displayed greater health literacy.	
Paterson et al (2018) 25	Reasons for non-vaccination: Parental vaccine hesitancy and the childhood influenza vaccination school pilot programme in England UK	To explore the reasons some parents decided not to vaccinate their child against influenza	25 parents of under 5 children	Qualitative study & Community based parents of school children	Multistage purposive sampling method and snow balling sampling method	Cross-sectional qualitative study Semi structured interview using an interview study guide	Yes	Yes	A third of parents who returned response forms had either vaccinated their child elsewhere, intended to have them vaccinated, or had not vaccinated them due to medical reasons (valid or perceived). Most interviewees were not convinced of the need to vaccinate their child against influenza. Parents expressed concerns about influenza vaccines effectiveness and vaccine side effects. Several parents interviewed declined the vaccine for faith reasons due to the presence of porcine gelatine in the vaccine.	Possibility of sample bias since those that took part in the study might have different views to that of the general population.

(Olaniyan et al. (2021) 26	The Socioecological Model as a framework for exploring factors influencing childhood immunization uptake in Lagos state Nigeria	To identify intrapersonal, interpersonal, organizational, community, and policy-level factors that influence childhood immunization uptake from various stakeholders' perspectives using the Socioecological Model (SEM)	1. 44 caregivers of under five children 2. 24 community leaders residing in Lagos State, Nigeria 3. 19 healthcare workers (routine immunization focal persons) working	Qualitative & Community and health facility	Convenient sampling	Socioecological theory Focus group sessions and semi structured interviews.	Yes	Yes	Study participants discussed intrapersonal factors that influence childhood immunization at different level including intrapersonal (care givers immunization knowledge caregiver welfare and love of children) Interpersonal (role of individual relationship and social network. Organizational and policy level	1. The use of a convenience sample creates the threat of selection bias. 2. All participants were recruited from Lagos state. Thus, findings cannot be compared with other states that might have different policies and programs in place.

			in the primary healthcare setting							
Paul et al (2022) 27	The last stretch: Barriers to and facilitators of full immunization among children in Nepal's Makwanpur District, Nepal	To understand the barriers to and facilitators of immunization in Makwanpur, Nepal from both the demand- and supply-sides.	154 mothers of children under 2years .25 fathers of children under 2 years 35 grand mothers of children under 2 years	Qualitative & Community based	Purposive sampling	Grounded theory 1.Focus group discussion 2.Indepth interview 3.Key informant interview	Yes	Yes	Respondents reported lack of mutual trust between service seekers and service provider as a prominent barrier	This study was conducted in one district of Nepal so the experiences of health workers and community members reported may vary from those in other parts of the country. 2. Member-checks was not performed in that the transcripts were not reviewed by participants. This oversight could introduce some error in the interpretations

			42 health workers							
Ward et al (2017)	Understanding the perceived logic of care by vaccine-hesitant and vaccine-refusing parents: A qualitative study in Australia	To explore the ways in which vaccine hesitant parents talked about the perceived risks and benefits incurred by vaccinating (or not vaccinating) their children.	29 parents of under five children	Qualitative & community	Snowballing sampling method	Interpretive qualitative research method Semi structured interview	Yes	Yes	Mothers trust their own judgement more than experts (drawing on embodied knowledge and intuition). They assessed risks of various diseases and saw some as lower than the risk of vaccination	The views of the parents who either partially or fully rejected vaccination for their children in both studies do not necessarily represent the view of all parents who reject vaccination
Author (Year)	Title	Aims	Sample	Methodology	Sampling method	Research design	Data collection		Findings/Result	Limitation
(Akwataghibe et al., 2019)	Exploring factors influencing immunization utilization in Nigeria	To identify factors influencing the use of immunization services in Remo North in order to inform intervention	215 carers of under five children 2	Mixed method & Community	Two stage clustered sampling method and	Convergent (concurrent) mixed methods design	Yes	Yes	32% (56) of children had immunization cards available for inspection. 59% (23) of them are fully immunized.	1. There is a Likelihood of recall bias 2. Quantitative data on adverse events following immunization was not

29		approaches to tackle barriers to immunization utilization	24 stakeholders involved in immunization services.		purposive sampling method	1. Questionnaires 2. Focused group discussion 3. Semi structured interview			84.9% of them were assessed to be fully immunized when immunization status was assessed with both card and recall. Health service factors like absence of delivery services, shortage of health workers, unavailability of vaccines at scheduled time, and indirect cost of immunization contributed to low utilization	collected and this would have added more values to the study.
Vasudevan et al 2020 30	Parental concern and uptake of childhood vaccines in rural Tanzania	To describe and contextualize parental concerns towards vaccines in Tanzania.	38 Mothers of under-five for focus	Mixed study & Health facility	Purposive and snowball sampling	Cross sectional study Questionnaire	Yes	Yes	72% of mothers reported missed or delayed receipt of vaccines for their child. Although vaccine coverage was high, timeliness of vaccinations was lower and varied by vaccine. Rural mothers reported more vaccine-related concerns compared to urban mothers;	Small sample size and reliance on facility-based recruitment The validity of the vaccine hesitancy measure in this context is unknown

			group discussion 134 mothers of under-five for cross sectional study			Semi structured focus group discussion guide			literacy and access to information were identified as key drivers of the difference. Mothers participating in FGDs indicated high perceived risk of vaccine preventable illnesses, but expressed concerns related to poor geographic accessibility, unreliability of services, and missed opportunities for vaccinations resulting from provider efforts to minimize vaccine wastage.	
Glanz et al 2013 31	A mixed method study of parental vaccine decision making and parent –provider trust.	To describe parental vaccine decision making behaviors and characterize trust in physician advice among parents with varying childhood	854 parents of under four	Mixed study & Health care setting	Stratified random sampling method	Questionnaire and semi structured focus group discussion guide	Yes	Yes	Parents who refused or delayed vaccines were 2 times more likely to report that they began thinking about vaccines before their child was born and 8 times more likely to report that they constantly reevaluate their	The study population was sampled from a single health plan in Colorado, and the survey response rate was 52%. Although this may affect the generalizability of the study.

		vaccination behaviors.							vaccine decisions than parents who accepted all vaccines. Although parents tended to report trusting their pediatrician's advice on nutrition, behavior, and the physical examination, they did not believe their pediatrician provided "balanced" information on both the benefits and risks of vaccination.	
Letley et al 2018 32	Tailoring immunization programme.: using behavioral insights to identify barriers and enablers to childhood immunization in	To identify barriers and enablers of childhood immunization using the WHO tailoring immunization programme (TIP) approach the WHO	126 parents of under five children and 38 key informant s	Mixed method & Health facility based	Purposive sampling	Cross sectional study Questionnaires and interviews			Mothers generally make the decisions around vaccination of their children. There was no evidence of community resistance against vaccination for example, related to cultural norms, opinions or religion. There was little evidence of the concept of childhood immunisation as an	There is a Likelihood of recall bias.

	a Jewish community in London UK	Tailoring Immunization Programmes (TIP) approach to fully explore the reasons for sub optimal vaccination uptake within the Charedi community.							important social value within the community. Parents who delayed or refused vaccinations did so for reasons on concerns about side effects or the mistaken belief that too many vaccinations would over-load an immature immune system. Ease of access to booking appointments, child friendly facilities and reducing waiting times were important issues for parents. As an example, due to the higher-than-average number of children in each family, a lack of waiting room space for small children to play, for storing buggies and long waiting times were identified as barriers to vaccination. •	

									Community specific initiatives such as community venues, Sunday clinics and Charedi nurse immunisers were identified as enablers to vaccination. There are un-met information needs within the community. Community specific information was particularly valued. Interviews with key informants identified pressure on providers of immunisation services due to having to manage a high proportion of young children with no additional resource.	

