SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA, LEGON

FACTORS ASSOCIATED WITH MEASLES VACCINE UPTAKE AMONG CHILDREN UNDER 5 YEARS IN SOUTH DAYI DISTRICT, VOLTA REGION

BY

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DECLARATION

I declare that with the exception of references to other people's work, which have been duly acknowledged, this research work is my own work done under supervision.

I also declare that this research work, partly or in whole, has not been submitted to any University for the award of any degree.

Emmanuel Yaw Bonsu …….…….. 26th April, 2023
(Student) (Signature) (Date)

Professor Francis Anto …….. 27th April, 2023
(Supervisor) (Signature) (Date)

DEDICATION

This work is dedicated to my wife and children for their prayers and support. Also, to my parents, I am forever grateful.

ACKNOWLEDGEMENT

I thank Almighty God for his protection and guidance which has seen me through this work successfully.

My heartfelt gratitude goes to my supervisor, Professor Francis Anto, for his guidance and invaluable contributions to this research work.

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I am most grateful to Samuel Bosoka for his contribution to the work.

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LIST OF ABBREVIATIONS

AEFI – Adverse Event Following Immunization

ANC – Ante-Natal Care

BCG – Bacille-Calmette Guerin

CWC – Child Welfare Clinic

CHAG – Christian Health Association of Ghana

CHPS – Community-based Health and Planning Service

DHIMS – District Health Information Management System

DHD – District Health Directorate

DPT – Diphtheria Pertussis Tetanus

EPI – Expanded Programme on Immunization

GHS – Ghana Health Service

GHSERC – Ghana Health Service Ethics Review Committee

GVAP – Global Vaccine Action Plan

MCV – Measles Containing Vaccine

MR – Measles Rubella

OPV – Oral Polio Vaccine

PCV – Pneumococcal Conjugate Vaccine

PNC – Post-Natal Care

UNICEF – United Nations Children's Fund

WHO – World Health Organization

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ABSTRACT

Background: Globally, more than 140,000 measles deaths were reported in 2018, mostly among children under 5 years. Measles is the fourth leading cause of death in children under 5 years of age in many African countries. Ghana reported 1,274 measles cases in 2020. The Volta region recorded 66.7% of children under 5 years receiving two doses of measles vaccine in 2021 and South Dayi district also recorded 58.1% coverage in the same year which is lower than the 95% minimum targeted coverage. The objective of this study was to identify factors associated with measles vaccine uptake in South Dayi District.

Methods: A cross-sectional cluster survey (WHO 30 by 7 cluster survey) method was used to estimate measles vaccination coverage and associated factors among children under 5 years. The 30 by 7 cluster survey is a modified two-stage cluster sampling technique used to obtain overall population estimates of immunization coverage. Caregivers with children aged 24 to 36 months were sampled from 30 clusters in the district. A structured questionnaire was used to collect socio-demographic data and other variables from the respondents. Stata version 7 was used to analyze the data. Multivariable logistic regression model was used to determine significant factors associated with measles vaccine uptake at 95% confidence level and 0.05 p-value.

Results: A total of 298 caregivers participated in the study. It was found that, 98% and 90% had received first dose and second dose of measles vaccine respectively. Caregivers who were aged 20-29 years [AOR=7.33 (95% CI: 1.24 - 43.34) p=0.028], 30-39 years [AORs=43.49 (95% CI: 5.68-332.76) p<0.001], and 40 years and above [AOR=23.22 (95% CI: 1.51 - 354.90) p=0.024 were more likely to have their children fully vaccinated compared to those aged less than 20 years. Caregivers who had two children were 86% less likely to have their child fully vaccinated compared to those who had one child [AOR=0.14 (95% CI: 0.02 - 0.86) p=0.035].

Conclusion: Uptake of first dose of measles vaccine exceeded WHO target, however, uptake of second dose was below the target. Caregivers less than 20 years old and those with more than one child are less likely to have the child complete measles vaccination. The District Health Directorate should intensify public education on the benefits of childhood vaccination and completing the required doses.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Measles is a febrile rash illness caused by a virus called paramyxovirus (Morbillivirus) and transmitted from human-to-human through airborne droplet (GHS, IDSR SOP, 2017). Measles can lead to complication like, blindness, deafness, brain damage, seizures and death. Measles is placed on the fourth among causes of death in children under 5 years of age in many African countries. It also has a potential to cause outbreaks in susceptible populations (WHO, 2020).

The current measles vaccines contain attenuated measles virus strains which were obtained by serial passage of wild-type viruses in cultured cells (WHO, 2020). Prior to the advent of the measles vaccine in 1963 and widespread immunization, significant outbreaks occurred around every two to three years, and measles is thought to be responsible for an estimated 2.6 million fatalities annually, particularly in children under five years. (WHO, 2018). Measles disease is reported in all the continents in the world, however, Africa contributed to about a third of all the cases (WHO, 2020). s

Measles vaccine is one of six childhood vaccines first introduced in Ghana in 1978 together with BCG, Diphtheria Pertussis Tetanus (DPT) and oral polio, in addition was tetanus toxoid (TT) vaccination for pregnant women (GHS, 2014). The Expanded Programme on Immunization (EPI) was introduced as part of the national health policy to reduce morbidity and mortality of vaccine preventable diseases which will then contribute significantly to the reduction of mortality among both infant and child in the country. There are three main strategies implored for delivery of immunization services in the country which are static clinics at health facilities, outreach clinics

at the communities and supplementary immunization campaigns to reach out to most of the unreached populations.

The measles vaccine is contained in measles and rubella vaccine which is used in Ghana's EPI. It is mainly given in two doses to children, first dose at 9 months and second dose at 18 months of age and can be given up to 59 months of age (EPI Field Policy Guide, n.d.). One of the targets for measles elimination by 2020, was for all countries in the WHO African Region to achieve and maintain at least 95% measles immunization coverage at national level and in all districts (WHO, 2020).

Measles elimination strategies include immunization, enhanced surveillance at the facility, district, regional and national levels and case management (WHO Office, 2015). The Integrated Disease Surveillance and Response (IDSR) provides guidelines for effective surveillance and response at all levels of service delivery.

1.2 Problem Statement

Measles is the fourth leading cause of death in children under 5 years of age in many African countries. Although reliable and affordable measles vaccines are available, more than 140,000 measles-related fatalities occurred in the world in 2018, mostly in children under the age of five (WHO, 2021). In 2020, about 149,553 measles cases were reported worldwide, and 115,364 cases were reported in Africa (WHO, 2020). According to WHO, Ghana reported 1,274 cases in 2020.

Measles vaccination coverage for Ghana was 94.1% in children under 1 year and 83.3% in children 18 to 59 months in 2021 (GHS DHIMS, 2022). Volta region recorded 72.5% measles vaccination coverage in children under 1 year and 66.7% in children 18 to 59 months in 2021 (GHS DHIMS 2, 2022). South Dayi District recorded 66.4% coverage in children under 1 year

and 58.1% of children 18 to 59 months in 2021 which was lower than the WHO target of 95% (GHS DHIMS 2, 2022).

Mother's place of residence, education, and religious affiliation are among factors that are significantly associated with completing childhood vaccination (Budu et al., 2020). Low measles vaccination coverage may lead to outbreaks of measles. This study therefore aimed at identifying factors associated with measles vaccine uptake in South Dayi District.

1.3 Justification of the Study

Measles is a vaccine preventable disease and the objective of measles vaccination is to build the immunity of vaccinees to prevent the outbreaks of measles. High measles vaccination coverage of more than 95% of eligible children would help to break transmission of measles and prevent outbreaks and epidemics the country (WHO, 2020).

Low measles coverage in some districts like South Dayi is of concern to the health service and there is the need to investigate and identify factors that may contribute to the uptake. Literature search for research work on the factors that influence low measles vaccination coverage in South Dayi District found inadequate information, therefore, this study sought to identify these factors that are associated with measles vaccine uptake in the district.

