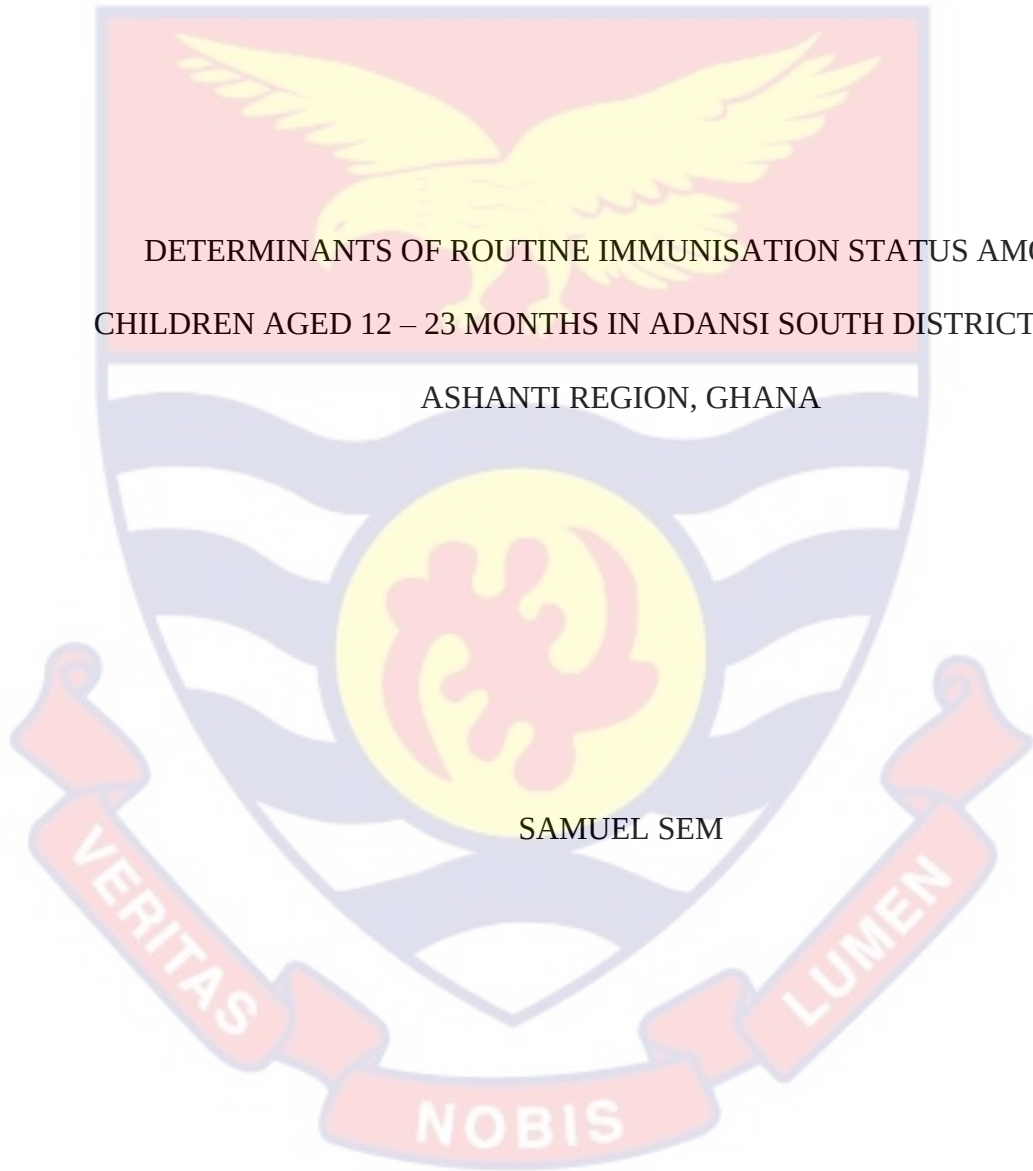


UNIVERSITY OF CAPE COAST

DETERMINANTS OF ROUTINE IMMUNISATION STATUS AMONG
CHILDREN AGED 12 – 23 MONTHS IN ADANSI SOUTH DISTRICT IN THE
ASHANTI REGION, GHANA

SAMUEL SEM



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UNIVERSITY OF CAPE COAST

DETERMINANTS OF ROUTINE IMMUNISATION COVERAGE AMONG
CHILDREN AGED 12 – 23 MONTHS IN ADANSI SOUTH DISTRICT IN THE
ASHANTI REGION, GHANA

BY

SAMUEL SEM

Thesis submitted to the Department of Health, Physical Education and Recreation
of the Faculty of Science and Technology Education, College of Education
Studies, University of Cape Coast, in partial fulfillment of the requirements for
the award of Doctor of Philosophy Degree in Health Promotion (Maternal and
Child Health Promotion)

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: Date:

Name: Samuel Sem

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of the thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: Date:

Name: Dr. Jacob Owusu Sarfo

Co-Supervisor's Signature: Date:

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ABSTRACT

The study sought to assess the routine childhood immunisation status (RCIS) and its determinants among children aged 12 – 23 months living in the Adansi South District (ASD) within the Ashanti Region of Ghana. To guide the investigation, five research questions were developed. An analytical cross-sectional survey design with a quantitative methodology was utilised for this study. The census sampling technique was employed to select a total of 3,312 participants. Data collection was conducted using a questionnaire, and the data were analysed using SPSS Version 27.0. The findings revealed a low RCIS, with only 56.8% of children aged 12-23 months in ASD having received routine childhood immunisations. The study identified several factors that influenced RCIS, including the child's age, the number of children in the family, the marital status of the parents, attendance at antenatal care (ANC), and the number of ANC visits. Maternal occupational status, adequacy of income, the perception of spousal income as adequate and regular, and if it is the sole source of livelihood, household wealth status, and the type of housing for dwelling was found as enabling factors to influence RCIS. Additionally, mothers' perspectives on the conduct of CWC, distance, hours used, means of transport, satisfaction with service providers' communication, and mothers' perceived attitudes of staff and their perception of vaccines, service providers, and immunisation services influence RCIS. The GHS/DHD of ASD should enhance efforts in conducting comprehensive public awareness and health education campaigns targeting mothers and households. These campaigns should emphasise the benefits of RCI and stress the importance of completing the immunisation schedules.

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DEDICATION

To my lovely and ever supportive wife Mrs Janet Sem



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LIST OF ACRONYMS



ANC	Antenatal Care
AOR	Adjusted Odds Ratio
ARHIU	Ashanti Regional Health Information Unit
	Records
CHOs	Community Health Officers
ASD	Adansi South District
ASDHD	Adansi South District Health Directorate
BCG	Bacillus Calmette–Guérin vaccine
CBSVs	Community-based Service Volunteers
CDs	Childhood Diseases
CDC	Centre for Disease Control and Prevention
CBHI	Community-based Health Insurance
CHPS	Community-based and Health Planning Services
CI	Confidence Interval
CIC	Childhood Immunisation Coverage
CIS	Childhood Immunisation Status
CRS	Congenital Rubella Syndrome
CVU	Childhood Vaccine Utilisation
CV	childhood vaccination
CWC	Child Welfare Clinic
DHD	District Health Directorate
DHS	Demographic and Health Survey
DPT	Diphtheria-Tetanus-Pertussis containing

DV	Dependent Variable
	vaccines
EPI	Expanded Programme on Immunisation
FP	Family Planning
GHS	Ghana Health Service
GoG	Government of Ghana
IC	Immunisation Coverage
IVs	Independent variables
LMICs	Lower and Middle-Income Countries
MCMs	Modern Contraceptive Methods
MCV	Measles Containing vaccine
MOH	Ministry of Health
MDGs	Millennium Development Goals
MTP	Medically Trained Providers
OPD	Outpatient Department
OPV	Oral Poliomyelitis Vaccine
PHIs	Public Health Issues
RCI	Routine Childhood Immunisation
RCIC	Routine Childhood Immunisation Coverage
RCIS	Routine Childhood Immunisation Status
RCV	Routine Childhood Vaccination
RCVU	Routine Childhood Vaccine Utilisation
R I	Routine Immunisation
RIC	Routine Immunisation Coverage

RIS	Routine Immunisation Status
RVU	Routine Vaccine Utilisation
RVUC	Routine Vaccine Utilisation Coverage
RVUS	Routine Vaccine Utilisation Status
SA	South Africa
SDGs	Sustainable Development Goals
SES	Socio - Economic Status
SIA	Supplemental Immunisation Activity
SSA	Sub-Saharan Africa
UNDP	United nations Development Programme
UNICEF	United Nations Children's Fund
UNIGME	United Nations Inter-Agency Group for Child Mortality Estimation
USAID	United States Agency for International Development
VC	Vaccination Coverage
VPDs	Vaccine-Preventable Diseases
VPFs	Vaccine-Preventable Fatalities
WBGs	World Bank Groups
WHO	World Health Organisation
WHO CO	World Health Organisation Country Office – Ghana
WHO/AFRO	World Health Organisation/Regional Office for Africa

WRA

Women of Reproductive Age



CHAPTER ONE

INTRODUCTION

Background to the Study

Surviving infancy and transitioning into adulthood presents a significant challenge, particularly for children under the age of five, and more so for those below one year old (Aregawi, Gebrehiwot, Abebe, Meles, & Wuneh, 2017). According to the United Nations Inter-Agency Group for Child Mortality Estimation [UNIGME] (2020), there were 5.2 million deaths globally among children under five in 2019. Of these, 2.4 million occurred within the first month of life, 1.5 million between 1-11 months, and 1.3 million between 1-4 years. Alarming, an average of 14,000 children continue to die each day worldwide, with a mortality rate of 38 per 1,000 live births (Fenta, Biresaw, Fentaw & Gebremichae, 2021; United Nations Children's Fund [UNICEF], 2020; World Health Organisation [WHO], 2020).

Children under five still face significant regional disparities in their chances of survival (Fenta et al., 2021). Africa stands out as the continent with the highest child mortality rates, with Sub-Saharan Africa (SSA) contributing over half of the global figures. Specifically, in 2019, SSA recorded 2.8 million under-five deaths (53 percent), followed by Central and Southern Asia with 1.5 million (28 percent). The remaining 19 percent of under-five deaths were distributed across regions such as Australia and New Zealand, Eastern and South-Eastern Asia, Northern Africa and Western Asia, Europe and Northern America, Latin America and the Caribbean, and Oceania [excluding Australia and New Zealand] (UNIGME, 2020). In 2019, the Sub-Saharan region reported an average child

mortality rate of 76 deaths per 1000 live births. Ghana, as part of Africa, mirrors these conditions, with reports from UNICEF (2020) and the World Bank Group [WBG] (2021) showing a rate of 46.2 deaths per 1000 live births among children under five years in 2019.

To address this global issue, the WHO adopted and implemented strategies in 1974, focusing specifically on vaccine-preventable diseases (VPDs) by initiating and expanding immunisation coverage (IC) among children worldwide (Tesema, Tessema, Tamirat, & Teshal, 2020). Recognising the importance of immunisation as a critical component of child survival programmes, UNICEF joined forces with WHO in 1986 to lead a global campaign. This campaign aimed to promote immunisation by providing technical, financial, and logistical support to developing countries for the Expanded Programme on Immunisation (EPI), which had already been initiated (WHO/Regional Office for Africa [AFRO], 1994). Subsequently, the United States Agency for International Development (USAID) also became part of this collaborative effort, advocating for universal access to childhood immunisation against VPDs.

Routine immunisation (RI) is an established and effective public health strategy aimed at decreasing morbidity and mortality in infants, serving as a vital approach for controlling childhood diseases (CDs) and acknowledged as the most cost-efficient health intervention (Centres for Disease Control and Prevention [CDC], 2018; Gavi, 2019). Consequently, numerous African nations, including Ghana, have now integrated free routine childhood immunisation (RCI) services into their national healthcare systems. The objective, established in 1977, was to

deliver vaccines to all children by 1990 to diminish morbidity and mortality in those under five years of age. Despite the WHO's global implementation of diverse strategies to bolster health system infrastructure and vaccination coverage (VC), the 1990 target was not attained. The EPI was initially designed to safeguard against six major childhood diseases such as tuberculosis, poliomyelitis, diphtheria, tetanus, whooping cough, and measles, with the yellow fever (YF) vaccine being introduced in 1988 exclusively for endemic countries, administered alongside the measles vaccine at nine months of age.

Following the inability to meet the 1990 target, as highlighted in a WHO report (2019), the UN called upon all governments to achieve a minimum of 90% IC for all antigens, including the three doses of diphtheria-tetanus-pertussis-containing vaccines (DPT3), to fulfill the Millennium Development Goals (MDGs) 4 by 2015. The aim was to reduce child mortality by two-thirds between 1990 and 2015, a target that was not achieved. In 2015, the United Nations adopted the Sustainable Development Goals (SDGs), with Target 3.2.1 focusing on ensuring healthy lives and well-being for all children by preventing avoidable deaths of newborn children and those below five years old. As specified in the SDGs, each country is required to accomplish this goal by reducing neonatal mortality to not more than 12 per 1,000 live births and under-5 mortality to not more than 25 per 1,000 live births by 2030 (UNDP, 2021; WHO, 2021). The achievement of this target is heavily dependent on vaccination efforts.

Immunisation is a global success story in development, saving millions of people's lives annually from VPDs (Gavi, 2019). Measles alone caused 777,000 fatalities and 2 million disabilities in the year 2000. Haemophilus influenza

caused about 400,000 deaths in children, 300,000 deaths from Pertussis, and 180,000 deaths from newborn tetanus (WHO, 2005). Between 2010 and 2018, the measles vaccine (MCV) notably prevented 23 million fatalities (Patel et al., 2019). Recent statistics on measles indicate that global coverage for the first dose of the measles-containing vaccine (MCV1) rose from 72 percent to 85 percent between 2000 and 2017. This increase was accompanied by an 83 percent reduction in the annual reported incidence of measles, with cases dropping from 145 to 25 per million population. Consequently, the estimated number of measles-related deaths decreased by 80%, falling from 545,174 to 109,638 cases per million population. During this period, measles vaccination alone is estimated to have averted 21.1 million deaths, highlighting the crucial role of immunisation in enhancing child survival (Dabbagh et al., 2018). However, data from 2018 shows that globally, over 1 in 10 children—approximately 20 million—missed out on lifesaving vaccines, including those for measles, diphtheria, and tetanus (WHO, 2019). Since 2010, the vaccine utilisation rate for three doses of diphtheria, pertussis, and tetanus (DPT3), and a single dose of the MCV, has plateaued at around 86 percent. Although this is an impressive figure, it remains below the recommended 95% coverage required globally, across countries and communities, to effectively prevent outbreaks of VPDs (WHO, 2019).

While immunisation efforts have demonstrated significant success in many developed nations, achieving coverage rates exceeding 90% (WHO, 2000), the scenario contrasts sharply in developing countries, particularly in Africa. In these developing regions, VPDs significantly contribute to mortality among children under the age of five. For instance, vaccine-preventable fatalities (VPFs)

accounted for nearly 40% of all under-five mortality in Nigeria. This high percentage was likely associated with a decline in RI rates, which fell from 74 percent in 2010 to 52 percent in 2012, with DPT3 used as a proxy for overall coverage (Health Care Dev Agency [NPHCDA], 2016).

Furthermore, in Nigeria, the National Demographic and Health Survey (NDHS) conducted in 2013 assessed the complete routine childhood immunisation status (RCIS) of children aged 12 to 23 months, including administering one dose each of Bacillus Calmette-Guérin (BCG) and MCV, along with three doses of diphtheria-pertussis-tetanus (DPT) and oral polio vaccine (OPV). The results indicated that only 25% of the children had achieved full immunisation, and the under-five mortality rate was recorded at 128 deaths per 1,000 live births (Nigeria Population Commission [NPC] and ICF Macro, 2014).

Moreover, earlier surveys indicated that in 2003, Nigeria experienced an under-5 death rate of 201 per 1000 live births, coupled with a national immunisation coverage (NIC) of only 12.7% (Doctor, Bairagi, Findley, Helleringer & Dahir, 2011; WHO Nigeria, 2005). Also, according to the 2018 report from the Nigeria Demographic and Health Survey (DHS), childhood mortality rates in Nigeria increased to 132 per every 1000 live births in 2018 from 128 per every 1000 live births in 2013. Nonetheless, there was an improvement in vaccine coverage, with 50% of children aged 12-23 months receiving full vaccination in 2018, compared to the 25% reported in 2013. Despite the rise in IC in 2018, it remained significantly below the global target of achieving 95% coverage (NPC [Nigeria] & DHS Programme ICF Rockville, 2019).

Ghana's situation differs from Nigeria's when similar indicators are compared. The recent data from UNICEF (2020b) for the five-year trend of childhood mortality in Ghana shows a consistent drop in the mortality rate. Ghana had 52.3, 50.0, 48.0, 46.2, and 32.8 deaths per every 1000 live births among children aged below five years old in 2016, 2017, 2018, 2019, and 2020 respectively. Despite improvements, the mortality rate remains above the national, and SDG target of 25 deaths per every 1000 live births. The WHO Country Office – Ghana [WHO CO] (2021) and UNICEF (2020) reported a declining trend of 100%, 99%, and 94% achievements using Penta 3 as a proxy for the three-year trend of vaccination usage performance for 2018, 2019, and 2020. According to the report, Ghana failed to reach the required coverage of at least 95% for all the routine childhood vaccinations (RCV) in 2020, and if this trend continues, attaining the SDG 3.2 objective may be impossible.

Routine immunisation coverages (RICs) serve as a significant indicator for assessing the effectiveness and utilisation of routine vaccinations (RV). While childhood immunisation coverage (CIC) is showing improvement in some SSA countries, disparities within countries persist. Inequality refers to the observed variations in coverage among different population subgroups. The measurement and monitoring of these inequalities can be useful in devising health interventions that prioritise the most disadvantaged subgroups (Arsenault et al., 2017; Gandhi, 2015). In Ghana, the routine childhood vaccine utilisation (RCVU) rate for 2020 is lower than the national SDG target of 95% (MOH/GHS, 2016; UNICEF, 2020; WHO CO, 2021). This coverage provides insufficient herd immunity to prevent transmission of other VPDs (Australian Government Department of Health,

2016). There are also pronounced disparities in routine vaccine utilisation coverage (RVUC) between and within regions of Ghana (UNICEF, 2020). These disparities disproportionately affect children whose parents, especially mothers, belong to the lowest socioeconomic quintiles, have limited or no education, and reside in areas with challenging accessibility to immunisation services (WHO, 2019).

Additionally, the diversity in socio-demographic, socio-cultural, and socio-economic factors and accessibility to healthcare services in Ghana imply variations in vaccine uptake between and within different geographical areas (WHO, 2019). These variations could potentially result in pockets of under-vaccinated children, leading to a reduction in herd immunity and an increased susceptibility of the broader population to significant outbreaks of VPDs. Despite intermittent successes in IC, RCI services remain significant in Ghana (WHO CO, 2021).

The Ashanti Region in 2017, and 2018 recorded IC of 97.1%, and 96.6% respectively using Penta 3 coverage as a proxy (GHS, 2019). Even though the RIC within the region met the national target, there still exist several districts and municipalities that are performing far below the 95% national target. For instance, Adansi South District (ASD) recorded low coverage rates and even a declining trend. In 2017, 2018, and 2019, ASD recorded IC of 80.7%, 69.6.7% and 68.2% respectively. Some other municipalities and districts in the region had similar or lower performances (Ashanti Regional Health Information Unit Records [ARHIU], 2020). These performances by the municipalities and districts may with time, leave more children uncovered and the effects may be detrimental. Also, it

may make the region and the country difficult to sustain the current regional and national levels up to the year 2030 SDG target.

Immunisation, a widely recognised practice, stands out as one of the most cost-effective tools in safeguarding children against morbidities, disabilities, and mortality (Mekonnen, Hussien, Tilahun, Gelaye, & Mamuye, 2019; Tilahun et al., 2020). Its efficacy is maximised when every child completes the recommended course of immunisation doses. However, numerous factors or circumstances often hinder the completion of the full vaccination schedule for children, leading to a lowered effectiveness of immunisation programmes designed to reduce childhood morbidity and mortality. Socio-demographic and socio-economic determinants, alongside challenges in accessing immunisation services, play a significant role in the incomplete adherence to RI, particularly in the ASD of the Ashanti Region (Hussin et al., 2020; Molan, 2020; UNICEF, 2017).

Statement of the Problem

Since the introduction of vaccines for routine use in infants, there has been a significant reduction in the incidence of VPDs (Allan, Adetifa, & Abbas, 2021). The EPI programme was officially launched by Ghana's Ministry of Health (MOH) in 1978, and it has been in operation since 1985 in all 10 and now 16 regions, as well as all Metropolitan, Municipalities, and Districts (MMDs). The EPI in Ghana aims to protect every child from the thirteen (13) VPDs (tuberculosis, poliomyelitis, diphtheria, tetanus, whooping cough, hepatitis B, Haemophilus influenza type b, measles, rubella, rotavirus diarrhoea, pneumonia, meningococcal meningitis, and yellow fever). The aim is to increase the structured childhood vaccine utilisation (CVU) and simultaneously reduce infant

and childhood mortality in Ghana (Government of Ghana [GoG], UNICEF, WHO & Gavi, 2019).

Immunisation has a direct impact on health (SDG3) and contributes to 14 of the 17 SDGs, including objectives related to poverty alleviation, hunger reduction, and reducing inequality. Consequently, the crucial role of immunisation in achieving the SDGs, particularly in low and middle-income countries like Ghana, is widely recognised (Decouttere, De Boeck, & Vandaele, 2021). SDG 3.2.1 aims to promote healthy lives and well-being for all children by preventing avoidable deaths among newborns and children under the age of five. Nations are also required to reduce newborn deaths to a minimum of 12 per 1,000 live births and children under five deaths to at least 25 per 1,000 live births by 2030 (UNDP, 2021; WHO, 2021).

The third target of Goal 3 is focused on eradicating epidemics such as acquired immune deficiency syndrome (AIDS), tuberculosis (TB), malaria, and neglected tropical diseases, and addressing hepatitis, waterborne illnesses, and other infectious diseases. Additionally, target 8 of Goal 3 aims to achieve universal health coverage (UHC), ensuring equitable access to essential healthcare services and providing safe, effective, quality, and affordable essential medicines and vaccines for all (United Nations Development Programme [UNDP], 2021; WHO, 2021). The accomplishment of SDG 3 targets is estimated to lead to an 11 million reduction in under-5 mortality between 2019 and 2030 (WHO, 2020). Consequently, it is crucial to achieve and maintain national routine childhood immunisation coverage (RCIC) targets.

Against this backdrop, the WHO, Ministry of Health (MOH), Ghana Health Service (GHS), and other health-related agencies and partners are providing technical, logistical, and financial support to every Metropolitan, Municipal, and District area. This assistance aims to enhance performance in RCI to attain and sustain higher levels in alignment with the SDG targets to boost performance in RCIS to achieve and maintain higher levels to meet the SDG targets. The goal is for each community, district, Municipality, Metropolis, and Region to cover and complete immunisation for at least 95% of children aged 12 months, covering all required antigens at the appropriate doses and intervals (MOH/GHS, 2016).

Despite ongoing interventions and extensive support to strengthen immunisation systems and adequately increase and sustain high levels of vaccine utilisation, in the Ashanti Region, pronounced disparities persist between ASD and the remaining 42 districts regarding vaccine uptake. For instance, Ahafo-Ano South West district covered 91.7% (2017), 96.0% (2018), and 100.5 (2019). Also, the Ahafo-Ano South East district covered 93.7% (2017), 97.7% (2018), and 100.3% (2019) indicating an increasing trend just like with the other districts. However, ASD in 2017, 2018, and 2019 covered 98.6%, 81.7 and 76.1% respectively in RCI, exhibiting a declining performance far below the national and SDG target of at least 95%. (Ashanti Region Annual Health Report, 2020). Notably, numerous searches aimed at finding community-based studies on RCI regarding the factors influencing the consistently low and declining vaccine uptake in ASD were very scarce. Identifying the fundamental factors and understanding parents' reasons for not immunising their children is significant for

improving RCIS. Therefore, this study aims to bridge these gaps by determining the RCI and identifying the determinants associated with full RCIS in the ASD in the Ashanti Region of Ghana.

Purpose of the Study

This study sought to assess the routine immunisation status (RIS) and its predictors among children aged 12 – 23 months residing in ASD in the Ashanti Region of Ghana.

Research Questions

1. What is the routine immunisation status of children aged 12-23 months in ASD in the Ashanti Region?
2. Which child and mother predisposing factors predict the routine immunisation status of children aged 12-23 months in ASD in the Ashanti Region?
3. What enabling determinants of parents predict routine immunisation status of children 12-23 months in ASD in the Ashanti Region?
4. Which access to immunisation services factors predict the routine immunisation status of children aged 12-23 months in ASD?
5. Which need factors predict the routine immunisation status of children aged 12-23 months in ASD?

Significance of the Study

The findings about the determinants of the current state of IC will help District/Municipal Health Directorates to repackaging how immunisation services are rendered especially those with low and declining coverages which will, in turn, improve immunisation status in these catchment areas. Practices that

perpetuate difficulty in accessing immunisation in the district will be identified and appropriate solutions proposed which will aid the community health officers (CHOs) to best serve their clients to achieve the set target. Data from this study will be useful for the MOH/GHS to ascertain the extent to which their policies on the provision of immunisation services influence the immunisation status of children under five years of age.

This study also contributes to the general knowledge on the utilisation of RCI services and will also provide a broad spectrum of information for the governments in matters concerning the achievement of national immunisation targets. With limited work done in this area, findings add to the current information on the subject, which would serve as a propensity for further work in the area. The study will indeed serve as reference material for academic purposes, especially for students in health education institutions in Ghana and worldwide.

Delimitations

The research was delimited to RCIS in ASD in the Ashanti Region of Ghana. Also, predisposing determinants of children and parents, enabling determinants of the parents, healthcare accessibility determinants and need factors of parents associated with RCI were focused on. Parents of children aged 12-23 months were sampled.

Limitations

This research adopts an analytical cross-sectional design, involving data collection at a single point in time. It is unable to assess the incidence, study rare health problems, and make a causal inference. It is also expensive and time-consuming if interviews are used for data collection. The challenges encountered

during data collection included inconveniences associated with the timing of the day and the valuable time participants dedicated to responding to the questionnaire. Moreover, due to the large sample size, there was an increased cost associated with questionnaire printing and data collection, although the study received funding. Notably, the perspectives of the fathers of the children were not considered in this study, and their input could have provided insights into the reasons behind mothers' failure to fully immunise their children routinely. Additionally, the study exclusively concentrated on the demand side of immunisation services, overlooking the supply side. Incorporating the supply side could have highlighted issues related to vaccine supply and associated services. Furthermore, there is a potential recall bias, as mothers without maternal and child health records for their children were required to recall past events.

Definition of Terms

Fully immunised: Children between the ages of 12 and 23 months who have received all the prescribed vaccine doses at the appropriate intervals and dates by the time they reach 23 months of age

Immunisation utilisation: The extent to which routine immunisation services are consumed by children

Immunisation centre: A designated place where routine childhood immunisation services are rendered

Non-immunised: Children aged 12-23 months who have never received any or a single vaccine dose in their lifetime

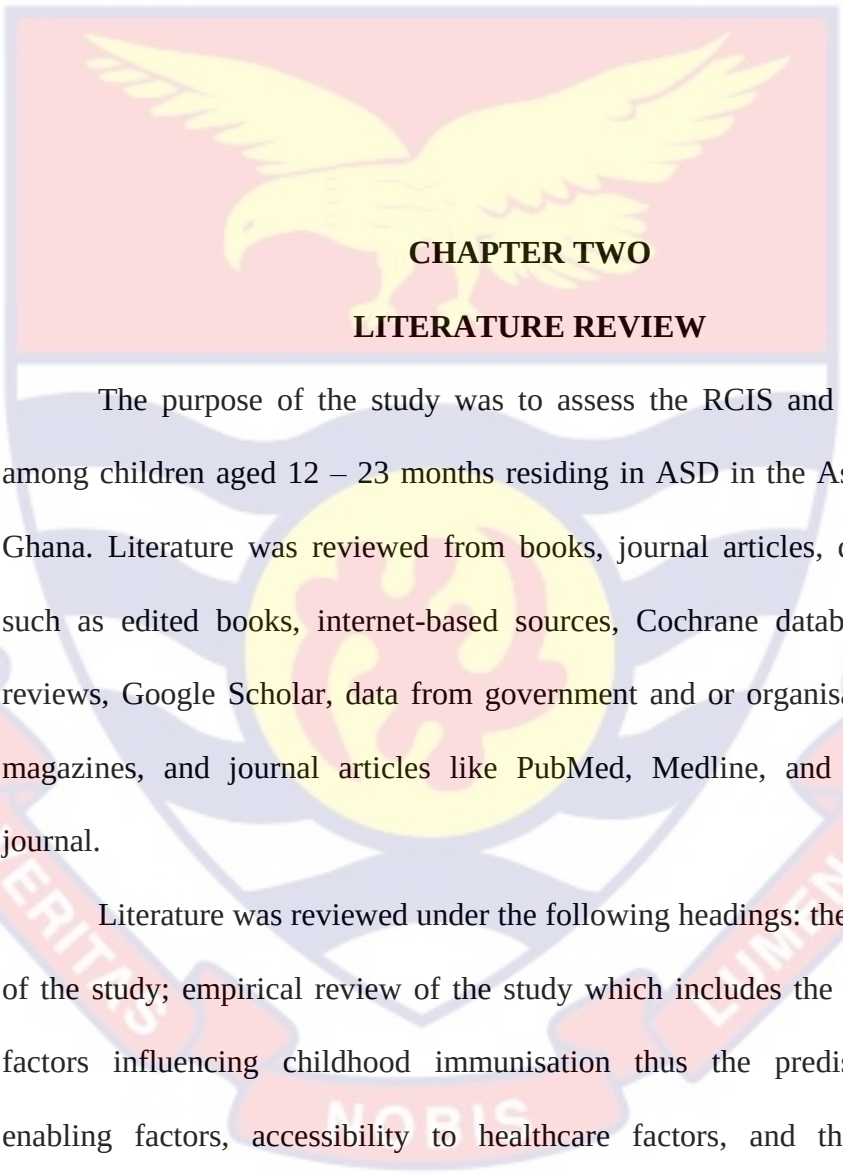
Partially immunised: Children aged 21-23 months who have missed some of the recommended vaccine doses but not all at 23 months of age

Vaccination: Involves the administration or inoculation with a vaccine to achieve resistance against an infectious disease

Vaccine: A suspension of live weakened/attenuated/killed infectious agent or its products/parts for achieving immunity against that infectious agent

Organisation of the Study

The remainder of the study is structured into four chapters: two, three, four, and five. Chapter two reviews relevant literature on the constructs that constitute the primary themes of the study. These themes cover an overview of the theoretical framework, the concept of immunisation, the immunisation status of children aged 12-23 months, the thirteen diseases linked to childhood immunisation in Ghana, predisposing characteristics, enabling characteristics of households, factors related to access to immunisation services, need factors, and the conceptual foundation of the study. Chapter three outlines the research design, study area, population, sampling procedure, data collection instruments, data collection process, data processing and analysis, and concludes with a summary of the chapter. Chapter four presents and discusses the findings of the study, addressing the research questions. The fifth and final chapter includes a summary, conclusions, recommendations, and suggestions for further research.



CHAPTER TWO

LITERATURE REVIEW

The purpose of the study was to assess the RCIS and its determinants among children aged 12 – 23 months residing in ASD in the Ashanti Region of Ghana. Literature was reviewed from books, journal articles, database sources such as edited books, internet-based sources, Cochrane database of systemic reviews, Google Scholar, data from government and or organisational websites, magazines, and journal articles like PubMed, Medline, and British medical journal.

Literature was reviewed under the following headings: the theoretical base of the study; empirical review of the study which includes the concept of RCI; factors influencing childhood immunisation thus the predisposing factors, enabling factors, accessibility to healthcare factors, and the need factors; conceptual framework of the study; and the summary of the literature reviewed for the study.

Theoretical Base of the Study

Theories are defined as a set of interconnected constructs (concepts), definitions, and propositions that provide a systematic perspective on phenomena by identifying relationships between variables, to explain and predict these phenomena (Glanz, Rimer, & Viswanath, 2008; Grbich, 1998; Hansen, 2006; Kivunja, 2018). In this research, Andersen's Healthcare Utilisation Model (AHU) provided the theoretical base. The model, developed by Andersen in 1968, suggests that health-seeking behaviour is shaped by three categories of personal characteristics: predisposing factors, enabling factors, and need factors (see Figure 1). The fundamental premise is that an individual's use of health services follows a sequential and conditional process, based on their propensity to seek such services, their perceived need for them, and their capacity to access and utilise these services. Some variables can fit into more than one of these categories. In such circumstances, I arbitrarily did self-categorisation of the determinants.

According to Andersen's (1968) findings, predisposing factors are socio-demographic elements that influence a person's use of available health services. These include age, sex, marital status, education level, and mothers' beliefs or perceptions about the benefits of health services. Individuals who perceive health services as useful for disease prevention are more likely to use them.

Enabling factors are those that facilitate the uptake of health services, such as income, household and community resources, access to free services, and dwelling places or living conditions. Community resources also encompass access to healthcare facilities and individuals who can assist (Andersen).

The need component includes elements that motivate individuals to seek out health services, such as the attitudes and perceptions of parents or caregivers about the benefits of health services. These perceptions may be based on individual, societal, or clinical evaluations of need. People who believe that health services are beneficial for disease prevention are more likely to use them (Ogbuabor, & Chime, 2021; Wolinsky, 1988).

The model is heavily criticised for over-emphasising the need for healthcare and paying less adequate attention to cultural barriers (Chowdhuri & Kundu 2020). However, Andersen vehemently contends that culture is inherently embedded in predisposing characteristics. The model is appropriate for childhood immunisation since it considers all the necessary variables that may prevent or facilitate service providers and service seekers from providing and utilising RCI services. Over the years, the model has undergone modifications, yet both the original and revised versions have proven successful in studying the utilisation of both curative and preventive health services, including the utilisation of preventive healthcare services like RCI, in both developed and developing countries.