Appendix 3.1. Permission to use the image at Figure 3.2

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Appendix 3.2 Permission to use the image at Figure 3.3

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Appendix 4.1 Ethical approval from National Ethics Committee, Nigeria



National Health Research Ethics Committee of Nigeria (NHREC)

Promoting Highest Ethical and Scientific Standards
for Health Research in Nigeria



Federal Ministry of Health

NHREC Protocol Number NHREC/01/01/2007-19/06/2023

NHREC Approval Number NHREC/01/01/2007-12/07/2023

Date: 12th July, 2023

Re: Understanding the Predictors of Vaccine Hesitancy in Caregivers of Under five Children and Impact on

Childhood Vaccination Status in Ondo State Nigeria

Health Research Committee assigned number: NHREC/01/01/2007

Name of Student Investigator: Olajumoke Bamidele Aladenola

Address Student Investigator: School of Health and Social Care

University of Essex, United Kingdom

Email: Oa21735@essex.ac.uk

Date of receipt of valid application: 19/06/2023

Date when final determination of research was made: 12-07-2023

Notice of Expedited Committee Review and Approval

This is to inform you that the research described in the submitted protocol, Consent form, advertisement and other participant information materials have been reviewed and *given expedited committee approval by the National Health Research Ethics Committee.*

This approval dates from 12/07/2023 to 11/07/2024. If there is delay in starting the research, please inform the HREC so that the dates of approval can be adjusted accordingly. Note that no participant accrual or activity related to this research may be conducted outside of these dates. *All informed consent forms used in this study must carry the HREC assigned number and duration of HREC approval of the study.* In multiyear research, endeavour to submit your annual report to the HREC early in order to obtain renewal of your approval and avoid disruption of your research.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the HREC. No changes are permitted in the research without prior approval by the HREC except in circumstances outlined in the Code.

The HREC reserves the right to conduct compliance visit to your research site without previous notification.

Signed

**Professor Zubairu Iliyasu MBBS (UniMaid), MPH (Glasg.), PhD (Shef.), FWACP, FMCPh, FFPu(UK)
Chairman, National Health Research Ethics Committee of Nigeria (NHREC)**

Department of Health Planning, Research & Statistics
Federal Ministry of Health
11th Floor, Federal Secretariat Complex Phase III
Ahmadu Bello Way, Abuja

Tel: +234-09-523-8367
E-mail: chairman@nhrec.net, secretary@nhrec.net,
deskofficer@nhrec.net
URL: <http://www.nhrec.net>

Appendix 4.2 Ethical approval from University of Essex Ethics Committee.



University of Essex

17/07/2023

Mrs Olajumoke Aladenola

Health and Social Care, Health and Social Care

University of Essex

Dear Olajumoke,

Ethics Committee Decision

Application: ETH2223-1101

I am pleased to inform you that the research proposal entitled "UNDERSTANDING THE PREDICTORS OF VACCINE HESITANCY IN CAREGIVERS OF UNDER-FIVE CHILDREN AND IMPACT ON CHILDHOOD VACCINATION STATUS IN ONDO STATE NIGERIA" has been reviewed on behalf of the Ethics Sub Committee 2, and, based on the information provided, it has been awarded a favourable opinion.

The application was awarded a favourable opinion subject to the following **conditions**:

Extensions and Amendments:

If you propose to introduce an amendment to the research after approval or extend the duration of the study, an amendment should be submitted in ERAMS for further approval in advance of the expiry date listed in the ethics application form. Please note that it is not possible to make any amendments, including extending the duration of the study, once the expiry date has passed.

Covid-19:

Please note that the current Government guidelines in relation to Covid-19 must be adhered to and are subject to change and it is your responsibility to keep yourself informed and bear in mind the possibility of change when planning your research. You will be kept informed if there are any changes in the University guidelines.

Yours sincerely,

Aaron Wyllie

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Appendix 4.3: Permission letter to have access to Health Centres in Akure South LGA.

 **ONDO STATE GOVERNMENT**
OFFICE OF THE PERMANENT SECRETARY
ONDO STATE PRIMARY HEALTH
CARE DEVELOPMENT AGENCY, (OSPHCDA)



OSPHCDA/AD.70/57

9th November, 2023

Dr. (Mrs) Olajumoke Aladenola,
PHD Candidate,
University of Essex,
Colchester, United Kingdom.

RE: REQUEST FOR APPROVAL TO HAVE ACCESS TO PRIMARY HEALTH CENTRES IN AKURE SOUTH LGA FOR THE PURPOSE OF A PHD RESEACH.

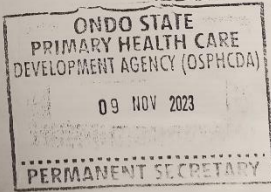
I wish to refer to your letter received on 17th October, 2023 on the above subject and convey the approval of the Agency to access some of the primary health care centres located in Akure South Local Government Areas for the purpose of seeking participants as respondents through a researcher administered questionnaire and a Focus Group Discussion (FGD) for your PHD research thesis.

2. You are to please ensure that the activities do not disrupt the regular functioning of the health centres. The agency wishes you well in your quest to contribute to improved primary health care in the state.

3. Thank you.



Dr. Francis Adegoke Akanbiemu. MBBS, MPH, FWACP, NPOM
(Consultant Community Physician)
Permanent Secretary





Agency Secretariat, Oke Eda, Akure, Ondo State. E-mail: osphcdb17@gmail.com, website: www.ondosphcdb.com

Appendix 4.4. Permission to use the image at Figure 4.2

https://en.wikipedia.org/wiki/GNU_Free_Documentation_License

Appendix 4.4B. Procedure for the determination of the sample size for a binary logistic regression with 7 predictors, a 25% event rate, and a 60/40 occurrence split, using the G*Power 3.1.

1. The G*Power software, a free software available online, was downloaded from the link <https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower>
2. The test family and statistical test were selected on the G*Power by setting the Test family to z tests and the statistical test to Logistic Regression.
3. The type of Power Analysis was set to A priori to compute the required sample size — given α (5% significance level-0.05), power (95%). The Odds ratio was fixed at 1.72 which represent a medium effect size.
4. The Effect Size and Probability Parameters were then inputted into the G*Power as follows:
 1. Tail(s): Select Two.
 2. Odds ratio: 1.72 was entered (representing a medium effect size).
 3. $\Pr(Y=1|X=1)$ H0: 0.25 was entered (this is the 25% base rate or event rate).
 4. α err prob: 0.05 was entered (this is 5% significance level).
 5. Power ($1-\beta$ err prob): 0.95 was entered (This is 95% power).
5. The Predictor distribution and Multi-predictor impact was defined based on the following assumptions:
 1. 0 was entered for the R^2 other X. In G*Power's logistic module, the impact of the 7 predictors is accounted for here and 0 is used based on the assumption that my main predictor is independent of the others.
 2. X distribution: Binomial was selected.

3. X parm π : 0.4 was entered representing the smaller portion of the 60/40 split of the predictors

6: Thereafter the calculate button was clicked.

Output

The Total Sample Size displayed in the output window was 431.

This calculation ensures that there are enough data to detect a medium effect for the primary predictor while maintaining a 5% significance level and 95% statistical power.

Appendix 4.5: Questionnaire for quantitative studies

SECTION A

SOCIO-DEMOGRAPHIC CHARACTERISTICS						
1	How old are you?	18-29	30-39	40-49	>50	
2	What is your gender?	Male		Female		
3	What is your marital status?	Single	Married	Widow/widower	Divorced	
4	What is your religion?	Christianity	Islam	Traditional religion	Others (please specify)	
5	What is your ethnic group?	Yoruba	Igbo	Hausa/Fulani	Others (please specify)	
6.	What is your educational level?	None	Primary	Secondary	Tertiary	
7	What is your current employment status?	Unemployed	Working part-time	Working full time	Others (Specify please)	
8	What is your current Job?					
9	What is your monthly income (Naira)?	< 20,000	20000-50000	50000 – 100000	Above 100000	
10	How many children do you have?	1	2	3	4 and above	
<i>The following questions is about the child you brought to the health facility</i>						
11	How old is your child?	0-12.0 months	12.1-24.0 months	24.1-36.0 months	36.1-48.0 months	48.1-60.0 months
12	What is the gender of your child?		Male		Female	
13	What is your relationship to the child	Mother	Father	Grandmother		

SECTION B

This section is made of two parts. Part 1 questions are aimed at acquiring information on your knowledge about the recommended vaccination and vaccine preventable diseases. Part 2 is concerned with your sources of vaccination information.