Knowing the factors associated with measles vaccine uptake will enable the South Dayi District health directorate to implement measures to improve uptake of the vaccine. The Ghana Health Service can also adopt findings from this study to develop interventions to improve vaccination coverage in other districts in the country.

1.4 Conceptual Framework

The conceptual framework depicts the relationship between factors that have the potential to affect measles vaccine uptake. The factors are grouped into socio-demographic, knowledge and experiences with vaccination and health care system factors.

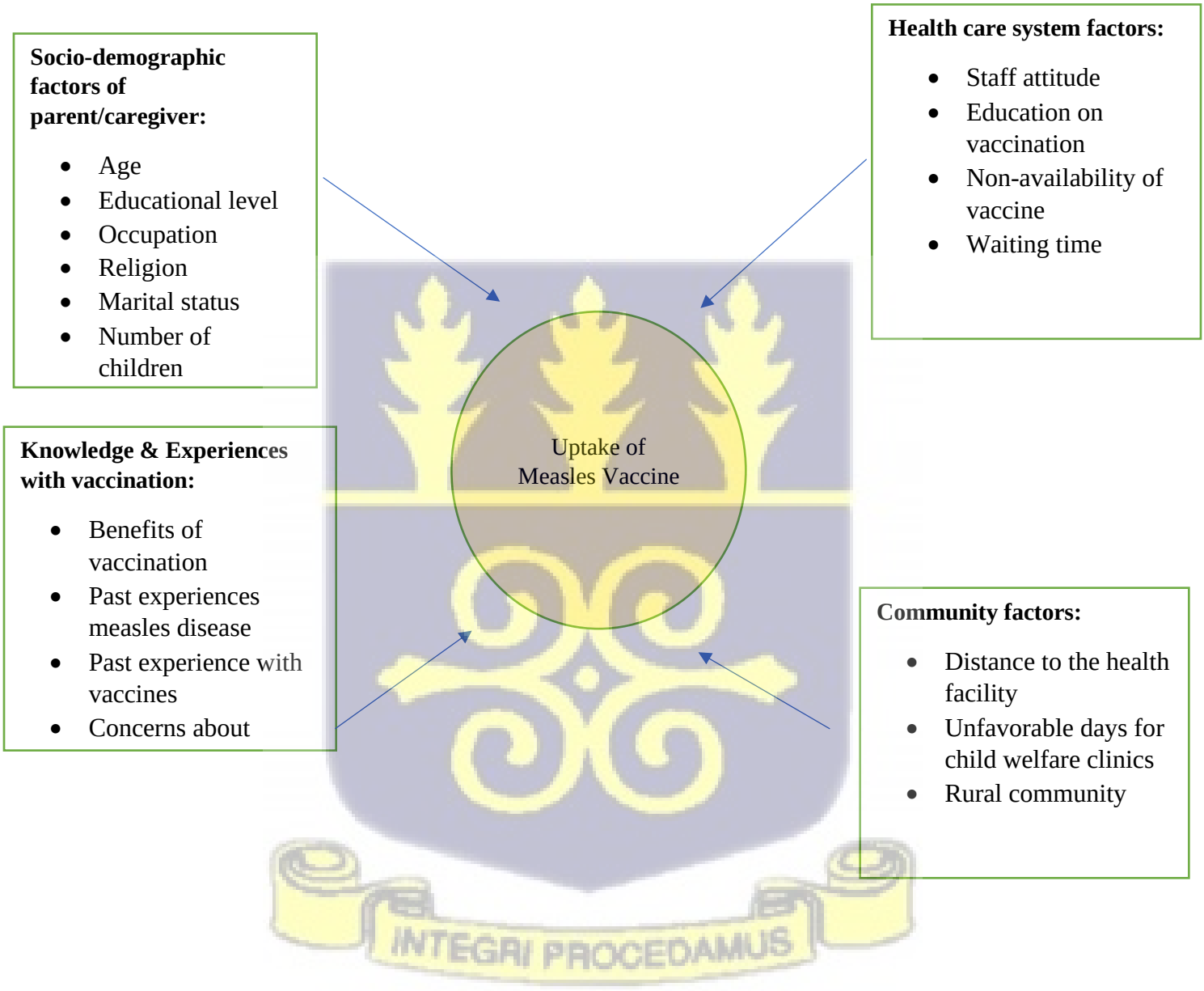


Figure 1: Conceptual Framework showing factors associated with Measles vaccine uptake.

1.4.1 Narration of Conceptual Framework

Socio-demographic factors of the caregiver and parent may affect the uptake of the measles/rubella vaccine. Socio-demographic factors like age, educational level, religion and marital status have the potential of affecting utilization of vaccination services (Budu et al., 2020). Marital status of caregivers whether married, divorced or single may influence their decision to send their children for vaccination, likewise their employment status (Anokye et al., 2018). Mother's age, especially older mothers may be associated with utilization of immunization services (Abebe et al., 2019).

Knowledge on benefits of vaccination to the child and past experiences with vaccination may influence utilization of vaccination service. Caregivers who are aware of the benefits of measles immunization have high likelihood to vaccinate their children than those with limited knowledge (Abebe et al., 2019). Past experiences with vaccination, for instance adverse events following immunization may lead to loss of trust by caregivers and affect uptake of vaccination (Akwataghibe et al., 2019). Some might not have any negative experiences with vaccination however, they have concerns about safety of the vaccine and may affect utilization of vaccination services.

Health system factors such as staff attitude could affect the uptake of the vaccine. Health workers' rudeness towards caregivers/parents can lead to low attendance to the clinics. Health workers not reminding caregivers/parents on time of the next vaccination services may contribute to incomplete vaccination of children (Akwataghibe et al., 2019). When vaccines are not available at the time of service could lead to missed opportunity for the child to receive the vaccine and contributes to low coverage. Long waiting time may contribute to low attendance to clinics for vaccination services.

Community factors such as long distance to health facility and days for outreach clinics not favorable for some parents and caregivers may contribute to defaulting and low uptake of the vaccine. Area of residence of the parents or caregivers, rural community may influence the utilization of vaccination services (Kiptoo et al., 2015).

1.5 Research Objectives

1.5.1 General Objective

To determine factors associated with Measles vaccine uptake among children under 5 years in South Dayi District.

1.5.2 Specific Objectives

1. To determine Measles vaccination coverage among children under 5 years in South Dayi District.
2. To identify caregiver factors associated with Measles vaccine uptake among children under 5 years in South Dayi District.
3. To identify community factors associated with Measles vaccine uptake among children under 5 years in South Dayi District.
4. To identify health care system factors associated with Measles vaccine uptake among children under 5 years in South Dayi District.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter reviewed current literature on the specific objectives of the study. The goal of the review was to explore existing literature on the research area and identify gaps and how this present study could fill those gaps. The first part of this review described the measles vaccination coverage among children under 5 years. The second part presented the timeliness of measles vaccine uptake. The third part identified caregiver's related factors associated with Measles vaccine uptake, the fourth described community related factors associated with Measles vaccine uptake and the final part examined the health care system related factors associated with Measles vaccine uptake.

2.2 Measles vaccination coverage among children under 5 years

Immunization is a highly effective public health intervention. However, over the last decade, coverage has levelled off. By the end of 2021, 81% of children had received one dose of measles vaccine by their second birthday, and 71% of children had received two doses of measles vaccine (World Health Organization [WHO], 2021). In Kenya, a community-based cross-sectional study has reported a 96.6%, and 56.6% coverages for Measles Containing Vaccine dose one (MCV 1) and MCV dose two (MCV 2) respectively based on the Maternal and Child Health (MCH) booklet. However, for verbal report a coverage of 98.2% for MCV 1 and 51.6% for MCV 2 were reported (Mamuti et al., 2022).

A previous study by Borus and colleagues also observed that coverage of first-dose MCV (MCV1) climbed from 65% to 86% from 2003 to 2012, then decreased to 75% in 2016. Since its introduction in 2013, coverage of MCV second dosage (MCV2) has remained below 50%. (Borus

et al., 2018). A cross- sectional study using the demographic health survey data two (DHS VII) in A study in Armenia reported that, only 79.6% of the children were vaccinated with measles vaccine (Kantner et al., 2021).