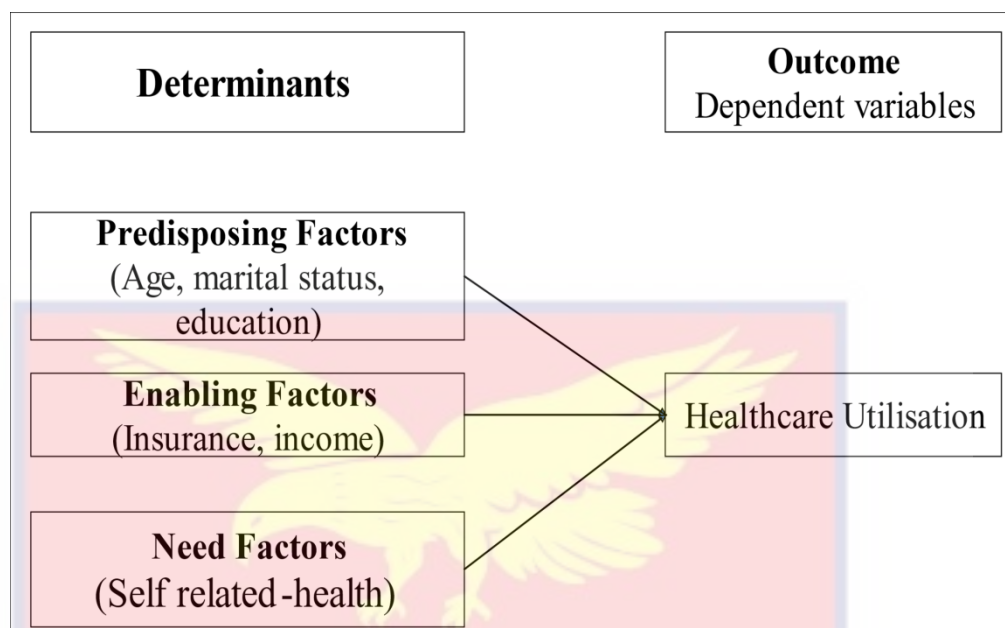


Figure 1: Andersen's Healthcare Utilisation Model (Andersen, 1968)

For example, Acosta-Ramírez et al. (2005) adapted the AHU model to carry out a survey in Bogotá, Colombia, aimed at identifying the factors facilitating CVU. Using a cross-sectional study design, the researchers conducted surveys across Bogotá and employed a random sampling method to select respondents from various households. The dependent variables collected included predisposing factors, family characteristics, enabling factors, need, knowledge, and satisfaction with immunisation services. Independent variables gathered involved characteristics of the healthcare system, such as public versus private services, proximity to the healthcare provider, and waiting times.

Data analysis involved the use of the chi-square test with 95% confidence intervals, multivariate regression models, and Cronbach's alpha coefficient. The results indicated that certain factors, such as having a household size of eight or more, residing in the East Central or South district, having a household head with four years or less of education, and possessing knowledge and understanding of

immunisation requirements, were statistically significant predictors of immunisation uptake (Acosta-Ramírez et al., 2005). However, other factors like poor localities, household income, and socioeconomic status (SES) did not show statistical significance in predicting RCIS.

At Komfo Anokye Teaching Hospital (KATH) in Ghana, the AHU model was recently employed to determine the factors associated with the use of traditional medicine (TM) among chronically ill patients seeking curative health services (Felix, 2020). The study focused on two main research questions central to the application of this model. The first question aimed to identify the need, predisposing, and enabling factors related to the adoption of TM. The second question explored the significant relationship between TM usage and individuals' perceived health condition. Analysis of these questions involved the use of Multinomial logistic regression and instrumental variable (IV) Tobit regression.

The findings revealed that predisposing factors played a significant role in predicting the use of traditional TM. These factors included marital status, the influence of family or friends who use TM, and positive beliefs associated with TM. Additionally, the presence of comorbidities, identified as a need factor, showed a strong correlation with TM use. However, contrary to the theoretical framework, enabling factors did not demonstrate a strong link to TM usage among the participants. Furthermore, no significant relationship was found between TM use and perceived health status. The application of the AHU model has proven to be highly effective in identifying potential determinants of healthcare and healthcare-seeking behaviours, as illustrated by the studies of Acosta-Ramírez et al. (2005) and Felix (2020).

From Christmalls and Gross's (2017) study, the benefits of applying models such as AHU in literature review allow for an overview of competing usable variables to determine which ones are more relevant to the subject under investigation. The brief description of the AHU models identified for this study on healthcare-seeking behaviours, clearly shows that it is more appropriate for preventive and curative health service utilisation. Personal characteristics, immediate social and economic factors, parents' experiences at healthcare centres, and how they are treated by health personnel impact their decision to vaccinate their children. This model is directly related to immunisation, requiring individuals and communities to participate fully in immunisation services to protect members from VPDs.

Since immunisation serves as a mechanism for disease prevention, considerable effort is needed to persuade parents to fully utilise this service. In many instances, parents only adopt help-seeking behaviours after witnessing others fall victim to VPDs. Therefore, the AHU model is particularly relevant to immunisation, as it articulates the predisposing, enabling, and need characteristics that influence the demand and provision of healthcare services, including vaccination.

Concept of Immunisation

Preventive healthcare, with immunisation as a key component, is a branch of public health significantly influenced by the interaction of demand and supply. To effectively address the health behaviours of stakeholders in immunisation, the "Ecological Perspective" is considered the most suitable approach (Chong, 2021; Glanz & Bishop, 2010; Halliday & Glaser, 2011; Van Lier, 1997). This

perspective argues that public health interventions should focus not only on individuals but also on their interrelationships and organisational and environmental factors (Glanz & Bishop; Halliday & Glaser; Van Lier). Even when focusing on one aspect of the immunisation equation, such as 'immunisation demand', it is crucial to recognise that vaccination is heavily influenced by the behaviours of its key stakeholders - the recipients. Many studies suggest that improving and strengthening the demand side of vaccination services can significantly enhance childhood vaccine uptake (Choudhary, Solomon, Awale, & Dey, 2018; Jalloh et al., 2019; Ostermann, Vasudevan, Baumgartner, Ngadaya, & Mfinanga, 2019). Despite the challenges in ensuring an adequate supply of vaccination logistics and services, the demand for accessible vaccination services is often not optimised fully.

The core concept of public health is that each individual protected from disease through immunisation reduces the potential for spreading the disease to others. Immunised individuals act as a protective barrier for those not immunised, provided that immunisation coverage reaches a certain threshold, thereby creating what is known as "herd immunity" (Feldstein et al., 2017). In pursuit of the public health goal of RCI, the Ghanaian government has adopted the guidelines set out by WHO and UNICEF for vaccinating children. These guidelines assess the immunisation status of children with all vaccines as they progress through infancy. Children are categorised into three groups: non-immunised, partially immunised, and fully immunised. A fully immunised child, according to the guidelines, must have received a dose of the bacillus Calmette-Guerin (BCG) vaccine at birth, four doses of the poliomyelitis vaccine at birth, and at the sixth,

tenth, and 14th weeks after birth. Additionally, the child should have received three doses of diphtheria, pertussis, tetanus, Haemophilus influenza type b, and hepatitis B (PENTA) vaccines at the sixth, tenth, and 14th weeks after birth. Furthermore, the child should receive measles-rubella and yellow fever vaccines at nine months of age, followed by measles-rubella and meningococcal meningitis vaccines at 18 months of age (Farzad, Reyer, Yamamoto, & Hamajima, 2017; Restrepo-Méndez et al., 2016; Wahl et al., 2021).

In 2002, the pentavalent vaccine "DPT/Hepatitis B (HepB)B/Haemophilus influenza type B(HiB)" was introduced, supplanting the DPT vaccine. This updated vaccine includes not only DPT components but also incorporates the HepB vaccine and a vaccine targeting HiB. Consequently, the WHO guidelines differentiate between "partial" and "full/complete" immunisation status, emphasising that the assessment should occur at an age when the cumulative impact of all vaccinations is relevant, rather than at the time of each immunisation (WHO, 2017). As part of routine practice, children in Ghana receive vaccinations against these VPDs on scheduled dates.

Routine Immunisation Status of Children Aged 12-23 Months

Immunisation coverage is the proportion of the target population vaccinated against a particular vaccine (Feldstein et al., 2017; Peck et al., 2019). The coverage of immunisation determines the immunisation status of children in a given catchment area. The immunisation status is determined by the proportion of children who have received all the required vaccines for their age. High coverage leads to higher immunisation status and vice versa. High

immunisation status protects against highly infectious diseases, especially among children under five years(Feldstein et al.).

Routine vaccine-preventable diseases (VPDs)

In Ghana, the WHO launched EPI in 1974 and adopted it in 1978. Ghana launched the programme with six (6) antigens, but it has since been gradually expanded to include more antigens, and the EPI schedule now includes 13 VPDs. Below is a brief description of VPDs targeted under the EPI services in Ghana.

Tuberculosis(TB)

Tuberculosis is a disease caused by the bacterium known as *Mycobacterium tuberculosis* and it is documented as a significant global health concern. It stands as the primary cause of death from a single infectious agent worldwide (Sylverken et al., 2021). Alongside the human immunodeficiency virus (HIV), TB ranks as a leading contributor to global mortality, impacting millions of individuals annually and constituting a major source of sickness and death (WHO, 2015).It is highly prevalent among HIV-infected individuals and predominates among deprived populations in developing countries.

Exposure to *M. tuberculosis* leads to latent infection, which can sometimes progress into active disease, potentially affecting various parts of the body, such as the brain, spine, or kidneys, although it primarily targets the lungs (Akeso, 2020; Feikin, Flannery, Hamel, Stack, & Hansen, 2015). TB is spread through the inhalation of microscopic droplets containing *M. tuberculosis*. Prevention can be achieved through several measures, including vaccination with the BCG vaccine. BCG vaccines are derived from live attenuated mycobacterial strains originating

from the original attenuated BCG. In countries with high rates of TB infection, infants are typically administered the BCG vaccine.

Poliomyelitis (Polio)

Poliomyelitis, commonly known as polio or infantile paralysis, affects the central nervous system. It is preventable through vaccination and highly contagious, playing a significant role in childhood disability. This ailment is triggered by three serotypes (1, 2, and 3) of the poliovirus and predominantly impacts children under five (Alves, Conde, & Ribeiro, 2021). Transmission primarily transpires through the faecal-oral route, although oral-oral transmission might also occur frequently (Kinsman et al., 2018).

In certain instances, the virus targets motor neurons in the spinal anterior horn and brain stem, leading to muscle weakness and flaccid paralysis (poliomyelitis) (Razum, 2019). The primary cause of mortality is respiratory failure, often resulting from diaphragm and intercostal muscle paralysis, in addition to airway blockage due to swallowing muscle paralysis. The resulting paralysis typically persists, although partial recovery is plausible. Regrettably, no cure exists for polio (Alves et al.).

The principal method of averting polio infection is through the utilisation of vaccines. Currently, two main vaccines are globally available and simultaneously used in polio-endemic regions. These are the orally administered, live attenuated polio vaccines (OPV) and the inactivated poliovirus vaccines (IPV), which are administered intramuscularly (or subcutaneously) (Feikin et al., 2015). The WHO no longer endorses a vaccination schedule that relies solely on OPV.

For countries that currently depend exclusively on OPV, it is advised to incorporate at least one dose of IPV into their vaccination programme. In regions where polio is prevalent or at high risk of being imported and spreading, the WHO recommends an initial OPV dose at birth (referred to as the "zero dose"), followed by the standard series of three OPV doses and, similar to the approach in Ghana, the inclusion of at least one IPV dose. The primary goal of implementing universal polio vaccination is the complete eradication of the disease (Feikin et al.).

Diphtheria

Diphtheria is a respiratory illness marked by the formation of a membrane-like inflammation in the upper respiratory tract. It is caused by *Corynebacterium diphtheriae*, a toxin-producing bacterium that spreads through respiratory droplets and coughing (Feikin et al., 2015). This bacterium typically affects the respiratory system and the skin. When it infects the lining of the respiratory system, it can cause symptoms such as weakness, a sore throat, mild fever, and swollen neck glands. Additionally, the bacteria can lead to skin infections, resulting in open sores or ulcers. Diphtheria is generally transmitted from person to person, mainly through respiratory droplets from coughing or sneezing. Vaccination using the penta-containing diphtheria vaccine is the most effective way to protect vulnerable children from the disease.

Pertussis (Whooping Cough)

Pertussis, commonly referred to as whooping cough, is a highly contagious respiratory disease caused by *Bordetella pertussis*. It is characterised by a persistent paroxysmal cough that can last for several weeks (Feikin et al.,

2015). Pertussis is prevalent in developing countries, often due to poor sanitary conditions. The disease is primarily transmitted through the inhalation of respiratory droplets released during coughing or sneezing. Infants are particularly vulnerable, and it is a leading cause of morbidity and mortality among children under five years old. The initial symptoms typically appear 7 to 10 days after infection and include mild fever, a runny nose, and cough. In many cases, the cough escalates into a severe hacking cough, often followed by the distinctive "whooping" sound that the illness is named after. Pneumonia is a common complication, although seizures and brain damage are less frequent (WHO, 2018). During an attack, the child's lips and fingers may turn blue, they may experience episodes of breath cessation, and vomiting, which can be fatal. Complications such as bleeding, malnutrition, pulmonary collapse, and bronchopneumonia may occur. Pertussis can be prevented through immunisation with vaccines containing pertussis, such as the pentavalent vaccine (WHO).

Tetanus

Tetanus is a lethal infectious disease caused by a toxin produced by the spore-forming bacterium *Clostridium tetani** (Feikin et al., 2015). These spores are found in various environments, including soil, ash, and the intestines of animals and humans, as well as in excrement. They can also be present on the surfaces of skin and rusted tools like nails, needles, and barbed wire. Remarkably resistant to heat and most antiseptics, these spores can survive for extended periods, sometimes lasting for years (WHO, 2018a).

Tetanus can affect individuals of any age, but it is particularly common and dangerous in newborns. When it occurs within the first 28 days of life, it is

known as "neonatal tetanus." Transmission typically occurs through wound contamination or unsterile practices, including inadequate care of the umbilical cord. The incubation period ranges from 3 to 21 days after infection, with most cases appearing within 14 days. The disease is marked by muscle spasms, commonly affecting the back, abdomen, and limbs. Sudden painful muscle spasms, often triggered by sudden noises, along with difficulty swallowing, seizures, headaches, fever, sweating, and fluctuations in blood pressure or a rapid heart rate, are typical symptoms. In neonates, symptoms include muscle spasms following an inability to suck or breastfeed and excessive crying (Hinfey, 2019; WHO). Tetanus can be effectively prevented through vaccination with tetanus-containing vaccines, such as the pentavalent vaccine.

***Haemophilus influenzae*-b (Hib)**

Haemophilus influenzae is a gram-negative bacterium distinguished by a polysaccharide capsule, which is crucial to its virulence. There are six serotypes (a, b, c, d, e, f) as well as unencapsulated strains, all of which can lead to a variety of diseases, including meningitis, pneumonia, septicaemia, epiglottitis, cellulitis, septic arthritis, and osteomyelitis. Before the widespread adoption of vaccination, *H. influenzae* type b (Hib) was the leading cause of meningitis in children under five years old in many countries (Feikin et al., 2015). Hib is a bacterial infection that can lead to life-threatening brain infections in young children. It is responsible for diseases such as meningitis (inflammation of the coverings of the brain and spinal cord), bloodstream infections, pneumonia, arthritis, and infections in various parts of the body (WHO, 2018b). To protect children under the age of 5, Hib vaccines are administered in a three-dose schedule as part of the

primary series, starting as early as six weeks of age. This vaccination strategy aims to provide effective protection against illness.

Hepatitis B (HBV)

Hepatitis B (HB) is a potentially life-threatening liver disease caused by infection with the Hepatitis B virus (HBV). This global health issue can present as either acute or chronic. Acute Hepatitis B refers to a short-term infection occurring within the first six months after exposure to the virus. The infection can range from mild, with few or no symptoms, to severe cases requiring hospitalisation. Hepatitis B, triggered by HBV, poses a significant risk to liver health (WHO, 2021; CDC, 2016). Chronic Hepatitis B involves a lifelong infection with the Hepatitis B virus, and the likelihood of developing chronic illness depends largely on the age at which the infection occurs. Around 90% of infants infected with HBV develop a chronic infection, compared to about 5% of adults who experience chronic Hepatitis B. This chronic condition can lead to serious health issues, including liver damage, cirrhosis, liver cancer, and potentially death (CDC).

The virus can be transmitted vertically from mother to child during childbirth, or horizontally through exposure to infected blood. Infected children can also pass the virus to uninfected peers within the first five years of life. Other modes of transmission include needlestick injuries, tattooing, piercing, exposure to infected blood and bodily fluids (such as saliva, menstrual, vaginal, and seminal fluids), as well as the reuse of contaminated needles, syringes, or sharp objects. Sexual transmission is also possible (WHO). The incubation period ranges from 30 to 180 days. While many people may not show symptoms, some

may experience signs such as jaundice (yellowing of the skin and eyes), dark urine, extreme fatigue, nausea, vomiting, grey-coloured stools, joint pain, and abdominal pain. Acute Hepatitis B can lead to acute liver failure, which may be fatal. There is no specific treatment for acute Hepatitis B, and vaccination, particularly with a Penta vaccine containing HBV antigen, remains the primary preventive measure against Hepatitis B in children (CDC).

Measles

Measles is an extremely contagious disease associated with severe complications that lead to significant illness and death among children in various regions globally (Zhang et al., 2020). Measles ranks among the leading causes of childhood disabilities, illnesses and deaths, contributing to over 2 million childhood deaths annually (Thar et al., 2020). The disease usually begins with a prodromal phase characterised by fever, malaise, cough, coryza, and conjunctivitis, followed by the appearance of a maculopapular rash. This rash typically spreads from the head to the trunk and then to the lower extremities. While often mild or moderately severe, measles can lead to serious complications, including pneumonia, encephalitis, laryngotracheobronchitis, otitis media, diarrhoea, hepatitis, keratoconjunctivitis, encephalitis, seizures, and death. Caused by the measles virus, the disease occurs seasonally in endemic regions (Lancella et al., 2017; Mondiale de la Santé & WHO, 2017).

Transmission mainly occurs through respiratory droplets or airborne spray, which reach the mucous membranes of the upper respiratory tract or the conjunctiva (Oregon Health Authority, 2021). The average incubation period for measles is 11–12 days, and the typical time from exposure to the onset of the rash

is about 14 days, with a range of 7–21 days. Although there is currently no specific treatment for measles, the most effective preventive measure for children under five years of age is administering the measles-containing vaccine (MCV).

Rubella

Rubella pertains to the family *Togaviridae* and typically induces a mild systemic infection that resembles a less severe manifestation of measles, formerly referred to as 'German' measles. It commonly manifests as a mild and self-limiting ailment in the paediatric population. Nevertheless, if acquired during gestation, it may lead to potentially severe repercussions for the developing foetus (Leung, Hon, & Leong, 2019; Mawson, & Croft, 2019). Its public health importance primarily arises from the teratogenic capacity of the virus, which can inflict damage upon an embryo or foetus (WHO, 2018c). While generally considered a mild affliction, there are rare instances where it can pose serious risks. Infection during pregnancy (congenital rubella) can culminate in congenital anomalies, spontaneous abortion, or foetal demise (Division of Disease Control, 2016). If the infection occurs in the initial weeks of gestation, approximately 85% of newborns might exhibit a constellation of growth impediments and significant congenital malformations collectively termed congenital rubella syndrome (CRS).

The clinical manifestations encompass a pink or red rash that initially appears on the visage, enlarged glands situated behind the ears, a slight elevation in body temperature, and arthralgia and/or myalgia (which is more prevalent in adults); nonetheless, some cases are frequently asymptomatic. The transmission of the disease ensues through the inhalation of microorganisms exhaled, sneezed, or coughed out by an infected individual. The virus invades cells within the upper

respiratory tract, disseminates throughout the circulatory system, and proliferates within the lymphoid tissue of the nasopharynx, impacting various organ systems, including the placenta in instances of early gestational infections (Leung et al., Mawson & Croft). At present, there exists no precise remedy for rubella, thus emphasising the importance of supportive care. Immunising children with rubella vaccine is an efficacious approach to conferring immunity against the ailment (Leung, et al).

Pneumococcal disease

Pneumococcal disease is the leading cause of severe pneumonia and pneumonia-related deaths worldwide (WHO, 2018d). This condition is caused by the pneumococcus bacterium, known scientifically as **Streptococcus pneumoniae**. This gram-positive bacterium has over 90 distinct serotypes, with a specific group being responsible for the majority of invasive pneumococcal disease (IPD) cases (Gierke, Wodi, Kobayashi, & Safety, 2021; Gierke, McGee, Beall, & Pilishvili, 2014). The bacteria frequently colonise the human nasopharynx, particularly in children, without causing symptoms. However, they can spread locally, leading to conditions such as otitis media and sinusitis, be aspirated into the lungs causing pneumonia, or invade sterile areas of the body resulting in sepsis or meningitis. The highest morbidity and mortality rates from serious infections are seen in children and the elderly (WHO). Transmission occurs through respiratory droplets, enabling the bacteria to spread within the host and cause a wide range of clinical syndromes (Scelfo et al., 2021). Routinely vaccinating children with the pneumococcal conjugate vaccine is the most effective way to protect against this disease.

Rotavirus

Rotavirus stands as a significant contributor to public health challenges, particularly as a leading cause of severe, dehydrating gastroenteritis in young children worldwide. It is accountable for approximately 450,000 child fatalities annually, with a notable impact in developing nations (Crawford et al., 2017; Hagbom, 2015). It presents a mild to severe disease which is characterised by vomiting, low-grade fever, and watery stool. With high transmissibility, the virus spreads through direct or indirect ingestion of contaminated food or water. The period of incubation is average between the day of exposure to the 3rd day, and the clinical spectrum ranges from the typical acute, watery, non-bloody diarrhoea accompanied by vomiting and fever to asymptomatic or mild cases. However, in immunocompromised individuals or the elderly, infections can be more severe (Hagbom, 2015; Pérez-Ortín, 2019; WHO, 2018e). WHO recommends including rotavirus vaccination as the most protective and preventive measure against childhood death from the disease (Inchauste et al., 2017).

Yellow fever (YF)

Yellow fever, a viral haemorrhagic illness, is transmitted by yellow fever-infected mosquitoes such as *Haemagogus* and *Aedes* spp. It is caused by an RNA virus belonging to the Flaviviridae family. This disease, which has a fatality rate of over 50% in severe cases, is currently incurable (Mares-Guia, 2020; WHO, 2020a). Endemic to tropical regions in Africa and the Americas, most individuals infected with yellow fever are asymptomatic. Clinical manifestations vary from mild febrile symptoms to severe cases characterised by jaundice and haemorrhage. Initial signs include a sudden increase in body temperature, severe

headache, backache, joint and muscle pain, and vomiting. Other possible symptoms are a slow pulse, elevated temperature, and leukopenia. Progression of initial symptoms may lead to jaundice and haemorrhagic manifestations like epistaxis, gingival bleeding, hematemesis, or melena (CDC, 2019). The incubation period ranges from 3 to 6 days, with a case fatality rate of 20% to 60% in severe cases. Recovery from yellow fever confers lifelong immunity. Transmission via transfusion and breastfeeding has also been documented. Despite the absence of a specific treatment, vaccination with the yellow fever vaccine offers effective prevention for children, as it is safe, cost-effective, and highly reliable.

Routine childhood vaccination schedule in Ghana

The immunisation schedule in Ghana is a key health intervention plan for children under the age of five. It necessitates a minimum of six visits to either child welfare clinics (CWC) or immunisation centres to fulfil the requirements.

Routine Childhood Immunisation Measurements

Fully immunised: children between 12 to 23 months who received one dose of BCG, at least three doses of Pentavalent, three doses of OPV, two doses of Rotavirus and one dose of Measles, IPV, rubella, yellow fever, Meningococcal meningitis vaccine by card plus mother history at the correct intervals/dates at the 12 months of age.

Partially immunised: children 12 to 23 months who had missed one or more of the eligible vaccines.

Non-immunised: children 12 to 23 months who have not received any vaccine before the study.

Coverage by card only: coverage is calculated with a numerator based only on documented dose, excluding from the numerator those vaccinated by history.

Coverage by card plus history: coverage is calculated with a numerator based on the card and mother's report.

Determinants of RCI

In this study, the key determinants have been broadly categorised into; predisposing factors; enabling determinants; healthcare accessibility factors, and need factors.

Predisposing Factors of RCI

From Andersen (1968), an individual's inclination to utilise healthcare services is influenced by predisposing factors. This study used various predisposing factors such as the child's sex, birth order, family size, maternal age, parental education and literacy, marital status, and the mother's religious affiliation.

Sex of the child

One predisposing factor in Andersen's model of health utilisation is sex. The term 'gender' has frequently been used as a synonym for 'sex'. 'Gender' is a social construct that refers not only to the biological 'sex' differences between males and females but to the different roles and expectations, behaviours and constraints that are placed upon an individual by culture and society, by their sex. In this study, gender refers to the biological sex of the child. Until the last three decades, little attention had been paid to women's health as it was assumed that the male biological model could simply be adapted (Kennedy et al., 2020).

Much research has been done in the way of gender and immunisation. In most studies examining correlates of immunisation, the sex of the child is often the first thing discussed. A scoping review of literature conducted in Ethiopia entitled, “what we know and don’t know” about the immunisation programme identified the sex of children as a determinant of childhood vaccination (CV) (Tilahun et al., 2020). From their review, it was identified and reported that some studies have found gender or sex of a child is not a statistically significant determinant of childhood vaccine utilisation (CVU) contrary to what AHU captures as one of the healthcare determinants (Hu, Wang, Chen, & Li, 2017; Joseph, & Ilemona, 2019; Lake, Boulanger, Wasswa, Merbratu, & Fenta, 2016; Meleko, Geremew, & Birhanu, 2017).

Most researchers across the globe believe that, even if there is some association, the consensus is that male children are more likely to be fully immunised than females (Herliana, & Douiri, 2017; Hu et al., 2017; Nozaki, Hachiya, & Kitamura, 2019; Srivastava, Fledderjohann, & Upadhyay, 2020; Thapa, Suwal, & Adhikary, 2019; Yehualashet, 2021). However, others have also argued that there is a strong association between the sex of children and full immunisation. For instance, in Africa, a community-based cross-sectional study with logistics regression analysis on the level of immunisation coverage and associated factors among children aged 12–23 months in Ethiopia was conducted. The results revealed a statistically significant association between the sex of children and immunisation coverage with the male children being 1.8 times more likely to be fully vaccinated than the females (Kassahun, Biks, & Teferra, 2015).

On the contrary, some studies from Africa also, found female children being fully vaccinated than males. For instance, a multinomial analysis of the population-based sample study on factors associated with non- and under-vaccination among children aged 12-23 months in Malawi found 50.51% of female children fully immunised compared to the males with 49.49% (Ntenda, 2019). Apart from this study finding from Malawi, a study from Ethiopia also found female children fully vaccinated against rotavirus and pneumococcal conjugate vaccines (Wondimu, Cao, Wilschut, & Postma, 2019). Another, cross-sectional study from Ethiopia on vaccination coverage and associated factors among children aged 12–23 months found a statistical association between the sex of children's IC with females being more likely to be vaccinated than males (Gualu, & Dilie, 2017).

From the previous studies, the sex of a child does not seem to matter, as to whether it could significantly affect RCIS or not. However, in Ghana and for that matter ASD in the Ashanti Region, this assertion cannot be substantiated because there is not enough data to support any of the claims. Hence, there is the need to practically assess whether the sex of a child could affect RCI in the ASD in the Ashanti Region of Ghana as posited by Andersen's model of healthcare utilisation.

Birth order of the child

Birth order is the chronological order of sibling births in a family (Isaacson, & Radish, 2002). It is an important predisposing factor that affects the welfare and health of the entire household including that of the child. It is one of the identified important determinants in childhood immunisation (Tilahun et al.,

2020). In some parts of the world, especially in Asia, it has been shown that there exists a strong association between CIS and birth order (Hu et al., 2017), with first-born children being more likely to be immunised fully or completely and on time than other subsequent births (Nadella et al., 2019). In Indonesia, a cross-sectional study was conducted to determine IC among children aged 12-59 months old and found a strong association between birth order and IC with higher levels of full or complete IC among firstborn children (Herliana & Douiri, 2017). A similar result was found in a previous study conducted in India. In the study, the percentage of full IC among those who are first and second-born children was higher than those who were born later. The results were that only 37% of children were fully immunised, 56% were partially immunised, and 7% had never been immunised. Among those who were fully immunised, 40.65% were either first or second-born, compared with 28.53% who were born later (Srivastava et al., 2020).

The results from other continents are not so much different from the findings from Africa. For example, a finding from a previous case-control study conducted to find the possible factors associated with incomplete childhood immunisation in Ethiopia revealed birth order as a significant factor in determining incomplete immunisation (Negussie, Kassahun, Assegid, & Hagan, 2015). In Nigeria, a West African country, also, children of the 4th or higher birth order were more likely to be partially or un-immunised than 1st born children [OR:3.4; CI: 1.5–7.8] (Ijarotimi, Fatiregun, Adebisi, Ilesanmi, & Ajumobi, 2018). Although in Senegal, a significant association was found between birth order and immunisation status of a child, the result however revealed higher levels of full or

complete immunisation status among the second and third-born children instead (Sarker, Akram, Ali, Chowdhury, & Sultana, 2019).

Even though a significant association is recognised between the birth order of the child and immunisation status globally, as reported from Asia and some other African countries, especially from the East and West African countries. Notwithstanding the prior findings across continents and countries, it is difficult to report on the same from Ghana, especially from the Ashanti Region since data to support the assertion is scarcely available. As a result, there is a need to find out if the birth order of a child is implicated in the low utilisation rate of RCI in the study areas.

Family size (FS)

Family size is termed as *sibship size* (Blake, 1986; Ryder, 1986). This refers to the number of children in an individual's parental family and not the total number of members in the family (Rathi, & Meena, 2017). A systematic literature review conducted on the topic, of barriers to childhood immunisation in SSA identified FS or the number of children in a household among the determinants of childhood immunisation (Bangura, Xiao, Qiu, Ouyang, & Chen, 2020). FS was associated with the probability of a child being fully immunised (Bangura et al). The higher the number of offspring in a household, the greater the likelihood that the youngest child will not be vaccinated (Luman, McCauley, Shefer, & Chu, 2003). It is emphasised that when the family increases in number, successive children are less likely to be vaccinated as the increasing family responsibilities demand more and more time and detract from healthcare decisions (Khan, Shil, & Mohanty, 2019).

Most studies have revealed that children from large families have low vaccine uptakes, considering the burden of other children at home in taking up immunisation services (Banjari et al., 2018; Elizabeth, George, Raphael, & Moses, 2015; Ntenda, 2019; Tefera, Wagner, Mekonen, Carlson, & Boulton, 2018;). Despite that, some studies have reported a significant relationship between family size and CVU, little can be said about that of Ghana, especially from ASD in the Ashanti Region, since there is limited research done in this regard.

Age of the mother

Socio-demographic differences among individuals are associated with their different behavioural intentions concerning health and healthcare decision-making. Differences like age are discovered to have an important impact on the acceptance of health-related services including CV services (Zhao, Ni, & Zhou, 2018). Maternal age as a sociodemographic factor is associated with healthcare utilisation including CV services (Agunwa et al., 2017; Tilahun et al., 2020). It can be a determinant on its own or in conjunction with other factors. Age can be considered a factor of greater vulnerability, as with children under five years or the elderly, or greater robustness, or because the age group 18 to 25 years is more likely to be engaging in higher risk behaviours such as sexual activity, and alcohol, tobacco, and other drug use (de Jager, & Naudé, 2018). It is a useful demographic indicator (de Jager, & Naudé, 2018; Esposito, Ferrara, Panzaru, & De Vito, 2020).

It is well-recognised that age plays an important role in women's utilisation of medical services (Duong et al., 2018). Maternal age may sometimes serve as a proxy for the women's accumulated knowledge of healthcare services, which may

have a positive influence on the acceptance of full immunisation of children (Duong et al.). Some studies have found an association between maternal age and healthcare services usage including immunisation. For instance, in Asia, a DHS was conducted in 2015 in Myanmar and regarding childhood immunisation, a significant relationship was found between maternal age and CVU. The outcome of the multivariate analysis of data demonstrated that old maternal age was a strong independent predictor of IC (Nozaki, Hachiya, & Kitamura, 2019). Also, in Indonesia, the results of multilevel logistic regression analyses on determinants of immunisation status among 12-to 23-month-old children found mother's age was significantly associated with RCI. The results showed that children of older mothers are more likely to be fully immunised than those of younger mothers (Maharani, & Kuroda, 2018). Adding to these, a case-control study was conducted in Wardha, India, civil hospital to investigate the determinants of low birth weight (LBW). The results revealed a significant association with high odds of maternal age and LBW among mothers aged below 20 years and above 30 years (Taywade, & Pisudde, 2017). A report from Asia has proven that maternal age is a significant determinant of RCI.

Apart from the findings from Asia showing a statistically significant link between mothers' age and RCIS, similar observations have been made in Africa. A systematic literature review conducted by Galadima, Zulkefli, Said, and Ahmad (2021) found a significant link between maternal age and the uptake of RCI in Africa. Subsequently, regression analysis on factors influencing mothers and children's health service uptake in a rural area of southeastern Nigeria also demonstrated a strong association between maternal age and healthcare utilisation

(Agunwa et al., 2017). In Tanzania, research investigating the factors behind delayed or incomplete DPT vaccination in parallel urban and rural birth cohorts of 30,956 infants found a significant link between maternal age and vaccination patterns (Nadella et al., 2019). Similarly, in Ethiopia, a multiple logistic regression analysis predicting the fully vaccinated status of children aged 12-23 months in the Jigjiga District highlighted maternal age as a key predictor for completing RI. The descriptive statistics revealed that full immunisation rates were 52% among children of mothers aged 30 and above, compared to 15.2% among those whose mothers were under 20 years old (Mohamud, Feleke, Worku, Kifle, & Sharma, 2014). Additionally, Geweniger and Abbas (2020) reported that full or complete IC was lowest among children whose mothers were between 15–19 or 35–49 years old at the time of birth, with rates of 29.5% [20.8–38.1] and 25.9% [18.6–33.2], respectively, at the time of the study.

Conversely, some studies have found no significant correlation between maternal age and RCIS (Al-Lela, Bahari, Baderden, Basher, & Hamoodi, 2017; Hu, Wang, Chen, & Li, 2017; Tilahun et al., 2020). For instance, a study conducted in Ethiopia using an unmatched community-based case-control design found no significant relationship between mothers' age and childhood vaccination status, contrasting with other research that identified mothers age as an important factor in determining vaccination completeness (Yenit, Assegid, & Abrha, 2015). Similarly, among Senegalese children aged 12-23 months, maternal age was not identified as a significant factor in determining complete immunisation (Mbengue et al., 2017).