Circle the correct answers where options are provided and provide your answers where necessary please.

APPENDIX 4.5B

S/N	KNOWLEDGE QUESTIONS	RESPONSE			
1	At what age is it appropriate for a child to start immunization?				
2	How many sessions are needed to complete vaccination?				
3	At what age does a child complete his/her vaccination?				
4	Mention vaccine preventable disease that you know				
5	Why do you vaccinate your child?				
6	Is there an Alternative mechanism to prevent infants from vaccine preventable disease?	Yes	No	I dont know	
7	Are Vaccines Harmful?	Yes	No	I dont know	
8	Is it necessary to vaccinate a breastfeeding infant?	Yes	No	I dont know	
9	Can a child with fever be vaccinated?	Yes	No	I dont know	
	Part 2				
	How do you get Information about vaccination?	Friends/family			
		Radio/TV			
		Social media			
		church/mosque			
		Health worker			
		Health facilities			

		Other mothers
		Others(specify)

APPENDIX 4.5C TEN LIKERT SCALE VACCINE

HESITANCY SURVEY QUESTIONS.

Please tick the right option.

PARENTAL RESPONSE						
Vaccine Hesitancy Scale		strongly agree	agree	neither agree nor disagree	disagree	strongly disagree
L1. Childhood vaccines are important for my child's health						
L2. Childhood vaccines are effective						
L3. Having my child vaccinated is important for the health of others in my community						
L4. All childhood vaccines offered by the government programme in my community are beneficial						
L5. New vaccines carry more risks than older vaccines						
L6. The information I receive about vaccines from the vaccine program is reliable and trustworthy						
L7. Getting vaccines is a good way to protect my child/children from disease						
L8. Generally, I do what my doctor or health care provider recommends about vaccines for my child/children						
L9. I am concerned about serious adverse effects of vaccines						
L10. My child/children does or do not need vaccines for diseases that are not common anymore						

APPENDIX 4.5.D. DICHOTOMOUS SCALE VACCINE HESITANCY SURVEY

QUESTIONS.

Vaccine Hesitancy Scale	PARENTAL RESPONSE	
	YES	NO
Q1. Do you believe that vaccines can protect children from serious diseases		
Q2. Do you think that most parents like you have their children vaccinated with all the recommended vaccines?		
Q3. Have you ever been reluctant or hesitated to get a vaccination for your children?		
Q4. Have you ever refused a vaccination for your children?		
Q5. Has distance, timing of clinic, time needed to get to clinic or wait at clinic, and/or costs in getting to clinic prevented you from getting your children immunized?		
Q6. Are there other pressures in your life that prevent you from getting your children immunized on time?		
Q7. Are there any reasons you can think of why children should not be vaccinated?		
Q8. Do you think that it is difficult for some ethnic or religious groups in your community/region to get vaccinations for their children?		
Q9. Have you ever received or heard negative information about vaccinations?		
Q10. Do leaders (religious or political leaders, teachers, health care workers) in your community support vaccinations for infants and children?		

APPENDIX 4.5E Parental attitude to childhood vaccination survey (PACV)

S/N	PACV QUESTIONS	PARENTAL RESPONSE		
1	Have you ever delayed having your child get immunization for reasons other than illness or allergy?	Yes	No	Don't know
2	Have you ever decided not to have your child get immunization for reasons other than illness or allergy?	Yes	No	Don't know
3	How sure are you that following the recommended shot schedule is a good idea for your child? 0 (Not at all sure) to 10 (Completely sure)	Completely sure		
		Not sure		
		Not at all sure		
4	If you have another infant today, would you want him/her to get all the recommended shots?	Yes	No	Don't Know
5	Overall, how hesitant about childhood shots would you consider yourself to be?	Not at all hesitant		
		Not too hesitant		
		Not sure		
		Somewhat hesitant		
		Very hesitant.		
6	Children get more immunization than are good for them.	Strongly Agree		
		Agree		
		Not Sure		
		Disagree		
		Strongly disagree		
7	I believe that many of the illnesses shots prevent are severe.	Strongly Agree		
		Agree		
		Not Sure		
		Disagree		
		Strongly disagree		
8	It is better for my child to develop immunity by getting sick than to get a shot.	Strongly Agree		
		Agree		
		Not Sure		
		Disagree		
		Strongly disagree		
9	It is better for children to get fewer vaccines at the same time.	Yes	No	Don't know
10	How concerned are you that your child might have a serious side effect from a shot?	Not at all concerned		
		Not too concerned		
		Not sure		
		Somewhat concerned		
		Very concerned		
11	How concerned are you that any one of the childhood shots might not be safe?	Not at all concerned		
		Not too concerned		
		Not sure		
		Somewhat concerned		
		Very concerned		
12	How concerned are you that a shot might not prevent the disease?	Not at all concerned		
		Not too concerned		
		Not sure		

		Somewhat concerned
		Very concerned
13	I trust the information I receive about shot.	Strongly Agree
		Agree
		Not Sure
		Disagree
		Strongly disagree
14	I am able to openly discuss my concerns about shots with my child's doctor.	Strongly Agree
		Agree
		Not Sure
		Disagree
15	Overall, how much do you trust your child's immunization provider	Strongly disagree
		Complete Trust
		Not sure
		Complete distrust

Appendix 4.6: Protocol for the training of Research Assistants

Research Topic: Understanding the predictors of vaccine hesitancy in caregivers of under five children and impact on vaccination status in Ondo State Nigeria.

Research Team.

1. Principal Investigator: Olajumoke Aladenola
2. Supervisor: Professor Camille Cronin
3. Co-Supervisor: Professor Maria Chiara Dicesare

Agenda

Welcome remarks by Principal Investigator

Self-Introduction by proposed Research Assistant

Overview by Principal Investigator

Module A: Research overview, respondents' recruitment and confidentiality

The RAs will be taken informed about the purpose of the research and the objectives. The recruitment criteria for respondents will be outlined, and the imperative of confidentiality will be stressed. This module consists of:

What RA has to know about the research objectives, procedures and respondents?

What RA has to know about the study design, sampling frame and key study parameters?

What RA has to know about respondent identification and selection procedure

What RA has to know about engaging respondents?

What RA has to know about respondent's consent

What RA has to know about confidentiality, data protection and security

What RA has to know about the study centres

Module B: Processes for data collection

Familiarisation with key research terms/words

Overview of questionnaire

Sample administration of questionnaire

Entering of data into a spread sheet

Questions and answers section

Closing remark

Training Guidelines

Training will be conducted in English Language.

Participants are expected to be punctual and pay full attention throughout the training session.

Participants are expected to seek for clarity on any issue if in doubt.

Training Objective

At the end of the training programme, proposed Research Assistants must be able to:

1. Understand the basis for the research programme
2. Understand the key terms of the research
3. Independently administer questionnaires to respondents
4. Comply with consent requirements when selecting participants
5. Be conversant with inclusion and exclusion criteria for respondent selection
6. Be able to enter data collected into a spreadsheet

1.0. Introduction:

1.1. Why is the study being carried out?

This study is being undertaken towards the award of a Doctor of Philosophy degree in Public Health. The study is about exploring the predictors or determinants of childhood vaccine hesitancy and vaccine refusal in the caregivers of under five children and the impact of this behaviour on childhood immunization status and coverage in Akure South Local Government Area, Ondo State, Nigeria.

1.2. What is the study about?

The purpose of the study is to assess the relationship between socio demographic /economic status, knowledge of vaccination and vaccine preventable diseases', attitude/ perceptions, and practices of caregivers of under five children with vaccine hesitancy and refusal in this local government area and to ascertain the predictors of vaccine hesitancy and vaccine refusal and the impact on childhood vaccination status.

1.3. Overview of The Research Project

I. Proposal – A proposal which include a literature review, methodology, a timeline, and a justification for the research was submitted to the Nigeria ethical board and the University of Essex ethical committee for approval to carry out the study.