Few studies have also estimated measles vaccination coverage in Ghana. A cross-sectional cluster survey in Techiman Municipality by Adokiya and colleagues has shown that, measles recorded the lowest coverage of 92% (Adokiya et al., 2017).

2.3 Assess timeliness of Measles vaccine uptake

Analysis of the Bangladesh Demographic Health Survey by Sheikh and colleagues observed that 24% of children got their BCG shots on time, 46% got their pentavalent 3 shots on time, and 53% got their measles shots on time, whereas 76%, 51%, and 36% of children didn't get their BCG, pentavalent 3, and measles shots on time, respectively. The proportion of early immunization was 3% for pentavalent 3 and 12% for measles, according to the authors. (Sheikh et al., 2018). Failure to vaccinate children against the measles in a timely manner was substantially associated with factors such as unemployed mothers and lower socioeconomic status, particularly in households without proper sanitation systems or potable drinking water. The fact that the majority of unemployed women in Bangladesh are actively engaged in household duties and other unpaid tasks may be one of the reasons for the late vaccination, since they frequently overlook the importance of immunization schedules for their children (Sheikh et al., 2018).

Another cross-sectional study in Armenia have also observed that many children in the studied population received their vaccination late (Kantner et al., 2021). The measles immunization should be administered at the age of 12 months, as per the Armenian vaccination schedule therefore when administered more than four weeks after the appropriate age, vaccinations are deemed to have been

delayed (Schweitzer et al., 2015) indicating that majority of children in the studied population may be vaccinated too late. Such delays in vaccination permit extended periods of susceptibility (Agopian et al., 2020) and could make it more likely for measles to spread throughout society (Sheikh et al., 2018). According to other research, mistimed vaccinations were linked to outbreaks and the re-emergence of a disease that may have been prevented by a vaccine. (Agopian et al., 2020; Schweitzer et al., 2015).

The timely administration of the measles vaccine in Armenia improved between the years of 2000 and 2010 according to another study by Schweizer and colleagues. (Schweitzer et al., 2015). However, there is still a potential delay. Agopian and colleagues similarly reached the same conclusion after analyzing the Armenia Demographic Health Survey, which revealed that the administration of measles-containing immunizations in Armenia was delayed with a median age of 61.1 weeks. (Agopian et al., 2020).

2.4 Caregiver related factors associated with Measles vaccine uptake

2.4.1 Maternal age

Comparatively, the probability of incomplete immunization was 3.21 and 3.01 times higher for children of younger mothers aged under 20 and 20–34 years respectively, than for children of older mothers (>34 years). (Sheikh et al., 2018).

2.4.2 Education

Several studies have documented mothers' educational level as a significant factor associated with complete immunization. According to a study by Budu and colleagues, mothers' educational attainment significantly affects how many children receive all their recommended vaccinations. The authors found that, compared to children whose mothers had no formal education, children

whose mothers have at least a secondary education had better probabilities of receiving a full course of immunization. (Budu et al., 2020). Also, other studies in different African countries have shown the association between educational level and complete vaccination coverage (Hu. et al., 2013; Kamau & Esamai., 2001; Tamirat & Sisay, 2019). Similar to this, children of mothers with lower levels of education (primary level) had about 2.7 higher odds of not receiving the recommended vaccinations than children of mothers with higher levels of education. (Sheikh et al., 2018). This conclusion may be explained by the fact that women with a secondary education may have sufficient knowledge and information about immunization and childcare and may help their children finish their immunizations. They are also more likely to understand the health education and the advantages of obtaining 100% vaccination coverage that healthcare professionals present during child welfare clinics in comparison to those with no formal education (Budu et al., 2020).

Regarding measles immunization, several studies have found mother's level of education was a significant predictor of measles vaccination of the child. Association between maternal level of education and measles vaccination. Mothers with higher education were more likely than mothers with only a primary education to get their child vaccinated against measles (Cockcroft et al., 2009; Kantner et al., 2021; Ntenda et al., 2017; Onsomu et al., 2015). This can be explained that educated mothers are more likely to recall dates, comprehend the importance of immunizations, or may have enough income to be able to pay fees.

Children of highly educated caregivers did not have a noticeably higher vaccination rate. Given how important maternal education is for the health of the child, this may come as a surprise. However, this finding may indicate a trend in Armenia that has been observed in other, primarily high-income contexts, where pockets of vaccine hesitancy may manifest among highly educated

populations. (Robert et al., 2014). Other studies have revealed that better educated women have a propensity to skip immunizations and that higher education is not related to more favourable perceptions of the value and efficacy of vaccinations (Sargsyan et al., 2016). However, Kantner and colleagues found that children of mothers with basic education had a lower likelihood of receiving the measles vaccine than children of mothers with higher levels of education. Their findings suggested that in order to boost measles vaccination rates, interventions should concentrate on mothers with less education. (Kantner et al., 2021; Onsomu et al., 2015).

2.4.3 Religious affiliation

The literature on the role of religion in explaining socioeconomic health inequities is very thin (Costa et al., 2020). However, religion may have a direct impact on values and beliefs, or it may result from unequal access to resources (Gyimah et al., 2006). Previous studies in Ghana (Budu et al., 2020), Ethiopia (Lakew et al., 2015), and 15 countries in Sub-Saharan Africa (SSA) (Costa et al., 2020) as well as in India (Weiss et al., 2013) have established that the religious affiliation of mothers is a statistically significant predictor of full vaccination coverage of children. In particular, compared to children whose mothers are Christians, children whose mothers are Traditionalists and those whose mothers have no religious affiliation had reduced probabilities of completing vaccination schedule. In order to reach parents whose children are not vaccinated or have not gotten the full course of immunization, Costa and colleagues explain that increasing involvement of religious leaders in vaccine promotion has proven to be helpful. (Costa et al., 2020).

Studies in Nigeria, Ethiopia (Mohamud et al., 2014), and Chad (Abakar et al., 2018) have found high rates of unvaccinated Muslim children and have identified the Muslim faith as a potential barrier to vaccine coverage. However, it has been argued that religious leaders' skepticism toward immunization stems from health-related concerns that spread through religious communities'

social networks rather than from faith-based beliefs (Costa et al., 2020; Larson et al., 2016). A multi-country study on vaccine confidence, on the other hand, found that being Muslim is not always associated with low coverage, using Saudi Arabia as an example, where all respondents were Muslims and there were few vaccine objections (Costa et al., 2020).

2.4.4 Caregiver's level of knowledge

There was a significant association between caregiver knowledge of the diseases that can be prevented by vaccination (POR = 0.55, 95% CI 0.38-0.80) and the number of MCV doses (POR = 0.13, 95% CI 0.09-0.02) were found. At the multivariate analysis, children born before the fifth child (POR = 0.5, 95% CI 0.22-0.95) and the Caregiver's knowledge of the number of MCV scheduled doses (POR = 5.73, 95% CI 3.48-9.45) were significant predictors of MCV uptake. (Mamuti et al., 2022). Knowledge of vaccine preventable disease can serve as both a hindrance or enabling factor to immunization uptake. Vaccine knowledge is critical for effective vaccine acceptance and utilization by parents. Low vaccination coverage in children is largely due to healthcare providers' and parents' lack of vaccine knowledge. Parents with a low level of education and socioeconomic status are more sceptical of immunization (Bangura et al., 2020). Several studies have documented parents' lack of vaccine knowledge as a barrier to immunization. Caregiver's with adequate or sufficient knowledge about vaccines are more likely to get their children vaccinated as compared to those with inadequate knowledge (Akwataghibe et al., 2019; Bangura et al., 2020; Bugvi et al., 2014; Matsumura et al., 2005)

2.4.5 Postnatal visits

Few studies have found postnatal visit as a significant predictor of complete vaccination. For instance, Kantner and colleagues have observed that postnatal visits within two months after birth was significantly associated with measles vaccination uptake. The authors noted that mothers who

had postnatal visit were more likely to have a complete vaccination (Kantner et al., 2021). Similarly, other studies within the African context have also shown that postnatal care is a significant predictor of vaccination (Canavan et al., 2014). The likelihood that women may seek care for their children may increase if they visit a health facility for a antenatal services after giving birth. Additionally, other vaccination-related information may have been given during the visits, and a positive relationship with the healthcare system may have been established . (Santosa et al., 2022). Therefore, encouraging mothers to attend postnatal care appointments may be beneficial for future interventions.