From the review, the age of mothers has been identified as a significant influencer on RCI however this may depend on the study setting and the respondents involved. This is very clear when studies from Ethiopia showed both statistical significance and insignificance between maternal age and RCI. In Ghana, which has similar characteristics just like Ethiopia and other African countries, any statistically significant results are possible however there is no concrete evidence to show otherwise since little information is available to consider.

Parental educational level

Ayub (2021) refers to educational level as the number of educational classes that a respondent or an individual has studied or attained. Education equips individuals with the necessary knowledge and skills that can contribute to an improved quality of life. The level of education has been identified as closely linked to the health of mothers, and their children, as well as the health behaviours of both women and men. It is strongly correlated with better health outcomes and increased life expectancy (Galama, Lleras-Muney, & Van Kippersluis, 2018; Raghupathi, & Raghupathi, 2020). Education is recognised as a vital socio-demographic determinant of health, offering people the knowledge and skills essential for an improved quality of life (GSS, GHS, & ICF Macro, 2009). People with advanced levels of education tend to report better health, with lower levels of morbidity, mortality, and disability (Raghupathi, & Raghupathi).

The level of education has consistently been linked to health outcomes, influencing the well-being of parents and their children (Robat Sarpooshi et al., 2020). Attaining education beyond senior high school is strongly related to

reduced morbidity and mortality, with the attainment of a degree further associated with even greater reductions in morbidity and mortality (Moore, Hill Jr, & Weaver, 2019). Consequently, parents with higher levels of education are better equipped to make informed decisions about their health and, importantly, their children's health, especially concerning RCI services. Across various countries, available data consistently highlights the relationship between health service utilisation and educational levels (Sim, Moey, & Tan, 2014; Xeuatvongsa, Hachiya, Miyano, Mizoue, & Kitamura, 2017).

A study conducted in the Lao People's Democratic Republic to identify factors affecting vaccination status in children aged 12–35 months found that the educational level of parents was a significant predictor of RCI [OR = 1.87, 95% CI: 1.12–3.10] (Xeuatvongsa et al., 2017). Further, a systematic review and meta-analysis, which utilised both qualitative and quantitative methods to examine variables such as geographic, demographic, and sociodemographic characteristics for improving vaccination policies, demonstrated a significant link between mothers' education and the immunisation status of their children. It was predicted and confirmed that children of mothers without formal education had a 28% (95% CI [18%, 47%]) lower likelihood of being vaccinated fully than those whose mothers had at least primary-level education (Ali et al., 2022). Similarly, a systematic review of literature conducted in Africa highlighted nine studies reporting a statistically significant link between maternal education and the utilisation of childhood immunisation services [AOR = 3.55–7.50; 95% CI: 1.02, 10.60] (Galadima et al., 2021). Additionally, in Tanzania, a notable association

was found between maternal education and a lower risk of partial or delayed DTP3 uptake in Morogoro ($p\text{-value} < 0.001$) (Mbengue et al., 2017).

Mothers' educational level: A mother's educational level serves as a robust indicator of health services utilisation, particularly concerning CV. It is widely agreed that a higher level of maternal educational achievement is linked to an enhanced probability of their offspring receiving complete vaccinations (Mora & Trapero-Bertran, 2018). A study conducted in Iraq, using a cross-sectional method to assess immunisation status and determine the familial and child demographic factors affecting immunisation rates, revealed a significant relationship between the mother's educational level and the adequacy of immunisation. The results indicated that mothers with more than 18 years of education were 9.7 times more likely to achieve complete immunisation compared to those with less than 13 years of education [OR = 9.7, 95% CI = 3.73–25.22, $p < 0.001$] (Al-Lela et al., 2017). Additionally, data from a DHS in Senegal, West Africa, focusing on the factors influencing complete vaccine uptake among children aged 12–23 months, underscored the crucial role of maternal education in achieving comprehensive RCIS. The findings from a multivariable logistic regression analysis showed that children aged 12–23 months, whose mothers had at least a secondary school education, had a higher likelihood of being fully immunised (AOR = 1.8, 95% CI [1.20–2.48], $p\text{-value} = 0.001$) compared to those whose mothers had lower levels of education (Mbengue et al., 2017).

Furthermore, there has been a consistent link between low levels of maternal education and limited vaccination coverage. An example of this is

evident in research conducted in Malawi, which aimed to identify factors predicting insufficient vaccine utilisation among children aged 12-23 months. The study found a significant association between maternal education and the under-vaccination of children. It showed that children of mothers with no formal education were more likely to be either unvaccinated or under-vaccinated (Ntenda, 2019). Similarly, in Ethiopia, an analysis that explored factors affecting the uptake of newly introduced childhood vaccines identified a significant correlation between maternal education levels and the acceptance of rotavirus and pneumococcal conjugate vaccines (RVV and PCV) (Wondimu, Cao, Wilschut, & Postma, 2019).

Paternal educational level: The educational level of fathers has been acknowledged as a strong predictor of healthcare service utilisation, including the use of RCI services, according to previous research (Nozaki et al., 2019). Due to their commonly held role as the family's primary decision-maker, fathers often play a crucial part in making decisions for not only themselves but also their spouses and children. The educational background of fathers plays a significant role in shaping healthcare decisions for their families. Numerous studies have highlighted a notable connection between paternal educational level and the utilisation of RCI services.

For instance, research conducted in Asia by Al-Lela et al. (2017) in Iraq revealed a strong association between fathers' educational levels and the degree of vaccine uptake. Fathers with over 18 years of education were nearly 20 times more likely to ensure complete immunisation compared to those with less than 13 years of schooling (OR = 19.7, 95% CI: 3.73-25.22, $p < 0.001$). Similarly, an

analysis of secondary data in India on the factors influencing timely OPV immunisation in regions covered by the CORE Group polio project in Uttar Pradesh identified fathers' education level as the most significant factor in predicting timely OPV immunisation. Children of fathers with limited or no education were more likely to miss OPV1 immunisation compared to those with better-educated fathers (Choudhary, Solomon, Awale, & Dey, 2018). Additionally, a systematic review of literature on RCI uptake in Africa highlighted three studies that underscored a significant correlation between paternal educational level and RCVU [AOR = 3.1; 95% CI: 1.3, 7.4] (Galadima et al., 2021).

Marital status

Marital status represents an additional predisposing factor influencing the utilisation of vaccines and RCIS. There exists a compelling argument suggesting that mothers who are married exhibit a greater propensity to ensure complete vaccination for their offspring in contrast to their unmarried counterparts. Numerous global studies have consistently indicated a substantial correlation between the marital status of mothers and the utilisation of vaccines (Al-Kazrajy & Hattat, 2018; Jibo, Karaye, Gajida, & Abulfathi, 2019; Uwaibi, & Omozuwa, 2021; Zida-Compaore et al., 2019). For instance, an examination conducted in Oceania based on a DHS report in Papua New Guinea from 2016 to 2018, focusing on the determinants of complete vaccine utilisation among 709 children aged 12–23 months, unveiled a significant relationship between maternal marital status and full vaccine utilisation. Both univariate and multivariate analyses demonstrated a notable association, indicating that children with married mothers

had increased odds of receiving full vaccination [AOR = 1.696, CI: 1.113, 2.587], compared to those with unmarried mothers (Budu et al., 2020).

Similar findings are observed in African contexts. A multi-level analysis of DHS data across sub-Saharan Africa, aimed at identifying the factors influencing full RCI among children aged 12–23 months, revealed that children of married mothers were 1.41 times more likely to be fully immunised compared to those with unmarried mothers [AOR = 1.41; 95% CI: 1.27, 1.56] (Fenta et al., 2021). Additionally, a cross-sectional study conducted in Ethiopia, which examined health extension workers' knowledge and factors related to RCI, identified marital status as a significant determinant [$\chi^2 = 6.30$; $P = 0.019$] (Umeta, & Girma, 2021).

In Ghana, Anokye et al. (2018) conducted a cross-sectional descriptive study in Koforidua to assess the socio-demographic factors affecting the incompleteness of RCI among children aged below 60 months. The study revealed significant findings, indicating a strong association between divorced mothers and incomplete immunisation. Divorced individuals [AOR = 3.01, 95% CI: 1.59–58.2] were three times less likely to complete immunisation compared to their married counterparts. Similarly, a quantitative cross-sectional study involving 322 participants in rural Ghana, which examined women's knowledge and factors influencing optimal antenatal care (ANC) utilisation, found a correlation. Logistic regression analysis revealed that unmarried mothers were 70% less likely to utilise ANC services at least four times compared to married mothers (Afaya et al., 2020).

While numerous studies consistently document adverse correlations between single and unmarried mothers and various health services utilisation outcomes, such as immunisation services, a minority of studies have indicated a positive and significant relationship. One such study, conducted in Ghana, revealed that single women, regardless of their previous marital status, exhibited a higher tendency to seek medical assistance from healthcare professionals compared to married women [OR = 1.607; $P \leq 0.01$]. This discovery implied that unmarried women, in comparison to their married counterparts, displayed greater mobility, ease of mobilisation, and enhanced autonomy over their healthcare decisions (Braimah, Sano, Atuoye, & Luginaah, 2019).

Despite the prevailing global pattern where most studies establish a significant link between maternal marital status and health service usage, particularly concerning childhood immunisation, there exist studies that challenge this pattern (Adenike, Adejumo, Olufunmi, & Ridwan, 2017; Ahmad, Jahis, Kuay, Jamaluddin, & Aris, 2017; Al-Lela, Bahari, Baderden, Basher, & Hamoodi, 2017; Makarić, Kolarić, Tomljenović, & Posavec, 2018). For example, a study in Malaysia did not find a significant relationship between maternal marital status and complete immunisation coverage (Lim et al., 2017). Likewise, in Nigeria, a study focused on the individual and socioeconomic factors associated with complete IC among children aged 0-59 months, revealed no notable correlation between mothers' marital status and RCIS (Oleribe, Kumar, Awosika-Olumo, & Taylor-Robinson, 2017).

The existing evidence derived from the literature review indicates that single mothers may encounter limited social support resources and face risks due

to heightened demands for family assistance and upkeep, potentially impeding healthcare decisions for single parents, particularly mothers lacking a partner to share responsibilities with. In the Ashanti region and, consequently, in ASD, there is a dearth of empirical data either substantiating or refuting this claim.

Religion of mothers

An individual's religious affiliation is recognised as a significant factor influencing health service delivery and utilisation (Pirutinsky, Cherniak, & Rosmarin, 2020; Rosmarin & Koenig, 2020). Religion serves as a repository of attitudes and beliefs that can be employed to reframe stressful circumstances in more positive ways (Pirutinsky et al.). Religious status can yield either positive or negative outcomes in terms of health service delivery and utilisation. Positive religiosity is often associated with favourable health outcomes, such as increased utilisation of preventive healthcare services, including RCI (Koenig, 2018; Pirutinsky et al.). Conversely, negative religiosity may be associated with adverse effects or negative health-related outcomes, such as a decrease in the use of medical services, especially those for mothers and children. (Pirutinsky et al.). Religion, as a factor, has a significant association with service utilisation (Wondimu et al., 2019). It has been linked to a decrease in cardiovascular disease rates, expediting recovery from illness, managing depression and anxiety, underutilisation of preventive health services, as well as improving psychological well-being and increasing the use of preventive care, such as mother and child health services (Koenig, 2018).

Research has shown that religion can both positively and negatively influence service utilisation, depending on the type of service and the population

in question (You, Yoo, & Koh, 2019). In a systematic review, Galadima et al. (2021) identified evidence of significant religious impacts on CVU. For example, Abdullahi (2018) reported that religion was a significant factor in the completion of RI schedules in northwestern Nigeria ($\chi^2 = 2100.000$, $p = .000$). The findings indicated that Muslim children were twice as likely to complete immunisation schedules compared to children from Traditionalist backgrounds (UOR = .224; CI .210 - .240). Similarly, multivariate logistic regression analysis from a study in rural western Ethiopia highlighted a significant correlation ($p < 0.01$) between religion and adherence to antenatal care visit schedules, showing that Christian women were 3.3 times more likely than Muslim women to attend three or fewer ANC visits, or none at all (Tolera, Gebre-Egziabher, & Kloos, 2020).

Antenatal care (ANC) Contacts

The World Health Organisation (WHO, 2016a) defines ANC as the provision of healthcare services by skilled professionals to pregnant women and adolescent girls, aimed at ensuring optimal health outcomes for both mother and child during pregnancy. ANC is a crucial component of maternal healthcare, particularly throughout pregnancy (Kifle, Azale, Gelaw, & Melsew, 2017). The frequency of ANC visits has been identified as a significant factor influencing RCVU (Tilahun et al., 2020). For instance, in India, it was observed that mothers who received tetanus immunisation during ANC visits were more likely to utilise immunisation services for their children. Similar patterns have been documented in Africa.

In Ethiopia, a community-based cross-sectional study highlighted a significant link between ANC follow-ups and complete immunisation. Mothers

with at least two ANC visits during pregnancy were four times more likely to ensure their children were fully vaccinated compared to those without ANC follow-ups (Gualu & Dilie, 2017). Furthermore, an analysis of secondary data from the 2011 Ethiopia DHS revealed a strong correlation between ANC attendance and childhood immunisation status, with children of mothers who did not attend ANC being more likely to be incompletely immunised (Mohammed, 2016). An unmatched case-control study in Ethiopia also found that children of mothers who did not attend ANC were over twice as likely to miss complete vaccination (Yenit, Assegid, & Abrha, 2015). Additionally, a cross-sectional study involving a large sample of mothers in Ethiopia reinforced the strong association between ANC attendance and full immunisation status (Lakew, Bekele, & Biadgilign, 2015).

Place of delivery

In this study, "place of delivery" refers to the location where pregnant women choose to give birth, whether in a health facility (public or private) with trained healthcare professionals or at home with unskilled attendants. This decision can have a significant impact on childhood immunisation outcomes (Tilahun et al., 2020). Institutional deliveries are often linked to higher uptake of immunisation services (Rathi & Meena, 2017). For instance, research has shown that children born at home are more than four times as likely to have incomplete vaccinations compared to those born in health facilities. Additionally, an analysis of data from the 2011 Ethiopia DHS revealed that children born at home had a higher likelihood of being incompletely immunised than those born in healthcare institutions.

While many studies underscore the significance of the place of delivery as a determinant of a child's immunisation status, some research presents contrasting findings. For example, a descriptive cross-sectional study conducted in Nigeria, which investigated factors influencing maternal satisfaction with immunisation services at primary healthcare (PHC) centres, found no significant correlation between the place of delivery and mothers' satisfaction with immunisation services [$p = 0.665$] (Uwaibi & Omozuwa, 2021).

Enabling Factors of Routine Childhood Immunisation

Health and socioeconomic status (SES) exhibit a strong correlation (Assari, & Caldwell, 2019; Kivimäki et al., 2020; Schultz et al., 2018; Tilahun et al., 2020). There is evidence demonstrating widespread socioeconomic gradients in health across and within countries, and communities, as well as highlighting social inequalities in health as a nearly universal element of society. People with low SES generally have poorer health outcomes than those who are better off in society (Kivimäki et al.,). Indeed, socio-economic indicators have been associated with immunisation service utilisation as noted by Rosengren et al, (2019). This study specifically explored SES variables such as parental occupation, parental income level, and the type of housing of the respondents.

Occupation

Occupation is a broad term that refers to the 'activity someone routinely engages in, particularly their regular job or method of earning a living'. It has been proven that the occupational status of an individual correlates well with health outcomes (Kim, Lee, Lee, & Park, 2017). Some have suggested that there is a health gradient related to one's job, where higher occupational status is linked to

better health and lower mortality rates. This connection not only persists but may even strengthen over time (Qi, Liang, & Ye, 2020). Arguments have also been made concerning the relationship between occupation and adverse health outcomes, including perceptions of low health, suboptimal physical and mental health, and diminished utilisation of preventive health services (Blanquet, Labbe-Lobertreau, Sass, Berger, & Gerbaud, 2017). In most instances, poverty from unemployment leads to adverse health outcomes as well as low health service utilisation (Olaitan, Okafor, Onajole, & Abosedo, 2017). A descriptive cross-sectional study on the factors affecting healthcare facility and service use among the elderly in Ghana found that the probability of accessing healthcare services was significantly impacted by whether the individual was actively employed and earning an income. (Yeboah, & Gyamfuah, 2014).

Concerning RCI, the decision to ensure the child is fully immunised is typically a collaborative effort between the mother and father. However, in many African contexts, husbands often serve as the primary breadwinners and major decision-makers (Olaitan et al., 2017). A systematic analysis of the literature on the obstacles to childhood vaccination in sub-Saharan Africa strongly emphasised that mothers are responsible for taking their children for immunisation services (Bangura et al., 2020). Nevertheless, challenges arise when husbands oppose and prevent their wives from immunising the children by withholding necessary financial support (Bangura et al.; Malande et al., 2019; Zewdie, Letebo, & Mekonnen, 2016). The situation is exacerbated when mothers are not engaged in any form of occupation or job and depend solely on their husbands for their livelihood and healthcare utilisation services. In such cases, the lack of finances is

identified as a significant barrier hindering full CVU (Adedokun, Uthman, Adekanmbi, & Wiysonge, 2017; Nadella et al., 2019; Ntenda, 2019; Mthiyane et al., 2019; Tefera, 2018).

Among working mothers, the nature of their occupation is often reported as a significant factor affecting RCI (Nolna et al., 2018; Tefera et al., 2018). For instance, a systematic review of the literature highlighted that mothers involved in coffee farming and processing struggled to send their children for vaccinations as scheduled during the first quarter of the year due to their busy schedules with coffee collection and processing (Bangura et al., 2020). Similarly, Tefera and colleagues found that housewives not engaged in any external economic activity had higher full immunisation coverage for their children compared to those in jobs such as merchants or public/private employees in Ethiopia (Tefera et al.).

Conversely, research has shown that women in the workforce are more likely to utilise healthcare services, including immunisation. On the other hand, research indicates that women in the workforce are more likely to use healthcare services, such as immunisation. For instance, research in India on the factors influencing prompt oral polio vaccination in Uttar Pradesh social mobilisation network districts discovered that children of working mothers were far more likely than those of jobless mothers to receive all recommended vaccinations (Choudhary et al., 2018). Additionally, Adegboye, Kotze, and Adegboye (2014) found that a multi-year trend study of RCI uptake and coverage in Nigeria revealed a positive relationship between women's gainful work and the use of high-quality medical services. This suggests that employed women are more empowered to make healthcare decisions within the family, positively influencing

their children's full immunisation even without financial support from their spouses.

Income level

Income plays a crucial role in determining healthcare-seeking behaviour in this study and has been prominently featured in previous research to examine health-seeking behaviour, risk factors, barriers, types of services, and delays in accessing care (Schultz et al., 2018; Tilahun et al., 2020). Numerous studies highlight a strong link between parental income levels and the utilisation of preventive care services for children. For instance, a scoping literature review by Tilahun et al. demonstrated that household income significantly influences the likelihood of a child being vaccinated, with children from wealthier families being more likely to receive full vaccination compared to those from poorer backgrounds.

In the USA, a study investigating vaccination coverage among children aged 19–35 months found that health insurance and poverty status were closely related factors contributing to lower vaccination coverage. The results indicated that children with private insurance, including Medicaid, had reduced coverage, and those without insurance had even lower coverage for most vaccines (Hill, Elam-Evans, Yankey, Singleton, & Kang, 2017). In Asia, a multilevel analysis of factors influencing the immunisation status of children aged 12–23 months in Indonesia between 2008 and 2013 revealed that children from high-income families were more likely to be fully vaccinated (Maharani & Kuroda, 2018). Similarly, a secondary data analysis in India, focusing on ‘demand-side’ factors affecting the prompt administration of the OPV in social mobilisation network

catchment areas of the CORE Group polio project, found that infants from the less wealthy quintile households had more likelihood of missing the OPV1 dose (Choudhary et al., 2018).

In Ghana, research demonstrated a significant relationship between household wealth and healthcare service accessibility, indicating that households with lower incomes had lower healthcare utilisation rates than households with higher incomes (Brammah, Sano, Atuoye, & Luginaah, 2019). These findings are consistent with numerous studies that highlight financial constraints as a major barrier to RCI (Adedokun, Uthman, Adekanmbi, & Wiysonge, 2017; Nadella et al., 2019; Ntenda, 2019; Mthiyane et al., 2019; Tefera, 2018).

Although most studies have identified a significant relationship between family income and CVU, some research presents contradictory findings, reporting no significant association between household income level and immunisation status. For instance, in the logistic regression analysis, an Ethiopian investigation of the factors influencing full childhood immunisation showed no evidence of a significant relationship between income level and childhood immunisation (Abshoko, 2016). Another case-control study from Ethiopia, which randomly selected children between the ages of 12 to 23 months old to determine the factors related to incomplete RCVU, also found no significant link between monthly income level and incomplete vaccine uptake (Negussie et al., 2015).

Type of housing

Housing, as per Henilane (2016), is described as a dwelling, residence, or any place suitable for human habitation. It serves as a shelter providing individuals with a space to rest, sleep, and ensure safety and warmth. Recognised

as a fundamental human need, housing plays a crucial role in the health and economic development of nations, contributing to 10-20% of overall economic activity and representing the primary fixed asset of households. Moreover, it serves as an indicator of a household's living standards (Henilane, 2016; Henilane, 2015). In Ghana, diverse housing types exist, characterised by varying materials used or architectural designs. Materials include mud, wood, bricks, and blocks, while designs encompass compound houses, apartments, flats, townhouses, semi-detached houses, detached houses, container houses, mansions, and penthouses (Eden Heights, 2020).

Similar to occupation and income, the type of housing can be considered a proxy for the socioeconomic status of a household, potentially influencing human health and healthcare service utilisation (Baxter, Tweed, Katikireddi, & Thomson, 2019). Housing quality is related to health outcomes and affects the use of preventive health services, with substandard housing contributing to health disparities. Research suggests that enhancing housing conditions can result in positive health outcomes. Individuals experiencing homelessness or residing in substandard housing are reported to have increased morbidity, mortality, and decreased utilisation of preventive health services compared to those in well-housed populations (Aldridge et al., 2018; Baxter et al.).

The findings suggest that women residing in households with cement and block structures have a higher likelihood of seeking preventive health services than those living in thatched houses. Approximately 29% of women in cement and block houses sought healthcare, compared to 27.4% in rudimentary houses.

However, these differences were not statistically significant (Chakraborty et al., 2003).

Access to Routine Childhood Immunisation Services Factors

Access to healthcare services entails the prompt use of available health resources to achieve the best health outcomes, influencing physical, social, and mental well-being. It plays a pivotal role in disease and disability prevention, health condition detection and treatment, overall quality of life, prevention of premature death, life expectancy, and the increased utilisation of childhood vaccination services. As an integral component of comprehensive health systems globally, it significantly influences the disease burden faced by numerous developing countries (Ashiagbor, Ofori-Asenso, Forkuo, & Agyei-Frimpong, 2020). However, healthcare, much like other public services, is not uniformly accessible to all individuals, and insufficient physical access to primary healthcare, including vaccination services, poses a significant obstacle to achieving universal healthcare objectives (Joseph et al., 2020; Noory, Hassanain, Edwards, & Lindskog, 2021). Limited healthcare access is a critical concern leading to unmet healthcare needs, delays in accessing adequate care, the inability to obtain preventative services, and avoidable hospitalisations (Ashiagbor et al., 2020). The concept revolves around the population's ability and willingness to overcome the physical gap between their residence and the location of a health facility, influenced by various behavioral, cost, and distance factors (Joseph et al.; Noory et al.).

In Ghana, RCI services are provided free of charge; nevertheless, a notable proportion of children still face challenges in accessing these health services. This

study measures the accessibility to a health facility for RCI by considering factors such as place of residence, the presence of static and outreach services, distance, time required to reach the facility, communication, type of service facility, transport, and community participation.

Place of residence

One major factor affecting access to health services, including the use of RCI services, is the place of residence, which is classified as either urban or rural. This distinction highlights the differences in living conditions between urban and rural areas. This distinction reflects the variations in living conditions between urban and rural settings (Braithwaite et al., 2019; Tilahun et al., 2020). Disparities in living conditions, encompassing aspects like access to electricity, well-maintained roads, water supply, transportation, communication facilities, poverty levels, and overall quality of life, tend to be more pronounced in urban areas compared to rural areas. These variations can significantly shape the perceptions and attitudes of individuals (Atuoye et al., 2015; Braithwaite et al.).

The implications of these differences extend to the performance of health services, where Primary Health Care (PHC) units responsible for immunisation services may be better equipped and staffed in urban areas than in rural counterparts. Notably, storage facilities for vaccines and drugs exhibit better conditions in urban areas. The reluctance of professional health personnel to accept postings in rural areas further contributes to this urban-rural divide. Given the concentration of PHC facilities in urban areas and the presence of secondary and tertiary healthcare facilities, urban populations generally receive more comprehensive health services compared to rural areas (Braithwaite et al.). Rural

populations often face disadvantages in accessing various health services, including emergency care (Li, Shi, Liang, Ding, & Xu, 2018). Despite economic growth and improvements in health outcomes in China, significant urban-rural gaps persist in healthcare resources, health outcomes, and illness prevalence.

In examining infant mortality rates, rural populations have been found to experience more than twice the mortality rate compared to their urban counterparts [5.2/1000 vs. 12.4/1000] (Li et al., 2018). Studies have consistently highlighted disparities in medical care utilisation between rural and urban inhabitants, citing imbalanced development in medical service provision as a reason for reduced healthcare consumption in rural areas (De la Cruz-Sánchez, & Aguirre-Gómez, 2014; Kamal, Curtis, Hasan, & Jamil, 2016; Li et al., 2018). A study in Bangladesh focused on trends in equity in the use of maternal health services, revealing higher rates of women receiving ANC from medically trained providers (MTP) in urban areas compared to rural areas [60% vs. 37%] (Kamal et al.).

The scoping review by Tilahun et al. (2020) supports these findings, highlighting that the place of residence has a substantial impact on VU, with children in urban areas being considerably more likely to receive all recommended vaccines compared to those in rural areas. For instance, a study on complete RCVU in Ethiopia, based on the 2011 DHS data, revealed significant disparities in vaccination rates between children in rural and urban areas. According to the report, the majority of the children (83.5 per cent) were residents of rural areas. Among these rural children, 96.3% of them were not fully immunised compared to their urban counterparts. After accounting for other

variables, 91.5% of the rural resident children exhibited lower rates of full immunisation compared to their urban counterparts (Abshoko, 2016).

Type of EPI facility available

The setting where vaccination services are offered is closely linked to immunisation outcomes. To maximise the utilisation of health services, various strategies for routine immunisation delivery have been implemented, including facility-based (fixed or static) services and outreach-based services (GoG, 2014; Rasmussen & Goodman, 2018; UNICEF, 2020b).

The fixed facility (static) approach involves regularly scheduled vaccination services at health facilities on specific days and hours. These services are available whenever eligible clients visit the facility and typically take place in hospitals or health centres in densely populated areas (GoG, 2014; UNICEF, 2020b).

Outreach services, in contrast, are designed to deliver healthcare to individuals who cannot easily access health facilities. The main goal of outreach clinics is to increase accessibility and ensure that distance is not a barrier to immunisation. In countries like Ghana, outreach trips are usually completed within a day by health facility staff using various modes of transportation. Monthly visits offer timely protection for children (GoG, 2014; UNICEF, 2020b). In addition to routine static and outreach services, many countries, including Ghana, carry out periodic catch-up campaigns aimed at reaching hard-to-access populations, such as those in remote regions, urban poor communities, and groups encountering cultural and religious obstacles. These efforts also include periodic mass campaigns (mop-ups) targeting high-risk groups, such as areas with low

vaccination coverage, high disease prevalence, inadequate surveillance, densely populated cities, slums, displaced persons, migrants, and border regions (GoG, 2014; UNICEF, 2020b).

A study emphasised that community outreach can be very effective by enhancing people's awareness of common illnesses and available treatments at community clinics, which in turn boosts their willingness to seek care at these facilities. For instance, in southwest China, efforts by officials and volunteers to promote community-based healthcare across seven townships and 49 villages led to a significant rise in the use of clinic services for child health, postpartum care, and chronic disease management (Sang & Cheng, 2020).

Distance and travel time

Geographical accessibility to healthcare relates to the connection between the spatial distribution of the population and the availability of healthcare facilities. It assesses the distance between locations, factoring in elements such as travel time, proximity to facilities, and road conditions (Ashiagbor et al., 2020). The distance or time taken to reach the nearest health facility is commonly used as an indicator of healthcare accessibility and significantly impacts utilisation. The WHO advises that everyone should reside within a 5 km radius or one hour's travel time from a health facility (Nesbitt et al., 2016). However, some individuals live closer to health services, while others must travel long distances, affecting their use of health services, including RCI services (Ashiagbor et al.; Nesbitt et al.). Numerous studies highlight that walking or travel time and distance are crucial factors influencing healthcare utilisation (Ashiagbor et al.; Khan et al., 2021; Nesbitt et al.; Xeuatvongsa et al., 2017).

For example, a multi-country study on health facility access, service utilisation, and child health outcomes found that children living closer to health facilities had higher odds of neonatal mortality. Specifically, those residing within 1 km of a health facility had 7.7% higher odds of neonatal mortality, those within 2-3 km had 16.3% higher odds, and those within 5 km had 25% higher odds. Children living more than 10 km away had 26.6% higher odds of neonatal mortality. Additionally, women living more than 10 km from a health facility were 55.3% less likely to deliver in a facility compared to those living within 1 km, highlighting the significant impact of distance on health outcomes (Karra, Fink, & Canning, 2017).

In Africa, research in Ethiopia found that children from families living an hour or more away from vaccination sites were less likely to be fully vaccinated compared to those living 30-59 minutes away (Tefera et al., 2018). Similarly, a study in Malawi noted that shorter travel distances to clinics increased the uptake of modern contraceptive methods (Hamon et al., 2020). These findings align with those from Ghana.

In Ghana, a study on the accessibility of health facilities in rural areas revealed that over half of the communities had high access to Community-based Health Planning and Services (CHPS) compounds and health centres, but only a small percentage (4%) had good physical access to the district hospital (Agbenyo, Nunbogu, & Dongzagla, 2017). Another study in the Brong Ahafo region found that 58% of deliveries occurred in health facilities, with distance being a significant factor: 79% of women living within 1 km of a facility had a facility delivery, compared to 28% of those living more than 10 km away. Women living

between 1 km and 5 km from a facility had 68% lower odds of delivering in a facility, and those living more than 10 km away had 90% lower odds (Nesbitt et al., 2016).

While many studies demonstrate significant relationships between distance and healthcare utilisation outcomes, some report no significant associations. For example, a study in Ghana's Eastern Region found that although each kilometre increase in distance reduced the number of facility deliveries by 6.7%, the quality of care did not significantly impact the number of deliveries. Women in rural areas travel an average of 4 km farther than those in urban areas to reach a hospital (Dotse-Gborgbortsi et al., 2020).

Travel time also impacts the utilisation of preventive health services, including RCI. A study in Laos identified travel time to healthcare facilities as a major obstacle to timely vaccination (Hefelet al., 2020). In Ethiopia, a study comparing health service utilisation between insured and uninsured households found significant differences in travel time to the nearest health institution and insurance enrollment (Atnafu, Tilahun, & Alemu, 2018). Another Ethiopian study found that shorter travel times to health facilities were linked with a lower likelihood of incomplete RCI (Yismaw et al., 2019). Tefera et al. (2018) also reported that households living an hour or more from vaccination sites had lower odds of being fully vaccinated than those living 30-59 minutes away. Miyahara et al. (2016) confirmed these findings, noting that greater distances from vaccination sites reduced the likelihood of timely vaccination in The Gambia.

In Ghana, existing literature shows a significant relationship between travel time and distance to healthcare facilities and service utilisation. However,

there is limited empirical evidence on preventive health services, specifically routine childhood vaccination, in the Ashanti Region and the ASD. Therefore, further investigation into the impact of distance and travel time on RCVU outcomes is necessary.

Transport

Transportation refers to the movement of people and goods from one location to another. Various modes of transportation are available for the movement of individuals as well as the transportation of goods and services between different places. Transportation is generally categorised into five main types: air, rail, road, water, and path. The choice of a particular mode of transport is influenced by several factors, including speed, accessibility, safety, reliability, capacity, fuel efficiency, privacy, and comfort (Odoom, Kyeremeh, Afram, & Tawiah, 2020). The predominant means of transport for people in most African countries especially in Ghana is by road which includes the use of vehicles, motorbikes, bicycles, or walking on foot (Massavon et al., 2017). Several studies including a review in Australia have found a relationship between means of transport and health service utilisation (van Gaans, & Dent, 2018).

Although, globally, RCI services are mostly delivered free of charge to clients especially those in underdeveloped countries, however, means of transport to access this service requires money, or mothers/caregivers have to walk long distances to access the services, or the health service staff have to pay for fuel or the fares to provide outreach services (Malande et al., 2019; van Gaans, & Dent, 2018; Yismaw et al., 2019). In Africa, means of transport to vaccination centres could influence VU rate. For instance, in Gondar City in Ethiopia, Yismaw and

colleagues found an association between means of transport and vaccine utilisation. The logistic regression analysis revealed that participants who travelled to nearby health facilities by car had a 90% reduction in incomplete vaccination rates compared to those who walked to the facility.

Although studies have found transport and transport costs as having a significant influence on health services utilisation including child healthcare services like vaccine utilisation, some studies have also found the contrary. For instance, a study was conducted in Nigeria to determine the levels of geographic differences in RCI between households in an urban and a rural community and to identify the determinants of RCVU in the two geographic areas. The results revealed an insignificant difference in the cost of transportation to healthcare facilities between those from the urban and rural areas (Sibeudu, Uzochukwu, & Onwujekwe, 2019). In Ghana, just like other African countries, means of transport to vaccination centres could probably affect access to RCVU however, there is limited data to support such a claim.

Waiting time

Waiting time is described as the period between a customer's arrival and the commencement of service (Worlitz, Vu, Hettling, & Woll, 2019). In a study on the effects of the "ideal clinic" implementation on patient waiting times in South African primary healthcare clinics, Egbujie et al. (2018) referenced the South African national policy, which defines patient waiting time as the duration a patient spends waiting for services in a healthcare setting, such as a hospital outpatient clinic, primary healthcare clinic, or specialist clinic. Similarly, Xie and Or (2017) defined waiting time as the length of time patients wait at healthcare

facilities to be seen for consultation and treatment, noting that the WHO views waiting time as a crucial indicator of a responsive health system. Therefore, waiting time is a vital factor in healthcare utilisation, including routine vaccination services for children.