II. Funding – This research is self-funded by the principal investigator

III. Ethics –An ethical clearance to conduct the research has been received from the Nigeria ethical board and the University of Essex ethical board.

IV. General information to note by the Research Assistants

First point of contact. The first point of contact on the team will be the principal investigator.

Transport Logistics: Arrangement for commuting to briefing locations and project site (health facilities) by the entire team will be provided by the Principal Investigator. This will be in form of provision of transport allowance to team members. Funds will be made available for transportation to the health centres and buying light refreshments.

RA feedback. issues identified during data quality checks should be conveyed to the principal investigator.

Clarification of issues. The principal investigator should be contacted if there is need for clarity on a question. This can be done through phone calls or text messages. This can also be discussed during the alternate days meeting.

Attitude: The attitude of RAs during the survey is very important. You must express a very cheerful disposition towards the respondents.

Teamwork: All RAs must be willing to work as a team. RAs must be willing to help their teammates with any issues they might face.

Communication: Good communication skill is an important quality for RAs. You should be able to convey issues and clarify any doubts raised by the respondents.

Scientific Approach: The most important quality of a good survey team is a commitment to the scientific method. A scientific method is the standard approach for surveys to produce concrete and valuable results that can be easily defended during peer-reviews. RAs should know that the scientific approach means that they are not to introduce personal bias or opinions to the data collection but rather be committed to identifying and capturing the actual situation on ground.

Confidentiality and Anonymity: There must be a commitment to anonymizing all interviews and safeguarding respondents' confidentiality. All interactions with respondents must be met with the strictest criteria for confidentiality. This entails:

Not disclosing any opinions, claims, and other features that can be associated with individuals.

Using confidential information only for the purposes set out in the training, and not for any other purpose.

Not copying or retaining any written information or record that could be associated with identifying features of individuals, or any other kind of identifying information.

Returning all confidential information (including notes, memos, photographs) to the survey team at the conclusion of the surveys, or when demanded by the survey team.

Data Security (Protocols for data security): RAs are to ensure that no data is lost, and that no personally identifiable information is made public. Data sharing and transfer by RAs must be according to specified guidelines. Each RA must sign a confidentiality agreement to ensure that personal details of respondents do not get used for any other purposes.

Key roles and duties

To introduce the survey objectives correctly and concisely to the respondent. They must also be able to read out the inform consent form.

Sometimes a respondent may have trouble understanding a question, or their answer might not be satisfactory. In such situations, the RA should be able to clarify as and when required. They must also be able to probe the respondent in a polite manner, and at the right time.

V. Feedback: A brief assessment of research assistants was carried out to determine their understanding of the assignment.

VI. Conclusion: The RAs were taken through the consent form, the Participant Information sheet and the survey tools (questionnaires). They were informed on how to relate with the team leader and co research assistants, interview procedures, obtaining informed consent, team structure and relating with the respondents. They were also taught how to complete the survey, the significance of each code and how to record responses.

Appendix 4.7. Focus Group Schedule

Title of study: Understanding the predictors of vaccine hesitancy in care givers of under five children and impact on childhood vaccination status in Ondo state Nigeria.

Researcher introduces herself to the participant formally and mentions her role in the research. She will also state it clearly to the participant that there is no right or wrong answer. Confidentiality and anonymity will be reiterated.

1.Explain research and cover the key points on the information sheet and reiterate the aims of the research.

The study is about exploring the predictors of childhood vaccine hesitancy in caregivers of under-five children and the impact this behaviour has on childhood immunization status and coverage. The study aims to assess the relationship between socio demographic /economic status, knowledge of vaccination and vaccine preventable diseases, attitude/ perceptions and practices of caregivers of under-five with vaccine hesitancy.

2.Participants introduction

Do you have any question before we begin?

3.About the participant

Participants will introduce themselves for the purpose of audio recording. No name is required but will be identified as participant 1,2,3 etc. with each participant mentioning his/her age, gender, number of children under their care, age of the youngest child and the immunization status of the child (fully vaccinated, partially vaccinated or unvaccinated).

4.Prompt questions on participants' opinions, beliefs and perspectives about childhood vaccination

Question 1: what are the 3 major reasons why you should immunize your child? (Please list them below in the order of priority).

Question 2: What are the reasons that will make you to hesitate or refuse to immunize your child

Question 3: Do you have any worries or concerns when you take your child for immunization?

Yes/No

If yes, what are they? (Please list them below in the order of priority).

Question 4: (ask this question only for Parent/Guardians who are known to have accepted immunization).

In your family, what was the reason behind your decision to vaccinate your child last week/month/year? (Please list them below in the order of priority).

Question 5: (ask this question only for Parent/Guardians who are known to have refused immunization)

In your family, what was the reason behind your decision NOT to vaccinate your child last week/month/year? (Please list them below in the order of priority).

Question 6: In your opinion, why do some persons refuse to vaccinate their children?

5. Other topics and clarifications

Is there anything else you would like to add to what you have said?

Is there anything that you think we could have covered, or you would like to talk about?

If you are happy to be contacted in the future for any similar research like this, please provide your contact details below (telephone/email)

Thank you for your participation.

Appendix 4.8: Spreadsheet for questionnaire administration

SN	Name of Ward	Name of Facility	Date of Data Collection	Research Team	No of Participants Recruited	No of Questionnaires Administered	Status on Excel
1	GBOGI/ISINKAN2	BHC AWULE	28TH NOV	Damilola, Halimat	8	8	Entered
	„	BHC IYANGE	30TH NOV	Damilola, Halimat	8	8	Entered
2	ODOPETU	BHC ODOPETU	28TH NOV	Beauty	5	5	„
3	ODA WARD	BHC ODA	28TH NOV	Bunmi, Pelumi, Aladenola	11	11	„
		BHC ILEKUN	30TH NOV	„	10	10	„
			5TH DEC	„	10	10	„
4	OKE ARO	BHC OKE ARO	5TH DEC	Theresa, Esther	5	5	„
		BHC GAGA	7TH DEC	„	7	7	„
5	OSHODI/ISOLO	BHC SHAGARI	12TH DEC	Bunmi, Pelumi, Halimat, Aladenola	15	15	„
		BHC ISOLO	14TH DEC	„	20	20	„
		„	19TH DEC	„	20	20	„
		„	21ST DEC	„	9	9	„
6	OWODE IMUAGUN	PHC ADEGBOLA	2ND JAN	Bunmi, Pelumi, Beauty, Aladenola	32	30	„
		„	4TH JAN	„	25	25	„
		„	30TH JAN	„	15	15	
		BHC ORITA OBELE	9TH JAN	„	35	35	„
		„	11TH JAN	„	30	30	„
		„	16TH JAN	„	25	25	„
7	GBOGI/ISINKAN 1	CHC ISIKAN	2ND JAN	Halimat, Dammy, Theresa, Esther, Tunrayo	15	10	„
		„	4TH JAN	„	13	10	„
		PHC DANJUMA	9TH JAN	„	20	20	„
		„	11TH JAN	„	20	20	„
		„	16TH JAN	„	15	13	„
8	IROWO	PHC ABUSORO	30TH JAN	Theresa, Esther	7	7	„
		PHC ILORO	1ST FEB	Theresa, Esther	7	7	„
9	ILISA	BHC ESURE	6TH FEB	Theresa, Esther, Aladenola	12	10	„
10	IJOMU OBANLA	CHC OKEIJEJU	8TH FEB	„	12	12	„
		„	13TH FEB	„	10	10	„
		„	15TH FEB	„	10	10	„
11	APONMU	AJEGUNLE	20TH FEB	Bunmi, Aladenola	11	11	„
		APONMU PHC	27th FEB	Bunmi, Aladenola	14	14	'
		IWOYE BHC	5TH MARCH	Bunmi, Aladenola	8	8	'