2.5 Community related factors associated with Measles vaccine uptake among

2.5.1 Place of residence

Several studies have observed that place of residence is a significant factor associated with complete vaccination. Budu and colleagues in Ghana found that among children under the age of five, place of residence was a significant predictor of full immunization. When compared to children whose mothers are from urban areas, the authors' research showed that children born to women in rural areas had reduced probabilities of receiving a full course of vaccination. (Budu et al., 2020). The Urban areas are expected to have more health facilities and health care workers than rural areas (Tsawe & Susuman, 2014), which may help to explain why the majority of children who had a full course of vaccinations had mothers who lived in urban areas. Similar to this, numerous earlier researchers have found that children in urban regions routinely report higher likelihood of receiving all recommended vaccinations than those living in rural areas. Additionally, a 2014 study in Ethiopia found that the location of a place of residence was a significant factor in determining whether a child received all of the recommended vaccinations in that country. (Tamirat & Sisay, 2019; Ushie et al., 2013).

2.5.2 Household wealth

Additionally, it has been discovered that partial immunization is more likely to occur in households with lower socioeconomic status than those with better socioeconomic status. Children from the poorest households had a higher odds of not completing immunization than children from the wealthy group, according to Sheikh and colleagues' research (Sheikh et al., 2018). It is already well established that when households are not economically sound, utilization of immunization services may not be adequate (Bugvi et al., 2014; Sheikh et al., 2018). Consistently literature has shown that household wealth is an important factor affecting childhood immunization status (Antai, 2009; Sabarwal et al., 2012; Wiysonge et al., 2012). Ntenda and colleagues have also noted that infants born from poor or middle household wealth were less likely to have vaccination coverage or complete vaccination (Ntenda et al., 2017). According to the research, children of poor parents may face more obstacles than those of rich parents in getting to health facilities, such as transportation costs and financial difficulties. Additionally, higher salaries are linked to a higher chance of improving one's health knowledge and engaging in health-promoting actions. (Abadura et al., 2015; Case et al., 2002; Ntenda et al., 2017). As a result, mothers from wealthy families are more likely to seek modern/medical health services for their families when necessary.

2.5.3 Community hospital delivery

Several studies within Africa have established that place of delivery either at home or in health facility is associated with fully vaccination (Mohamud et al., 2014; Ntenda et al., 2017; Oleribe et al., 2017; Rossi, 2015). In both the crude and adjusted analyses, Rossi et al. found that having the child not fully immunized was strongly associated with the place of delivery, either at home or in a health facility and the mothers utilizing postnatal services (Rossi, 2015). Mohamud and colleagues discovered that among children under the age of five in Ethiopia, the place of delivery

was a significant predictor of full immunization (Mohamud et al., 2014) . They found that compared to 29.4% of babies born at home, 56.1% of babies born in hospitals had received their full complement of vaccinations. In addition, babies delivered in health facilities had a 2.02 times higher chance of receiving all recommended vaccinations than babies born at home. In a similar vein, earlier research in various parts of Ethiopia and Nigeria shown that children born in health facilities had higher vaccination rates than those born in households. (Etana & Deressa, 2012; Mebrahtom & Health, 2013). The reason for this could be that government hospitals and healthcare centers provide vaccination as a matter of policy, as well as health education about the importance of vaccination to mothers/caregivers after delivery in most Africa countries.

2.6.4 Distance to health facility

The distance to the nearest health facility has been reported as one of the community related factors contributing to incomplete immunization (Ismail et al., 2014; Legesse & Dechasa, 2015; Obasohan et al., 2018; H. Tadesse et al., 2009). In a descriptive cross-sectional study in Malawi, Ntenda and colleagues observed that communities with a higher percentage of the women perceiving distance to the nearest health facility as a big problem were less likely to have had the complete vaccination (Ntenda et al., 2017). Similar studies in other African countries have also noted that distance to the nearest health facility disparities to be important factor influence fully vaccination among children under-five years (Muller et al. 1998; Torun & Bakirci 2006). Distance between the child's residence and the health center and difficult-to-reach terrain are barriers to non-completion of immunization. Tefera et al. (2018) indicated that "families whose home was at least an hour from the vaccination site were less likely to be fully vaccinated (56%) than families whose home was between 30 and 59 min away (67%)". According to Miyahara et al. 2016, "the longer the distance from vaccination site, the lower the chances of vaccination by one week of a child's life".

In South Africa, Ndirangu and colleagues discovered that distance to the closest outreach clinic was strongly related to the vaccination status of a child, whereas distance to the nearest fixed clinic is not. (Ndirangu et al., 2009). The authors claim that stationary clinics offer comprehensive primary care, of which vaccinations are only a small part, while mobile clinics in the community only offer immunizations and some antenatal care. An explanation for why mothers prefer to utilise mobile vaccination clinics for these vaccination services and why distance to fixed services is not a significant predictor of vaccination status is that mothers believe mobile vaccination services to be the best places for their children to receive immunizations.

2.6 Health care system related factors associated with Measles vaccine uptake

2.6.1 Staff attitude

Few studies have found that negative attitudes of health providers have an impact on immunization uptake among children under the age of five in various settings. Hostile, unfavourable attitude and bad treatment of health workers have been documented as health system related barriers influencing immunization (Bangura et al., 2020; T. Tadesse et al., 2017). Bosu and colleagues have also attributed lack of motivation of health workers as a significant factor associated with incomplete immunization (Bosu et al., 1997). Poor planning and coordination of immunization seasons at the health center level has also been identified as a barrier or factor influencing incomplete immunization in the health system (Bosu et al., 1997; Legesse & Dechasa, 2015; Negussie et al., 2016; Tadesse et al., 2009).

2.6.2 Education on vaccination

Several studies have highlighted inadequate information about immunization as a health system related barrier contributing to non-completion of immunization sessions (Bangura et al., 2020; T.

Tadesse et al., 2017). Literature suggest that caregivers lack knowledge about immunization benefits (Bosu et al., 1997), some also have negative perception of vaccine side effects (Negussie et al., 2016) as well as lack of faith in immunization (Sato, 2020). These negative perceptions stem from inadequate health education by health system. Health education is a multifaceted approach that promotes knowledge, attitudes, and skills while raising awareness of the factors that affect one's health. It is a crucial instrument for inspiring change, assessing the reliability of information received, developing communication channels, and enabling people and communities to take up the cause of human, environmental, and organizational redesign through acts that are global in nature. However, research indicates that there are insufficient health promotion and education programs at the district and facility levels. By effectively implementing health education and promotion programs at the facility and community levels, focused learning should be encouraged in all processes to modify health-damaging behaviors or to sustain healthy ones.

2.6.3 Non-availability of vaccine

Intermittent vaccine shortages at health facility level and difficulties of transporting vaccines such as long distance and cost of transportation to the clinic for immunization has been widely documented as a health systemic factor that significantly hinder immunization services (Bangura et al., 2020; Ismail et al., 2014; Mekonnen et al., 2019; H. Tadesse et al., 2009; Tefera et al., 2018). For instance, Mthiyane and colleagues in South Africa discovered that clinics' shortages of specific vaccines were the most often cited factors by parents as to why their children skipped or delayed receiving any immunizations. Approximately 58.1% of the study participants reported that shortage of vaccine as the main reason for delay of vaccination (Mthiyane et al., 2019).

2.6.4 Waiting time

A Ghanaian study by Bosu and colleagues observed that long waiting times was one of the health system related factors associated with immunization (Bosu et al., 1997).