Long waiting times are frequently observed in outpatient facilities and contribute to various public health challenges, including limited access to care, disruptions to hospital schedules, missed appointments, patient dissatisfaction, and patients moving from one clinic to another in search of shorter waiting times (Egbujie et al., 2018; Sun, 2017). Conversely, shorter waiting times result in higher patient satisfaction and an increased likelihood of facility use. In Africa, waiting time is a significant factor influencing healthcare utilisation, including child welfare clinic (CWC) services such as routine childhood vaccinations (RCVs). For instance, a community-based cross-sectional study in Ethiopia assessed maternal satisfaction with childhood immunisation services and its associated factors using bivariable and multivariable logistic regression analyses. The study found that mothers who received immunisation services within 30 minutes were 1.83 times more likely to be satisfied compared to those who waited longer than 30 minutes (Gebreyesus et al., 2020).

However, other studies in Africa have yielded different results. In Nigeria, a comparative cross-sectional study in two communities in Anambra state examined geographical differences in routine vaccine uptake between urban and rural households. Using a multistage sampling technique and analysing data with descriptive and multiple logistic regression, the study concluded that long waiting times were not a significant factor influencing households' preference for health

facilities for RI services (Sibeudu et al., 2019). While it is reasonable to assume that waiting time could impact RCVU in Ghana, it is difficult to make conclusive assertions due to a lack of current data.

Communication

Effective communication, an essential component of high-quality healthcare delivery, improves interactions between healthcare users and providers. (Agyemang-Duah et al., 2021; Trimmer & Målqvist, 2019). Within healthcare settings, effective communication hinges on a provider's ability to understand and address their patient's needs and comprehension levels (Trimmer & Målqvist). Improved communication between providers and patients has been associated with better health outcomes, while poor communication can hinder effective healthcare delivery (Agyemang-Duah et al.; Trimmer & Målqvist).

Globally, evidence indicates that effective patient-provider communication positively influences healthcare outcomes, particularly in high-income countries. However, in lower and middle-income countries (LMICs), especially in sub-Saharan Africa, there is limited documentation on the quality and impact of such communication (Trimmer & Målqvist, 2019). Nonetheless, some evidence has been identified in a few African countries.

For instance, in Ethiopia, a community-based cross-sectional study conducted in the Wadla district involved 682 mothers of children under one year old. The study used a two-stage cluster sampling technique to select households for data collection. Bivariable and multivariable logistic regression analyses showed that mothers were 2.03 and 2.24 times more likely to be satisfied with and use childhood immunisation services, respectively, compared to those who did not

receive adequate information about current vaccines and vaccine doses (GebreEyesus et al., 2020). Additionally, mothers who were informed about the next immunisation schedule were 3.21 times more likely to be satisfied with the service (GebreEyesus et al.).

Recent qualitative research aimed at optimising health facility and community linkage to enhance immunisation services identified inadequate communication with clients as a barrier. The study, which used an explanatory method, found that most participants cited insufficient communication due to workload, lack of ability or motivation, and a shortage of information, education, and communication (IEC) resources as barriers to community-to-facility linkage (Kerebih et al., 2021). In Ghana, a related study examined communication barriers to formal healthcare utilisation among impoverished elderly individuals in the Atwima Nwabiagya district of the Ashanti Region. The study employed bivariate and multivariate statistical methods and found that poor communication significantly impeded formal healthcare use among the elderly population in the area (Agyemang-Duah et al., 2021).

Need Factors of Routine Childhood Immunisation

Healthcare utilisation is shaped by the socio-demographic factors of individuals, socio-economic characteristics of households, accessibility to healthcare, and the specific needs of the households. The need factors are influenced by an individual's awareness and understanding of health requirements and their willingness to seek care (National Academies of Sciences, Engineering, and Medicine, 2018). According to Andersen (1995), these need factors can be categorised into perceived needs and evaluated needs.

Perceived need involves how individuals or communities perceive their own overall health and functional status, their experiences of symptoms, pain, and health concerns, and whether they deem these issues significant enough to warrant seeking assistance from healthcare providers. This concept of perceived need provides insight into healthcare-seeking behaviours and the extent to which individuals adhere to health services. In contrast, evaluated need is determined by professional assessments of an individual's or community's health status and their requirement for healthcare. It is closely associated with the type and amount of treatment recommended once a patient consults a healthcare provider.

Parental knowledge

Knowledge serves as a critical need factor, encompassing experiences, relevant information, and specialised insight that collectively form a foundation for interpreting and assimilating new experiences and data (Mohajan, 2016). This factor plays a pivotal role in shaping health-related decisions and the utilisation of healthcare services.

The knowledge possessed by parents significantly impacts their use of healthcare services, particularly RCI (Lake et al., 2016). For instance, a key barrier to immunisation and an understanding of the importance of vaccines is often linked to a lack of parental knowledge (Nolna et al., 2018).

A systematic study examining barriers to RCI in sub-Saharan Africa identified limited parental knowledge about immunisation as a major factor contributing to the high number of unvaccinated children in the region. The study observed that children born to mothers with minimal or no knowledge of vaccination were less likely to complete the required vaccine series (Bangura et

al., 2020). Another systematic literature review and meta-analysis highlighted various factors related to completed vaccine utilisation, including a mother's understanding of the appropriate age to complete immunisation, knowledge of the immunisation schedule, and the benefits of vaccination as key predictors of RCIS in Ethiopia (Nour et al., 2020). Similarly, Tilahun et al. (2020) found that children whose parents had a strong understanding of immunisation, and VPDs were more likely to be fully vaccinated. This knowledge positively influences parental health-seeking behaviours and contributes to enhancing CVU.

In addition to parental knowledge, awareness of vaccines and vaccination activities plays a significant role in influencing RCIS. For example, a study noted that low community awareness, misconceptions about vaccines causing illness, and doubts regarding vaccine safety and effectiveness are substantial barriers to immunisation uptake, particularly in the case of polio (Toole, 2016).

While global research generally indicates a strong relationship between parental knowledge and RCIS, some studies have found little or no significant association. For instance, a community-based unmatched case-control study in Ethiopia revealed no significant link between a child's vaccination status and the mother's understanding of the vaccine schedule (Yenit et al., 2015). Similarly, a multivariable analysis conducted in Ethiopia found no statistically significant correlation between a mother's knowledge of the immunisation schedule and the incomplete immunisation status of their child (Negussie et al., 2016).

In sub-Saharan Africa, the relationship between mothers' knowledge and awareness of vaccines and vaccination activities and RCIS has shown mixed results, with some data indicating a significant relationship and others showing no

clear link. In Ghana, while parental knowledge about vaccines and vaccination activities could potentially influence RCIS, the lack of empirical data makes it challenging to draw definitive conclusions.

Mothers perceived attitude of healthcare providers

The concept of attitude is defined as a mental and neural state of readiness that develops over time, influencing an individual's responses to related objects and situations (Allport, 1935). Essentially, attitude is shaped by experience and affects behaviour. Another definition describes attitudes as complex internal states that guide actions and behaviours toward people, objects, and events (Scarpa, Smeltzer, & Jasion, 1992). Haddock and Maio (2008) further define attitude as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour" (p. 114). These definitions collectively indicate that attitude is a mental state determining a person's reactions, whether positive or negative, toward others, objects, and events.

Parental perceptions of healthcare providers' attitudes can significantly influence service utilisation. The attitudes of healthcare providers towards mothers are crucial for making immunisation services accessible (Abdullahi, Stewart Williams, Sahlèn, Bile, & Kinsman, 2020; Liu et al., 2019). Globally, and likely in Africa as well, the perceived attitudes of healthcare providers play a significant role in determining RCIS. For example, a qualitative study in East Africa on childhood vaccine uptake in Somalia highlighted that healthcare providers' attitudes are critical for vaccination coverage. A vaccine-hesitant mother recalled witnessing a service provider destroying polio vaccines and

falsifying records, which made her suspicious and unwilling to vaccinate her children (Abdullahi et al.).

Positive attitudes from healthcare providers are likely to lead to positive outcomes. A study in Ethiopia found that mothers who were satisfied with the service and developed a favourable attitude towards childhood immunisation had 3.80 odds higher of being satisfied with the service than those with an unfavourable attitude (Gebreyesus et al., 2020). This supports the notion that a positive attitude towards childhood immunisation can positively affect vaccine uptake. Data suggest that positive attitudes of healthcare providers can enhance childhood vaccine uptake. In Ghana, this projection could be applicable, though empirical data to support this, particularly in the Ashanti Region, is limited.

Perception of mothers on vaccines and vaccination services

Fernández-Niño et al. (2019), describe perception as a cognitive process that facilitates the creation of judgments or categories that shape our understanding of reality. Additionally, it can be described as the sensory experience of the environment, involving both the identification and reaction to environmental stimuli (Cherry, 2020; Williams, 2014). These definitions emphasise that through the perceptual process, individuals grasp the vital characteristics and elements of their environment that are essential for survival. Perception shapes experience and influences our ability to interact with the environment (Cherry; Williams). Furthermore, perception is crucial for health because it helps identify population impressions of health status, determine needs, and inform actions (Fernández-Niño et al.).

The behaviour of healthcare providers in delivering immunisation services, as well as parents' perceptions of this delivery, can impact RCIS. Sometimes, healthcare providers may be unfriendly to parents, undermining their sense of security and creating feelings of alienation and suspicion (Lifalaza, Stern, & Ashipala, 2018). Various studies have identified the influence of parents' perceptions of healthcare system delivery on health outcomes, including RCIS.

For instance, in East Africa, a study explored how the population perceives health services and how the quality of these services is affected by expectations, sociodemographic and socioeconomic factors, as well as the demand for curative and preventive care in five sub-cities of Mekelle City, Ethiopia. This qualitative study, grounded in phenomenological philosophy, found that perception was a significant factor in determining health service delivery and utilisation (Girma, Robles, Asrat, & Hagos, 2020). Another qualitative study conducted in Ethiopia on improving health facilities and community connections to enhance immunisation services found that perception is crucial in attaining vaccination coverage. The study noted that participants often mentioned that community perceptions of healthcare providers' friendliness, communication, counselling, and responsiveness were barriers to community linkage (Kerebih et al., 2021). In Ghana, while concluding that parental perception of healthcare providers is a significant factor influencing RCIS is challenging due to insufficient data, the possibility cannot be dismissed, particularly in the Ashanti Region.

The Conceptual Base for the Study

The conceptual framework for this study is based on Andersen's Healthcare Utilisation (AHU) model, adapted for an empirical literature review and theoretical analysis (see Figure 2). The AHU model outlines the relationship between independent and dependent variables. In this study, the dependent variable is RCIS measured within the study area. The independent variables are categorised into predisposing factors, enabling factors, access to RI services, and need-based determinants.

Adapting the AHU model demonstrates how predisposing, enabling, and access-related factors, as well as need-based determinants, influence mothers' decisions to fully utilise childhood immunisation services. The predisposing factors consist of variables like the sex of the child, birth order of the child, family size, age of the mother, education and literacy levels, marital status, and religion. Mothers are likely to fully vaccinate their children if the child's gender is preferred if the child is the first or second born, and if the family size is small. Additionally, if the mother is older, literate, well-educated, married, supported by her husband, and her religion supports vaccination, she is more likely to fully utilise immunisation services. Regular attendance at antenatal services during pregnancy also increases the likelihood of accepting childhood immunisation services.

The enabling indicators also explain the relationship between the mother's income, employment status, type of housing, and the child's immunisation status. Employed mothers with a stable income and comfortable housing are more likely to fully utilise immunisation services for their children.

Access to immunisation services considers the parents' ability and resources to access childhood immunisation services. If parents live near vaccination sites, either static or outreach, and the distance and time required for immunisation are minimal, they are more likely to utilise immunisation services. Effective communication between caregivers and service providers and accessible service delivery points further enhance participation in immunisation services.

The need-based factors focus on parental knowledge about childhood immunisation and their perceptions of the service. If parents are well-informed about the benefits of immunisation and have a positive perception of the service and its providers, they are more likely to fully utilise immunisation services for their children. In summary, this adapted model aids in identifying crucial variables for the conceptual framework of this study. The predisposing, enabling, and access-related factors, as well as parental need factors, are anticipated to have a significant influence on RCIS in ASD in the Ashanti Region.

Summary

The purpose of the study was to assess the RCIS and its determinants among children aged 12 – 23 months residing in the ASD of the Ashanti Region of Ghana. Vaccine utilisation coverage of children aged 12-23 months determines their health state. Higher CVU levels protect them against childhood communicable preventable diseases as well as prevent them from mortality due to such diseases. To be fully immunised against deadly childhood communicable diseases depends on several factors.

This review offers an overview of how the literature on factors influencing vaccine utilisation has evolved. While many determinants could be explored,

several key ones have been highlighted in the literature. Each determinant is discussed in terms of its relevance to this study and the reasons for its selection. These factors reflect different aspects of vaccine utilisation and they include predisposing, enabling, and other factors. In addition, the study examines how issues of access to immunisation services impact vaccine utilisation and the status of children aged 12-23 months.

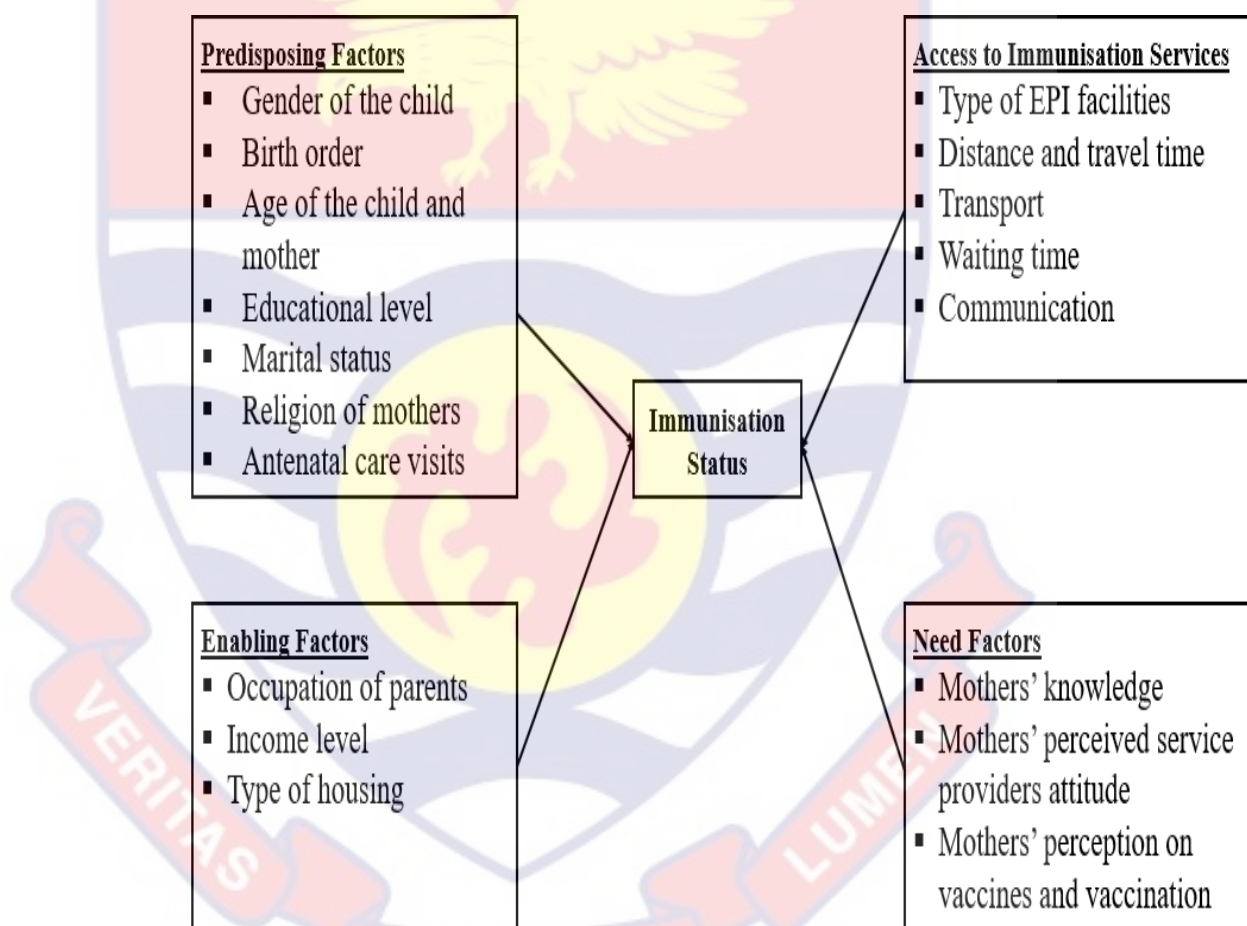


Figure 2: The Conceptual Framework of the Study

Source: Conceptual Framework, Adapted from the AHU Model (Andersen, 1968)

Since the focus is on identifying factors affecting RCIS, the relevant literature on VPDs has been reviewed. However, getting literature about vaccine utilisation in present times in Ghana's context was difficult since few studies have been conducted in this area.

The next chapters presented the methodology used to obtain the required data to determine which factors affected the RCIS in ASD in the Ashanti Region of Ghana. The analysis of the results as well as discussions, conclusions, and recommendations from the study was also involved.



CHAPTER THREE

RESEARCH METHODS

The study sought to evaluate the RCIS and their determinants among children aged 12–23 months in the ASD in the Ashanti Region of Ghana. This chapter details the research design, study area, population, and sampling procedure. This chapter also presents details on the data collection tools and procedures, and data analysis.

Research Design

This study is a community-based household investigation using an analytical cross-sectional design and guided by a quantitative approach. This design is suitable for describing and analysing the current situation by allowing participants to respond to a questionnaire, thereby facilitating meaningful conclusions (Sarantakos, 2005). It is regarded as cross-sectional because the data was collected at one specific point in time (Ogah, 2017). This design is effective for estimating the prevalence of health outcomes, such as RCVU, and understanding health determinants (Wang & Cheng, 2020). The study aims to assess the current RCI rates to determine RCIS and identify possible factors influencing the immunisation status of children aged 12-23 months living in the ASD of the Ashanti Region of Ghana.

Additionally, the quantitative nature of this design involves collecting numerical data that can be converted into statistics for making inferences (Sharma, 2018). This method allows for the quantitative measurement of variables such as predisposing factors, enabling factors, access to healthcare services, need and specific respondent factors, allowing for the generalisation of results to a

larger sample population. Consequently, the data obtained from this approach can be used to develop factual insights useful for identifying research patterns (Sharma).

The analytical cross-sectional studies are noted with a lot of strengths. The strengths include being relatively quick and inexpensive to conduct compared to prospective cohort studies. They are also the most effective method for determining the prevalence and relationships between various exposures and outcomes. Furthermore, since the study participants are neither intentionally exposed to treatments nor subjected to any interventions, ethical issues are seldom a concern. In addition, data are mostly collected through the use of questionnaires or sometimes interviews. With this, larger populations are reached within a short period (Jarvista, 2003; Rivers, 2017; Wang & Cheng, 2020).

Despite the strengths associated with this design, there are also some identified weaknesses. Some major limitations include the inability to assess incidence, investigate rare health issues, and establish causal relationships. It is also expensive and time-consuming if interviews are used for data collection. Additionally, if questionnaires are used for data collection, it can result in low response rates. Furthermore, cross-sectional studies are often required to select their participants from a large and heterogeneous study population which makes them more susceptible to sampling bias as well as nonresponse bias and recall bias (Wang & Cheng, 2020).

This cross-sectional research design is grounded in positivist ontological and epistemological perspectives. According to Crotty (2003), ontology is defined as "the study of being," which explores the nature of existence, the structure of

reality, and the fundamental or potential aspects of what exists. Guba and Lincoln (1989) further clarified that ontological assumptions deal with questions like, "What can be known?" or 'What is the nature of reality?' In essence, ontology delineates what is knowable (Lessick et al., 2016; Berryman, 2019).

Epistemology, in contrast, focuses on the study of knowledge, examining how we acquire knowledge and determining who is capable of knowing (Crotty, 2003; Luttrell, 2010). It involves creating a philosophical basis to identify the types of knowledge that are possible and the criteria needed to ensure that this knowledge is both adequate and valid (Ahmed, 2008). Together, ontology and epistemology shape the researcher's perspective on the world (Luttrell). They offer insight into the researcher's perspective on the nature of truth, the world, and the approaches used to interact with it.

From an ontological standpoint, I posit that the RCIS of children aged 12-23 months, along with the predisposing factors, enabling determinants of parents, access to childhood immunisation services, and need factors, exist independently of the respondents. Additionally, the knowledge and perceptions of mothers with children in this age group are relevant only to the extent that they pertain to the measurement of these variables. Moreover, it is believed that these variables exist and will continue to exist regardless of whether an eligible respondent takes part in the study (Andersen, 1968). My approach in this regard was not to create or uncover hidden variables but rather to identify their existence and assess how any of the identified variables might influence RCIS in ASD within the Ashanti Region of Ghana.

Epistemologically, my perspective is that the RCIS of children aged 12-23 months old, along with predisposing factors, enabling determinants for parents, and access to childhood immunisation services, can be observed and measured directly or indirectly through the perceptions of eligible respondents and their interpretations of these variables. Mothers are central to this study as they are primarily responsible for ensuring their children are vaccinated against childhood VPDs in their communities. Consequently, these mothers are the most suitable respondents to provide valuable information regarding their children's immunisation status. To gather this data, a structured questionnaire was utilised, and the survey applied an analytical cross-sectional design with a quantitative approach.

Study Area

The Ashanti Region, located centrally within Ghana, is one of the country's sixteen regions. It is positioned approximately between longitudes 0.15° E and 2.25° W, and latitudes 5.50° N and 7.46° S, with Kumasi serving as the regional capital. Spanning a total land area of 24,389 km² (9,417 sq mi), the region constitutes 10.2 percent of Ghana's overall landmass. With a population density of 223.1 individuals per square kilometre, the region has a total population of 5,440,463, making it the second most populous in Ghana. The region comprises 1,523,101 households, with an average household size of 3.2 and an annual population growth rate of 2.7 percent (Ghana Statistical Service [GSS], 2021).

Administratively, it shares boundaries with the Bono East Region to the North, the Ahafo and Western Regions to the West, the Eastern Region to the

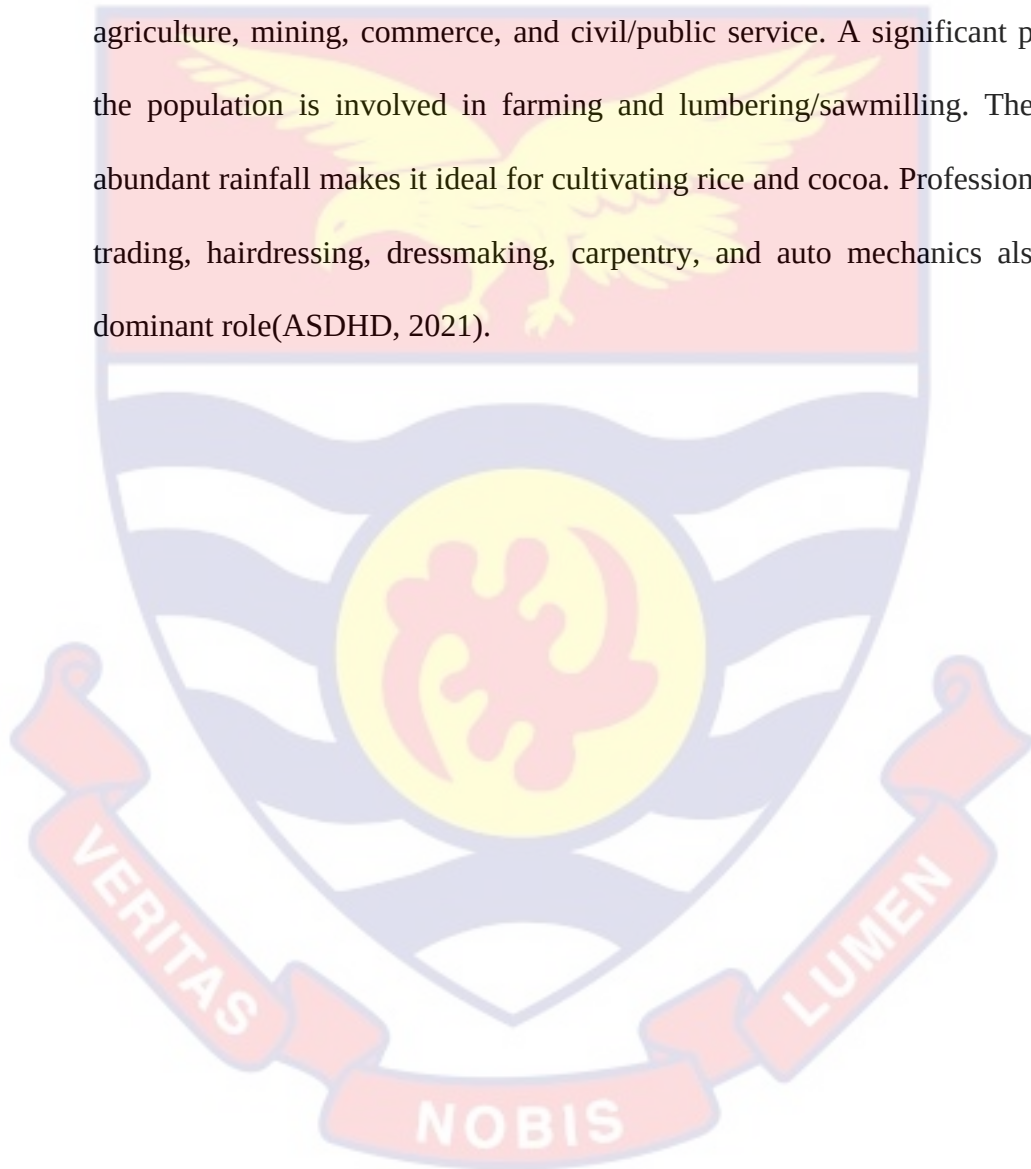
East, and the Central Region to the South. It has 43 administrative divisions (CWSA, 2020). The divisions include one (1) Metropolitan assembly, eighteen (18) Municipal assemblies, and twenty-four (24) Districts [MMDAs]. Among the 43 administrative divisions, ASD is selected for the study. This catchment area was selected because it had a unique RCIC performance issue. Their RCIC trends for the past five years have been consistently low and even declining in the region (ARHD, 2021).

The administrative centre of ASD is New Edubiase, located in the south-eastern part of the Ashanti Region. The district's geographic coordinates extend from 4° North to 6°22' North latitude and from 1° West to 1°38' West longitude. Spanning a total area of 771 square kilometres, around 25.2% of this land is made up of forest reserves. The district has a population of 85,200, with 49.9% being males (42,552) and 50.1% females (42,648), leading to a population density of 110.5 people per square kilometre. The total household size in the district is 24,118, with an average household size of 3.5 individuals (GSS, 2021).

ASD is bordered to the north and northeast by Adansi Akrofuom and Adansi North District, respectively. It borders Bosome Freho District to the southeast and Assin North District in the Central Region to the south. The Eastern Region's Birim South and Akyemanso Districts border it to the east. The western boundary is marked by River Offin, while the eastern boundary is defined by River Pra (CWSA, 2020). From both a health and administrative perspective, ASD is divided into three sub-districts: Akutreso, Ataase, and New Adubiase subdistricts. The district is served by eight healthcare institutions, including one hospital, two health centres, four CHPS centres, and one maternity home. These

facilities collectively offer institutional clinical care and preventive health services. The district also has 86 outreach sites for CWC services (Adansi South District Health Directorate [ASDHD], 2021).

The primary socio-economic activities in the district encompass agriculture, mining, commerce, and civil/public service. A significant portion of the population is involved in farming and lumbering/sawmilling. The region's abundant rainfall makes it ideal for cultivating rice and cocoa. Professions such as trading, hairdressing, dressmaking, carpentry, and auto mechanics also play a dominant role(ASDHD, 2021).



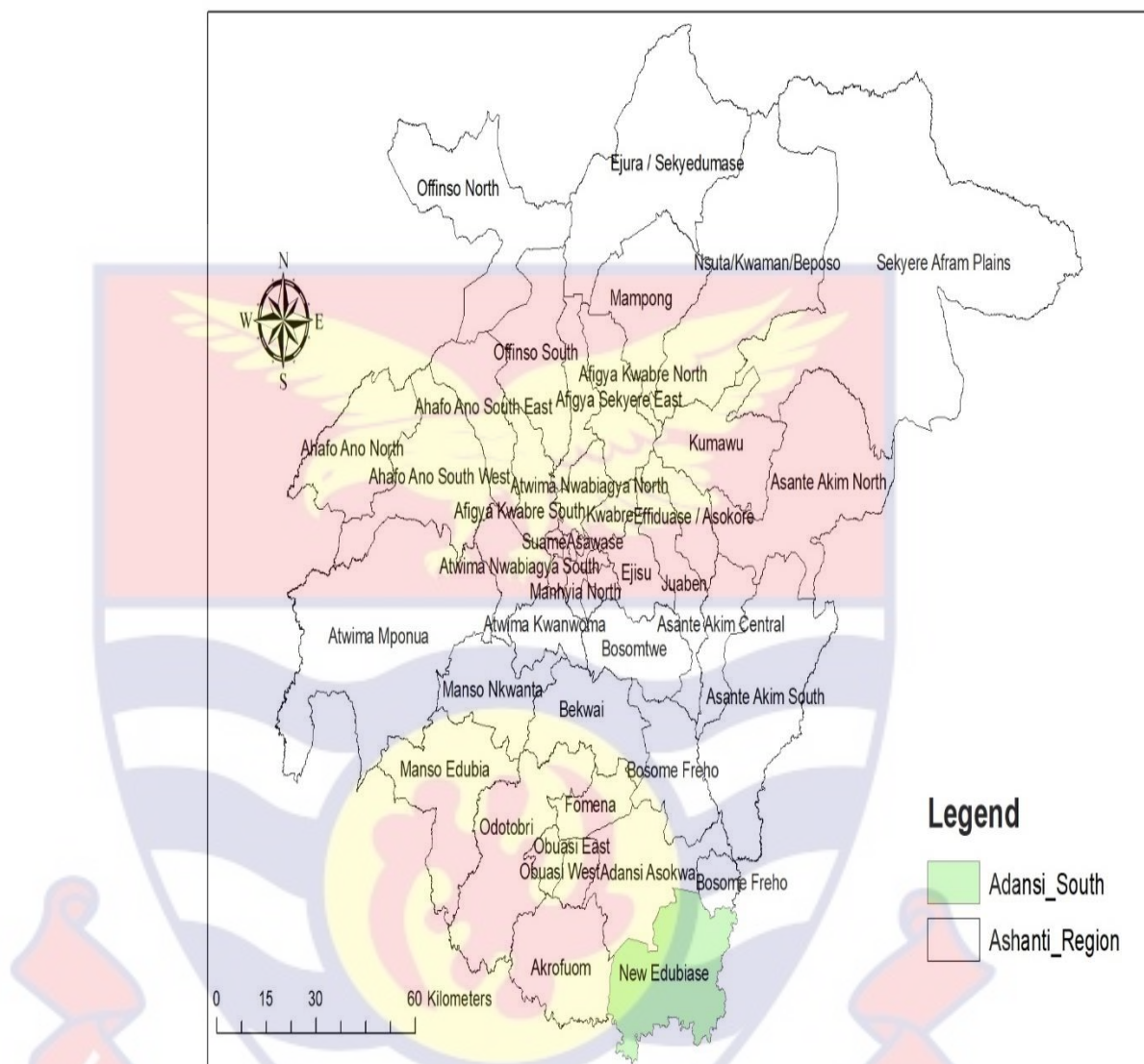


Figure 3: Map of the Ashanti region and study site (ARHD, 2021)

Population

The study's population comprised mothers residing within the ASD of the Ashanti Region, specifically those with children between the ages of 12 and 23 months old. Although the study focused on the RCIS of children within this age range, the respondents were their mothers, who were residing in the ASD of the Ashanti Region at the time of the survey. The decision to use mothers as respondents was driven by considerations of consent and the assumption that

children aged 12-23 months cannot talk, respond to issues, or make independent health decisions. Therefore, data obtained from mothers is likely more indicative of the decision-making adult, typically their mother (Hickey, 2007; Kang, & Sanders, 2014; McDougall, & Notini, 2014). Additionally, as primary caregivers, mothers are responsible for accessing healthcare services, including immunisation, for their children, considering that the children themselves cannot independently access such services. The mothers in question, falling within the age bracket of 15-49 years, are commonly regarded as women of reproductive age (WRA). Many of these mothers are engaged in the workforce, either in the informal sector (e.g., trading, farming, artisanal work, etc.) or the formal sector (e.g., teaching, nursing, banking, etc.). However, some mothers in this group are unemployed and serve as housewives.

For surveys and estimations related to RCIS, the WHO, in their updated reference manual for vaccination coverage cluster surveys, has established and defined target populations based on 12-month groups representing annual birth cohorts. According to these criteria, the population for most surveys related to RCI is outlined as follows: children aged 12–23 months when the final primary vaccination is administered at 9 months of age (commonly selected as the target population); children aged 24–35 months when the recommended age for a particular vaccination (e.g., OPV3, PENTA3, etc.) falls between 12–23 months; for the assessment of supplemental immunisation activity (SIA) coverage, the targeted age group is estimated within subgroups (such as <5 year-olds, 5-9 year-olds, 10-14 year-olds for a measles-rubella (MR) SIA) (WHO, 2018).

In Ghana, including ASD in the Ashanti Region, the primary vaccination is administered at 9 months of age. Consequently, for this study, it was deemed most suitable to focus on the age cohort of 12-23 months. Moreover, on a global scale, numerous studies have consistently utilised the age category of 12-23 months to assess RCIS and its associated determinants (Budu et al., 2020; Elizabeth et al., 2015; Farzad et al., 2017; Fenta et al., 2021; Mbengue et al., 2017; Meleko et al., 2017; Yismaw et al., 2019).

Regarding the population proportions for public health activities, particularly for children under five years old, age group cohorts are allocated based on the overall population of a specific catchment or geographical area. Recent data indicates that children aged 0-11 months and those aged 12-23 months each represent 4% of the total population, while children aged 24-59 months account for 7.8% of the total population (ARHD, 2021). In this study, which focused on children between the ages of 12 and 23 months old, the relevant population proportion was 4% of the total population. Consequently, 4% of a population of 85,200 amounts to 3,408.

In Ghana, it is expected that every child should complete the full regimen of required antigens by the age of one, ensuring correct adherence to age, interval, and dosage guidelines. Exceptions include the second doses of measles and rubella vaccines, along with the conjugate meningococcal A vaccine, which are administered in the 18th month. The administration of vaccines with precise age specifications, intervals, and dosages is crucial, as it prompts the child's immune system to generate an immune response, fostering adaptive immunity against potential pathogens and providing protection from severe VPDs. While CV is

effective in protecting against VPDs, any deviation from the recommended schedules may compromise immunity. For instance, if a child does not receive all doses of a multi-dose vaccine, is vaccinated before the recommended minimum age, or receives subsequent doses before the stipulated minimum interval, the vaccine may not offer full protection against VPDs (WHO, 2018). Thus, strict adherence to and timely follow-up of RCI services is imperative.