Appendix 5.1: Categorisation/dichotomisation of variables

CATEGORISATION		FREQUENCY
Age Category	Below 30	162
	Above 30	288
Gender of Respondent	Male	31
	Female	419
Marital Status	Married	418
	others	32
Ethnicity	Yoruba	386
	Other tribes	64
Religious affiliation	Christianity	397
	Others	53
Educational Status	Tertiary	244
	others	206
Employment Status	Working part-time/Working full-time	285
	others	165
Income Status	Low income(0 to 50,000)	372
	High income (Above 50,000)	78
Gender of index child	Male	238
	Female	212
Number of Children	2 and below	293
	above 2	157
Index Child Age Category	0 to 24 months	282
	Above 24 months	168
Relationship with child category	Mother	415
	Father or Grandma	35

Appendix 5.2: Initial codes for FGD one

FGD 1 CODING	FILES	REFERENCES
Reasons for vaccination	1	22
essential for travelling abroad	1	1
prevent effect of ingestion of dirty things	1	1
protect against polio	1	2
reduce side effect of sickness	1	1
to fight against measles	1	1
to make child active	1	1
to make him strong	1	2
to make my child healthy	1	4
to prevent diarrhoea	1	2
to prevent hepatitis a	1	2
to prevent severity of illness	1	1
to prevent sickness	1	3
Reasons for vaccine hesitancy	1	34
child crying excessively	1	1
child had diarrhoea	1	1
child had fever	1	2
child had headache	1	1
child had many discomforts	1	1
child inability to sleep	1	2
fear of hospital visit	1	1
fear of injection	1	1
fear of nurses' white dress	1	1
fear of side effects of vaccine	1	1
fear for the way nurses give injection	1	1
mother could not sleep due to child's discomfort	1	4
mothers' hatred for injection	1	1
my child gets irritable	1	1
negative information about immunisation	1	1
new vaccines causing more side effects	1	1
no reason for hesitating	1	3
nurses don't show empathy	1	1
swollen injection site	1	5
seeing cases of leg paralysis	1	1
the injections are too many	1	1
the way the nurses talk to us	1	1
wasting of time in the clinic	1	1
workers in the clinic are too slow	1	1
Reasons other people gave for hesitating vaccination	1	5
can worsen child's spiritual problem	1	1
child death after immunisation	1	1
child having fever	1	1
diseases vaccine present not serious	1	1
wasting of time in the clinic	1	1
Sources of discouragement for immunisation uptake	1	2
information from others about side effect of immunisation	1	1
people living close to my shop	1	1
Sources of encouragement for immunisation uptake	1	11
I encourage myself	1	1
my husband encourages me	1	3
my mother-in-law encourages me	1	2
my mum usually encourages me	1	2
my own parents do encourage me	1	1
my sisters always encourage me	1	1
the health workers in the clinic	1	1

Appendix 5.3: Initial codes for FGD two

FGD 2 CODING	Files	References
REASONS FOR VACCINATION	1	19
It prevents sicknesses	1	5
Makes my child brain develop	1	1
Prevent frequent hospital visit	1	3
prevent severity of illness	1	1
Reduction in incidence of diarrhoea and other disease	1	1
To boost the immune system of my child	1	2
To fight diseases	1	1
To make my child healthy	1	1
To make them grow well	1	2
REASONS FOR VACCINE HESITANCY	1	19
Cases of Leg paralysis	1	1
Child crying all the time	1	2
Child refused to suck	1	1
Child was irritable	1	4
child was not active	1	1
Child was running fever	1	6
Fear of leg paralysis caused by injection	1	2
No reason for hesitation	1	1
Swollen injection site	1	1
REASONS GIVEN BY OTHER PEOPLE FOR HESITATING VACCINATION	1	8
Because of culture	1	1
Belief that herbal concoction will work than vaccines.	1	1
Belief that natural immunity is enough	1	2
Child does not have any issue	1	1
Dislike for vaccination	1	1
Some people are less informed	1	1
Thinking of adverse effect of vaccines.	1	1
SOURCES OF DISCOURAGEMENT FOR IMMUNIZATION UPTAKE.	1	4
A woman that stays close to my shop	1	1
Deformities seen in children on social media	1	1
I saw a child whose leg was affected by injection	1	2
SOURCES OF ENCOURAGEMENT FOR IMMUNIZATION UPTAKE.	1	14
I don't allow anyone to discourage me, I pray to God	1	1
I usually encourage myself	1	1
I was immunized by my parents	1	1
My grandmother encouraged me	1	1
My husband and I are learned	1	1
My husband encourages me	1	3
My mother	1	3
Songs on immunization from health workers	1	1
The person that encourages me is my mother-in-law	1	2

Appendix 5.4: Initial codes for FGD three

FOCUS GROUP 3 CODING	Files	References
Reasons for vaccination	1	16
for my mind to be at peace	1	1
I don't know much about immunisation	1	1
I have not immunised my child before	1	1
It protects from whooping cough	1	1
To be confident	1	1
To build up my child immunity	1	2
To curb diseases in the air	1	1
To fight diseases	1	2
To prevent Polio	1	1
To make my child healthy	1	1
To prevent diarrhoea	1	1
To protect from infection	1	4
Reasons for vaccine hesitancy	1	20
Fear that the Nurses hand can be painful	1	1
I am always afraid of how he reacts to injections	1	1
I travelled to my hometown after delivery	1	1
If my child is having fever	1	3
If my child is not feeling well	1	1
My baby will be in pain	1	1
My child cried excessively	1	1
My child gets irritable	1	2
My child refused to sucking breast	0	0
My child usually runs fever	1	3
My child was irritable.	1	1
Previous experience of swollen injection site	1	2
The fear that something can happen to my child	1	1
When my child has cough and catarrh	1	2
Reasons for vaccine hesitancy given by others	1	12
Being lazy	1	1
Belief in use of holy water	1	1
Belief that it is God that protects children	1	2
Child crying excessively	1	1
Child is not sick, so no need for immunisation	1	1
Child will be running temperature	1	1
Child will not be able to sleep	1	1
Fear of leg paralysis because of injection	1	1
Injection site will be swollen	1	1
Previous experience of leg paralysis	1	1
The wrong information they get from outside	0	0
Use of herbal concoction	1	1
Sources of discouragement for immunisation uptake	1	2
People living in my household	1	1
Things that happen in the olden days	1	1
Sources of encouragement for immunisation uptake.	1	1
My mother encouraged me.	1	1

Appendix 5.5. Code book for the 3 FGDs transcripts

Name	Description	Files	References
WHAT ARE THE REASONS FOR ACCEPTING VACCINATION FOR YOUR CHILDREN	THIS IS THE FIRST RESEARCH QUESTION.	3	80
Non-vaccine related promoters of vaccine uptake	Theme One under the first research question (What are the reasons for accepting vaccines for your children)	3	26
Education	Subtheme 1 under the theme non-vaccine related promoters of vaccine uptake	1	1
My husband and I are learned	The participant said that the fact that both her and her husband are learned has made them to realize the need for vaccination.	1	1
Effect of People	Subtheme 2 under the theme non-vaccine related promoters of vaccine uptake	3	23
I encourage myself		2	3
I was immunised by my parents	The participant cited that the fact that she was immunized by her parents who had no regret for immunizing her has also encouraged her to immunize her own child.	1	1
My grandmother encouraged me		1	1
My husband encourages me		2	6
My mother encouraged me.		3	6
My mother-in-law encourages me		2	4
My own parents do encourage me		1	1
My sisters always encourage me		1	1
Institutional enablers for vaccine acceptance	Subtheme under the theme non-vaccine related promoter of vaccine uptake	2	2
Songs on immunisation from health workers	The participant said that songs rendered by health workers on house-to-house immunization services when she was young has encouraged her on immunizing her child,	1	1
The health workers in the clinic		1	1
Perceived efficacy of vaccine in disease prevention and general wellbeing		3	53
General wellbeing	Subtheme under the theme Perceived efficacy of vaccine in disease prevention and general wellbeing	3	24
for my mind to be at peace		1	1
immunisation reasons	Mothers cited the various reasons why they immunize their children and why they immunization is good for their children.	1	2
Makes my child brain develop		1	1
prevent effect of ingestion of dirty things	The mother said that immunization will help to prevent the effect that will arise	1	1