2.7 Theoretical Review

The theory reviewed for this study is the healthcare utilization model

2.7.1 Health Service Utilisation Model

The three main tenets of the model are predisposing, need, and enabling factors which was first proposed by Anderson in 1972 and later revised by Anderson and Newman (1973). (Andersen, 2008).

According to the theory, the predisposing factors are the individual characteristics, such as sex and age. Social factors such as religion, occupation, education, ethnicity, attitude toward health, and social relations such as family status. And mental factors, such as health beliefs (e.g., values, attitudes, and knowledge on health and health-related services).

The approach describes enabling variables as being external to an individual but significant in influencing his or her choices regarding the utilization of health services. These elements may either encourage or discourage the use of health care (Andersen, 2008).

The need factors according to the model refer to perceptions of the seriousness of a disease or health condition. Just as in the case of enabling factors, exist at both the individual and contextual levels. At the individual level, the model distinguishes between the perceived need for health services, functional state and illness symptoms and evaluated need (objective measurements of patients' health status and professional assessments and need for medical care) (Andersen & Davidson, 2001; Babitsch et al., 2012). At the contextual level, individuals make a differentiation between population health indices and environmental need characteristics (Babitsch et al., 2012).

According to the concept, environmental needs explain the environmental conditions that have an impact on health, whereas population health indices are the overall assessments of community health, including epidemiological markers of disability, morbidity and death. (Andersen & Newman, 1973; Babitsch et al., 2012).

Figure 2 below illustrates the health service utilization model.

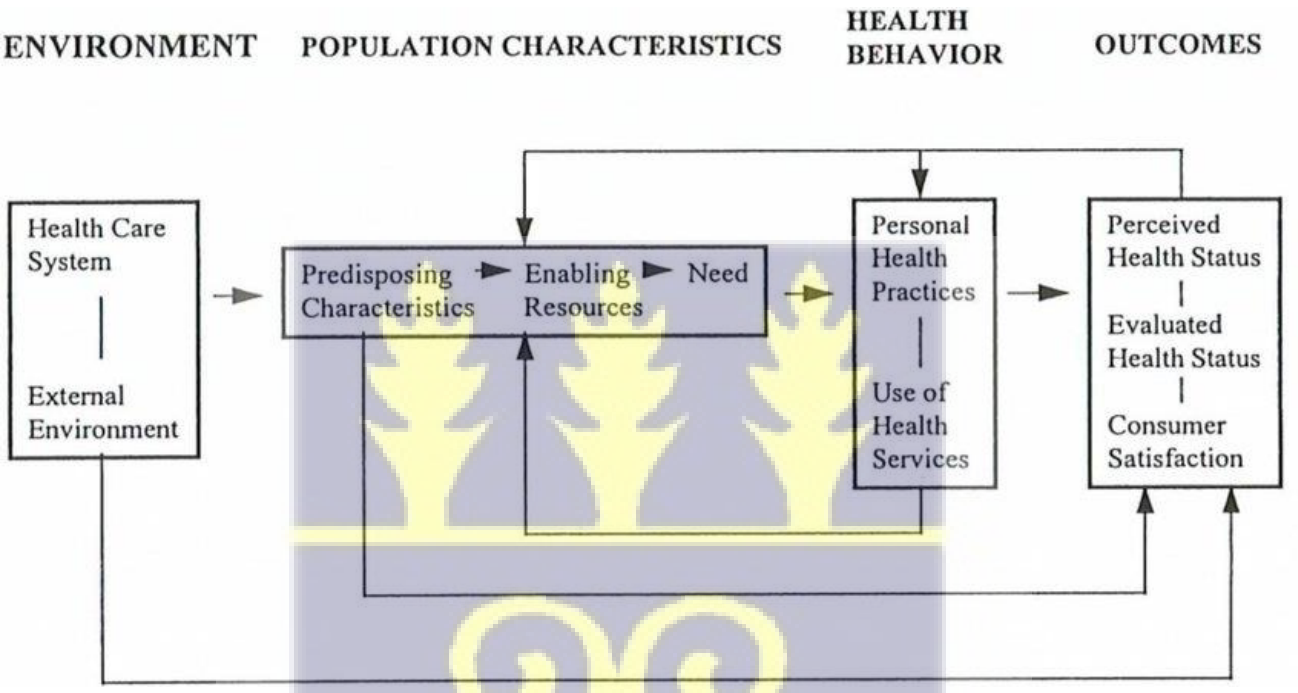


Figure 2: Health Services Utilisation Model

Source: Andersen and Davidson (2001)

The health care utilisation model is considered relevant to this current study because of its strength in spelling out the various factors that may influence measles immunization. Based on the tenet of the model, predisposing factors for this study are demographic characteristics of individuals such as age, sex, education, and occupation. These factors are found to influence the immunization.

The enabling factors are factors that promote or hinder the immunization uptake of respondents may be, the enabling factors are distance to the health facility, unfavorable days for child welfare clinics, rural community. The needs for care factors in this study are benefits of vaccination, past experiences measles disease, past experience with vaccines, concerns about vaccine safety. These are factors that influence the readiness to perform a behavior.

CHAPTER THREE

3.0 METHODS

3.1 Study Design

A cross-sectional cluster survey (WHO 30 by 7 cluster survey) method was used to estimate Measles vaccination coverage and associated factors among children under 5 years in South Dayi District from January to April, 2023. The 30 by 7 cluster survey is a modified two-stage cluster sampling technique used to obtain overall population estimates of immunization coverage. In the first stage, the population of the district was divided into sub-populations known as 'clusters' and 30 of these clusters were sampled with probability proportionate to the size (PPS) of the population in the cluster. In the second stage of sampling, seven subjects were selected within each cluster using random sampling method.

Structured questionnaire was used to collect data on Measles vaccine uptake and related factors. Data was collected from parents/caregivers in the district about themselves and their children on factors related to Measles vaccine uptake.

3.2 Study Area

South Dayi District is one of the 18 Administrative Districts in the Volta Region. It shares boundaries with North Dayi and Afadjato South to the north, Ho West to the east and Asougyaman Districts to the South, while the Volta Lake forms the Western boundary. Kpeve is the district capital, it is about 18 km from Ho the regional capital. There are five sub-districts and 51 communities in the district. The district has a total population of 57,526 from 2020 population and housing census.

The district has two major markets, which are Kpeve and Dzemeni markets. There is a static child welfare clinic at Dzemeni on market days. The main occupation of the people in the district is farming (crop and fish farming).

The district has 21 electoral areas and 23 demarcated CHPS zones. There are 18 health facilities including one hospital, nine CHPS compounds, six Health Centres, one CHAG Clinic and one Private Clinic. Apart from the private clinic, all the other facilities provide immunization services.

The figure below shows the map of South Dayi district presenting some communities and the border districts.