The ASD, with a total population of 85,200 and 24,118 households (GSS, 2021), has an estimated 4% of its population comprising children between the ages of 12 and 23 months old (ASDHD, 2021). Consequently, the specific population of children within the 12-23 months age range in ASD is 3,408. In terms of health and administrative organisation, the district is divided into 30 electoral areas, each functioning as a CHPS zone in ASD. These electoral areas or CHPS zones serve as distinct clusters where health services, including CWCs, are rendered to the residents (ASDHD, 2021).

As per the WHO definition, a cluster is described as a "collection of elements (e.g., households, communities, villages, census enumeration areas, etc.) grouped within defined geographical or administrative boundaries" (WHO, 2018). Each electoral area or CHPS zone in the context of this study served as a cluster, and data were collected from these clusters. The available data indicates an average of 804 households per CHPS zone, with an average of 114 children between the ages of 12 and 23 months old in each CHPS zone (ASDHD, 2021). The mothers of these children, residing in the households within the zones, were identified to participate in the questionnaire survey. In total, the study population

comprised 3,408 mothers of children between the ages of 12 and 23 months old across all the 30 CHPS zones in the ASD of the Ashanti Region.

Sampling Procedure

The study sample comprised 3,312 mothers of children between the ages of 12 and 23 months old, representing 97% of the population of 3,408, which itself made up 4% of the total population (85,200) of the ASD. The selection of this sample size ($n=3,312$) was not derived from specific statistical calculations but was guided by the understanding that a larger sample size enhances the robustness of the findings (Acharya et al., 2018; Ogah, 2017; 2013). Consequently, all members of the target population were included in the study, with a sample size of 3,312 considered adequate for ensuring accurate and reliable results (Ogah). A census sampling method was employed to enlist mothers of children aged 12-23 months for the research.

In employing the census approach, each household within a CHPS zone was screened, and every eligible mother was included in the sample. This involved visiting each residence in a zone to identify households with eligible mothers and enrolling all of them, regardless of the initially estimated number of respondents per zone (WHO, 2018a). The entire population of 3,408 mothers with children aged 12-23 months in the ASD of the Ashanti Region in Ghana was chosen for the study because of its well-defined and accessible nature. Studying the entire population eliminated potential biases that could arise from the sampling procedure, and the issue of generalisation was avoided since every member of the population was included (Ogah, 2017; 2013).

To identify eligible households, each residence within every zone in the ASD was visited to find mothers with children between the ages of 12 and 23 months old. If multiple eligible mothers were found in a single household, all were included in the study. The presence of the eligible children was not required for considering their respective mothers eligible. In total, 3,312 mothers ultimately participated. The response rate was 97.2%, based on the population of 3,408 children between the ages of 12 and 23 months old, which also represented 4% of the total population (85,200) of ASD.

Inclusion Criteria:

1. Mothers of children between the ages of 12 and 23 months were eligible to participate in the study.
2. Only mothers residing in the study area during the survey who had children between the ages of 12 and 23 months were considered for inclusion.
3. Mothers of children between the ages of 12 and 23 months who provided consent and expressed a willingness to participate were also included.

Exclusion Criteria:

1. Mothers of children between the ages of 12 and 23 months who either declined to provide consent or chose not to participate in the study were excluded.
2. Mothers of children between the ages of 12 and 23 months identified as mentally or critically ill during the data collection were excluded.
3. Mothers of children between the ages of 12 and 23 months who had recently relocated to the study areas were also excluded from the study.

The total number of children involved in the study was 3,312 of which 1,736 (52.4%) were males and 1,576 (47.6%) were females, with the mean age (M

= 16.26, $SD = 3.52$) in months. The mean age of the mothers was ($M = 30.16$, $SD = 5.58$) in years. Among the mothers 695 (21.0%) were single and 2,617 (79.0%) were married. Regarding their occupation, 499 (15.1%), 1039 (31.4%), 1,380 (41.7%), and 394 (11.9%) were into government work, private work, self-employment, and unemployment respectively. Also, with household income, mothers received GH¢ 500.00 or less 1,600 (48.3%), GH¢ 501.00-1,000.00 1,358 (41.0%), GH¢ 1,001 or more 354 (10.7%) per month.

Data Collection Instrument

A survey questionnaire in paper format, which was distributed by interviewers, was employed to collect data from the eligible mothers. The survey was carried out by trained interviewers, with some questions in the questionnaire being borrowed from the WHO and DHS for CIC, while others were developed based on the existing literature on childhood immunisation status. Initially in English, the questionnaire underwent translation into Twi (Asante) by a language expert from the Department of Languages at Kwame Nkrumah University of Science and Technology (KNUST). This translated questionnaire version was utilised for participants who lacked proficiency in English, given that Twi (Asante) is the main language in the research area. The primary aim of the questionnaire was to assess RCI among children between the ages of 12 and 23 months in the ASD of the Ashanti Region and to identify the factors that affect this status.

A questionnaire serves as a collection of questions provided to respondents, aiming to gather statistically relevant data on a specific research problem (Roopa & Rani, 2012). In situations involving a substantial sample size,

such as the 3,312 participants in this study, a questionnaire proves highly beneficial for obtaining a diverse range of data. Given the need for quantitative primary data analysis, the questionnaire was deemed the suitable tool for this study (Roopa & Rani).

The questionnaire utilised in this study elicited direct responses from the participants and incorporated data extraction from the Mother and Child Health Records Book (MCHRB), commonly known as the home-based record or immunisation card. The MCHRB serves as a home-based health record designed for mothers, newborns, and children, aiming to enhance the continuum of care for maternal and child health (MOH, GHS & JICA, 2018). Focusing on the CWC section of the MCHRB, the study concentrated on reviewing the child's vaccination history to determine their RIS in the study setting. In instances where the MCHRB was unavailable, mothers of eligible children were requested to recall the immunisation history, guided by the count of vaccinations outlined in the national immunisation schedule. The data collected through this process facilitated the assessment of immunisation status and the identification of significant variables associated with immunisation status in the study areas.

The questionnaire comprised five sub-sections addressing various aspects, including the RIS of children between the ages of 12 and 23 months, predisposing variables related to the child and mother, determinants of parents associated with the RIS of children between the ages of 12 and 23 months, factors related to access to immunisation services, and need factors for RCI. There was a total of 74 items in the questionnaire, organised into sub-sections labelled A, B, C, D, and E (refer to Appendix A for details). The design and content of the questionnaire drew

inspiration and insights from EPI surveys, vaccination coverage cluster surveys reference manuals, and relevant literature sources (Krishna, Mohd Zulkefli, Md Said, & Mahmud, 2019; WHO, 2018f; WHO, 2015a).

Section A of the questionnaire focused on gathering data about the immunisation status of children aged 12-23 months in the ASD of the Ashanti Region. This section consisted of 14 items (1-14), and participants indicated their responses by marking the appropriate checkboxes. The purpose was to measure the extent to which children were fully covered with all essential vaccines against the deadly VPDs according to the EPI schedule in Ghana. The questions asked in section A included: how old is your child? Has your child been ever vaccinated? Do you have a health card for your child? And what is your child's immunisation status? Responses to these questions were cross-verified and extracted from the MCHRB (or vaccination card) through documentary review. This review of the vaccination record for a child's immunisation history aligns with Prior's (2003) assertion that documents aid in making phenomena more visible, and Bailey (1994) highlighted the benefits of documentation studies, including the revelation of personal and detailed data that might not be apparent otherwise.

Section B of the questionnaire focused on the predisposing factors related to mothers of children between the ages of 12 and 23 months. These factors included variables such as the child's sex, number of children, the child's birth order, the mother's marital status, the size of the household, the mother's age, the educational level of parents, as well as the mother's religious affiliation and beliefs. This particular section comprised 9 items (15-23), and respondents were required to indicate their answers by choosing the most suitable option.

Section C also asked questions on the enabling factors of mothers, such as the occupation of the spouse and whether the job pays; the occupation of the mother, whether it is paid and the sole source of income to the household as well as if the income is regular; and the type of house the household dwells in. The section also has 12 (24-35) items.

Section D addresses the question of “Which access to immunisation services factors predict the routine immunisation status of children aged 12-23 months in ASD?” The items in this section were 10 (36-45) and participants ticked their appropriate options. The variables include the place of residence, the type of EPI service facility available, how often, and regular CWC is conducted, distance to cover, how long it takes to reach the vaccination centre, means, and cost of transport, waiting time, and communication.

Section E comprised 29 items (46-74) employing a 5-point Likert scale ranging from strongly disagree (1), disagree (2), not sure (3), agree (4) to strongly agree (5). This section was subdivided into three categories: the knowledge of mothers regarding vaccines and vaccination services [46-55], the attitude of health providers towards immunisation delivery [56-68], and mothers’ perception of vaccines and vaccine delivery [69-74]. The purpose of this section was to collect data directly from the respondents, while data related to vaccinations was obtained from the children’s MCHRB (vaccination card). Additionally, participants without the MCHB were allowed to recall relevant data.

Validity of the instrument

Validity pertains to the degree to which a tool precisely gauges what it claims to measure (Lakshmi & Mohideen, 2013). It encompasses evaluating the precision with which a research tool produces consistent outcomes when repeatedly administered in similar circumstances (Heale & Twycross, 2015). Hence, validity is linked to the precision of the measuring scale. In this study, an examination of the survey was executed to confirm its efficacy in assessing the targeted variables. This research aimed to evaluate the extent of RCIS in identifying the factors influencing the status in the ASD study.

To validate the survey, an initial version was circulated among various individuals, including two Ph.D. students two faculty members, and the thesis supervisory panel, composed of the principal investigator and co-supervisors. Moreover, an expert lecturer from the Population and Health Department at UCC was provided with draft questionnaires for assessment, concentrating on the survey's face and content validity. To facilitate the validation procedure, the colleagues, faculty, and supervisors were briefed on the research's objectives and inquiries, which formed the foundation for the specific survey items. This enabled them to pinpoint the items that effectively captured the desired data. The reviewers evaluated the survey items for coherence, linguistic appropriateness, respondent-friendly language, and clarity of instructions. A designated section after the survey allowed reviewers to furnish additional feedback on the overall adequacy of the tool.

Pre-testing of the research instrument

The pre-test took place in Kuntanase, the district capital of Bosomtwe district in the Ashanti Region of Ghana, to ensure question clarity and address any

necessary corrections to the instrument before commencing the actual data collection. Kuntanase was selected due to its similarities in background characteristics to the study areas, including the mothers of children aged 12-23 months old. Like ASD, Kuntanase has both urban and rural populations. In terms of socioeconomic activities and other social amenities, Bosomtwe and ASD are comparable. Responses from mothers in this age group were collected, analysed, and utilised to assess the instrument's reliability for the study. The reliability of questionnaire items was independently determined using the Kuder-Richardson 20 (K-R 20) method, which evaluates how the items interrelate. The reliability coefficient was interpreted on a scale ranging from 0.00 (indicating very unreliable) to 1.00 (representing excellent or very reliable) (Heale & Twycross, 2015; Tavakol & Dennick, 2011). Based on the pre-test results, one item related to enabling factors was excluded, and various adjustments, including revisions to the wording and translation of the questionnaire from English to Twi, were made to enhance clarity and understanding.

Reliability pertains to the consistency and stability of measured values when repeated measurements are conducted using the same measuring instrument under similar circumstances. It focuses on the reliability of a measure over time (Sürücü & Maslakçi, 2020). Despite the incorporation of some items from an already established and reliable instrument, it was essential to measure the reliability. Therefore, the internal consistency reliability was examined and reported based on the data obtained from the pre-test.

The developed questionnaire underwent a pre-testing phase in Kuntanase, Bosomtwe district, Ashanti Region. Sixty questionnaires were distributed to

eligible mothers; however, 50 completed questionnaires were utilised for the pre-testing analysis. This process aimed to identify any ambiguities or incomplete statements in certain items based on the respondents' reactions, and adjustments were made to address the identified issues before the main study. Additionally, the reliability of the questionnaire was assessed using the K-R 20 coefficient, measuring the accuracy, consistency, dependability, and trustworthiness of the instrument and the collected data. The K-R 20 coefficient for the pre-test instrument, consisting of 75 items, was calculated to be 0.816.

Table 1: Kuder Richardson (K-R 20) Coefficient of each of the Research Question

Categories	KR-20 Coefficient
Child predisposing factors category	.876
Mothers' predisposing factors category	.877
Household wealth status category	.876
Access to EPI and CWC services	.566
Mothers' knowledge category	.872
Mothers attitude category	.871
Mothers' perception category	.872

Data Collection Procedures

The data collection process involved visiting all eligible and consenting households within their residences in the ASD of the Ashanti Region in Ghana. The population was mothers with children between the ages of 12 and 23 months who were present during the data collection period. The research instrument

(questionnaire) was administered by trained research assistants (RAs) to gather direct responses from the eligible mothers. Data collection occurred from January to March 2023, starting promptly after receiving approval for the thesis and following all required protocols.

Ethical approval was granted by the Committee on Human Research, Publication, and Ethics (CHRPE) at Kwame Nkrumah University of Science and Technology (KNUST) on December 6, 2022, with reference number CHRPE/AP/797/22 (see APPENDIX C). Before obtaining ethical clearance, introductory letters from my supervisor and the head of the department were also secured (see APPENDIX D & E). The Ethical clearance, along with the approval letter requested from the District Health Director of Health Services, ASD was distributed to all pertinent stakeholders, including community elders and opinion leaders in each of the CHPS zones, to inform them about the project. Participants who could not write were offered the option to provide a thumbprint as a form of informed consent after a detailed explanation of the study's purpose. However, none of the respondents opted for thumbprinting; instead, they confirmed their approval by having their initials written.

Twenty research assistants (RAs) from the Adansi South District Health Directorate (ASDHD) were enlisted and provided with training to carry out data collection. Training sessions involved using sample questionnaires (both in English and an expert-translated Twi version) and mother and child health record books. The RAs received training on how to extract data from the MCHRB, administer the questionnaire, and identify eligible respondents. They were also trained on how to establish rapport with potential participants. The training

included pairing the trainees into ten (10) groups, allowing each participant to guide their colleague through the processes until they acquired the necessary knowledge and skills for effective data collection. Subsequently, eligible mothers who had provided consent and resided in the designated clusters were approached as respondents for the questionnaire. Data collection occurred from morning to evening, aligning with the availability of most mothers during these hours. For those who faced difficulties reading, understanding, or writing, a translated Twi version of the questions was provided. Given that the questions were close-ended, respondents marked their possible responses with a pen. The MCHRB served as an additional source of information, with research assistants reviewing and extracting data on the child's immunisation status for recording on the questionnaire.

Trained RA conducted face-to-face administration of the questionnaire directly with the mothers. This method was deemed the most efficient, reliable, and consistent way to collect data, ensuring that the intended individuals completed the questionnaire themselves (Nworgu, 1991). The choice of person-to-person administration took into account the literacy levels of the respondents, particularly those in rural areas who might not have had formal education (National Council for Population and Development (NCPD) et al., 1999). For respondents who were unable to read and write, the RAs employed the questionnaire as a survey interview, using the translated Twi version for them to respond. Conversely, literate respondents provided answers to the questionnaire independently, without assistance from the RAs.

The collected data was promptly transmitted to me, the principal investigator (PI), within either the same day or the following day of the questionnaire administration. The entire data collection process spanned three months, encompassing the period from January to March 2023.

Data Processing and Analysis

The collected data underwent a thorough facial assessment to ensure consistency, completeness, and accuracy before being coded into IBM SPSS Versions 27.0. Once coded and entered, the data in SPSS underwent statistical screening to check for accuracy and identify any missing data, as well as to examine the potential impact of extreme values on the analysis. Descriptive statistics, including frequencies and percentages, and histograms, were employed to screen the data. Any outliers detected during the screening process were duly addressed to maintain data accuracy. This comprehensive screening process not only helped gauge the adequacy of the data but also guided the precise procedures for subsequent analyses. Following this, frequencies were computed for the variables, and any identified errors were rectified. This analytical approach was aligned with the research questions posed in the study.

Research Question One: What is the immunisation status of children Aged 12-23 months in ASD in the Ashanti Region?

This research question seeks to measure the extent to which vaccines are administered routinely to eligible children in ASD in the Ashanti Region of Ghana to protect them from acquiring VPDs. This question is measured on a nominal scale and seeks to report on proportions. Therefore, descriptive statistics, specifically simple frequencies and percentages, were employed for the analysis of this data. The thrust of this statistical tool aligns with the recommendations of

Hanlon and Larget (2011) and Hole (2000), who advocate for the use of descriptive statistics, particularly frequencies, and percentages when dealing with data reported in proportions. Globally, reporting on proportions using simple percentages and frequencies has been extensively used to analyse the RCIS (Adokiya et al., 2017; Ateudjieu et al., 2020; Negussie, 2015). This approach is adapted from WHO reference manuals on vaccination coverage cluster surveys (WHO, 2018; 2018a; 2005).

Research Question Two: Which child and mother predisposing variables predict the immunisation status of children aged 12-23 months in ASD in the Ashanti Region?

This study aimed to predict the factors influencing both mothers and children that affect the immunisation status of children aged 12 to 23 months in the ASD of the Ashanti Region, Ghana. The RCIS, which served as the dependent variable (DV), was measured on a nominal scale as dichotomous (fully and partially immunised). In contrast, the independent variables (IVs) were measured using various scales. The appropriate statistical methods for analysing this research question included bivariate analysis and binary logistic regression. The selection of these techniques was guided by Mertler and Vannatta (2017), who recommended that in binary logistic regression, the DV should be dichotomous, while the IVs can be either categorical or continuous. This approach enabled the calculation of outcomes such as odds ratios, confidence intervals, Wald statistics, and p-values, with statistical significance determined at $p < 0.05$. This statistical approach has been applied in the analysis of various studies concerning RCIS.

Research Question Three: What enabling determinants of parents predict the routine childhood immunisation status of children aged 12-23 months in the ASD in the Ashanti Region

This study aimed to investigate the facilitating factors impacting parents of children aged 12-23 months and to determine the variables linked to RCIS in individuals with ASD. The DV for this study was binary and assessed using a nominal scale. The IVs were also evaluated on a nominal scale, covering various factors. Given the characteristics of the variables at hand, binary logistic regression was identified as the most appropriate statistical method for analysis. This decision is in line with the recommendation of Mertler and Vannatta (2017), which suggests that when dealing with dichotomous DVs measured nominally and categorical IVs, whether discrete or continuous, binary logistic regression is suitable. The findings were two-tailed, and statistical significance was set at $p < 0.05$. Results were presented as odds ratios (Odds) along with a 95% confidence interval.

Research Question Four: Which access to immunisation services factors predict the routine immunisation status of children aged 12-23 months in ASD in the Ashanti Region?

This research question aimed to explore the significant RCI services accessibility factors that could predict the RCIS in the Ashanti region of Ghana. To analyse this research question, a binary logistics regression statistical tool was employed. The binary logistics regression was used because it requires the DV to be categorical and dichotomous with a nominal scale. The IVs must also be discrete or continuous (Mertler & Vannatta, 2017). This research question four had DV (the RCIS) been dichotomous and nominal with several continuous scale

IVs. With this, the use of logistics regression was appropriate since the assumptions for using this model were met.

Research Question Five: Which need factors are central in predicting the routine immunisation status of children aged 12-23 months in the ASD in the Ashanti Region?

Healthcare needs factors also determine the RIS of children (Andersen, 1995). Several need factors are responsible for the immunisation status of children in a given area. To identify these need factors, this research question sought to examine the significant need factors that could predict the RIS of children in ASD in the Ashanti Region of Ghana. The DV for this analysis was dichotomous with a nominal scale and the IVs are also discrete. These assumptions were better when applied to binary logistics (Mertler & Vannatta, 2017). Consequently, bivariate and binary logistics regression was used to analyse this research question. All the research questions one to five were done using the IBM SPSS Version 27.0. In all, 3408 questionnaires were distributed, but 3,312 were retrieved and used for the analysis.

Chapter Summary

This chapter details the research methodology adopted for the study. An analytical cross-sectional design was utilised, employing a quantitative approach to fulfill the study's objectives. The research was conducted in the ASD of the Ashanti Region in Ghana, using a census sampling method. Participants included mothers with children aged 12 to 23 months. The primary data collection tool was a structured survey questionnaire. The collected data was processed using IBM SPSS Version 27.0 software and analysed through both descriptive and inferential statistical methods.

CHAPTER FOUR

RESULTS AND DISCUSSION

The study seeks to assess the RCIS and identify its predictors among children aged 12 to 23 months in the ASD within the Ashanti Region of Ghana. This chapter provides the outcomes in alignment with the research questions. A total of 3,408 questionnaires were distributed, with 3,312 successfully returned, resulting in a questionnaire return rate of 97.2%.

Research Question One: What is the Routine Childhood Immunisation Status of Children Aged 12-23 months in Adansi South District in the Ashanti Region?

This research question aimed to evaluate the extent of RCIS in ASD within the Ashanti Region of Ghana. The assessment of RCIS relied on mothers' responses gathered through a survey questionnaire regarding their children's vaccination history against the 13 childhood VPDs. Responses were categorised into fully, partially, and non-immunised based on the documentation of all vaccination history. Fully immunised children aged 12-23 months were those with documentation of all 13 vaccines, meeting the recommended doses and dates. Partially immunised children had missed one or more eligible vaccines, while non-immunised children had none of the vaccines.

To measure the determine the RCIS in ASD, a descriptive statistic of simple frequencies and percentages on the proportions of immunisation status was used. The results are presented in Table 2. Out of the total number of 3,312 captured in the district, children who were fully immunised were 56.8% (n = 1,881), partially immunised 41.3% (n = 1,369), and non-immunised 1.8% (n = 62).

Table 2: Immunisation Status of Children 12–23 Months in ASD

Immunisation Status N = (%)				
Gender	Fully Immunised	Partially Immunised	Not Immunised	Total
Male	992 (30%)	710 (21.4%)	34 (1.0%)	1,736 (52.4%)
Female	889 (26.8%)	659 (19.9%)	28 (0.8%)	1,576 (47.6%)
Total	1,881 (56.8)	1,369 (41.3%)	62 (1.8%)	3,312 (100%)

The study found an overall RCIS of 56.8%. This overall RCIS is lower than the national target of 95% (MOH/GHS, 2016). This finding indicates low immunisation status among children between 12-23 months old who are at risk of diseases for which immunisation is given in ASD. Thus, this finding indicates that a significant number of children aged 12-23 months are not receiving RCI which is essential for protecting them against various killer diseases. The target for full routine vaccine uptake in Ghana has since 2016 been set at 95% for all the approved RCI antigens even to be sustained up to 2030 (MOH/GHS, 2016; UNICEF, 2020; WHO CO, 2021). However, the observed vaccination status within the study district significantly lags behind the 95% target. This lower uptake implies that a substantial portion of children within the specified age range in the ASD remains susceptible to preventable diseases, despite the availability of immunisation through the EPI.

According to the ARHD (2021) annual report, the RCIC for ASD for the period 2017, 2018, and 2019 were 80.7%, 69.6.7%, and 68.2%, respectively which indicated uptake figures far below the expected 95% and even at a

declining trend. This finding from this study further confirms the decreasing trend of full vaccine utilisation in the district, which means that a large proportion of unvaccinated children are being pushed into extreme vulnerabilities. These children who have not received vaccinations face an increased risk of enduring severe health complications or even mortality, as vaccinations play a crucial role in shielding them from serious infections and diseases (NPHCDA, 2016). Inadequate vaccination rates pose a challenge to achieving herd immunity, a critical barrier against the spread of VPDs in childhood, emphasising the importance of addressing this issue (AGDH, 2016; AIHW, (2016). Without full immunisation, children remain susceptible to outbreaks of VPDs.

The high level of partially immunised eligible children in the ASD of Ashanti Region faces several substantial effects. Firstly, they become more susceptible to VPDs, putting them at a higher risk of severe complications and even death (Gebeyehu, Asmare Adela, Dagnaw Tegegne, & Birhan Assfaw, 2022; WHO, 2020b). Also, they may contribute to the transmission of diseases within their communities, potentially impacting vulnerable individuals (Auzenberg, Fu, Abbas, Procter, Cutts, & Jit, 2023; Metkie, Melese, W/silassie, & Ali, 2023; Syiroj, Pardosi, & Heywood, 2019). It is noteworthy that, poor immunisation status or a larger number of unvaccinated children may put a strain on the health system specifically in the ASD, and can lead to increased rates of hospitalisation and mortality among young children (Metkie et al.; Syiroj et al.). Thus, in a resource-limited setting like Ghana, the health system may be overly burdened exposing children to extreme vulnerabilities. Finally, there are economic implications, including higher healthcare costs, caregiver productivity loss, and

potential long-term disabilities (Nandi, & Shet, 2020). To mitigate these effects, it is crucial to improve access to immunisation services, raise awareness about the importance of complete immunisation, and implement targeted interventions to ensure optimal vaccine coverage in the district.

The low status of RCI in ASD of the Ashanti Region can be attributed to various factors, including challenges related to accessibility. Many communities, especially those situated in remote and challenging-to-reach areas within the ASD, encounter difficulties in accessing adequate immunisation services (Li, Shi, Liang, Ding, & Xu, 2018; WHO, 2019). Additionally, the district's low immunisation status may be linked to vaccine hesitancy—a phenomenon characterised by reluctance or refusal to vaccinate despite vaccine availability. Vaccine hesitancy can stem from various factors, including concerns about vaccine safety, misinformation, cultural beliefs, and a lack of trust in healthcare systems. Such hesitancy may contribute to decreased immunisation rates, as mothers may opt to postpone or decline vaccinations for their children (Khattak et al., 2021).

Furthermore, a lack of awareness and education may have played a role in the low number of fully immunised eligible children. Inadequate knowledge and awareness regarding the significance of immunisation can contribute to reduced coverage (Bolsiewicz, Steffens, King, Abdi, Bullivant, & Beard, 2023; Khattak et al., 2021). In some cases, mothers may lack adequate information about the benefits of vaccines, the recommended immunisation schedules, or the locations where immunisation services are offered. A lack of comprehensive educational and awareness initiatives aimed at mothers and communities, particularly those

situated in hard-to-reach areas within the districts, may lead to missed opportunities for immunisation and a decline in overall utilisation rates(Bolsewicz et al.).

Moreover, the low RCIS observed in the district might also be linked to the worldwide effect of the COVID-19 pandemic. For instance, during the initial pandemic period, WHO conducted an extensive survey globally. The survey revealed significant decreases in all routine health services with a fall of 70% in RI services (Ota, Badur, Romano-Mazzotti, & Friedland, 2021). These decreases in RI services may plausibly occur during the pandemic period because governments across the globe including Ghana initiated varied measures to reduce the outbreak including imposing social-distancing laws and shutting down nonessential businesses (Ali, 2020; Ota et al.; SeyedAlinaghi et al., 2022). Although in Ghana, RCI services were carried out during the period, some health providers were absent from work for a variety of reasons. The reasons may align with what Ota et al. reported in their study, indicating that the absence of service providers from work was directly linked to COVID-19 infection or as a precautionary measure due to being in close contact with infected individuals. Other factors contributing to the decline included limited access to transportation, quarantine measures for suspected cases, isolation of confirmed cases, public misinformation about the safety of vaccines and vaccination services, and anxiety regarding contracting COVID-19 (Ali & Hamid, 2022; Bimpong et al., 2021; Kissi et al., 2022). These factors collectively harmed the provision and utilisation of RCI services, contributing to the observed low RCIS in the ASD of Ashanti.

The low immunisation rate carries implications for attaining specific SDG targets, particularly Goal 3, which centres on good health and well-being in the ASD. SDG target 3.2 is particularly focused on eradicating avoidable deaths of children younger than five and reducing maternal mortality, with immunisation playing a pivotal role in realising this goal (UNDP, 2021; WHO, 2021). The observed low coverage in ASD poses a challenge to advancing progress towards achieving SDG Target 3.2 within the district, thereby impeding Ghana's broader endeavours to meet the SDGs concerning health and well-being.

Furthermore, SDG target 3.8 concentrates on attaining universal health coverage, encompassing access to high-quality essential healthcare services and the availability of safe, effective, quality, and affordable essential medicines and vaccines for all. The aim of SDG Target 3.8 is to ensure fair access to healthcare services, particularly vaccination, irrespective of socio-economic status or geographic location (UNDP, 2021; WHO, 2021). The low immunisation status in the ASD indicates a gap in providing essential healthcare services, specifically in terms of vaccination which undermines efforts to achieve SDG target 3.8. Immunisation constitutes an essential component of primary healthcare, and by achieving a robust immunisation status, both ASD and Ghana contribute to the broader goal of achieving universal health for all and guaranteeing access to high-quality essential healthcare services. In the context of SDG target 3.8, the low immunisation rate in the district means that a large proportion of children are not receiving essential preventive healthcare services, such as vaccinations. This suggests or indicates a gap in providing equitable access to vaccination, which

can lead to increased health risks and reduced financial protection for families and communities in the district.

Research Question Two: Which Child and Mother Predisposing Variables Predict the Routine Immunisation Status of Children Aged 12-23 Months in the Adansi South District in the Ashanti Region

This investigation aimed to ascertain the pertinent predisposing factors (independent variables) associated with children and their mothers that are likely to forecast the RIS (DV) of children aged 12-23 months residing in the Ashanti Region. The research methodology involved utilising bivariate correlation, along with a chi-square test and analysis using a binary logistic regression model, to pinpoint the relevant factors. Initially, a bivariate correlation was conducted employing the chi-square test to identify the independent variables that exhibited significant correlation with the dependent variable. Any variables that did not display significance were excluded from the binary logistic regression model. Consequently, only the predictor variables that displayed significance in the bivariate correlation were included in the regression model. The main aim of the logistic regression was to identify the predisposing factors that significantly affected the immunisation status of children aged 12-23 months in the Ashanti Region.

As previously described, children between the ages of 12 and 23 months who were fully immunised had gotten every recommended vaccination, children who were partially immunised had missed one or more shots, and children who were not immunised had not had any shots at all. Nonetheless, the proportion of non-immunised children identified in this study was minimal [1.8% (n = 62)], and they were categorised with the partially immunised group, given that both

categories are prone to acquiring VPDs and have the potential to spread infections. The predisposing factors under consideration in this study encompassed the child's gender, age, birth order, family size, mother's age, parental educational level, marital status, maternal religion, ANC visits, and the place of delivery of the eligible child.

The bivariate analysis revealed that the child's age, birth order, mother's age, maternal religion, belief in the acceptance of childhood immunisation, ANC visits, frequency of ANC visits, and the place of delivery of the index child displayed a significant correlation with RCIS ($p = 0.001$). Similarly, the number of children a mother had exhibited statistical significance ($p = 0.043$). However, no significant correlation was found between RCIS and factors such as the child's sex, household size, and the level of education of both mothers and fathers ($p = 0.670$). Additional information regarding the bivariate correlation among independent variables based on immunisation status can be located in Appendix B1.

In addition to the bivariate correlation analysis, a multivariate analysis using logistic regression was conducted to investigate the relationship between the predisposing variables (IVs) and RCIS (DV). The enter (simultaneous) method was chosen for this analysis. This method was selected because it allows the model to include all independent variables and control for their effects simultaneously, considering their combined impact. Additionally, it enables the inclusion of all relevant variables, helping to avoid omitted variable bias (Mertler & Vannatta, 2017). Furthermore, this method was employed because it is commonly used in similar studies. The enter method was used to estimate the

adjusted odds ratio (AOR). Statistical significance was observed in the logistic regression model, with -2 Log likelihood = 4185.413a, Cox and Snell R² = .099, Nagelkerke R² = .133, and p = 0.001, achieving a correct prediction rate of 63.5%. The results, detailing how individual mother and child predisposing predictors influenced RCIS, are presented in Table 3.

According to the results in Table 3, children aged 18-23 months were 40% [AOR = .591, (CI = .507 – 1.418), p = 0.001] less likely to be fully immunised compared to those aged 12-17 months. In households with two children, families were 43% [AOR = .571, (CI = .343-.592), p = 0.032], and those with three children were 50% [AOR = .518, (CI = .328-.818), p = 0.005] less likely to fully immunise their children against all recommended childhood immunisations compared to households with one child. Married mothers were 30% [AOR = .692, (CI = .572-.837), p = 0.001] less likely to fully immunise their children compared to single mothers in the ASD of the Ashanti Region of Ghana. Additionally, mothers who did not attend ANC during pregnancy were 60% [AOR = .409, (CI = .267-.626), p = 0.001] less likely to immunise their children fully compared to those who did attend ANC. Similarly, mothers with no ANC contact during pregnancy were 60% [AOR = .442, (CI = .22-.765), p = 0.004] less likely to receive full immunisation for their children compared to those with some ANC contact. These variables significantly influenced the RCIS outcome in the district.

While various child and mother predisposing variables predicted RCIS in the ASD of the Ashanti Region, some did not show a significant impact. These variables include the age of the mother [AOR = 1.609, (CI = .375-1.103), p = 0.109], child's birth order [AOR = 1.609, (CI = 1.002-2.582), p = 0.049],

religious affiliation of mothers [AOR = .853, (CI = .603-1.207), $p = 0.370$], belief in the acceptance of childhood immunisation [AOR = .889, (CI = .610-1.295), $p = 0.541$], and place of delivery [AOR = 1.153, (CI = .937-1.498), $p = 0.178$].