Name	Description	Files	References
	even if i child eat anything that is picked from the ground		
Prevent frequent hospital visit	Mother said there is reduction in hospital visit as a result of child falling sick.	1	3
To be confident		1	1
To boost the immune system of my child	The mother said she takes immunization for her child to boost the child's immune system	2	4
to make child active	The care caregiver said that immunization will make her child active	1	1
to make him strong		1	2
to make my child healthy		3	6
To make them grow well	To make children grow very well	1	2
Perceived benefits of vaccination	Subtheme under the theme Perceived efficacy of vaccine in disease prevention and general wellbeing	3	26
It prevents sicknesses		2	8
It protects from whooping cough		1	1
protect against polio	polio is one of vaccine preventable disease	2	3
Reduction in incidence of diarrhea and other disease		1	1
To curb diseases in the air		1	1
to fight against measles		1	1
to fight diseases (2)		2	2
to prevent diarrhea		2	3
To prevent hepatitis a		1	2
To protect from infection		1	4
Sickness severity reduction	Subtheme under the theme Perceived efficacy of vaccine in disease prevention and general wellbeing	2	3
reduce side effect of sickness		1	1
to prevent severity of illness		2	2
WHAT ARE THE REASONS FOR VACCINE HESITANCY GIVEN BY PARTICIPANTS	THIS IS THE SECOND RESEARCH QUESTION	3	102
Attitude and Knowledge on vaccination		3	16
Attitude		3	8
Being lazy		1	1
Dislike for vaccination		1	1
I have not immunised my child before		1	1
No reason for hesitating	This caregiver says she has no reason to hesitate	2	4
The injections are too many		1	1
Lack of proper knowledge of vaccination	Subtheme under the theme Attitude and knowledge of vaccination	3	8
Child does not have any issue		1	1
Child is not sick, so no need for immunisation		1	1

Name	Description	Files	References
Diseases that vaccines prevent are not serious	The caregiver believes that the vaccine preventable diseases are not such a severe disease that warrants subjecting a child to injection pains.	1	1
I don't know much about immunisation		1	1
Information from others about side effects of immunization		1	1
Negative information about immunization		1	1
New vaccines causing more side effects	The mothers feel that her child reaction to the vaccine is due to the facts that newer vaccines different from the old ones were introduced. She said the older siblings that took the old ones did not react in such ways	1	1
Some people are less informed		1	1
The wrong information they get from outside		0	0
Cultural beliefs, Traditional Practices & Spirituality	Theme under the second research question	3	10
Cultural beliefs and dependence on natural immunity	Subtheme under the theme Cultural beliefs, traditional practices and spirituality	1	3
Because of culture		1	1
Belief that natural immunity is enough	The mother said that some people belief that natural immunity is enough for their child to fight disease.	1	2
Traditional practices and Spirituality	Subtheme under the theme Cultural beliefs, traditional practices and spirituality	3	7
Belief in use of holy water		1	1
Belief that herbal concoction will work than vaccines.		2	2
Belief that it is God that protects children	This caregiver believes that since it is God that protects, there is no need for immunization.	1	2
Can worsen child spiritual problems		1	1
I travelled to my hometown after delivery	The mother said she travelled to her hometown after having her baby and so could not immunize her child.	1	1
Perceived risk and adverse effect of vaccines	Theme under the second research question	3	63
Sickness, Irritation and discomfort	Subtheme under the theme Perceived risk and adverse reaction of vaccines	3	45
Child crying all the time		3	5
Child had diarrhea		1	1
Child had fever	Mother said the child had fever throughout the night	3	16
Child had headache		1	1

Name	Description	Files	References
Child had many discomfort		1	1
Child inability to sleep	mother said child was not able to sleep for 3 days due to the effect of the vaccination.	2	3
Child was irritable		3	8
child was not active		1	1
If my child is not feeling well		1	1
Mother will not be able to sleep due to child's discomfort		1	4
My baby will be in pain		1	1
My child refused to suck breast		1	1
When my child has cough and catarrh		1	2
Swollen limbs, Paralysis and Death	Subtheme under the theme Perceived risk and adverse reaction of vaccines	3	18
Cases of Leg paralysis	The mother said she saw a child whose leg was paralysed as a result of injection, and this made her to hesitate taking immunization for her child.	2	4
Child death after immunization		1	1
Deformities seen in children on social media		1	1
Fear of leg paralysis because of injection		1	2
I saw a child whose leg was affected by injection		1	2
Past experience of swollen injection site		3	8
Phobia	Theme under the second research question	3	10
Fear of hospital visits	Subtheme under phobia	1	2
Fear of hospital visit	Mother said she is always scared of visiting the hospital	1	1
Fear of Nurses white dress		1	1
Fear of vaccine Administration	Subtheme under Phobia	3	8
Fear of injection	mother said she gets discouraged because of her personal phobia for injections.	1	1
Fear of side effect of vaccines	Mother said she develops fear for the side effect they are about experiencing again probably due to the fact that this has been experienced before.	1	1
Fear of the way Nurses give injection	The caregiver here refers to the way the nurses handle the injections when they are giving the vaccine.	1	1
Fear that the Nurses hand can be painful		1	1
I am always afraid of how he reacts to injections		1	1
Mothers' hatred for injection	Mother said she doesn't like to take injection	1	1

Name	Description	Files	References
The fear that something can happen to my child		1	1
Thinking of adverse effect of vaccines.		1	1
Social Network and Interaction with Health workers	Theme under the research question "What are the reason why participants exhibit vaccine hesitancy (SECOND RESEARCH QUESTION)	3	3
Effect of health workers	Subtheme under the theme Social Network and interaction with health workers	0	0
Nurses do not show empathy		1	1
The way the Nurses talk to us	This participant said that the nurses in the clinic don't talk or address them in a good manner.	1	1
Wasting of time in the clinic		1	2
Workers in the clinic are too slow		1	1
Social Network (Influence of people)	Subtheme under the theme social network and interaction with health workers	3	3
A woman that stays close to my shop		1	1
People living close to my shop		1	1
People living in my household		1	1
Name	Description	Files	References
A woman that stays close to my shop		1	1
Because of culture		1	1
Belief that herbal concoction will work than vaccines.		1	1
Belief that natural immunity is enough	The mother said that some people belief that natural immunity is enough for their child to fight disease.	1	2
Cases of Leg paralysis	The mother said she saw a child whose leg was paralysed as a result of injection, and this made her to hesitate taking immunization for her child.	1	1
Child crying all the time		1	2
child crying excessively	Mother said that the child was crying excessively in the night to the extent that the neighbours were awake,	1	1
Child does not have any issue		1	1
child had diarrhea		1	1
child had fever	Mother said the child had fever throughout the night	1	2
child had headache		1	1
child had many discomforts		1	1
child inability to sleep	mother said child was not able to sleep for 3 days due to the effect of the vaccination.	1	2
Child refused to suck		1	1

Name	Description	Files	References
Child was irritable		1	4
child was not active		1	1
Child was running fever		1	6
Deformities seen in children on social media		1	1
Dislike for vaccination		1	1
essential for travelling abroad		1	1
fear of hospital visit	Mother said she is always scared of visiting the hospital	1	1
fear of injection	mother said she gets discouraged because of her personal phobia for injections.	1	1
fear of nurses' white dress		1	1
fear of side effects of vaccine	Mother said she develops fear for the side effect they are about experiencing again probably due to the fact that this has been experienced before.	1	1
fear for the way nurses give injection	The caregiver here refers to the way the nurses handle the injections when they are giving the vaccine.	1	1
Fear of leg paralysis caused by injection	Mother is afraid that the injection may lead to paralysis of the leg	1	2
Fear that the Nurses hand can be painful		1	1
for my mind to be at peace		1	1
I am always afraid of how he reacts to injections		1	1
I don't allow anyone to discourage me, I pray to God		1	1
I don't know much about immunization		1	1
I encourage myself		1	1
I have not immunized my child before		1	1
I saw a child whose leg was affected by injection		1	2
I travelled to my hometown after delivery	The mother said she travelled to her hometown after having her baby and so could not immunize her child.	1	1
I usually encourage myself		1	1
I was immunized by my parents	The participant cited that the fact that she was immunized by her parents who had no regret for immunizing her has also encouraged her to immunize her own child.	1	1
If my child is having fever		1	3
If my child is not feeling well		1	1
information from others about side effect of immunization		1	1
it prevents sicknesses		1	5
it protects from whooping cough		1	1