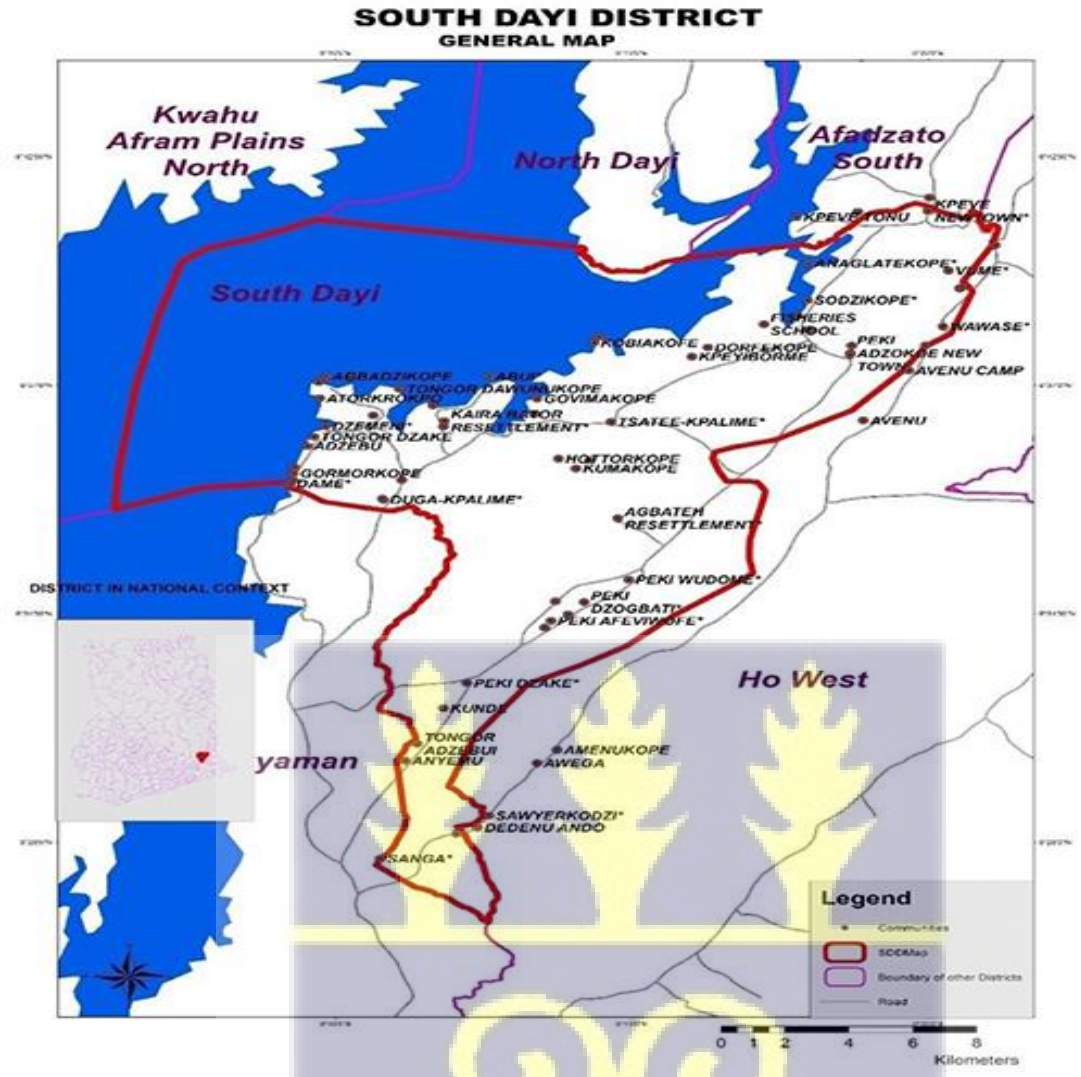


Figure 3: Map of South Dayi District

Source: South Dayi District Assembly, 2022

3.3 Study Variables

The dependent variable was uptake of measles vaccine among children under 5 years. This was ascertained through review of the Child Health Record Books. The independent variables were socio-demographic characteristics, health care system factors, community factors, knowledge about the vaccine and pass experiences with vaccination.

Table 1: Operational Definition and Scale of Measurement of Variables

VARIABLES	OPERATIONAL DEFINITION	TYPE OF VARIABLE	SCALE OF MEASUREMENT
Dependent			
Uptake of measles vaccine	Number of doses of measles vaccine a child has received	Categorical	Ordinal ▪ Full uptake (child has received all 2 doses) ▪ Partial uptake (child has Received only first dose) ▪ No uptake (child has not received any dose)
Independent			
Socio-demographic factors of parent/caregiver:			
Age of Caregiver	Age as at the last birthday	Continuous	Ratio
Age of Child	Age in months	Continuous	Ratio
Sex of Caregiver	Male or Female	Categorical	Nominal
Marital status	Single, Married, Divorced, Widowed	Categorical	Nominal
Level of education	None, Primary, Secondary, Tertiary	Categorical	Ordinal
Religion	Christian, Muslim, Traditionalist, etc	Categorical	Nominal
Parity	Number of Children alive	Discrete	Count
Place of residence	Rural, Urban	Categorical	Nominal
Knowledge & Experiences with vaccination:			
Knowledge	• Whether parent/caregiver has ever heard of measles vaccine?	Binary	Nominal
	• Where parent/caregiver first heard about measles vaccine	Categorical	Nominal
	• What disease does measles vaccine prevent?	Categorical	Nominal Count

	• Number of times a child is supposed to receive measles vaccine • Knowledge of age a child should receive measles vaccine	Discrete Binary	Nominal
Experiences of vaccination	Whether child has ever suffered an adverse reaction following the administration of a vaccine	Binary	Nominal
Perception of vaccines	Whether caregiver believe vaccines are safe or not	Binary	Nominal
Health system factors:			
Health worker attitude	Whether health workers are polite, and responsive to clients' needs	Binary	Nominal
Education on vaccination	Whether health workers educate clients on importance on vaccination	Binary	Nominal
Availability of measles vaccines	Whether measles vaccines are always available at the vaccination centre	Binary	Nominal
Waiting time	The average time a client spends at a vaccination centre - Less than 30mins - 30mins – 1 hour - 1-2 hours - More than 2 hours	Categorical	Ordinal
Community factors:			
Distance to the vaccination centre	Whether the available vaccination center is; - Close - Far - Very far - Too far	Categorical	Ordinal
Unfavorable vaccination days	Whether the days schedule for vaccination are favorable	Binary	Nominal

3.4 Study Population

The study population was children aged 24 – 36 months by the time of data collection (February, 2023) and residing in the South Dayi District. One parent/ caregiver of an eligible child was identified and interviewed. The target population of children aged 24 – 36 months is 4% of the total population (DHIMS 2). The total population under study was 2,301.

The first dose of the measles vaccine is administered at age 9 months and second dose at 18 months, this implies that at age 24 – 36 months the child should have received all two doses (full uptake) of the measles vaccine.

3.4.1 Inclusion criteria:

All children aged 24 - 36 months by February, 2023 and residing in South Dayi District.

3.4.2 Exclusion criteria:

An eligible child whose parent or caregiver is not available at the time of data collection was not part of the study. Also, eligible child whose parent/caregiver did not give consent was excluded.

3.5 Sample Size Determination

The minimum sample size for this study was computed using Open Epi software with the formular;

$$n = \frac{[Deff * N * p * (1-p)]}{d^2 / Z^2_{1-\propto/2} * (N-1) + p * (1-p)}$$

where; N = a finite population correction factor = 1,000,000

Deff = design effect = 1

$Z_{1-\propto/2}$= z-score on the standard normal curve of 1.96 at 95% confidence level

p = using 23% receiving measles vaccination among children 12-23 months in a study conducted in Ethiopia (Mebrahtom & Health, 2013).

d^2 = margin of error 5%

The Open Epi software is a free epidemiological calculator used for estimating the exact sample size for epidemiological studies. It is easier and efficient to use (Charan & Biswas, 2013).

Substituting the values into the above formula,

$$n = \frac{1*1{,}000{,}000*0.23*(1-0.23)}{\frac{(0.05)^2}{(1.96)^2}*(1000000-1)+0.23*(1-0.23)} = \frac{177100}{650.9469} = 272.065$$

Adjusting for non-response rate of 5%,

0.05* 272.065 =13.603

n= 272.065+13.603

n=285.67 =286

Therefore, minimum sample size was 286

3.6 Sampling Technique

A two-stage cluster sampling technique was used. Firstly, to identify clusters to be surveyed, the total population of the communities in the district was obtained from the district health directorate. Then a sample interval was calculated by dividing the total population to be surveyed by the 30. A random number which is less than or equal to the sampling interval was selected. The number should have the same number of digits as the number of digits in the sampling interval. The total population under study was 2,301 (4% of the total district population).

Therefore, sample interval= $\frac{2301}{30}$ = 76.7

The sample interval was rounded up to nearest whole number, giving us, 77.