Table 3: Binary Logistic Regression Predictors of Mother and Child Predisposing Factors of RCISin ASD

Variables	B	Wald test (x-ratio)	Adjusted Odds Ratio (AOR)	95% Confidence Interval	
				Lower	Upper
Child Predisposing Factors					
Child's age:			1		
12-17 months					
18-23 months	-.525	45.174	.591***	.507	1.418
Child's birth order:					
1 st			1		
2 nd	.372	1.885	1.449 ^{NS}	.853	2.462
3 rd	.475	3.880	1.609 ^{NS}	1.002	2.582
4 th and above	-.175	.632	.840 ^{NS}	.546	1.292
Mother Predisposing Factors					
Number of children:					
1			1		
2	-.560	4.617	.571*	.343	.952
3	-.657	7.958	.518**	.328	.818
4 and above	-.068	.101	.935 ^{NS}	.615	1.420
Age of mother:					
19 years or less			1		
20-29 years	-.441	2.568	.643 ^{NS}	.375	1.103
30-34 years	.076	.543	1.079 ^{NS}	.881	1.321
35 years or more	-.199	3.430	.820 ^{NS}	.665	1.012
Marital status:					
Single			1		
Married	-.368	14.404	.692***	.572	.837

Table 3: Cont'd

Number of children:					
Christian			1		
Muslim	-.159	.803	.853 ^{NS}	.603	1.207
Traditionalist	.080	.189	1.083 ^{NS}	.756	1.551
No religion	.315	1.468	1.370 ^{NS}	.823	2.281
Belief acceptance of childhood vaccination:					
Yes			1		
No	-.117	.374	.889 ^{NS}	.610	1.295
Antenatal contacts:					
Yes			1		
No	-.894	16.981	.409***	.267	.626
Number of times ANC contacted					
Less than 4 visits			1		
4 or more visits	.079	.078	1.083 ^{NS}	.621	1.888
No visit	-.817	8.484	.442**	.255	.765
Place of delivery:					
Home			1		
Health facility	.142	1.817	1.153 ^{NS}	.937	1.498

***p < 0.001; **p < 0.01; *p < .05; ^{NS}p > 0.05; -2 Log likelihood = 4185.413^a, Cox and Snell R² = .099, Nagelkerke R² = .133, p = 0.001; Omnibus test of model coefficients, χ^2 (19) = 344.663, p = 0.000

The study revealed that children in the 18-23 months age range were 40% less inclined to have complete immunisation compared to those aged 12-17 months. This observation implies that a child's age serves as a reliable predictor of RCIS. In light of this, children aged 12-17 months exhibit a higher likelihood of being fully immunised than those over 17 months old. This indicates a diminishing inclination among mothers to ensure complete immunisation as their children grow older. Consequently, there exists a crucial timeframe, specifically between 18-23 months of age, during which proactive measures can be taken to guarantee full immunisation status in children. Therefore, the findings emphasise the importance of directing efforts toward improving childhood immunisation rates by targeting children within this specific age range to ensure they receive all necessary vaccinations. One possible explanation for this finding is that as children grow older, mothers may face increased challenges in adhering to vaccination schedules. Busy schedules, responsibilities, and other commitments might take precedence over scheduled CVs. Additionally, as children become more mobile and active, it may be more challenging for parents to keep up with regular visits to healthcare facilities for vaccinations.

The implications of this outcome to the household may include an increased risk of VPDs which can affect the health status of the family, especially the susceptible ones (Summan, Nandi, Shet, & Laxminarayan, 2023). An increased rate of unimmunised children aged 18-23 months can impose a public health burden on the state. This burden arises from several factors, including the potential increase in healthcare costs and hospitalisations. Children who have not

received immunisation face an elevated risk of acquiring VPDs, potentially leading to the necessity for medical care, treatment, and hospitalisation (Summan et al.). The resultant healthcare expenses and utilisation of resources create a burden on the healthcare system, diminishing its ability to respond efficiently to the population's demands.

To mitigate these consequences, efforts should concentrate on improving the immunisation status of children aged 18-23 months by ensuring timely vaccination (Scholz, Weidemann, Damm, Ultsch, Greiner, & Wichmann, 2021). Implementing targeted educational and awareness campaigns can address potential obstacles like insufficient knowledge or vaccine hesitancy. Additionally, enhancing the accessibility of vaccination services can facilitate easy reach to CWCs in the district. Moreover, healthcare providers, particularly public health officers and health promotion officers may be an extremely helpful role in educating parents about the significance of timely vaccinations and dispelling any misconceptions or concerns they may harbour (Machado, Edwards, Mueller, & Saini, 2021). Through these measures, barriers preventing older children from achieving full immunisation status can be addressed, thereby bolstering overall vaccination rates and safeguarding children against VPDs.

Concerning the household's eligible child count, families with two and three children were 43% and 50% less inclined to ensure complete immunisation for all recommended CVs compared to those with a single child. This observation implies that as the number of children in a household increases, the probability of achieving full immunisation for all children diminishes. Mothers with multiple

children encounter difficulties in ensuring timely and comprehensive immunisation for each child, resulting in an overall lower immunisation rate in larger families. This outcome may stem from the competing demands on mothers' time, as they manage the individual needs of each child, along with responsibilities related to school, work, and household tasks, making adherence to immunisation schedules challenging. Additionally, negative past experiences with vaccination for one child might lead mothers to question the necessity of vaccinating their subsequent children (Abdullahi, Stewart Williams, Sahlèn, Bile, & Kinsman, 2020).

The current findings about the effect of household size on immunisation align with a systematic literature review on barriers to childhood immunisation in sub-Saharan Africa, which highlighted the number of children in a household as a key factor influencing immunisation rates (Bangura, Xiao, Qiu, Ouyang, & Chen, 2020). Similarly, it has been noted that as family size increases, subsequent children are less likely to receive vaccinations due to increased family responsibilities, which consume more time and divert attention from healthcare decisions (Khan, Shil, & Mohanty, 2019). Numerous studies have consistently shown that children from larger families have lower vaccine uptake, given the added burden of caring for multiple children when accessing immunisation services (Banjari et al., 2018; Elizabeth, George, Raphael, & Moses, 2015; Ntenda, 2019; Tefera, Wagner, Mekonen, Carlson, & Boulton, 2018). The present study has also identified the number of children as a significant predictor of childhood immunisation status in the ASD of the Ashanti Region.

According to the literature, marital status emerged as a noteworthy factor influencing immunisation status. The finding indicated that married mothers in the district had 30% less likelihood of ensuring full immunisation for their children compared to single mothers. This outcome implies that married mothers are more likely to fail in immunising their children fully, in contrast to single mothers who exhibit a greater tendency to prioritise and ensure comprehensive immunisation. A possible explanation for this pattern may be the limited autonomy in decision-making for married mothers, as cultural norms often necessitate them to consult with and reach agreements with their spouses when making significant decisions about child vaccination. Conversely, single mothers might have more autonomy in deciding on their children's immunisation. Additionally, married mothers may contend with additional responsibilities, such as managing domestic tasks and balancing work and family life, which could make it challenging to allocate time for their children's immunisation. In contrast, single mothers may experience greater freedom or fewer competing demands, allowing them to prioritise their children's immunisation schedules more effectively.

Previous research has generated similar significant findings concerning the impact of a mother's marital status on childhood immunisation (Al-Kazrajy & Hattat, 2018; Jibo, Karaye, Gajida, & Abulfathi, 2019; Uwaibi, & Omozuwa, 2021; Zida-Compaore et al., 2019). Nevertheless, the majority of these investigations have pointed out that married mothers are more inclined to ensure complete immunisation for their offspring. For instance, a study conducted in Papua New Guinea, Oceania, focusing on factors influencing full vaccination

status among children aged 12–23 months, unveiled that married mothers have increased chances of achieving full vaccination for their children in comparison to unmarried mothers (Budu et al., 2020). Likewise, in sub-Saharan Africa, an analysis utilising DHS data to identify factors influencing full CV among children aged 12–23 months concluded that children of married mothers had 1.41 times higher odds of being fully immunised compared to children of unmarried mothers (Fenta et al., 2021).

In Ghana, Anokye et al. (2018) uncovered a significant outcome in their cross-sectional descriptive study examining socio-demographic factors impacting incomplete childhood immunisation among children aged 0 to 59 months in Koforidua. The research revealed a notable link between single (divorced) mothers and incomplete immunisation, signifying that single mothers [AOR 3.01 (95%CI: 1.59–58.2), $p = 0.048$] were less likely to complete immunisation in contrast to their married counterparts. Similarly, a quantitative cross-sectional study investigating women's knowledge and factors related to optimal utilisation of ANC in rural Ghana established a correlation. The results suggested that unmarried mothers were 70% less likely to utilise antenatal care services at least four times compared to married mothers [AOR = 0.30 (95%CI: 0.18–0.50), $p < 0.001$] (Afaya et al., 2020).

While numerous researches have demonstrated that single mothers are less likely to have a significant association with comprehensive health service utilisation, including immunisation services, in comparison to married mothers, there are instances where single mothers display an increased tendency to utilise

health services, as noticed in the current research. For instance, in a bivariate analysis assessing the impacts of CHPS in Ghana, the outcomes revealed that single women were more inclined to seek care from a health professional compared to married women [OR = 1.607; $P \leq 0.01$]. This discovery implies that compared to their married counterparts, single women are generally more mobile, easily mobilised, and possess greater autonomy over their health decisions (Braimah, Sano, Atuoye, & Luginaah, 2019). These resemblances might be ascribed to the study design, characteristics of the population, and settings (mainly rural communities) across the diverse studies.

While some surveys have shown a significant link between marital status and childhood immunisation status, most have reported no significant relationship (Adenike, Adejumo, Olufunmi, & Ridwan, 2017; Ahmad, Jahis, Kuay, Jamaluddin, & Aris, 2017; Al-Lela, Bahari, Baderden, Basher, & Hamoodi, 2017; Makarić, Kolarić, Tomljenović, & Posavec, 2018). For instance, in Malaysia, an analysis of data from the NHMS on fullvaccine utilisation and related factors among children between the ages of 12 and 23 months discovered no statistically significant link between mothers' marital status and full vaccine uptake (Lim et al., 2017). Similarly, in Nigeria, a review of a DHS report on individual and socioeconomic factors affecting childhood vaccine uptake among 27,572 children below 60 months old observed no significant link between mothers' marital status and vaccine uptake (Oleribe, Kumar, Awosika-Olumo, & Taylor-Robinson, 2017).

The finding in this current study has implications for public health interventions and healthcare providers. Understanding the association between marital status and immunisation practices can help target educational efforts to address specific barriers and challenges married mothers face in ensuring their children's vaccination. Additionally, healthcare providers can actively collaborate with married mothers, offering support and resources that streamline the process of timely and comprehensive immunisation for their children. Furthermore, public health campaigns should underscore the significance of vaccination for all children, irrespective of marital status, to promote fair access to immunisation services and enhance overall CV rates in the region.

This research uncovered a significant correlation between mothers' attendance at ANC during pregnancy and their children's immunisation status. Compared to mothers who attended ANC, those who had not attended had a 60% lower chance of fully immunising their infants. This finding indicates that ANC is vital in providing mothers with essential information about the importance of immunisation and its beneficial effects on their children's health. Mothers who opt out of ANC may miss out on this essential education, leading to a lack of understanding about immunisation schedules and their benefits. Additionally, mothers who do not prioritise ANC may be less inclined to prioritise routine vaccines for their children, potentially due to a limited understanding of the preventive measures available for their children's health. Mothers who attend ANC have a higher likelihood of receiving information and guidance on

vaccination schedules, leading to greater compliance with immunisation requirements.

The significant relationship between ANC contacts during pregnancy and RCIS found in this study situates well with the findings from a scoping review which identified ANC contacts by pregnant women as a significant determinant that affects CVU (Tilahun et al., 2020). In line with this, an analysis of data extracted from Ethiopia's DHS, focusing on mothers of children aged 12–23 months to explore the relationship between childhood immunisation status and determinants of non-utilisation of immunisation services, revealed significant findings. Both bivariate and multivariate analyses identified mothers' attendance at ANC as a significant determinant of their children's immunisation status, indicating that children of mothers who received no antenatal care were more likely to be incompletely immunised [OR = 4.83; 95% CI: 4.11 – 5.67] (Mohammed, 2016). The reason assigned was that mothers who never attended ANC might lack contact with service providers, leading to less awareness of the benefits of childhood immunisation (Mohammed). Furthermore, a multistage cluster sampling procedure focusing on employed mothers of infants between the ages of 12 and 23 months revealed a strong link between attending ANC during pregnancy and achieving full vaccination status in Ethiopia (Lakew, Bekele, & Biadgilign, 2015).

The evaluation included an assessment of how frequently mothers attended ANC during their pregnancy with the index child. The findings suggested that mothers who did not have any ANC contacts during pregnancy had 60%

lower odds of vaccinating their children fully compared to mothers who had some contacts, though fewer than four. These findings unveiled a noteworthy correlation between the number of ANC contacts and the probability of completing RCI in the ASD of Ghana. Mothers who neglected ANC attendance during pregnancy exhibited less inclination towards complete vaccination of their offspring. This observation can plausibly be expounded by the conventional knowledge that ANC facilitates healthcare providers in imparting crucial information to pregnant women concerning the importance of childhood vaccination. Consequently, pregnant women who regularly attend ANC sessions receive more comprehensive insights regarding immunisation, its significance, and the recommended timetable in contrast to those who abstain. The heightened awareness levels of childhood vaccination may serve as a driving force for these mothers to ensure the comprehensive immunisation of their offspring.

An unmatched case-control research undertaken in Ethiopia within a community also illustrated a substantial connection between ANC visits and the uptake of childhood immunisation, aligning with the outcomes of this investigation. The outcomes of the multivariate logistic regression analysis unveiled that children born to mothers without ANC visits during pregnancy were 2.55 times more prone to encountering an incomplete vaccination schedule in comparison to children whose mothers attended ANC sessions during pregnancy [AOR = 2.549, 95% CI: 1.312, 4.955] (Yenit, Assegid, & Abrha, 2015). Another Ethiopian study underscored the importance of adhering to ANC follow-ups during pregnancy in ensuring complete immunisation. It disclosed that mothers

who underwent a minimum of two ANC follow-ups during pregnancy manifested a fourfold increase in the likelihood of receiving vaccination fully for their children compared to those without ANC follow-ups (Gualu & Dilie, 2017). Likewise, a study carried out in India noted that a significant proportion of mothers who received tetanus vaccination during ANC visits availed themselves of immunisation services for their children (Rathi & Meena, 2017).

This study's outcome underscores the pivotal role of ANC in promoting childhood immunisation rates. Reinforcing ANC services and integrating immunisation education as a standard element can augment vaccination rates among children. Healthcare providers should leverage ANC visits as a platform to enlighten mothers about the significance of immunisation, addressing any queries or misconceptions they might harbour. Furthermore, public health campaigns should accentuate the role of ANC in fostering child health and immunisation, encouraging all expectant mothers to attend ANC sessions routinely. By enhancing ANC attendance and accentuating immunisation education within this framework, we can strive to enhance childhood immunisation rates and shield children from VPDs.

The outcomes of the predisposing factors align with the AHU model. As per Andersen (1968), an individual's likelihood of using health services is influenced by predisposing factors, including age, gender, marital status, education within the social structure, and parental beliefs regarding the benefits of health services. Those who perceive healthcare services as valuable for disease prevention are more inclined to utilise them. This study specifically examined

these predisposing factors to assess their impact on RCI in the ASD of Ghana. The child's age, number of children, maternal marital status, ANC contacts, and the frequency of ANC visits emerged as significant predictors of RCIS. Conversely, predisposing variables encompassing child sex, birth order, mother age, religious affiliation, mothers' beliefs, place of delivery for the index child, household size, and maternal and paternal educational levels did not exhibit a connection to RCIS in the ASD of Ashanti Region. Some of Andersen's predisposing factors are relevant today with no time bound and are still significantly related to CVU even in this era of serious economic challenges among most individuals and households.

Research Question Three: What Enabling Determinants of Parents Predict the Routine Immunisation Status of Children Aged 12-23 Months in ASD in the Ashanti Region?

This research question purposed to examine the enabling variables (IVs) among parents with children aged 12-23 months old to determine which of the variables predicts RCIS (DV) in ASD. The enabling variables used in the study are the household economic factors of the respondents that have the potential to influence RCIS. A bivariate correlation with a chi-square test was carried out to determine which of the IVs correlates significantly with the DV. The enabling variables used in this study included the mother's occupation, is how good is income from the occupation, how regular is the income, whether the mother's income the sole source of living, the household monthly income level, the spouse's occupation, is spouse's income good, is spouse's income regular, spouse's income the sole source of living, household wealth index, building

material for the house, and kind of house for dwelling. These variables were analysed with a chi-square test to determine which of them correlated significantly with the RCIS in ASD in the Ashanti Region. From the bivariate analysis, all the enabling variables were significantly associated with the RCIS ($p = 0.001$) except the household income status of the respondents ($p = 0.073$) (see Appendix B2).

The multivariate analysis with binary logistic regression examined the relationship between the enabling variables (IVs) and the RCIS (DV). The enter (simultaneous) method was performed for data analysis. This method allows for the isolation of the effect of a specific variable on the outcome while statistically controlling for the potential confounding effects of other variables. It includes all independent variables and controls for their effects simultaneously, considering their combined effects. Additionally, it incorporates all relevant variables into the model, which helps prevent omitted variable bias (Mertler & Vannatta, 2017). This method was chosen because it is commonly used in studies within this field.

With research question three, the enter method was employed to estimate the AOR. The overall binary logistic regression model was significant with $-2 \text{ Log likelihood} = 4067.869$, Cox and Snell $R^2 = .013$, Nagelkerke $R^2 = .175$, and $p = 0.001$. The correct prediction rate was 66.3%. In the analysis, the household monthly income level variable was omitted from the binary logistic regression model because it did not demonstrate a significant association with the RCIS in the bivariate correlation test. The results illustrating how individual enabling predictors influenced the RCIS in ASD of Ghana are presented in Table 4.

From Table 4, the results showed that mothers self-employed had 30% [AOR = .697, (CI = .741-.926), $p = 0.013$], and unemployed 25% [AOR = .750, (CI = .577-.973), $p = 0.031$] lower odds respectively to achieve full immunisation for their children compared to their counterparts who worked in the government sector. In terms of mothers' income, whether it was adequate for the household, it was revealed that mothers whose income was not good were 40% [AOR = .643, (.506-.818), $p = 0.001$] less likely to immunise their children fully against all the recommended childhood vaccines compared to those who had good income. Concerning the perspectives of respondents regarding the adequacy of their spouse's income for the household, the findings indicated that mothers who were highly certain that their spouses' income was insufficient had 44% [AOR = .564, (CI = .387-.821), $p = 0.003$] less likelihood to fully immunise their children compared to those who were confident in their spouses' income is satisfactory.

The results further indicated that mothers who were uncertain about the consistency of their spouses' income had a 70% (AOR = 2.714, 95% CI: 1.919-3.839, $p = 0.001$) higher likelihood of fully immunising their children compared to mothers who were confident about the regularity of their spouses' income. Upon examination of the results, mothers who expressed optimism (responding 'No') that their spouses' income was not the exclusive means of supporting the household were 50% [AOR = .489, (CI = .358-.669), $p = 0.001$] less likely. Similarly, those who were uncertain about whether their spouses' income served as the sole source for household living also demonstrated 50% [AOR = .513, (CI = .365-.721), $p = 0.001$] lower odds of achieving full immunisation status for their children

compared to mothers who were optimistic that their spouses' income constituted the sole source of living for the household. Regarding mothers' perceived household wealth status, it was revealed that mothers who perceived their household wealth status as middle-class had 10% [AOR = 2.113, (CI: 1.416-3.135), $p = 0.001$] increased odds of achieving full immunisation status for their children than those who considered their household's wealth status as poor. The results further suggested that mothers residing in self-contained houses had a 40% [AOR = 0.636, (CI: 0.497-0.814), $p = 0.001$] lower likelihood of achieving full immunisation for their children compared to those living in compound houses.

While certain parental enabling variables were identified as influential predictors of RCIS in the ASD of the Ashanti Region in Ghana, some variables did not exhibit significance. These non-significant variables include the regularity of mothers' income [AOR = 1.132, (CI = 0.875-1.463), $p = 0.345$], whether respondents' income was the sole source of household living [AOR = 0.811, CI = 0.650-1.013, $p = 0.065$], the type of spousal occupation [AOR = 0.987, CI = 0.603-1.616, $p = 0.958$], and the building material used for the houses [AOR = 0.881, CI = 0.628-1.237, $p = 0.464$]. These variables were found to lack a significant relationship with RCIS in the ASD of the Ashanti Region of Ghana.

Regarding the role of mothers' occupations in influencing RCIS, the findings indicated that self-employed mothers, and unemployed were 30% and 25% less likely, respectively, to ensure full immunisation for their children compared to mothers employed in the government sector. On the type of mothers' occupation as an enabling factor of RCIS, the findings suggested that self-

employed and unemployed mothers exhibited 30% and 25% respectively less likelihood to immunise their children fully than mothers who worked in the government sector.

This finding suggests that mothers' occupational status plays a critical role in influencing their decisions and actions regarding childhood immunisation. This outcome could probably be explained with the reason that self-employed and unemployed mothers mostly suffer financial difficulties when compared to those who work in stable government sectors.

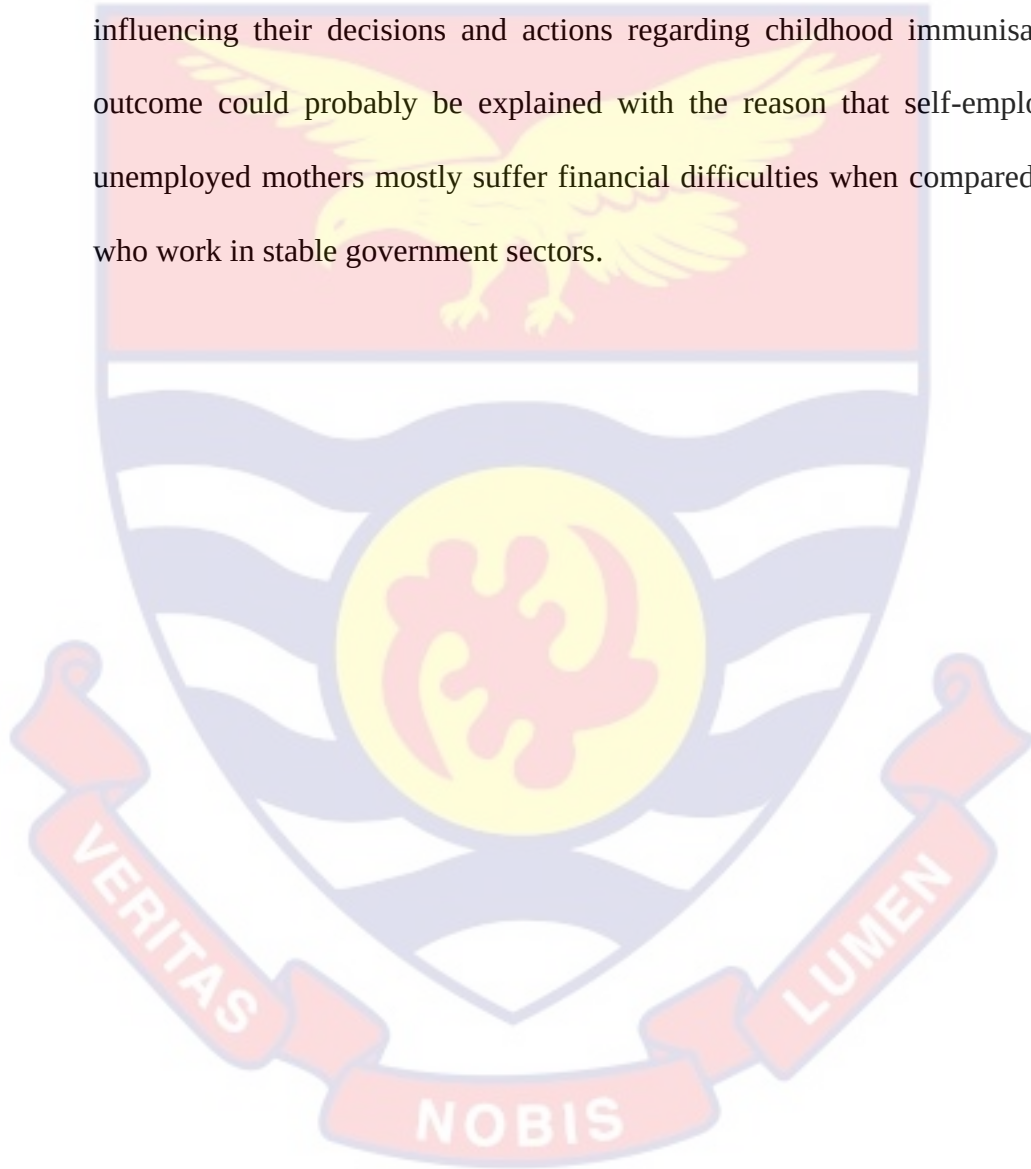


Table 4: Binary Logistic Regression Predictors of Enabling Factors of RCIS in ASD of Ghana

Variables	B	Wald test (x-ratio)	Adjusted Odds Ratio (AOR)	95% Confidence Interval	
				Lower	Upper
Respondents' occupation					
Government work			1		
Private work	.031	.034	1.031 ^{NS}	.741	1.435
Self employed	-.361	6.221	.697*	.525	.926
Unemployment	-.288	4.675	.750*	.577	.973
Is income from this occupation okay					
Yes			1		
No	-.441	12.887	.643***	.506	.818
Is income regular					
Yes			1		
No	.124	.892	1.132 ^{NS}	.875	1.463
Is income the sole source of living					
Yes			1		
No	-.209	3.395	.811 ^{NS}	.650	1.013
Spouse's occupation					
Government work			1		
Private	-.013	.003	.987 ^{NS}	.603	1.616
Self employed	-.177	.563	.838 ^{NS}	.528	1.330
Unemployment	-.016	.005	.984 ^{NS}	.627	1.544
Is spouse's income okay					
Yes			1		
No	-.573	8.931	.564**	.387	.821
No idea	-.317	3.385	.728 ^{NS}	.520	1.021

Table 4: Cont'd

Is spouse's income regular					
Yes			1		
No	.243	1.765	1.275 ^{NS}	.891	1.824
No idea	.999	31.859	2.714 ^{***}	1.919	3.839
Spouse's income sole source of living					
Yes			1		
No	-.714	20.122	.489 ^{***}	.358	.669
No idea	-.668	14.802	.513 ^{***}	.365	.721
Household wealth status					
Poor			1		
Middle	.748	13.421	2.113 ^{***}	1.416	3.135
Rich	.131	.601	1.140 ^{NS}	.819	1.586
Building material for the house					
Bloch house			1		
Brick house	-.127	.536	.881 ^{NS}	.628	1.237
Mud house	.035	.046	1.036 ^{NS}	.750	1.431
Kind of house for dwelling					
Compound house			1		
Self-contained house	-.452	12.903	.636 ^{***}	.497	.814
Semi-detached house	.064	.233	1.066 ^{NS}	.823	1.381

***p < 0.001; **p < 0.01; ^{NS}p > 0.05; -2 Log likelihood = 4067.869, Cox and Snell R² = .013, Nagelkerke R² = .175, p = 0.001; Omnibus test of model coefficients, χ^2 (21) = 462.207, p = 0.000.

Though RI is free of charge in Ghana, there may be additional costs, such as travel and other unbudgeted costs which can be stressful for low-income and unemployed mothers. The situation is worsened when mothers are not engaged in any kind of occupation or job which would earn them something. In this sense, the lack of finance is cited as a strong barrier that hinders full CVU (Adedokun, Uthman, Adekanmbi, & Wiysonge, 2017; Nadella et al., 2019; Ntenda, 2019; Mthiyane et al., 2019; Tefera, 2018). Also, working in the government sector may provide certain benefits, including access to healthcare information and resources, which could positively influence immunisation decisions.

The findings from a study conducted in Uttar Pradesh, India, investigating the factors influencing the promptOPV administration in areas with social mobilisation networks align with the findings of the current research. This study revealed that children whose mothers had stable and gainful employment had significantly greater chances of obtaining immunisation fully than the children of unemployed mothers (Choudhary et al., 2018). Similarly, in Nigeria, an analysis spanning several years examining the trends in childhood vaccine uptake indicated that women engaged in gainful employment were among the important factors positively linked to the utilisation of quality medical services (Adegboye, Kotze, & Adegboye, 202014). Conversely, in Ethiopia, Tefera et al. (2018) found that eligible children of housewives who were not involved in any economic activity had higher coverage of full immunisation according to schedules compared to children of mothers engaged in jobs such as traders, public and or private sector employees.

Furthermore, mothers' views about the income from their occupation whether it was good (adequate) or otherwise influenced RCVU in the ASD of Ghana. Mothers whose incomes were not good were at higher risk of not fully immunising their children against all the recommended childhood vaccines. This finding could be inferred that mothers perceived income whether it is enough or not as an enabling factor is a significant variable in predicting RCIS in ASD of Ghana.

This finding situates well with the general assumption that the cost of immunisation and related expenditure can be a financial burden for mothers with low income. Even when immunisation services are provided at no cost by the government, as is the case in Ghana, there could still be indirect costs such as transportation or time off work, which may prove challenging for mothers with low incomes. Hence, mothers who have the opinion that their occupation does not fetch them enough income are less inclined to ensure full immunisation for their children. Consistent with this, most studies have documented similar findings, underscoring that financial constraints represent a prominent barrier impeding CVU (Adedokun, Uthman, Adekanmbi, & Wiysonge, 2017; Nadella et al., 2019; Ntenda, 2019; Mthiyane et al., 2019; Tefera, 2018).

The evidence on the relationship between mothers' occupation and childhood immunisation can help target specific groups for educational campaigns and outreach efforts. Healthcare providers can engage with self-employed and unemployed mothers and educate them about the benefits of timely and complete immunisations and provide information about available vaccination

services. Moreover, public health campaigns can emphasise the accessibility and affordability of immunisation services to ensure equitable coverage for every child, irrespective of their mothers' occupational standing. By addressing the specific needs of self-employed and unemployed mothers, we can work towards improving overall CVU rates and protecting children from VPDs.

Also, on the respondents' opinions on whether their spouses' income from their occupation was adequate for the household or not, mothers whose spousal incomes were not good enough for the household were at 44% risk of not fully immunising their children against the killer diseases compared to those who were sure that their spouses' income was good. The reduced probability of complete immunisation in the case of children whose mothers view their spouses' income as insufficient may be attributed to financial constraints and concerns about affordability. Mothers who feel that their spouses' income is not sufficient for the household may prioritise other immediate needs over healthcare expenses, including CVs. Thus, spousal income status is linked to the financial state of the household and in turn could influence childhood immunisation. This finding could probably be explained that mothers who had the opinion that their spouse's income was not good may face financial challenges that may hinder their ability to pay for the expenses related to child immunisation resulting in a low immunisation rate.

Numerous studies, including the present one, have found a connection between household wealth status and childhood vaccine uptake. For instance, a multilevel analysis in Indonesia aimed at identifying influencing vaccine uptake

among children between the ages of 12 and 23 months found that those from higher-income families had a higher likelihood of being vaccinated fully (Maharani & Kuroda, 2018). Similarly, a secondary data analysis in India examining the demand-side factors of timely OPV utilisation in areas with social mobilisation networks under the CORE Group polio project revealed that poor household children were more likely to miss OPV1 (Choudhary et al., 2018).

In Africa, particularly in Ghana, a study found a strong relationship between household wealth and access to healthcare services. The outcome was that impoverished households were less likely ($OR = 0.581$; $P \leq 0.01$) to have access to healthcare services compared to the wealthiest households (Braimah, Sano, Atuoye, & Luginaah, 2019). Similar outcomes have been observed in various studies, underscoring that financial constraints constitute a significant obstacle impeding childhood immunisation (Adedokun, Uthman, Adekanmbi, & Wiysonge, 2017; Nadella et al., 2019; Ntenda, 2019; Mthiyane et al., 2019; Tefera, 2018).

While numerous studies have identified a significant relationship between household wealth and CVU, there are instances where studies have documented contradictory findings with no significant relationships. For example, a study conducted in Ethiopia to determine the determinants of full childhood immunisation observed no significant association between income level and childhood immunisation (Abshoko, 2016). Similarly, another case-control study in Ethiopia, which employed a random selection method to choose 12-23 months old children to investigate factors associated with incomplete childhood vaccine

uptake, also found no significant association between monthly income level and incomplete immunisation (Negussie et al., 2016). The similarities in the results could be linked to the use of the cross-sectional survey.

Additionally, mothers who lacked knowledge about the regularity of their spouses' income demonstrated a 70% increased likelihood of immunising their fullchildren compared to mothers who were certain about the regularity of their spouses' income. This significant discovery can be linked to the idea that mothers uncertain about their spouses' income may hold lower expectations of financial stability. As a result, they may adopt a more proactive stance in accessing available healthcare services, including immunisation, to safeguard their children's well-being. Likewise, these mothers might cultivate a sense of self-reliance and assume increased responsibility for their children's healthcare.

However, this finding may also imply that the differences in the rate of vaccination as a result of irregularity of their spouse's income may contribute to health disparities within the community. Should households with stable incomes exhibit a decreased likelihood of providing complete vaccinations for their children, it may result in clusters of more vulnerable children and elevate the risk of VPDs within the district. With such an outcome, the state may have to commit more resources to design public health policies and interventions to address the fundamental factors contributing to income uncertainty and vaccine hesitancy to promote equitable access to healthcare services.

This finding highlights the importance of addressing financial barriers to childhood immunisation. Public health interventions should focus on raising

awareness about the significance of vaccinations and assuring mothers that immunisation services are often available at low or no cost. Moreover, providing information about government-sponsored vaccination programmes or community-based initiatives can help alleviate financial concerns and increase immunisation rates among children. Healthcare professionals can actively communicate with mothers to understand their financial challenges and offer support or resources or resources. This proactive engagement aims to guarantee that all children, irrespective of their families' financial circumstances, have access to timely and comprehensive immunisation. Healthcare providers can also engage with mothers to understand their financial constraints and offer support or resources to ensure that all children have access to timely and complete immunisations, regardless of their families' financial situation (Rajaonarifara et al., 2022). By addressing the perceptions of financial adequacy, we can work towards improving RCIS and safeguarding children from VPDs.

Similarly, respondents' responses on whether their spouses' income was the sole source of living for the household or not were found to be an important predictor of the RCIS in ASD of Ashanti. The findings revealed that, optimistic mothers who said their spouses' income was not the sole source of living for the household and those who had no idea about whether their spouses' income was the sole source of household living respectively had 50% odds of being less likely of achieving full immunisation status for their children compared with mothers who were optimistic that their spouses' income was the sole source of living for the household.

This finding could probably mean that mothers sure and those not sure whether their spouse's salary was not the sole source of household livelihood may have uncertainty or a lack of information about the family's financial state. The uncertainty may cause further stress, which could affect their ability to prioritise and obtain healthcare services, including vaccines for their children. Despite this noteworthy discovery, a case-control study carried out in Ethiopia using a random selection technique to select 12-23-month-old children and evaluate the variables associated with incomplete childhood immunisation failed to find a significant relationship between the regularity and sufficiency of an individual's income monthly and incomplete immunisation status(Negussie et al., 2016).

The discovery in the present study underscores the significance of financial awareness in making health-related decisions, particularly concerning childhood immunisation. Mothers who are uncertain or optimistic about their spouses' income as the primary source of household living may have limited financial awareness or may not fully understand the implications of their family's financial situation on accessing healthcare services like immunisation. Public health interventions should focus on providing information and education aimed at improving financial literacy among mothers. This support can empower them to make insightful decisions concerning the health and well-being of their children.