Name	Description	Files	References
makes my child brain develop		1	1
mother could not sleep due to child's discomfort		1	4
mothers' hatred for injection	Mother said she doesn't like to take injection	1	1
My baby will be in pain		1	1
My child cried excessively		1	1
my child gets irritable		2	3
My child refused to sucking breast		0	0
My child usually runs fever		1	3
My child was irritable.		1	1
My grandmother encouraged me		1	1
My husband and I are learned	The participant said that the fact that both her and her husband are learned has made them to realize the need for vaccination.	1	1
My husband encourages me		2	6
My mother	She said her mother immunized them when they are young, so she is a source of encouragement to her to take immunization for her own child.	1	3
My mother encouraged me.		1	1
My mother-in-law encourages me		1	2
My mum usually encourages me		1	2
My own parents do encourage me		1	1
My sisters always encourage me		1	1
negative information about immunization		1	1
new vaccines causing more side effects	The mothers feel that her child reaction to the vaccine is due to the facts that newer vaccines different from the old ones were introduced. She said the older siblings that took the old ones did not react in such ways	1	1
no reason for hesitating	This caregiver says she has no reason to hesitate	1	3
no reason for hesitation		1	1
nurses don't show empathy		1	1
past experience of swollen injection site		1	2
people living close to my shop		1	1
People living in my household		1	1
prevent effect of ingestion of dirty things	The mother said that immunization will help to prevent the effect that will arise even if i child eat anything that is picked from the ground	1	1
Prevent frequent hospital visit	Mother said there is reduction in hospital visit as a result of child falling sick.	1	3
prevent severity of illness	immunization prevents the child disease from being severe	1	1

Name	Description	Files	References
protect against polio	polio is one of vaccine preventable disease	1	2
reduce side effect of sickness		1	1
Reduction in incidence of diarrhea and other disease		1	1
Some people are less informed		1	1
Songs on immunization from health workers	The participant said that songs rendered by health workers on house-to-house immunization services when she was young has encouraged her on immunizing her child,	1	1
swollen injection site	The mother side the child's leg got swollen and had pus to the extent that they have to incise to bring out the pus	2	6
seeing cases of leg paralysis	Mother talked about children seen with leg paralysis as a result of injections	1	1
The fear that something can happen to my child		1	1
The health workers in the clinic		1	1
the injections are too many		1	1
The person that encourages me is my mother-in-law		1	2
THE WAY THE NURSES TALK TO US	This participant said that the nurses in the clinic don't talk or address them in a good manner.	1	1
Things that happen in the olden days	Here the respondent was saying that the things people witness in the olden days when children were not immunized but were still able to survive as a result of the lifestyle they adopted in the olden days such as good eating habit and breastfeeding their children for longer time when compared to the happenings of this present time may serve as a way of discouragement towards immunization uptake.	1	1
Thinking of adverse effect of vaccines.		1	1
To be confident		1	1
To boost the immune system of my child	The mother said she takes immunization for her child to boost the child's immune system	1	2
To build up my child immunity		1	2
To curb diseases in the air		1	1
to fight against measles		1	1
To fight diseases	To fight diseases	1	1
To fight diseases (2)		1	2
To prevent Polio		1	1
to make child active	The care caregiver said that immunization will make her child active	1	1
to make him strong		1	2

Name	Description	Files	References
to make my child healthy		1	4
To make my child healthy (2)		1	1
To make my child healthy (3)		1	1
To make them grow well	To make children grow very well	1	2
to prevent diarrhoea		1	2
to prevent diarrhoea (2)		1	1
to prevent hepatitis a		1	2
to prevent severity of illness		1	1
to prevent sickness		1	3
to protect from infection		1	4
wasting of time in the clinic		1	1
When my child has cough and catarrh		1	2
workers in the clinic are too slow		1	1

Appendix 5.6. Frequency distribution of the words in the word cloud.

Word	Length	Count	Weighted Percentage (%)	Similar Words
immunizing	10	314	4.71	immune, immunity, immunization, immunizations, immunize, immunized, immunizing
child	5	264	3.96	child
participant	11	143	2.15	participant, participants, participate, participation
children	8	110	1.65	children
taking	6	104	1.56	take, takes, taking
vaccine	7	89	1.34	vaccinate, vaccinated, vaccinating, vaccination, vaccine, vaccines
give	4	87	1.31	give, giving
one	3	87	1.31	one, ones
want	4	86	1.29	want, wants
people	6	71	1.07	people
thank	5	66	0.99	thank
erm	3	65	0.98	erm
like	4	64	0.96	like, likely
know	4	56	0.84	know, knows
moderator	9	56	0.84	moderator
reason	6	56	0.84	reason, reasons
injections	10	54	0.81	inject, injected, injection, injections
just	4	53	0.80	just
thing	5	53	0.80	thing, things
time	4	49	0.74	time, times
even	4	43	0.65	even, evening
now	3	40	0.60	now
much	4	39	0.59	much
coming	6	38	0.57	@come, come, comes, coming
encourage	9	38	0.57	encourage, encouraged, encouragement, encourages, encouraging
may	3	37	0.56	may
told	4	36	0.54	told
make	4	35	0.53	make, makes, making
mother	6	35	0.53	mother, mothers
think	5	35	0.53	think, thinking, thinks
get	3	33	0.50	get, gets, getting
good	4	33	0.50	good
hesitate	8	33	0.50	hesitancy, hesitant, hesitate, hesitated, hesitating, hesitation

person	6	32	0.48	person, personal, personally
usually	7	32	0.48	usually
way	3	32	0.48	way, ways
day	3	31	0.47	day, days
gave	4	30	0.45	gave
sick	4	30	0.45	sick, sickness, sicknesses
also	4	29	0.44	also
legs	4	29	0.44	leg, legs
diseases	8	28	0.42	disease, diseases
health	6	28	0.42	health
anything	8	27	0.41	anything
discouraged	11	27	0.41	discourage, discouraged, discouragement, discourages, discouraging
fever	5	27	0.41	fever
first	5	27	0.41	first
took	4	27	0.41	took
discussion	10	26	0.39	discussing, discussion
prevent	7	26	0.39	prevent, prevented, preventing, prevention, prevents
start	5	26	0.39	start, started, starting, starts
well	4	26	0.39	well
happen	6	25	0.38	happen, happened, happening, happens
ask	3	24	0.36	ask, asked, asking
baby	4	24	0.36	babies, baby
questions	9	24	0.36	question, questions
running	7	23	0.35	run, running
see	3	23	0.35	see
always	6	22	0.33	always
bring	5	22	0.33	bring, bringing
still	5	22	0.33	still
believe	7	21	0.32	believe, believed, believes
feel	4	21	0.32	feel, feeling
help	4	21	0.32	help, helped, helpful, helping, helps
house	5	21	0.32	house
nurse	5	21	0.32	nurse, nurses, nursing
second	6	21	0.32	second, secondly
since	5	21	0.32	since
body	4	20	0.30	body
workers	7	20	0.30	worker, workers
wrong	5	20	0.30	wrong, wrongly
given	5	19	0.29	given
need	4	19	0.29	need, needed

okay	4	19	0.29	okay
refuse	6	19	0.29	refuse, refused, refuses, refusing
able	4	18	0.27	able
looking	7	18	0.27	look, looked, looking
morning	7	18	0.27	morning
supposed	8	18	0.27	suppose, supposed
work	4	18	0.27	work, working, works
years	5	18	0.27	year, years
hospital	8	17	0.26	hospital
husband	7	17	0.26	husband
let	3	17	0.26	let, lets
problem	7	17	0.26	problem, problems
really	6	17	0.26	really
different	9	16	0.24	different, differs
experiences	11	16	0.24	experience, experiences
focus	5	16	0.24	focus
group	5	16	0.24	group
lot	3	16	0.24	lot, lots
mind	4	16	0.24	mind, minds
two	3	16	0.24	two
going	5	15	0.23	going
scared	6	15	0.23	scare, scared, scaring
talk	4	15	0.23	talk, talked, talking
birth	5	14	0.21	birth
informed	8	14	0.21	inform, information, informed
keep	4	14	0.21	keep, keeping
last	4	14	0.21	last, lasted