Then, the 30 clusters were sampled with probability proportionate to the size (PPS) of the population in the clusters. To obtain a cumulative population we added the population of the next community to the combined total of all populations in preceding community. The final cumulative population should be the same as the total population to be surveyed. To select the first cluster, a random number which is less than or equal to the sampling interval was picked. The number must have the same number of digits as the number of digits in the sampling interval and located the first community on the list in which the cumulative population equals or exceeds the random number. A random number of 50 was used as the starting point to select the first cluster. The second cluster was selected by adding the sampling interval (77) to the random number (50) to get 127 and identified the community with 127 cumulative study population as Cluster 2. This procedure was used until all 30 clusters are selected.

The table 2 below presents the name of communities in the district and their population. Also illustrates the selection of the 30 clusters. The last column (clusters) indicates selected clusters and the corresponding communities where data were be collected from. The columns that are empty indicates that no data collected from the corresponding communities.

Table 2: Cluster Identification form Showing Communities and their Population in South Dayi District.

No	Name of Community	Total Population	Study Population	Cumulative Study Population	Clusters
1	Adzebui	237	9	9	
2	Agordeke	721	29	38	
3	Atoklokpokope	1194	48	86	1
4	Badzikpe	143	6	91	
5	Dawusukope	114	5	96	
6	Dorlanyonukope	244	10	106	
7	Dzakiti	2995	120	225	2, 3
8	Dzemeni Market	4021	161	386	4, 5
9	Fantekope	279	11	397	
10	Kpongbonikope	311	12	410	
11	Pickfarm	2768	111	521	6, 7
12	Thalas	2568	103	623	8
13	Tsanakpe	3020	121	744	9, 10
14	Abui 1	405	16	760	
15	Abui 2	336	13	774	
16	Abui 3	325	13	787	
17	Ahor	1079	43	830	11
18	Kaira	688	28	857	
19	Kpalime-Duga	2568	103	960	12
20	New Kaira	801	32	992	13
21	Toh-Kpalime	2144	86	1078	14
22	Tsatee	1131	45	1123	
23	Tsita	491	20	1143	15
24	Anyensu	375	15	1158	
25	Bobli	36	1	1159	

26	Dzake Anyigbe	1280	51	1210	16
27	Dzake Dzigbe	1767	71	1281	17
28	Sanga	1182	47	1328	
29	Tsiyinu	523	21	1349	
30	Afeviwofe	620	25	1374	18
31	Agbateh	640	26	1400	
32	Avetile	4099	164	1564	19, 20
33	Blengo	2258	90	1654	21
34	Dzogbati	985	39	1693	22
35	Gadzakpe	117	5	1698	
36	Nyidibu	263	11	1709	
37	Tsame	3051	122	1831	23, 24
38	Wudome	2195	88	1918	25
39	Adzokoe	2075	83	2001	26
40	Ahiamadzi	26	1	2003	
41	Akpato	66	3	2005	
42	Anaglate	31	1	2006	
43	Avenui Camp	152	6	2012	
44	Kpeve Newtown	2584	103	2116	27
45	Kpeyibome	673	27	2143	28
46	Sodzikope	287	11	2154	
47	Todome	1592	64	2218	29
48	Tsokpokope	580	23	2241	
49	Wawase	121	5	2246	
50	Wegbe-Kpalime	1214	49	2295	30
51	Wugbadzi	151	6	2301	
	TOTAL POP.	57526	2301		

Population Source: South Dayi District Health Directorate, 2022

Sample Interval _____77 Random Number_____50

After selecting the cluster, we randomly selected at least 9 households from each cluster. To select a first household in every cluster, a central point was located in the community. A bottle was spined at the central point and when it stopped the direction of the tip was identified. We walked in the direction and counted the houses until we get to the edge of the community. Number of houses were written on a piece of papers, folded, put into a bowl and shook. We randomly picked one piece of paper and the number on it was the first house we visited. One eligible child was selected from each household. The next house closer to the main entrance of the house was entered until all 9 eligible children were selected from the cluster. The procedure was replicated in all other clusters until the sample size was reached.

3.7 Data Collection Method

Parents and caregivers were contacted at their homes to complete the questionnaire. The questions centered on socio-demographic factors and other independent variables known to affect vaccine uptake. Each questionnaire administration and card review took about 20 minutes.

Data collection properly followed the COVID-19 guidelines on facemask use, hand washing, and social distancing. This was done to reduce the danger of COVID-19 infection for both the interviewer and the respondent. Data collection was done by the principal investigator and two trained research assistants.

3.8 Data Collection Tool

A Structured questionnaire designed in KoboCollect tool kit was used to collect data from respondents on the factors associated with uptake of measles vaccine using face-face interviews.

The questions were based on socio-demographic characteristics, knowledge about measles vaccine, previous experience with vaccines and vaccination and accessibility of vaccines. We reviewed and documented the vaccination status of the child and timeliness of vaccination using the child's vaccination card.

3.9 Data Management and Analysis

Questionnaires were checked for completeness after interviewing every respondent. Data was extracted to excel sheet, cleaned and processed for analysis.

Data was analyzed using STATA version 17. Data was described using frequencies and cross tabulations, based on the research objectives and the nature of the variable that is either continuous or categorical. Multiple logistic regression was conducted to determine the adjusted strength of the association between sociodemographic variables and other independent variables and the outcome of interest. The Hoshmer and Lemeshow's goodness of fit was used to assess whether the multiple regression model was fit. A model with p-value <0.05 of the Hoshmer and Lemeshow's test was considered as fit for multiple logistic regression. Variables with p-value <0.05 at 95% confidence interval was considered statistically significant.

Results was presented as frequencies and proportions in tables, text, charts, and graphs.

3.9.1 Objective 1: Measles vaccination coverage

Proportion of children who had received the full two doses of measles vaccine out of the total sampled in the district was determined. We also determined the proportion of those who have received only one dose of measles vaccine from to sample size. This was presented in a bar graph.

3.9.2 Objective 2: Caregiver factors associated with Measles vaccine uptake

Inferential statistics was conducted by performing a bivariate analysis to determine the association between caregiver factors and full uptake of measles vaccine as the outcome using Chi-square test.

Using responses to five knowledge items, we graded participants responses dichotomized as "0" for absent and "1" for present. Good knowledge was defined as having a score of at least 3 out of 5 knowledge questions.

3.9.3 Objective 3: Community factors associated with Measles vaccine uptake

Categorical variables like; distance to the health facility and unfavorable outreach clinic days were analyzed using Chi-square test to determine the association between the independent variables and the outcome.

3.9.4 Objective 4: Health care system factors associated with Measles vaccine uptake

Categorical variables like; attitude of health staff, availability of vaccine and long waiting time were analyzed using Chi-square test to determine the association between the independent variables and the outcome.

3.10 Quality Control

Two persons were trained to assist in data collection. They were trained on the study protocol, the informed consent form and ethical guidelines. Pre-test of the data collection tool was done in North Dayi district. All questionnaires were reviewed at close of each day to ensure its completeness and accuracy. Data entered were double checked to ensure accuracy of data entered for analysis.

3.11 Ethical Consideration

3.11.1 Ethical Approval

Ethical approval for the study was sought from the Ghana Health Service Ethics Review Committee. Approval was given on 20th February, 2023 with reference number: GHS-ERC 047/01/23.

3.11.2 Informed Consent

Written informed consent was solicited from all participants. All study participants were informed on the purpose of the study, procedures, risks and benefits of participating in the study and a written consent was sought without any form of duress.

3.11.3 Confidentiality

All records reviewed were treated with confidentiality and used solely for research purposes. Code numbers were used on questionnaires instead of names of participants. Only the researcher had access to the collected data/information obtained from participant's records. The data gathered was saved and password protected to prevent unauthorized access.

3.11.4 Possible Risks and Benefits

No direct risk in participating in the interviews is encountered, except for possible uneasiness when answering certain questions. When such a thing happened, the question would be rephrased to be more suitable and comfortable for participants.

There were also no direct benefits for participating in this study. However, findings from this research will enable the Ghana Health Service and other stakeholders to develop appropriate plans and policies that will improve immunization coverage in children under 5 years.