Furthermore, to address the lower odds of full immunisation among mothers who are uncertain or optimistic about their spouses' income, targeted financial support initiatives may be necessary. This could include subsidising vaccination-related costs such as free transportation to families with financial

constraints to encourage and enable them to fully immunise their children, especially in hard-to-reach areas. Community-based programmes or government initiatives that provide financial assistance for immunisation can be effective in ensuring equitable access to vaccinations for all children. Providing social support to mothers who may have doubts or uncertainties about their financial situation can be beneficial. Community support groups, peer education programs, or counselling services can create a supportive environment where mothers can discuss their concerns and receive guidance on accessing healthcare services like immunisation. Strengthening social support networks can help build confidence in vaccination decisions and improve overall childhood immunisation rates.

Correspondingly, information about household wealth status also predicted the RCIS in the ASD of Ashanti. The finding indicated that, mothers who perceived their status as middle-class had increased odds of achieving full immunisation status for their children compared to mothers who considered their household's wealth status as poor. In this regard, mothers' perceptions of their household wealth state emerged as a significant facilitating factor influencing the status of routine childhood immunisation in ASD. Thus, the finding indicates that household economic perception plays a significant role in influencing mothers' decisions and actions regarding childhood immunisation.

This finding could be explained generally that middle-wealth status mothers might have had a stable income and they have had more financial resources compared to those who were poor. Also, middle-wealth status mothers may have had access to social benefits, or financial support from their families or

partners and friends. This means they may be better able to afford the costs associated with immunisation, such as transportation expenses, and any out-of-pocket not covered by the current free-of-charge immunisation policy by the government compared to the poor. Furthermore, they might possess enhanced knowledge about the significance of vaccinations and access to vaccination services, increasing the probability of ensuring complete immunisation for their children. On the other hand, mothers who perceive their household's economic status as "poor" may face financial constraints, which can hinder their ability to obtain and prioritise health services uptake, potentially leading to reduced rates of childhood vaccine uptake.

This significant finding aligns with many studies worldwide. For example, Tilahun et al. (2020) discovered a significant relationship between the utilisation of childhood preventive care services and parents' income levels. They observed that children born to parents in the wealthiest quintile had higher rates of full vaccination, reflecting the current study's findings. Similar results were seen in the United States by Hill, Elam-Evans, Yankey, Singleton, and Kang (2017), in Asia by Maharani and Kuroda (2018), and in Ghana by Braimah, Sano, Atuoye, and Luginaah (2019), indicating that children from higher-income families had a higher likelihood of complete vaccination compared to those from lower-income families. These findings highlight financial constraints as a significant barrier to childhood immunisation, as echoed in various studies (Adedokun, Uthman, Adekanmbi, & Wiysonge, 2017; Nadella et al., 2019; Ntenda, 2019; Mthiyane et al., 2019; Tefera, 2018).

Despite many studies highlighting a strong link between household income status and the utilisation of childhood vaccines, there are also contrasting findings indicating no significant relationship between household income level and immunisation status. Notably, research conducted in Ethiopia by Abshoko (2016) and Negussie et al. (2015) observed no evidence of a significant correlation between income level and children's immunisation status. This divergence in results could potentially stem from the fact that these studies were carried out in the same country with a similar population.

Health education campaigns can be designed to specifically target households who perceive themselves as "poor." These campaigns can raise awareness about the availability of free or subsidised immunisation services, highlight the benefits of vaccinations for child health, and address any misconceptions or concerns related to vaccination costs. Furthermore, targeted financial support initiatives can be implemented to reduce financial barriers to immunisation, for families who perceive their household's economic status as "poor." This may involve offering free or low-cost vaccination clinics in underserved areas or providing transportation assistance to vaccination centres.

Moreover, healthcare providers can use tailored communication strategies when engaging with mothers from different economic backgrounds. By understanding their specific concerns and barriers, healthcare providers can provide tailored information and assistance to address the unique concerns and obstacles of individuals, ensuring that every child has access to complete immunisation. Finally, community-based efforts can be made to address the perception of household

economic status and its impact on immunisation decisions. Engaging with community leaders and local organisations can help promote the importance of childhood immunisation and foster a supportive environment for vaccination uptake.

Concerning the type of residences as an enabling factor for RCIS in ASD, mothers residing in self-contained houses exhibited a 40% lower likelihood of fully immunising their children against recommended VPDs compared to those living in compound houses. This finding, similar to occupation and income, serves as an indicator of the household's wealth status and can influence both human health and healthcare utilisation, including childhood immunisation (Baxter et al. 2019).

In Ghana, it is generally perceived that mothers residing in self-contained houses are economically and educationally advantaged compared to those in compound houses. However, mothers in compound houses may have more opportunities to interact and share information with individuals in their compounds and the community. This social network can facilitate discussions on health programmes and the importance of childhood immunisation, leading to higher vaccine utilisation. Conversely, mothers residing in self-contained houses might face constraints in accessing vital health information and participating in community activities, potentially leading to reduced vaccine utilisation for their children.

The implications of this finding for households are significant, as it increases the risk of VPDs among unimmunised children. These children are more vulnerable to severe illnesses, complications, and even death. Additionally,

households may face higher healthcare costs due to the need for long-term care and hospitalisation. The failure to immunise their children may also subject families to social stigma and rejection. At the district level, there is a potential decline in herd immunity within the population, which can lead to disease outbreaks if immunisation rates fall below the recommended threshold. The increased cases of VPDs can result in higher healthcare costs for the state, including expenses for medical care, hospitalisation, disease surveillance, and containment. Moreover, there may be economic consequences, such as loss of productivity, reduced tourism, and impact on trade. Another implication is the negative effect on public health messaging. A low immunisation rate can erode trust in vaccines, leading to vaccine hesitancy and decreased immunisation coverage. This poses a challenge to public health efforts in promoting the importance of vaccines and maintaining high vaccination rates.

The findings concerning enabling factors in this study align with the AHU model. According to Andersen (1968), an individual's likelihood of utilising health services is influenced by the existing enabling factors. The enabling category comprises family and community resources such as income and household materials. Family resources include economic statuses, such as income level and household materials, and where dwelling places are located (Andersen, 1968).

In this study, the enabling factors were assessed to determine how they influence RCIS in the ASD of Ashanti. The results of the multivariate regression analysis highlighted specific enabling variables that significantly influenced the

prediction of RCIS in ASD. These variables encompassed mothers' occupation, how good was their income, how good their spouse's income was, how regular their spouse's income was, whether their spouse's income was the sole source of living for the household, household wealth status, and the kind of houses for dwelling. Nevertheless, the regularity of their income, whether their income served as the sole household income, and the type of building material used for their houses were identified as inadequate determinants of RCIS in ASD of the Ashanti Region. These significant factors support Andersen's (1968) argument that enabling factors are relevant predictors of health outcomes since they can potentially affect the availability of resources that support childhood immunisation.

Research Question Four: Which access to immunisation services factors predict the routine immunisation status of children aged 12-23 months in ASD in the Ashanti Region?

This research question sought to explore the significant RCI services accessibility factors (IVs) that could predict the RCIS (DV) in ASD in the Ashanti Region of Ghana. To predict RCIS based on factors related to access to RCI services, an initial step involved conducting a bivariate correlation with a chi-square test to identify the IVs that had a significant impact on the DV. The identified significant variables were further analysed with multivariate binary logistic regression to determine the IVs that significantly predicted the childhood immunisation status. The access factors used in this study were the place of residence (community classification), available EPI facility, how often CWC is conducted, how regular CWC is conducted, distance to cover for immunisation,

how long it takes to immunisation centre, means of travel to immunisation centre, transportation cost to immunisation centre, waiting time at immunisation centre, and satisfied with how nurses communicate. From the bivariate chi-square analysis, all the access factors were associated significantly with the childhood immunisation status ($p = 0.001$) except for a place of residence [community classification] ($p = 0.182$) which was not significant (See Appendix B3 for details).

In addition to the bivariate correlation analysis, a multivariate logistic regression analysis was performed to uncover the variables related to RCI services (IVs) that significantly served as predictors for RCIS (DV). The enter method was used to estimate the significance and AOR of the variables. The overall binary logistic regression model was significant at 2 Log likelihood = 4102.804, Cox and Snell $R^2 = .121$, Nagelkerke $R^2 = .162$, $p = 0.001$ with the correct prediction rate of 56.8%. During the analysis of the variables related to the accessibility of RCI services (IVs) and RCIS (DV), the respondents' place of residence was excluded from the multivariate logistic model. This decision was made because it did not show a significant correlation with RCIS in the bivariate correlation analysis with the chi-square test. Table 5 displays the results concerning accessibility factors and RCIS. The enter method was employed to analyse the data for this research question, as it allows the model to encompass all independent variables and concurrently control for the effects of each variable. Additionally, all relevant variables can be included in the model and can avoid omitted variable bias (Mertler, & Vannatta, 2017). Further, this method was used because it has mostly been used

in similar studies conducted. The results showed how the individual access to immunisation services predictors influenced the RCIS in the ASD of Ashanti are shown in Table 5.

The results indicated that mothers who perceived the CWC as being conducted irregularly had a 40% [AOR = .630, (CI = .500-.749), $p = 0.001$] lower likelihood of achieving full immunisation status for their children than mothers who perceived CWC as being conducted regularly. Also, mothers living between 1 to 5 kilometres away from the CWC delivery point had a 40% [AOR = 609, (CL = .436-.850), $p = 0.001$] lower likelihood of obtaining full immunisation status for their children compared to those living within less than 1 kilometre. It further emerged that mothers who took over 1 hour to reach the vaccination centre had 40% [AOR = (0.635, CI = 0.485-0.832), $p = 0.001$] lower odds likelihood of vaccinating their children fully than mothers who took less than 1 hour. Similarly, the study revealed that mothers who used motorbikes as a means of travel to the immunisation centre had 30% [AOR = .733, (CI = .543-.991), $p = 0.043$] lower odds of fully immunising their children compared to those who travelled on foot. Likewise, concerning how the service providers (nurses) communicate information about the CWC services to mothers, the results revealed that the odds of mothers who were not satisfied with how the nurses communicated to them were 63% [AOR = .372, (CI = .289-.480), $p = 0.001$] lesser of obtaining full immunisation for their children than mothers who were satisfied with how the nurses' communicated to them.

In contrast to the significant variables considered, certain factors related to access to immunisation services, as identified in the literature, did not

demonstrate any significant influence on determining RCIS in this particular study. For instance, available EPI facility in the community (static clinic, outreach clinic, door-to-door clinic) [AOR = 1.360, (CI = .498-3.713), $p = 0.548$], how often CWC conducted (daily, weekly, monthly) [AOR = 1.845, (CI = .574-5.936), $p = 0.304$], and transportation cost to immunisation centre [AOR = 1.170, (CI = .895-1.530), $p = 0.251$] did not influence the outcome of RCIS in the ASD of Ashanti Region of Ghana.

Among the factors related to access to immunisation services, the regularity of conducting CWCs was found to have influenced RCIS in the district. Mothers who perceived the CWC as being conducted irregularly had a 40% lower likelihood of achieving full immunisation status for their children compared to mothers who perceived that CWCs were conducted regularly in their communities.

Table 5: Binary Logistic Regression Analysis of Access to Immunisation Services Predictors of RCIS in ASD of Ghana

Variables	B	Wald test (x-ratio)	Adjusted Odds Ratio (AOR)	95% Confidence Interval	
				Lower	Upper
Available EPI facility					
Static clinic			1		
Outreach clinic	.308	.361	1.360 ^{NS}	.498	3.713
Door to door service del	.128	.064	1.137 ^{NS}	.419	3.084
None	.210	.159	1.233 ^{NS}	.440	3.450
How often CWC conducted					
Daily			1		
Weekly	.613	1.056	1.845 ^{NS}	.574	5.936
Monthly	.792	1.945	2.207 ^{NS}	.725	6.713
None	.210	.071	1.163 ^{NS}	.384	3.516
How regular CWC conducted					
Very regular			1		
Not regular	-.462	15.286	.630 ^{***}	.500	.794
Distance to cover for immunisation					
< 1 km			1		
Between 1 to 5 km	-.496	8.482	.609 ^{**}	.436	.850
>5 km	.016	.008	.984 ^{NS}	.700	1.384
How long it takes to immunisation centre					
Within 1 hour			1		
More than 1 hour	-.453	10.829	.635 ^{**}	.485	.832
Means of travel to immunisation centre					
Foot			1		
Motor bike	-.310	4.080	.733 [*]	.543	.991
Vehicle	.050	.118	1.051 ^{NS}	.790	1.400

Table 5: Cont'd

Transportation cost to immunisation centre					
Expensive			1		
Affordable	.157	1.315	1.170 ^{NS}	.895	1.530
Free	-.030	.060	.971 ^{NS}	.765	1.232
Waiting time at immunisation centre					
Within 1 hour			1		
More than 1 hour	-.161	1.707	.852 ^{NS}	.669	1.084
Satisfied with how nurses communicate					
Yes			1		
No	-.988	58.343	.372 ^{***}	.289	.480

***p < 0.001; **p < 0.01; *p < 0.05; ^{NS}p > 0.05; -2 Log likelihood = 4102.804, Cox and Snell R² = .121, Nagelkerke R² = .162, p = 0.001; Omnibus test of model coefficients, χ^2 (16) = 427.272, p = 0.000

This outcome has significant effects on routine childhood vaccine utilisation. This finding suggests that the irregular provision of CWCs creates missed opportunities for immunisation. Lack of awareness about clinic dates hinders mothers from planning and adhering to the immunisation schedule. Additionally, irregular scheduling of CWCs leads to inconveniences and difficulties in attending appointments, ultimately resulting in lower rates of regular immunisation. Inadequate communication regarding clinic schedules further contributes to missed immunisation.

Besides, this study outcome also highlights the critical role of regular and consistent CWCs in facilitating and promoting vaccines uptake (GoG, 2014; UNICEF, 2020). To address this issue, healthcare systems and policymakers should prioritise the establishment of well-organised and consistent CWC schedules, ensuring that they are accessible and conveniently located for mothers and their children. Also, targeted health education campaigns can be implemented to raise awareness among mothers about the importance of attending CWCs regularly for immunisation and other essential child health services. By addressing the irregular provision of CWCs and promoting regular attendance, this implication aims to increase immunisation status and reduce the incidence of VPDs among children, ultimately improving overall public health outcomes (Dabbagh et.al, 2018; Sang, & Cheng, 2020).

Another access to immunisation services factors found was distance to cover for childhood immunisation services in the district. Mothers living between 1 to 5 kilometres away from the CWC delivery point had a 40% lower likelihood

of obtaining full immunisation status for their children compared to those living within less than 1 kilometre. This finding highlights the significant role of distance as a barrier to accessing immunisation services. Challenges in transportation, limited infrastructure, and geographical obstacles such as rough terrain or inadequate road networks may hinder mothers from reaching healthcare facilities. Moreover, the additional time and effort required to travel longer distances, particularly for mothers with multiple responsibilities, can pose difficulties in prioritising immunisation appointments. Comparable findings have been documented in prior research studies (Ashiagbor et al., 2020; Khan et al., 2021; Nesbitt et al., 2016; Xeuatvongsa et al., 2017).

Corroborating the findings of this research, a multi-country study covering 21 low and middle-income nations analysed data from 29 DHS. Employing a multivariable logistic model and meta-analysis regression, the study explored the relationship between facility distance, child mortality, and healthcare utilisation. The research revealed that children residing within 1 kilometre of a health facility exhibited 7.7% higher odds of neonatal mortality in comparison to those living at a greater distance. Likewise, children residing within distances of 2-3 kilometres, 5 kilometres, and beyond 10 kilometres exhibited gradually increased odds of neonatal mortality. Additionally, the research highlighted that women located more than 10 kilometres away from a health facility had 55.3% lower odds of experiencing an in-facility delivery compared to those residing within 1 kilometre. These outcomes offer further support for the influence of distance on healthcare outcomes and utilisation (Karra, Fink, & Canning, 2017).

Furthermore, research conducted in Malawi delved into an investigation within the community, focusing on the integration of family planning (FP) and childhood immunisation services during routine outreach clinics. The study revealed that reduced travel distances to the clinics significantly influenced the adoption of enhanced modern contraceptive methods [MCMs] (Hamon et al., 2020). Similarly, a study carried out by Nesbitt and colleagues (2016) in the Brong Ahafo Region of Ghana explored the impact of distance and quality on healthcare concerning the place of delivery, yielding similar results. Out of the 11,274 deliveries examined, 58 percent took place in a health facility, with proximity playing a substantial role: 79 percent of women residing within 1 kilometre of a facility opted for facility delivery, compared to only 28 percent of those residing more than 10 kilometres away. In addition, after adjusting for individual-level determinants of facility delivery, women situated between 1 km and 5 km from their nearest facility exhibited 68 percent lower odds of delivering in a facility compared to those within 1 km, while women residing over 10 km away had 90 percent lower odds of facility delivery than those within 1 km.

While many studies have demonstrated a significant link between the distance from one's residence and health service utilisation outcomes, some have shown conflicting findings. For example, a study conducted in the Eastern Region of Ghana investigated the impact of distance and quality on the utilisation of birthing services at healthcare facilities. The study aimed to measure the impact of distance and healthcare quality on the use of birthing services by employing routine health data and a spatial interaction model that combined routine birth

data, emergency obstetric care surveys, pregnancy estimates, and health facility locations. The findings indicated that each additional kilometre in distance notably decreased the rate of facility deliveries by 6.7%. Despite the rise in deliveries linked to improved quality care, the correlation was considered statistically insignificant. Additionally, it was disclosed that women who exceeded the anticipated distance to access facility-based deliveries travelled an average distance of 4.7 km beyond the nearest facility for delivery (Dotse-Gborgbortsi et al., 2020).

The examination of travel time concerning mothers' journey duration to the immunisation centre for vaccinating their children against VPDs was shown to impact RCIS in ASD. The study indicated that mothers who spent over 60 minutes travelling to the centre were 40% less inclined to vaccinate their children fully than those who took less than an hour. This observation underscores the significance of travel time as a key determinant of utilisation for preventive healthcare services, such as childhood immunisation services. The rationale behind this finding may be that extended travel durations can encroach on a mother's daily schedule, reducing the time available to arrange and attend vaccination appointments. Consequently, this outcome of travel time might lead to delays in immunisation or missed opportunities, resulting in lower vaccination rates. The substantial influence of travel time on vaccination uptake emphasises the necessity of enhancing the accessibility and availability of vaccination facilities, especially in remote or underserved regions. Health authorities should contemplate strategically siting vaccination centres to decrease travel time for

mothers, thereby simplifying and making it more convenient for them to access immunisation services. Furthermore, the introduction of mobile or outreach vaccination initiatives in areas with lengthy travel durations could aid in reaching populations facing challenges in accessing healthcare facilities. By tackling the travel time issue, these practical implications aspire to boost immunisation coverage and guarantee that more children receive vaccines promptly, ultimately contributing to better public health outcomes.

The current revelation concerning travel time corresponds with a similar outcome in the Lao People's Democratic Republic in Asia. In this study, which used a cross-sectional approach and included 1,162 children aged 8 to 28 months, factors influencing the timeliness of pentavalent vaccine uptake were examined across various levels of the healthcare system. The preliminary outcomes recognised travel time to healthcare facilities as a notable obstacle to timely vaccination (Hefelet al., 2020). Likewise, in Africa, particularly in Ethiopia, a quantitative analysis using a community-based comparative cross-sectional design was conducted, involving a total of 652 participants (326 insured and 326 uninsured households). Statistical analyses, including sample t-tests and chi-square (χ^2) tests, revealed a significant difference in travel time to the nearest health facility depending on the households' community-based health insurance (CBHI) enrollment status (Atnafu, Tilahun, & Alemu, 2018).

Another community-based cross-sectional quantitative study from Ethiopia, involving a sample size of 301, aimed to evaluate partial CV and related factors among children aged 12-23 months. It discovered a strong correlation

between travel time and partial vaccine utilisation. The logistic regression analysis revealed that travel time to the nearest health facility within 15–30 minutes led to a 78% reduction in incomplete vaccination (AOR = 0.22, CI = 0.06, 0.9), and travel time within 30 minutes to 1 hour reduced incomplete vaccination by 60% (AOR = 0.4, 95% CI = 0.35, 0.72) (Yismaw, Assimamaw, Bayu, & Mekonen, 2019). Similarly, Tefera et al. (2018) found that households located an hour or more from the vaccination site were 56% less likely to achieve full vaccination compared to those 30 to 59 minutes away. These findings are aligned with Miyahara et al. (2016) in the Gambia, which indicated that "the longer the distance from the vaccination site, the lower the chances of the baby being vaccinated by day 7 (of life)."

The study further unveiled that mothers utilising motorbikes as their mode of transportation to the immunisation centre had a 30% lower likelihood of fully immunising their babies compared to those who travelled on foot. This discovery underscores the significance of the means of transport to the CWC as a predictor of RCIS in the district. The finding suggests that mothers with easier access to the vaccination centre, without incurring transportation costs, were more inclined to achieve full immunisation for their children. A parallel study conducted in Gondar City, Ethiopia, similarly identified an association between means of transport and vaccine utilisation. Logistic regression analysis in that study indicated that participants using cars for transportation to nearby health facilities experienced a 90% reduction in incomplete vaccination compared to those who had to cover

long distances on foot. These findings highlight the crucial importance of accessible transportation in enhancing vaccination rates. (Yismaw et al., 2019).

Interestingly, A cross-sectional study in Nigeria, aimed at examining geographic differences and factors influencing RCI among households in urban and rural communities, observed no significant difference in the average transportation costs to health facilities between urban and rural areas. This finding suggests that transportation costs might not be a significant obstacle to immunisation in that particular context (Sibeudu et al., 2019). However, in some African nations including Ghana, the mode of transportation to vaccination centres has been recognised in some prior and this current study as a factor influencing access to RCVU. These findings underscore the importance of conducting research tailored to specific contexts to comprehend the unique factors influencing vaccines uptake in diverse settings.

Regarding the communication of information about CWC services by service providers (nurses), the study demonstrated that mothers dissatisfied with how nurses communicated information were at a 63% higher risk of not achieving full immunisation for their children compared to mothers who were content with the nurses' communication. This finding underscores the significance of effective communication between service providers and mothers as an important determinant of RCIS in ASD.

In line with the results of this study, a community-based cross-sectional study carried out in Wadla district, Ethiopia, encompassing 682 mothers of infants under the age of one, yielded significant outcomes. The study employed a two-

stage cluster sampling method to choose the households of the participants. The bivariable and multivariable logistic regression analyses demonstrated that mothers who were adequately informed about current vaccines were 2.03 and 2.24 times more likely, respectively, to express satisfaction and utilise childhood immunisation services compared to those who did not receive such information (Gebreyesus et al., 2020). Furthermore, mothers who received details regarding the upcoming immunisation schedule were 3.21 times more likely to be content with the service than those who did not receive such information (Gebreyesus et al.).

In a similar domain of research in Ghana, an inquiry into the obstacles in communication hindering the use of formal healthcare among economically disadvantaged older individuals was conducted. The findings emphasised that ineffective communication was identified as a significant barrier with the potential to impact the uptake of formal healthcare services among the economically disadvantaged elderly population. Drawing parallels from this investigation, it can be deduced that effective communication plays a crucial role in establishing trust between healthcare providers and mothers. In cases where communication is perceived as dismissive, hurried, or lacking empathy, mothers might be less willing to trust the information and guidance provided, potentially leading to vaccine hesitancy or refusal to fully vaccinate their children (Agyemang-Duah et al., 2021). The similarity in the outcomes between these surveys may be due to the study design and the crucial role of effective communication in healthcare settings.

Research Question Five: Which Need Factors Predict the Immunisation Status of Children Aged 12-23 Months in ASD in the Ashanti Region?

This research question sought to investigate the significant need factors (IVs) related to the RCIS (DV) in ASD in Ghana. To determine these factors, a bivariate analysis was performed on mothers' knowledge, attitudes, and perceptions regarding vaccines, immunisation services, and service providers. The bivariate analysis outcomes indicated that maternal knowledge, attitudes, and perceptions were statistically significant predictors of RCIS, as detailed in Appendix B4.

For the multivariate analysis, binary logistic regression was employed to examine the mothers' knowledge, attitude, and perception concerning vaccines and immunisation services. The 'enter method' was utilised to assess the significance and adjusted odds ratios of these need factors RCIS. The binary logistic regression model demonstrated significance, with a -2 Log likelihood of 4512.196, Cox and Snell R² of .005, Nagelkerke R square of .007, and a p-value of 0.001. The model exhibited a prediction rate of 58.8%. Knowledge was categorised into low and high variables, while attitude and perception were classified into good and poor variables, as shown in Table 6.

The 'enter method' was utilised for the analysis of research question five. This model was selected because it enables the isolation of a specific variable's effect on the outcome and can statistically control for potential confounding influences from other variables. Additionally, it enables the consideration of the combined effects of all variables (Mertler & Vannatta, 2017). Further, it was used because most studies conducted in this area of study used this method. The results

of how individual predictors of need factors influenced the RCIS in the ASD of the Ashanti Region are shown (see Table 6).

The results from Table 8 revealed that mothers perceiving service providers' attitudes as good were 30% [AOR = 0.741, CI = 0.622 - 0.883], $p = 0.001$] less likely to achieve full immunisation status for their children compared to those who perceived service providers' attitudes as poor. Conversely, mothers with a positive perception of vaccines, service providers, and immunisation services were 35% [AOR = 1.352, (CI = 1.140-1.601), $p = 0.001$] more likely to achieve full immunisation status for their children than those with a poor perception. However, in terms of mothers' knowledge of immunisation [AOR = 1.045, (CI = 0.878-1.243), $p = 0.621$], it was found not to be a significant predictor of the need factors for RCIS in the ASD of Ghana.

Regarding the need factors, mothers who viewed service providers' attitudes as positive had a 30% lower likelihood of achieving full immunisation status for their children than mothers who perceived service providers' attitudes as poor. Although the observed results underscore the significance of service providers' attitudes as a crucial variable in determining RCIS, the observed pattern is somewhat unusual. This finding could potentially be explained by the fact that, despite positive attitudes displayed by service providers toward vaccines and vaccination services, mothers may encounter various obstacles that impede their capacity to fully immunise their children. Challenges such as the absence of nearby CWC facilities, extended distances to vaccination centres, limited transportation access, and financial constraints may significantly affect mothers'

capability to access and utilise immunisation services for their children, irrespective of the positive attitudes demonstrated by service providers.

Contrary to this finding, numerous reports have consistently indicated that both mothers and service providers with positive attitudes towards vaccines and related activities tend to achieve better outcomes.



Table 6: Binary Logistic Regression Predictors of Need Factors of RCIS in ASD of Ghana

Variables	B	Wald test (x-ratio)	Adjusted Odds Ratio (AOR)	95% Confidence Interval	
				Lower	Upper
Mothers' knowledge on immunisation					
Low knowledge			1		
High knowledge	.044	.245	1.045 ^{NS}	.878	1.243
Mothers perceived providers' attitude					
Poor attitude			1		
Good attitude	-.300	11.272	.741 ^{**}	.622	.883
Mothers' perception about vaccination					
Poor perception			1		
Good perception	.301	23.994	1.352 ^{**}	1.140	1.601

***p < 0.001; **p < 0.01; *p < .05; ^{NS}p > 0.05; -2 Log likelihood = 4512.196, Cox and Snell R² = .005, Nagelkerke R² = .007, p = 0.001; Omnibus test of model coefficients, χ^2 (1) = 17.880, p = 0.001

For instance, a study in Ethiopia on maternal satisfaction with childhood vaccination services found that mothers who were satisfied with the services and had a positive attitude towards childhood immunisation were 3.80 times more likely to be satisfied compared to mothers with a negative attitude (Gebreyesus et al., 2020). Additionally, a qualitative study from East Africa investigating factors influencing childhood vaccination uptake in Somalia highlighted the significant impact of the attitudes of both mothers and service providers. It recounted an incident involving a vaccine-hesitant mother who witnessed a service provider destroying polio vaccines under trees and falsifying daily records, leading to her ongoing mistrust and refusal to vaccinate her children (Abdullahi et al., 2020).

This current study's findings and others reviewed in the literature underscore the importance of healthcare providers' attitudes and interactions in influencing mothers' decisions and willingness to fully vaccinate their children. To address this issue, healthcare institutions should prioritise training and promoting positive attitudes among service providers, fostering a supportive and respectful environment for mothers seeking vaccination services. Moreover, enhancing communication and empathy skills among healthcare providers can help build trust and confidence in immunisation services, encouraging mothers to adhere to recommended vaccination schedules. Improving service providers' attitudes is envisaged to strengthen the relationship between healthcare providers and mothers, leading to increased immunisation uptake and ultimately resulting in an enhanced health outcome for children.

The research additionally identified the positive perception of mothers regarding vaccines, service providers, and immunisation services as a significant determinant of RCIS in the ASD of Ghana. The study demonstrated that mothers with a positive perception of vaccines, service providers, and immunisation services were 35% more likely to vaccinate their children fully compared to mothers with a less favourable perception. This finding aligns with the widely accepted notion that mothers with positive perceptions are more inclined to acknowledge the benefits of childhood vaccinations. They tend to be well-informed about the importance of immunisation, the diseases it can prevent, and the risks associated with vaccine refusal. They also have trust in healthcare providers and value their recommendations regarding childhood immunisation. These positive perceptions may significantly influence their commitment to ensuring that their children receive the recommended immunisation.

The behaviour of healthcare providers and parents' perceptions of immunisation delivery has a significant impact on childhood vaccination status. There are instances where healthcare providers may exhibit unfriendly attitudes toward parents while delivering immunisation services, leading to a sense of insecurity, alienation, and suspicion among parents (Lifalaza, Stern, & Ashipala, 2018). Several studies have highlighted the influence of parents' perceptions of healthcare systems on childhood immunisation status.

In support of these findings, a qualitative study in East Africa examined the population's perception of health services and how expectations, sociodemographic and socioeconomic characteristics, and curative and preventive

service needs in Mekelle City, Ethiopia, influenced service quality. The study revealed that respondents' perceptions significantly influenced health service delivery and utilisation. (Girma, Robles, Asrat, & Hagos, 2020). Another qualitative study from Ethiopia explored how to enhance immunisation services by optimising the linkages between health facilities and the community. The study highlighted the importance of perception in achieving vaccination coverage, with participants mentioning that community perception towards healthcare providers acted as a barrier to community engagement (Kerebih et al., 2021).

Andersen's healthcare utilisation model (1968) posits that individuals' perceptions of the benefits and drawbacks of receiving health services influence their utilisation of those services. People who perceive health service utilisation as beneficial in preventing diseases are more likely to seek and use them, while those with negative perceptions may be less inclined to do so (Ogbuabor & Chime, 2021; Wolinsky, 1988). In this study, the need component of Andersen's model was employed, focusing on the knowledge, attitudes, and perceptions of mothers regarding vaccines, vaccination services, and the behaviour of service providers during service provision. The study explored how these need factors influenced RCIS in the ASD of the Ashanti Region. Aside from knowledge, the attitudes and perceptions of mothers regarding vaccines, service providers and vaccination services were significantly related to RCIS in ASD of the Ashanti Region. This implies that socioeconomic factors, including poverty and low socioeconomic status, can markedly influence a mother's capability to prioritise the knowledge she possesses. Additionally, while mothers may have adequate knowledge,

challenges related to time, finances, and transportation may hinder their ability to ensure timely vaccination. Moreover, in Ghana, various beliefs surrounding childhood immunisation exist and can exert a stronger influence on mothers' attitudes and perceptions than their knowledge alone.

The finding in this current study emphasises the critical role of maternal attitudes and perceptions in influencing vaccination decisions and uptake. To capitalise on this positive association, targeted health education campaigns can be designed to address misconceptions and concerns about vaccines, providing accurate and evidence-based information to mothers. Also, healthcare providers can play a key role in promoting positive perceptions by engaging in open and informative discussions with mothers about the benefits of vaccination and addressing any doubts or fears they may have. Creating a supportive and respectful environment during vaccination visits can also contribute to enhancing positive perceptions among mothers. By focusing on improving maternal attitudes and perceptions, this practical implication aims to increase immunisation acceptance and uptake, ultimately contributing to better overall public health outcomes and protecting children from VPDs.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study assessed the RCIS and its determinants among children aged 12 to 23 months living in the ASD of Ghana. Specifically, the study aimed to: assess the RCIS among children in this age group within the ASD of the Ashanti Region; identify child and maternal predisposing factors that predicted the RCIS in these children; determine the enabling factors among parents that influenced the RCIS in children aged 12-23 months; evaluate the extent to which access-related factors anticipated the RCIS in these children; and identify the need factors that predicted the RCIS among children aged 12-23 months in the ASD of the Ashanti Region in Ghana.

Summary

Childhood mortality poses a considerable global challenge, particularly in Africa and sub-Saharan Africa. In 2019, Africa reported the highest number of childhood deaths, and sub-Saharan Africa alone accounted for more than half of the global figures. Ghana, despite making advancements, continues to grapple with under-5 mortality rates that exceed the targets outlined in the SDGs. Immunisation has emerged as a crucial strategy for mitigating childhood mortality and preventing VPDs. RCI has demonstrated its effectiveness, annually saving millions of lives. The increased global coverage of measles vaccination, for instance, has resulted in a substantial reduction in both measles incidence and related deaths.

Ensuring that children receive the entire recommended immunisation course is essential for its effectiveness in protecting them against diseases, disabilities, and mortality. However, several factors impede mothers from completing the vaccination schedule, leading to a compromise in the significant effect of immunisation programmes on reducing childhood morbidity and mortality. Factors such as predisposing, enabling conditions, access to immunisation services, and other need-related elements contribute to the low utilisation of routine vaccines. Despite support from organisations like WHO, MOH, GHS, and partners, the ASD in Ghana has faced challenges in achieving and sustaining the targeted immunisation coverage of 95%. Additionally, there is a lack of community-based studies aimed at identifying the contributing factors to the consistently low and declining immunisation coverage in ASD.

The current research endeavour aims to address this gap by investigating the RCIS and recognising the determinants associated with achieving full immunisation status in individuals with ASD. Through the utilisation of a community-based household methodology, this research adopted an analytical cross-sectional framework, administering a quantitative survey instrument. The survey instrument gathered data on RCIS, predisposing factors concerning both the child and the mother, enabling factors related to parents, the accessibility of immunisation services, and need factors encompassing knowledge, attitude, and perception. Data were obtained from 3,312 mothers of children aged 12-23 months residing in ASD. The analytical techniques employed included descriptive

statistics, bivariate correlation (chi-square test), and multivariate analysis (binary logistic regression) to respond to the research inquiries.