Appendix 5.7: Sociodemographic characteristics of participants of the focus groups

FGD ONE

S/N	N	AGE	SEX	MS	EL	Occupation	T	CN	HLE	HO	CA (months)	CG	RC
1	PA	30	F	Married	tertiary	unemployed	Yoruba	1	tertiary	Government worker	6	Female	Mother
2	PB	24	F	Married	Secondary	Fashion designer	Ibo	3	Tertiary (ND)	Clergy man	7	male	Mother
3	PC	30	F	Married	Tertiary	Teaching	Yoruba	1	Tertiary	Counsellor	12	Male	Mother
4	PD	41	F	Married	Tertiary (HND)	Government worker	Hausa	4	Tertiary	Government worker	2	Female	Mother
5	PE	32	F	Married	Tertiary	Teaching	Yoruba	1	Tertiary	clergy	9	Male	Mother
6	PF	29	F	Married	Tertiary (ND)	Tailor	Yoruba	1	Tertiary (NCE)	Mechanic	2	Male	Mother
7	PG	24	F	Married	Secondary	Tailor	Yoruba	2	Tertiary (ND)	Artisan	3	Male	Mother
8	PH	29	F	Married	Tertiary	Teaching	Yoruba	2	Tertiary	Self employed	2	Male	Mother

FGD TWO

S/N	N	Age	Sex	MS	EL	Occupation	T	CN	HLE	HO	CA (months)	CG	RC
1	PA	35	F	Married	Tertiary (NCE)	Trading	Yoruba	4	Tertiary (ND)	Self employed	9	Female	Mother
2	PB	32	F	Married	Tertiary	Entrepreneur	Yoruba	1	Tertiary	School Administrator	15	Female	Mother
3	PC	32	F	Married	Tertiary (HND)	Unemployed	Yoruba	2	Tertiary	Car dealer	1	Female	Mother
4	PD	27	F	Married	Tertiary (HND)	employed	Yoruba	4	Tertiary	Fire Fighter	6	Female	Mother
5	PE	28	F	Married	Tertiary (ND)	Tailor	Yoruba	1	Tertiary	Self employed	2	Male	Mother
6	PF	31	F	Married	Tertiary (HND)	Pharmacy assistant	Yoruba	2	Tertiary (ND)	employed	2	Female	Mother
7	PG	31	F	Married	Tertiary (HND)	Self employed	Yoruba	1	Tertiary (HND)	Self employed	2	Female	Mother

FGD THREE

S/N	N	Age	Sex	MS	EL	Occupation	Tribe	CN	HLE	HO	CA (months)	CG	RC
1	PA	30	F	Married	Tertiary	Entrepreneur	Zuru	2	Tertiary	Employed	24	Male	Mother
2	PB	36	F	Married	Tertiary	Government worker	Yoruba	2	Tertiary	Banker	8	Male	Mother
3	PC	38	F	Married	Tertiary (HND)	Trading	Ibo	5	Secondary	Self employed	60	Female	Mother
4	PD	21	F	Married	Secondary	Unemployed	Delta	2	Secondary	Driver	1	Female	Mother
5	PE	27	F	Married	Tertiary (ND)	Business	Yoruba	1	Tertiary	Gym Instructor	9	Male	Mother
6	PF	52	F	Married	Secondary	Health attendant	Yoruba	2	Secondary	Self employed	4	Female	Grand mother
7	PG	34	F	Married	Secondary	Pharmacy assistant	Yoruba	1	Secondary	Driver	2	Male	Mother
8	PH	29	F	Married	Tertiary (HND)	Health attendant	Yoruba	1	Tertiary	Teacher	48	Male	Mother

Appendix 6.1: Output of the mediation analysis using Hayes Process macro on SPSS

Run MATRIX procedure:

***** PROCESS Procedure for SPSS Version 4.2 *****

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2022). www.guilford.com/p/hayes3

Model : 4
Y : rrd
X : PACV100
M : ATS

Sample
Size: 450

OUTCOME VARIABLE:
ATS

Model Summary

	R	R-sq	MSE	F	df1	df2
p	.8914	.7945	1.6150	1732.1537	1.0000	448.0000
	.0000					

Model

	coeff	se	t	p	LLCI	ULCI
constant	1.2895	.1312	9.8263	.0000	1.0316	1.5474
PACV100	.1716	.0041	41.6192	.0000	.1635	.1797

OUTCOME VARIABLE:
rrd

Coding of binary Y for logistic regression analysis:

rrd	Analysis
.00	.00
1.00	1.00

Model Summary

	-2LL	ModelLL	df	p	McFadden	CoxSnell
Nagelkrk	215.8301	217.3879	2.0000	.0000	.5018	.3831
	.6198					

Model

	coeff	se	Z	p	LLCI	ULCI
constant	-5.7462	.6921	-8.3024	.0000	-7.1027	-4.3897
PACV100	.3367	.0393	8.5777	.0000	.2598	.4136
ATS	-1.0701	.1777	-6.0207	.0000	-1.4184	-.7217

These results are expressed in a log-odds metric.

***** DIRECT AND INDIRECT EFFECTS OF X ON Y *****

Direct effect of X on Y

Effect	se	Z	p	LLCI	ULCI
.3367	.0393	8.5777	.0000	.2598	.4136

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
ATS	-.1836	.0398	-.2769	-.1223

***** ANALYSIS NOTES AND ERRORS *****

Level of confidence for all confidence intervals in output:
95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:
5000

NOTE: Total effect model not available with dichotomous Y.

NOTE: Direct and indirect effects of X on Y are on a log-odds metric.

----- END MATRIX -----

Run MATRIX procedure:

***** PROCESS Procedure for SPSS Version 4.2 *****

Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2022). www.guilford.com/p/hayes3

Model : 4
Y : rrd
X : PACV100
M : KSF

Sample
Size: 450

OUTCOME VARIABLE:
KSF

Model Summary

	R	R-sq	MSE	F	df1	df2
p	.1635	.0267	2.8368	12.3081	1.0000	448.0000
	.0005					

Model

	coeff	se	t	p	LLCI	ULCI
constant	6.5940	.1739	37.9129	.0000	6.2522	6.9358
PACV100	-.0192	.0055	-3.5083	.0005	-.0299	-.0084

OUTCOME VARIABLE:
rrd

Coding of binary Y for logistic regression analysis:
rrd Analysis

.00	.00
1.00	1.00

Model Summary

-2LL	ModelLL	df	p	McFadden	CoxSnell
Nagelkrk					
265.7713	167.4467	2.0000	.0000	.3865	.3107
.5027					

Model

	coeff	se	Z	p	LLCI	ULCI
constant	-7.7980	.9407	-8.2899	.0000	-9.6417	-5.9543
PACV100	.1566	.0172	9.1106	.0000	.1229	.1903
KSF	.1246	.0903	1.3796	.1677	-.0524	.3016

These results are expressed in a log-odds metric.

***** DIRECT AND INDIRECT EFFECTS OF X ON Y *****

Direct effect of X on Y

Effect	se	Z	p	LLCI	ULCI
.1566	.0172	9.1106	.0000	.1229	.1903

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
KSF	-.0024	.0020	-.0070	.0009

***** ANALYSIS NOTES AND ERRORS *****

Level of confidence for all confidence intervals in output:

95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:

5000

NOTE: Total effect model not available with dichotomous Y.

NOTE: Direct and indirect effects of X on Y are on a log-odds metric.

----- END MATRIX -----