This investigation aims to contribute by examining the factors influencing RCIS to uncover the obstacles and rationales affecting why mothers might not adhere to the complete vaccination regimen for their offspring. The knowledge acquired from this study has the potential to guide targeted interventions and tactics to boost immunisation acceptance in ASD, ultimately striving to alleviate childhood morbidity and mortality.

Main Findings

The following findings were drawn from the results of the study:

1. The RCIS of children aged 12-23 months in the ASD in the Ashanti Region of Ghana was observed to be only 56.8% (n = 1881), significantly below the national, and SDG target of 95%. This outcome highlights a notable deficit in vaccine utilisation rates for children aged 12-23 months, leaving them vulnerable to VPDs.
2. The predisposing factors associated with mothers and children that predicted RCIS in ASD included the age of the child, wherein children aged 18-23 months displayed a decreased likelihood of being fully immunised compared to those aged 12-17 months. Additionally, the number of children had an impact, with mothers having two or more children showing a reduced probability of achieving full immunisation in comparison to those with a single child. Marital status also played a role, with married mothers exhibiting a lower likelihood of fully immunising

their children compared to single mothers. Moreover, the absence of attendance at any ANC sessions had a detrimental effect on full immunisation, as mothers who had no ANC contact at all or had less than four contacts been less likely to fully immunise their children.

3. The enabling determinants of parents that predicted the RCIS of children aged 12-23 months in the ASD of Ghana were; employment status which significantly impacted full immunisation, with self-employed and unemployed mothers exhibiting lower odds than those employed in the government sector. Financial stability was a factor, as mothers with less favourable income levels were less likely to fully immunise their children. Mothers' perspectives on their spouses' income, such as adequacy of their income, the regularity of their income, and whether their income was the sole source of household living were identified. Additionally, households with middle-class mothers are more likely to immunise their children fully compared to those with mothers in poorer financial situations. The kind of house mothers resided in further significantly influenced the RCIS in the ASD of the Ashanti Region.

4. Regarding the access to immunisation services factors of vaccine utilisation, mothers' perspectives on the conduct of CWC and geographical factors played a role, with mothers residing over 1 kilometre from the CWC delivery point, or spending more than an hour to reach vaccination centres, having a notable influence on RCIS. Means of travel

to the immunisation centre, such as walking or using motorbikes, as well as satisfaction with nurse communication, were also impactful.

5. With regards to the need factors of RCIS in the ASD of the Ashanti Region of Ghana, maternal perception played a pivotal role, with mothers perceiving positive staff attitudes showing less likelihood of achieving full immunisation compared to those with less favourable staff attitudes. Favourable perceptions of vaccines, service providers, and immunisation services positively influenced the likelihood of achieving full immunisation status.

Conclusions

Based on the findings from the study, the following conclusions have been drawn:

1. Undoubtedly, the RCIS among children aged 12-23 months in ASD of the Ashanti Region falls considerably below both national and SDG targets. This deficient utilisation of routine vaccines highlights a substantial disparity in attaining the desired level of vaccine coverage. The diminished use of vaccines may potentially result in lower herd immunity, posing a heightened risk of deadly VPDs for the children.
2. Mothers tend to fall short of completing their children's immunisation schedules as their children age and their number increases. Marital status also plays a role, with married mothers demonstrating a reduced likelihood of fully immunising their children compared to their single counterparts. Moreover, the lack of attendance at ANC sessions has a detrimental

impact on immunisation, emphasising the importance of maternal involvement during pregnancy.

3. The employment and income status of mothers significantly shape immunisation outcomes in ASD. Mothers who are self-employed, unemployed, or have inadequate income exhibit lower odds of achieving full immunisation compared to those employed in the government sector with sufficient income. Perspectives on spousal income adequacy, income stability, and being the sole source of household living significantly influence the immunisation status of children in the district. In general, households with middle or higher wealth status positively impact full immunisation outcomes, while housing types, especially self-contained households, negatively influence full immunisation status in the district.
4. Regularity on the conduct of CWC and, geographical factors proved influential, with mothers residing more than 1 kilometre from vaccination centres and facing longer travel times exhibiting a notable impact on immunisation rates. Transportation modes and satisfaction with nurse communication also played a role in determining immunisation status, pointing to the crucial interplay between accessibility and healthcare service quality.
5. Maternal perceptions emerged as influential, with positive staff attitudes paradoxically associated with lower likelihood of achieving full immunisation, possibly reflecting an overconfidence in healthcare services. Favourable perceptions of vaccines, service providers, and

immunisation services significantly correlated with higher likelihood of full immunisation, highlighting the importance of informed maternal views in driving immunisation uptake.

Recommendations

Based on the conclusions, the following recommendations have been proposed for practice and policy;

1. The GHS/DHD of ASD should enhance efforts in conducting comprehensive public awareness and health education campaigns targeting mothers and households. These campaigns should emphasise the benefits of RCI and stress the importance of completing the immunisation schedule. To facilitate greater utilisation of RCI services, collaboration between the DHD and various community stakeholders such as community leaders, influencers, household heads, opinion leaders, religious groups, and local organisations is essential. These partnerships can be leveraged to promote RCI through interactive community durbars, support groups, and home visits. Such initiatives will help address concerns and provide accurate information about childhood vaccination, ensuring that mothers have the necessary knowledge to make informed decisions.
2. The GHS and DHD should develop strategies targeting interventions that focus on specific age range. The strategies to engage parents and caregivers, ensuring timely vaccination across all age categories more importantly those above 17 months of age, will be vital in achieving a

comprehensive immunisation coverage rate. Effective health education programmes on the benefits of utilising ANC fully during pregnancy should be intensified in the District by the staff at the Health Directorate and those at the hospital. Also, the integrated free maternal healthcare policy with the national health insurance scheme and implemented by the government aimed at overcoming financial barriers to service utilisation should be maintained and strengthened to motivate all pregnant women in the district to access ANC fully during pregnancy since this service has the potential to influence RCI.

3. The Government of Ghana, District Assembly, and their partners should open sustainable jobs or assist in entrepreneurship to help increase the economic standards of parents especially mothers in the district. Also, in collaboration with the District Assembly, the DHD should identify and address the fundamental financial challenges that contribute to low rates of immunisation such as unemployment, unstable jobs, irregular incomes of mothers and their spouses in the district.
4. The DHD should offer accessible RCI services to the low-income and or irregular-income households by establishing CWCs in easy-to-reach areas, and offer flexible hour services to enable full patronage of the service. Also, the Directorate should set up mobile clinics to commute between communities and households that may have transportation and financial challenges to enable them to have easy access to immunisation services. In addition, Directorate should increase the current outreach clinics for child

welfare services to cover more communities in the CHPS zones and reduce the distance and time mothers have to cover for immunisation services in the district.

5. The GHS should empower the service providers through training on the benefits of immunisation and effective communication strategies. This may help build trust and improve the provider-mother relationship resulting in high routine immunisation rates. Furthermore, the directorate should create a system to track immunisation records of all children due for immunisation and remind mothers about their next visit through calls, text messages, WhatsApp messages, or the use of community-based service volunteers (CBSVs) whichever is appropriate in the communities to ensure that households are aware of the upcoming schedule of immunisation and participate fully. Additionally, the district health directorate should monitor the trend and evaluate the effectiveness of RCI activities in the district by targeting the households and communities with low immunisation rates, identifying the challenges, and preferring solutions accordingly to improve the rates.

Recommendations for Further Studies

The following areas for further studies are proposed:

1. Future studies should consider adopting a longitudinal research design to capture changes in immunisation status and factors influencing it over time, providing a more dynamic perspective on childhood immunisation patterns.

2. Researchers should offer flexible data collection timing options to accommodate participants' availability and preferences, reducing participant burden and enhancing data quality.
3. Incorporating qualitative methods, such as interviews or focus groups, alongside quantitative data collection is recommended to obtain more profound insights into the viewpoints of both mothers and fathers concerning decisions related to childhood immunisation.
4. Future studies should involve both mothers and fathers in assessing childhood immunisation status, recognising the importance of both parents' viewpoints in understanding immunisation decisions.
5. To provide a holistic understanding, future research should investigate both the demand and supply sides of immunisation services, uncovering factors influencing vaccine availability and healthcare provider engagement.
6. Future research could undertake comparative analyses across different regions or districts to identify contextual factors that influence childhood immunisation decisions, leading to more tailored interventions.

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APPENDICES

APPENDIX A: QUESTIONNAIRE

UNIVERSITY OF CAPE COAST

FACULTY OF EDUCATION

DEPARTMENT OF HEALTH PHYSICAL EDUCATION AND RECREATION
QUESTIONNAIRE FOR ROUTINE CHILDHOOD IMMUNISATION DATA

I am Samuel, a PhD (Health Promotion; Maternal and Child Health) candidate at the Department of HPER, UCC. I am conducting research survey on the **“Determinants of Routine Immunisation Status among Children Aged 12 – 23 Months in Adansi South District in the Ashanti Region, Ghana.”** The purpose of this exercise is to identify the determinants of RCIS and as well generate information that will be used to initiate a discussion that will bring about a variety of possible strategies to improve immunisation coverage in these study settings. Please be assured that all responses provided in this survey are strictly confidential and for academic research purposes only. You are required to complete a 74-item survey. This may take between 30 to 40 minutes of your time. To participate in this study is completely voluntary and you are free to participate or not should it be found necessary. If you fully understand your duties as required and wish to take part in this study, please, kindly sign in the space below.

Signature.....

Date.....

For any information, contact my supervisors Dr. J. O. Sarfo (0246485735) or Dr. T. Hormenu (0244213465).

You may also contact me (Samuel) on 0208208949 or yaw_sems@yahoo.co.uk

Thank you for your participation.

NAME OF INTERVIEWER:.....

Community/Stratum name.....

Cluster name.....

Rural/Urban.....

District name.....

	D	D	M	M	Y	Y	Y	Y
Date of Assessment					2	0	2	3
Date of Birth of Child (Verify from card if Available)								

SECTION A: Predisposing Factors

Kindly tick (✓) the appropriate response in the box provided

1. What is the age of the child? (in months)

2. What is the gender/sex of the child?

a. Male ()

b. Female ()

3. How many children do you have?

a. 1 ()

b. 2 ()

c. 3 ()

d. 4 and above ()

4. What is the birth order of this child?
 - a. One ()
 - b. Two ()
 - c. Three ()
 - d. Four and above ()
5. What is the household size of your family?
 - a. Two ()
 - b. Three ()
 - c. Four ()
 - d. Five and above ()
6. What is your age? (completed years)
7. What is the level of your education?
 - a. No formal education ()
 - b. Primary education ()
 - c. Secondary education ()
 - d. Tertiary education ()
8. What is the educational level of the child's father?
 - a. No formal education ()
 - b. Primary education ()
 - c. Secondary education ()
 - d. Tertiary education ()
9. What is your marital status? (Married through generally accepted ceremony)
 - a. Single ()
 - b. Married with spouse ()

10. What is your religion?

- a. "Christian" ()
- b. "Muslim" ()
- c. "Traditional" ()
- d. "No religion" ()

11. Does your religious belief accept or promote childhood immunisation?

- a. Yes ()
- b. No ()

12. Did you attend antenatal services (ANC) before giving birth to this child?

- a. Yes ()
- b. No ()

13. How many times did you visit ANC services before delivering this child?

- a. Less than 4 visits ()
- b. 4 and above visits ()
- c. No visit ()

14. Where was this child delivered?

- a. Home ()
- b. Health facility ()

SECTION B: Immunisation coverage of children 12 – 23 months in ASD in the Ashanti Region of Ghana

Kindly tick (✓) the appropriate response in the box provided

15. Did you ever receive or were given a mother and child health records book (MCHRB) or vaccination card or a family folder for this child?

- a. Yes ()
- b. No ()
- c. Do Not Know ()

16. May I see it, please? (if card seen, skip question 17)

- a. Yes, Card Seen ()
- b. Yes, Card Not Seen ()
- c. No Card ()

17. Why do you no longer have the vaccination card?

- a. Lost Card ()
- b. Card destroyed ()
- c. Do not Know ()

18. Is the card the original that you received or a replacement/copy? (if original, skip question 19)

- a. Original ()
- b. Replacement/Copy ()
- c. Do Not Know ()

19. Did you have to pay for the replacement card?

- a. Yes ()
- b. No ()
- c. Do Not Know ()

20. Has the child ever received any vaccinations, drops, or injections in the past?

- a. Yes ()
- b. No ()
- c. Do Not Know ()

21. Which of the vaccines has the child received?(**Verify from the maternal and child health record book at page 51 and write the date of immunisation against the appropriate disease [vaccine]. If maternal and child health record is not available record orally from the mother**)

Age	Vaccine	Date Given
At Birth	BCG	
	OPV 0	
	Hepatitis B	
6 Weeks	OPV 1	
	DPT/Hep B/Hib 1	
	Pneumococcal 1	
	Rotavirus 1	
10 Weeks	OPV 2	
	DPT/Hep B/Hib 2	
	Pneumococcal 2	
	Rotavirus 2	
14 Weeks	OPV 3	
	DPT/Hep B/Hib 3	
	Pneumococcal 3	
	IPV	
9 Months	Measles-Rubella 1	
	Yellow Fever	
18 Months	Measles-Rubella 2	
	Meningitis A	

22. Has the child received every vaccine for his/her age in this survey?

a. Yes ()

b. No ()

23. What is the immunisation status of the child?

a. Fully immunised ()

b. Partially immunised ()

c. Not immunised ()

SECTION C: Enabling Factors of Childhood Immunisation

Kindly tick (✓) the appropriate response in the box provided

24. What kind of occupation are you engaged in?

a. Government work ()

b. Private work ()

c. Self-employed ()

d. Unemployed ()

25. Is your income from this occupation okay?

a. Yes ()

b. No ()

26. Is the income from your occupation regular?

a. Yes ()

b. No ()

27. Is your income the sole source of living for the household?

a. Yes ()

b. No ()

28. What is your household income level (per month)? **[Write the amount in the space provided]**

a.

29. What kind of occupation is your spouse engaged in?

a. Government sector work ()

b. Private sector work ()

c. Self-employed ()

d. Unemployed ()

30. Is your spouse's income from this occupation okay?

a. Yes ()

b. No ()

c. No idea ()

31. Is your spouse's income regular?

a. Yes ()

b. Not ()

c. No idea ()

32. Is your spouse's income the sole source of living for the household?

a. Yes ()

b. No ()

c. No idea ()

33. What is the wealth index/status of your household?

a. Poor ()

b. Middle ()

c. Rich ()

34. What kind of building material is the house made of?

a. Block house ()

b. Brick house ()

c. Mud house ()

35. What kind of house are you dwelling in?

a. Compound house ()

b. Self-contain house ()

c. Semi-detached house ()

SECTION D: Access to immunisation services

Kindly tick (✓) the appropriate response in the box provided

36. How is this community classified?

a. Urban town ()

b. Rural community ()

37. What type of EPI service facility is available to your community?

a. Static clinic ()

b. Outreach clinic ()

c. Door to door service delivery ()

d. None ()

38. How often is child welfare clinic (CWC) conducted in your community?

a. Daily ()

b. Weekly ()

c. Monthly ()

d. None ()

39. How regular is the CWC conducted in your community?

a. Very regular ()

b. Not regular ()

40. What distance (Kms) do you travel to bring your child for routine immunisation?

a. < 1 km ()

b. Between 1 to 5 km ()

c. > 5 km ()

41. Using the way you would normally access routine immunisation services, how long does it take you to get to the immunisation centre?

a. Within 1 hour ()

b. More than 1 hour ()

42. How do you travel to the routine immunisation centre?

a. Foot ()

b. Motor bike ()

c. Vehicle ()

43. How do you see the cost of transportation to the health facility for childhood immunisation?

a. Expensive ()

b. Affordable ()

c. Free ()

44. For how long do you wait before your child is immunised?

- a. Within 1 hour ()
- b. More than 1 hour ()

45. Are you always satisfied with how the nurses communicate information about your child to you?

- a. Yes ()
- b. No ()

SECTION E: Need Factors of Childhood Immunisation Coverage

Instruction: Please kindly respond to the following statements by ticking [✓] the column that most accurately represents your opinion of the extent to which you agree or disagree with these statements. There are no 'correct' or 'wrong' responses; your views are important.

		Strongly Disagree (SD)				
		Disagree (D)				
		Not Sure (NS)				
		Agree (A)				
		Strongly Agree (SA)				
	Knowledge about childhood immunisation	(SA-5)	(A-4)	(NS-3)	(D-2)	(SD-1)
46.	Routine immunisation provides strong protection for children and prevents the spread of diseases and their complications					
47.	Routine immunisation saves live					
48.	Immunisation are safe					
49.	Immunisation save money					
50.	First dose in vaccination is given at birth					
51.	Most diseases against which children are vaccinated occur during the first years of					

	life					
52.	Multi-doses of the same vaccine given at scheduled intervals are important for child immunity					
53.	More than one vaccine at the same time has no negative impacts on child immunity					
54.	Sources of information on immunisation is through the traditional and social media outlets					
55.	Sources of information on immunisation is through the health care system including the antennal care service					
	Attitudes towards childhood immunisation	(SA-5)	(A-4)	(NS-3)	(D-2)	(SD-1)
56.	Immunisation schedules are always convenient					
57.	Children do not become infected after immunisation with the disease/s against which he/she was vaccinated					
58.	Compliance with immunisation schedule is important					
59.	Immunisation keep your child healthy					
60.	Vaccination staff are sometimes rude towards mothers					
61.	Positive staff attitude encourages mothers to adhere to and complete immunisation schedules					
62.	Manner in which staff deliver information is conducive for mothers returning to complete immunisation for their children					
63.	Mothers are always satisfied with the nurse's attitude toward vaccination providers at vaccination centres					
64.	The nurses always charge only authorised fees for vaccination of children					
65.	There are at times shortages of vaccines and other supplies at immunisation centre					
66.	When visit the vaccination centre, the nurses always inform you when the next immunisation day is due					
67.	Vaccination hours and days are always					

	favourable					
68.	Service providers always tell mothers about the vaccines before vaccinating your child					
	Mothers' perception on vaccine and immunisation services	(SA- 1)	(A-2)	(NS-3)	(D-4)	(SD-5)
69.	Vaccines have dangerous side effect on the child					
70.	Vaccination provides no protection for the child against dangerous diseases					
71.	Sick children cannot take vaccines					
72.	Childhood immunisation is not important					
73.	Immunisation is more harmful than beneficial					
74.	Vaccines for child immunisation are not safe					



APPENDIX B: BIVARIATE ANALYSIS RESULTS TABLES

B1

Table 7: Bivariate Analysis of Child and Mother Predisposing Factors Predicting RCIS in ASD of Ghana

Variables	Category	Immunisation Status		χ^2	Phi
		Fully immunised n (%)	Partially immunised n (%)		
Child's predisposing factors					
Child's age (n = 3312)	12-17 months	1313 (39.7%)	846 (25.5%)	40.89***	.111***
	18-23 months	568 (17.1%)	585 (17.7%)		
Child sex (n = 3312)	male	992 (30.0%)	744 (22.5%)	.181 ^{NS}	.670 ^{NS}
	female	889 (26.8%)	687 (20.7%)		
Child's birth order	1 st	475 (14.3%)	388 (11.7%)	24.81***	.087***
	2 nd	741 (22.4%)	630 (19.0%)		
	3 rd	539 (16.3%)	302 (9.1%)		
	4 th and above	126 (3.8%)	111 (3.4%)		
Mother's predisposing factors					
Number of children	1	513 (15.5%)	396 (11.9%)	8.14*	.050*
	2	850 (25.7%)	586 (17.7%)		
	3	382 (11.5%)	321 (9.7%)		
	4 and above	136 (4.1%)	128 (3.9%)		

Table 7 (Continued)

Household size	Two	251 (7.6%)	204 (6.2%)	1.666 ^{NS}	.022 ^{NS}
	Three	413 (12.4%)	309 (9.3%)		
	Four	747 (22.6%)	543 (16.4%)		
	Five or more	470 (14.2%)	375 (11.3%)		
Age of mother	19 years or less	57 (1.7%)	24 (0.7%)	19.56 ^{***}	.077 ^{***}
	20-29 years	800 (24.2%)	691 (20.9%)		
	30-34 years	616 (18.6%)	394 (11.9%)		
	35 years or more	408 (12.3%)	322 (9.7%)		
Mothers educational level	No formal education	400 (12.1%)	291 (8.8%)	2.99 ^{NS}	.030 ^{NS}
	Primary education	597 (18.0%)	428 (12.9%)		
	Secondary education	726 (21.9%)	575 (17.4%)		
	Tertiary education	158 (4.8%)	137 (4.1%)		
Fathers educational level	No formal education	325 (9.8%)	233 (7.0%)	1.76 ^{NS}	.023 ^{NS}
	Primary education	458 (13.8%)	363 (11.0%)		
	Secondary education	830 (25.1%)	615 (18.6%)		
	Tertiary education	268 (8.1%)	220 (6.6%)		
Marital status	Single	417 (12.6%)	278 (8.4%)	3.69 [*]	.03 [*]
	Married	1464 (44.2%)	1153 (34.8%)		
Mothers' religion	Christian	1330 (40.2%)	870 (26.3%)	43.66 ^{***}	.115 ^{***}
	Muslim	417 (12.6%)	397 (12.0%)		
	Traditionalist	43 (1.3%)	72 (2.2%)		
	No religion	91 (2.7%)	92 (2.8%)		

Table 7 (Continued)

Belief acceptance of child vaccination	Yes	1799 (54.3%)	1320 (39.9%)	17.09***	.072***
	No	82 (2.5%)	111 (3.4%)		
Antenatal clinic (ANC) contacts	Yes	1829 (55.2%)	1314 (39.7%)	49.15***	.122***
	No	52 (1.6%)	117 (3.5%)		
No. of times ANC contacted	Less than 4	597 (18.0%)	735 (22.2%)	182.66***	.235***
	4 or more	1257 (38.0%)	629 (19.0%)		
	No visit	27 (0.8%)	67 (2.0%)		
Place of delivery	Home	251 (7.4%)	284 (7.6%)	25.37***	-.09***
	Health facility	1630 (49.2%)	1147 (34.6%)		

Source: Sem's Fieldwork, 2023

Ref: ***p<0.001; **p<0.01; *p<.05; ^{NS}p>0.05

APPENDIX B

B2

Table 8: Bivariate Analysis of Enabling Factors Predicting RCIS in ASD of Ghana

Variables	Category	Enabling factors		χ^2	Phi
		Fully immunised	Partially immunised		
Mothers' occupation	Government work	254 (7.7%)	245 (7.4%)	57.060***	.131***
	Private work	677 (20.4%)	362 (10.9%)		
	Self employed	770 (23.2%)	610 (18.4)		
	Unemployment	180 (5.4%)	214 (6.5%)		
Is income okay (good)	Yes	1244 (37.6%)	614 (18.5%)	178.046***	.323***
	No	637 (19.2%)	817 (24.7%)		
Is income regular	Yes	1344 (40.6%)	769 (23.2%)	110.400***	.183***
	No	537 (16.2%)	662 (20.0%)		
Is income the sole source of living	Yes	1342 (40.5%)	777 (23.5%)	102.485***	.176***
	No	539 (16.3%)	654 (19.7%)		
Household income (monthly)	Gh¢ 500 or less	923 (27.9%)	677 (20.4%)	5.248 ^{NS}	.040 ^{NS}
	Gh¢ 501-1000	777 (23.5%)	581 (17.5%)		
	Gh¢ 1001 or more	181 (5.05%)	173 (5.2%)		

Table 8 (Continued)

Spouse's occupation	Government work	323 (9.8%)	268 (8.1%)	40.649***	.111***
	Private	700 (21.1%)	397 (12.0%)		
	Self employed	818 (24.7%)	706 (21.3%)		
	Unemployment	40 (1.2%)	60 (1.8%)		
Is spouse's income okay (good)	Yes	1240 (37.4%)	558 (16.8%)	237.484***	.268***
	No	443 (13.4%)	604 (18.2%)		
	No idea	198 (6.0%)	269 (8.1%)		
Is spouse's income regular	Yes	1360 (41.1%)	664 (20.0%)	246.305***	.273***
	No	269 (8.1%)	485 (14.6%)		
	No idea	252 (7.6%)	282 (8.5%)		
Spouse's income sole source of living	Yes	1472 (44.4%)	893 (27.0%)	08.210***	.181***
	No	242 (7.3%)	268 (8.1%)		
	No idea	167 (5.0%)	270 (8.2%)		
Household wealth index	Poor	151 (4.6%)	284 (8.6%)	100.684***	.174***
	Middle	1603 (48.4%)	1075 (32.5%)		
	Rich	127 (3.8%)	72 (2.2%)		
Building material for the house	Block	780 (23.6%)	559 (16.9%)	29.609***	.096***
	Brick	999 (30.2%)	722 (21.8%)		
	Mud	102 (3.1%)	150 (4.5%)		
Kind of house for dwelling	Compound house	1154 (34.8%)	725 (21.9%)	37.880***	.107***
	Self-contained	501 (15.1%)	482 (14.6%)		
	Semi-detached	226 (6.8%)	224 (6.8%)		

Source: Sem's Fieldwork, 2023; Ref: ***p<0.001; **p<0.01; *p<.05; ^{NS}p>0.05

APPENDIX B

B3

Table 9: Bivariate Analysis of Access to Routine Immunisation Services Factors Predicting RCIS in ASDof Ghana

Variables	Category	Enabling factors		χ^2	Phi
		Fully immunised	Partially immunised		
Place of residence	Urban	774 (23.4%)	556 (16.8%)	1.780 ^{NS}	.032 ^{NS}
	Rural	1107 (33.4%)	875 (26.4)		
Available EPI facility	Static clinic	535 (16.2%)	517 (15.6%)	55.596 ^{***}	.130 ^{***}
	Outreach clinic	1270 (38.3%)	799 (24.1%)		
	Door to door delivery	66 (2.0%)	97 (2.9%)		
	None	10 (0.3%)	18 (0.5%)		
How often CWC conducted	Daily	50 (1.5%)	57 (1.7%)	115.433 ^{***}	.187 ^{***}
	Weekly	398 (12.0%)	526 (15.9%)		
	Monthly	1425 (43%)	834 (25.2%)		
	None	8 (0.2%)	14 (0.4%)		
How regular CWC conducted	Very regular	1720 (51.9%)	1122 (33.9%)	113.384 ^{***}	.185 ^{***}
	Not regular	161 (4.9%)	309 (9.3%)		
Distance to cover for immun.	< 1 km	1457 (44.0)	839 (25.3%)	140.376 ^{***}	.206 ^{***}
	Between 1 to 5 km	345(10.4%)	447 (13.5)		
	>5 km	79 (2.4%)	145 (4.4%)		

Table 9 (Continue)

How long it takes to immunisation centre	Within 1 hour	1751 (52.9%)	1152 (34.8%)	118.932***	.189***
	More than 1 hour	130 (3.9%)	279 (8.4%)		
Means of travel to immunisation centre	Foot	1310 (39.6%)	724 (21.9%)	124.862***	194***
	Motor bike	436 (13.2%)	529 (16.0%)		
	Vehicle	135 (4.1%)	178 (5.4%)		
Transportation cost to immunisation centre	Expensive	212 (6.4%)	301 (9.1%)	115.340***	187***
	Affordable	497 (15.0%)	494 (14.9%)		
	Free	1172 (35.4%)	636 (19.2%)		
Waiting time at immun. centre	Within 1 hour	1688 (51.0%)	1118 (33.8%)	84.668***	160***
	More than 1 hour	193 (5.8%)	313 (9.5%)		
Satisfied with how nurses communication	Yes	1752 (52.9%)	1149 (34.7%)	124.717***	.194***
	No	128 (3.9%)	282 (8.5%)		

Source: Sem's Fieldwork, 2023

Ref: ***p<0.001; **p<0.01; *p<.05; ^{NS}p>0.05

APPENDIX B

B 4

Table 10: Bivariate Analysis of Need Factors Predicting RCIS in ASD of Ghana

Variables	Category	Enabling factors		χ^2	Phi
		Fully immunised	Partially immunised		
Knowledge category	Low knowledge	807 (24.4%)	602 (18.2%)	133.044***	.200***
	High knowledge	1074 (32.4%)	829 (25.0%)		
Attitude category	Poor attitudes	794 (24.0%)	647 (19.5%)	115.533***	.187***
	Good attitudes	1087 (32.8%)	784 (23.7%)		
Mothers' perception	Poor perception	905 (27.3%)	628 (19.0%)	212.327***	.253***
	Good perception	976 (29.5%)	803 (24.2%)		

***p < 0.001; **p < .01; *p < .05; ^{NS}p > 0.05

APPENDIX C: APPROVAL LETTER

 **Kwame Nkrumah**
University of Science
and Technology, Kumasi

College of Health Sciences
SCHOOL OF MEDICINE AND DENTISTRY

COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

Our Ref: CHRPE/AP/797/22

6th December 2022

Mr. Samuel Sem
Department of Health Physical
Education, and Recreation
University of Cape Coast
CAPE COAST.

Dear Sir,

LETTER OF APPROVAL

Protocol Title: "Determinants of Routine Immunization Coverage among Children Aged 12-23 Months in Adansi South District in the Ashanti Region, Ghana."

Proposed Site: Adansi South District, Ashanti Region.

Sponsor: Self Sponsored.

Your submission to the Committee on Human Research, Publications, and Ethics on the above-named protocol refer.

The Committee reviewed the following documents:

- A notification letter of 27th October from the Adansi North District Health Directorate (study site) indicating approval for the conduct of the study in the District.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

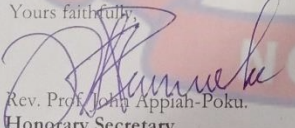
The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, beginning 6th December 2022 to 5th December 2023 renewable thereafter. The Committee may, however, suspend or withdraw ethical approval at any time if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you for your application.

Yours faithfully,


Rev. Prof. John Appiah-Poku.
Honorary Secretary
FOR: CHAIRMAN

Room 7, Block L, School of Medicine and Dentistry, KNUST, University Post Office, Kumasi, Ghana
Tel: +233 (0) 3220 63248 Mobile: +233 (0) 20 5453785 Email: chrpe.knust.kath@gmail.com/chrpe@knust.edu.gh

APPENDIX D: INTRODUCTORY LETTER FROM THE DEPARTMENT

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF HEALTH, PHYSICAL EDUCATION & RECREATION

TELEPHONE: +233 - (0)206610931 / (0)543021384 /
(0)268392819
TELEX: 2552, UCC, GH. EMAIL: hper@ucc.edu.gh

Cables & Telegrams:
UNIVERSITY, CAPE COAST

Our Ref: ET/HTP/20/0001

19th October, 2022

The Chairman
Committee on Human Research, Publication and Ethics
Kwame Nkrumah University of Science and Technology
Kumasi

INTRODUCTORY LETTER: SAMUEL SEM (ET/HTP/20/0001)

The above named person is a student of the Department of Health, Physical Education and Recreation of the University of Cape Coast. He is pursuing a Doctor of Philosophy degree in Health Promotion. In partial fulfilment of the requirements for the programme, he is conducting a research for his thesis titled **"Determinants of Routine Immunisation Coverage among children aged 12-23 Months in the Bekwai and Adansi South Districts in the Ashanti Region, Ghana."**

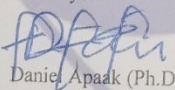
He has defended his thesis proposal and has passed. I therefore kindly request that your office assists him to acquire Ethical Clearance to enable him conduct the research.

For further information or clarification, please contact the following:

Dr. Jacob Owusu Sarfo, Principal Supervisor on 0246485735
Dr. Thomas Hormenu, Co-Supervisor on 0244213465

Counting on your usual co-operation.

Thank you.


Daniel Apaak (Ph.D)
(For: Head of Department)
Tel.: +233 (0)247703379
Email: edward.ansah@ucc.edu.gh

VERITAS
LUMEN
NOBIS

APPENDIX E: THE SUPERVISOR'S CONSENT LETTER

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF HEALTH, PHYSICAL EDUCATION & RECREATION

TELEPHONE: +233 - (0)206610931 / (0)543021384 / (0)268392819
EMAIL: hper@ucc.edu.gh
TELEX: 2552, UCC, GH.
Cables & Telegrams:
UNIVERSITY POST OFFICE
CAPE COAST

Our Ref: ET/HTP/20/0001

The Chairman
Committee on Human Research, Publication and Ethics
Kwame Nkrumah University of Science and Technology
Kumasi

Dear Sir/Madam,

SUPERVISOR'S CONSENT LETTER

I write in the capacity of the Principal Thesis Supervisor to introduce to you Mr. Samuel Sem (ET/HTP/20/0001), a Doctor of Philosophy (Health Promotion) Candidate from the Department of Health, Physical Education and Recreation, University of Cape Coast.

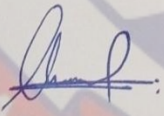
His thesis is titled **"Determinants of Routine Immunisation Coverage among Children Aged 12-23 Months in the Adansi South District in the Ashanti Region, Ghana."**

He has duly satisfied the necessary conditions for data collection and would be grateful if you process his application for ethical clearance.

I count on your usual cooperation.

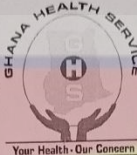
Thank you.

Yours faithfully,


Jacob Owusu Sarfo, PhD
Senior Lecturer
Email: jacob.sarfo@ucc.edu.gh
Mobile: +233 246 485 735

APPENDIX F: PROTOCOL SUBMISSION FOR ETHICAL CLEARANCE

In case of reply the number
and the date of this letter
Should be quoted
My Ref. No: ASDHD/ADM.20/078/2022
You're Ref:

 GHANA HEALTH SERVICE
DISTRICT HEALTH DIRECTORATE
P. O. BOX 12
ADANSI SOUTH
27TH OCTOBER, 2022

The Chairman
Committee on Human Research, Publications and Ethics
Kwame Nkrumah University of Science and Technology School of Medical Sciences
& Komfo Anokye Teaching Hospital

Dear Sir/Madam,

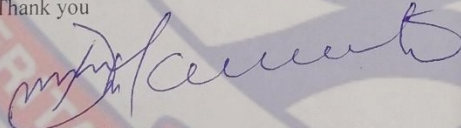
PROTOCOL SUBMISSION FOR ETHICAL REVIEW

I write to introduce to you Mr. Samuel Sem a Ph.D. (Health Promotion) student at University of Cape Coast. I am introducing his dissertation titled "**Determinations of routine Immunisation Coverage among Children Aged 12-23 Months in Adansi South District in the Ashanti Region, Ghana at New Edubiase in the Adansi South District**" for which he is submitting this protocol for ethical review.

Kindly accord him the necessary assistance needed for the ethical review process.

Counting on your usual co-operation.

Thank you


DANIEL YEBOAH
DIST. DIR. OF HEALTH SERVICES
ADANSI SOUTH.