At the community levels, we will integrate the dissemination of outcome into community meetings organized by the health professionals at the health facilities. The dissemination meeting will enable us to share the outcome of the study with the community members and the caregivers.

3.11.5 Compensation

There was no compensation for involvement in this study. However, findings from the study will benefit the population.

3.11.6 Voluntary Participation and Right to Leave the Research

Participation was voluntary and one could freely withdraw anytime they wish without any form of penalty.

3.11.7 Infection Prevention and Control Strategies (COVID 19 protocols)

The study took into consideration all the principles and guidelines as outlined in the Ghana Health Service Ethics Review Committee (GHSERC) for researchers to follow during the COVID- 19 pandemic to protect the safety, rights and welfare of research participants as well as study teams. All COVID 19 protocols were strictly adhered to.

All data collectors were provided with hand sanitizers, nose-mask and ensured social distancing. Participants without nose masks were provided with nose masks at no cost to them. Study participants were educated to adhere to all COVID-19 preventive measures including COVID-19 vaccination.

3.11.8 Conflict of interest

The researcher had no conflict of interest in this study.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-Demographic Characteristics of Caregivers

A total of 298 parents/caregivers participated in the study. They were drawn from the five sub-districts in the South Dayi District in Volta Region.

Most of the respondents (33.6%) were from Tongor sub-district which is the sub-district with the highest population. More than half (59.4%) of the caregivers reside in rural communities. The mean age of caregivers was 28±6.2 years. Majority (57.1%) of the caregivers were aged 20-29 years and the least were those aged 40 years and above. Female caregivers formed majority (94.0%) of the respondents. The predominant religion of caregivers was Christianity (90.6%). Most caregivers (46.9%) attained secondary school and few (8.1%) attained tertiary education. More than half of caregivers (51%) were unemployed. Among those employed, 53.4% were self-employed whereas, 14.4% were Government workers.

Forty-four percent of caregivers were married and 19.5% were not married. Most (31.5%) of the caregivers had a child and more than 80% of the caregivers delivered at a health facility as shown in Table 3.

Table 3: Socio-demographic characteristics of Caregivers

Variable	Frequency [N=298]	Percentage (%)
Mean Age in years (S.D)	28.2 (6.2)	
Age group (years)		
<20	16	5.4
20-29	170	57.1
30-99	97	32.5
40+	15	5.0
Sex		
Male	18	6.0
Female	280	94.0
Level of education		
No formal education	36	12.1
Primary	98	32.9
Secondary	140	46.9
Tertiary	24	8.1
Employment Status		
Employed	146	49.0
Unemployed	152	51.0
Employment Type		
Self-employed	78	53.4
Government worker	21	14.4
Other	41	32.2
Marital Status		
Single	58	19.5
Married	130	43.6
Co-habiting	110	36.9
Religion		
Christian	270	90.6
Muslim	21	7.1
No Religion	7	2.3
Number of Children		
One	94	31.5
Two	89	29.9
Three	46	15.4
Four or more	69	23.2
Place of Delivery		
Health Facility	259	86.9
Home	39	13.1
Place of Residence		
Urban	121	40.6
Rural	177	59.4

4.2 Socio-Demographic and Vaccination Characteristics of Children

Table 4 shows the demographic and vaccination information of children. Out of the 298 children (aged 24 – 36 months) that participated in the study, the mean age of the children was 28.9 ± 4.0 months. More than half (66.9%) of the children were aged 24-30 months. Majority (50.1%) of the children were males. Children who had their vaccination card available at the time of interview was 70.8%. Almost all (98.3%) of the children had received the first dose of measles vaccine.

Table 4: Socio-demographic Characteristics and Vaccination Status of Children

Variable	Frequency [N=298]	Percentage (%)
Age of Child (months)		
Mean Age (S.D)	28.9 (4.0)	
24 – 30	200	66.9
31 – 36	99	33.1
Sex of Child		
Male	152	50.1
Female	146	49.9
Child's Vaccination Card		
Vaccination card available	211	70.8
Vaccination card not available	87	29.2
Child receive measles vaccine at 9 months		
Child vaccinated	293	98.3
Child not vaccinated	5	1.7
Child receive measles vaccine at 18 months		
Child vaccinated	269	90.3
Child not vaccinated	29	9.7

4.3 Measles Vaccination Coverage among Children Under-five Years

4.3.1 Measles Vaccination Uptake

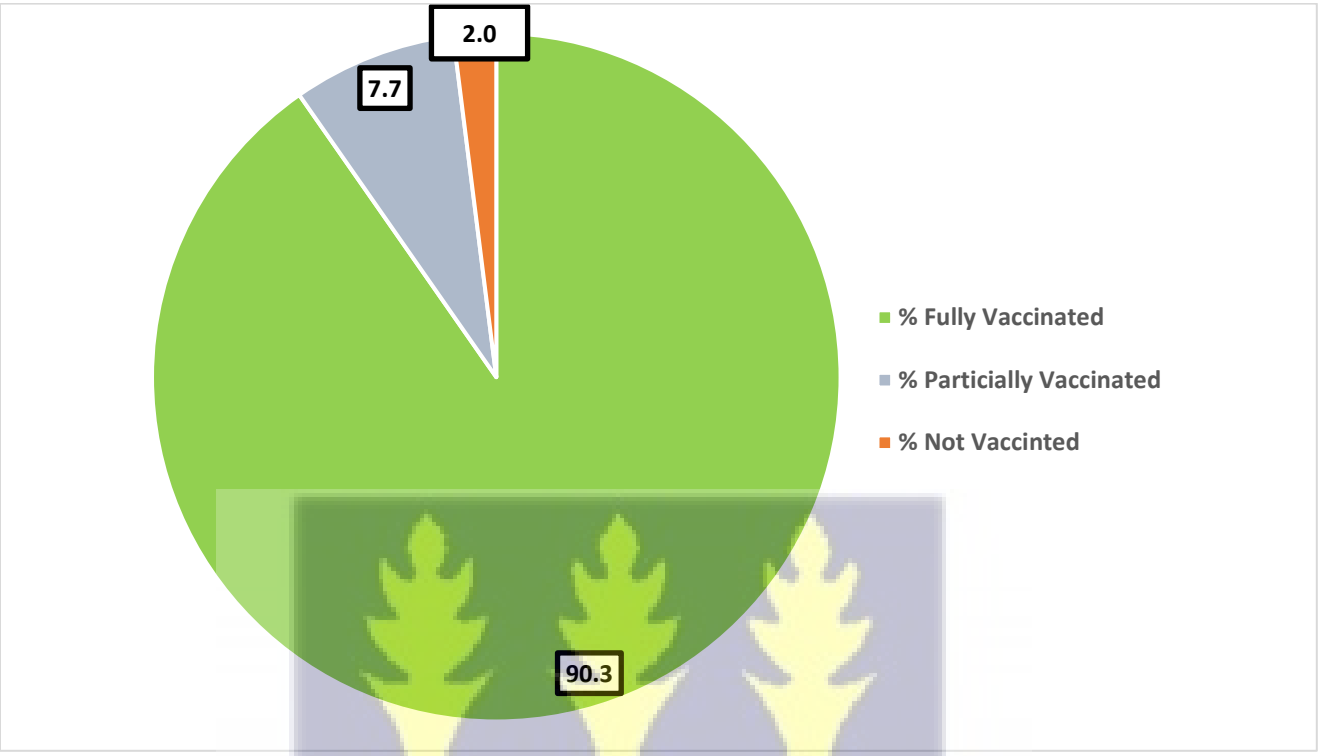


Figure 4: Measles Vaccination among children under 5 years in South Dayi District

Out of the 298 children who participated in the study, 90.3% (95% CI: 0.863-0.931) were fully vaccinated (receiving all two doses), 7.7% (95% CI: 0.051-0.113) were partially vaccinated (receiving one dose) and 2% (95% CI: 0.009-0.044) had not received a dose at all as shown in figure 4

4.3.2 Measles vaccination Uptake among children under 5 years by Sub-district

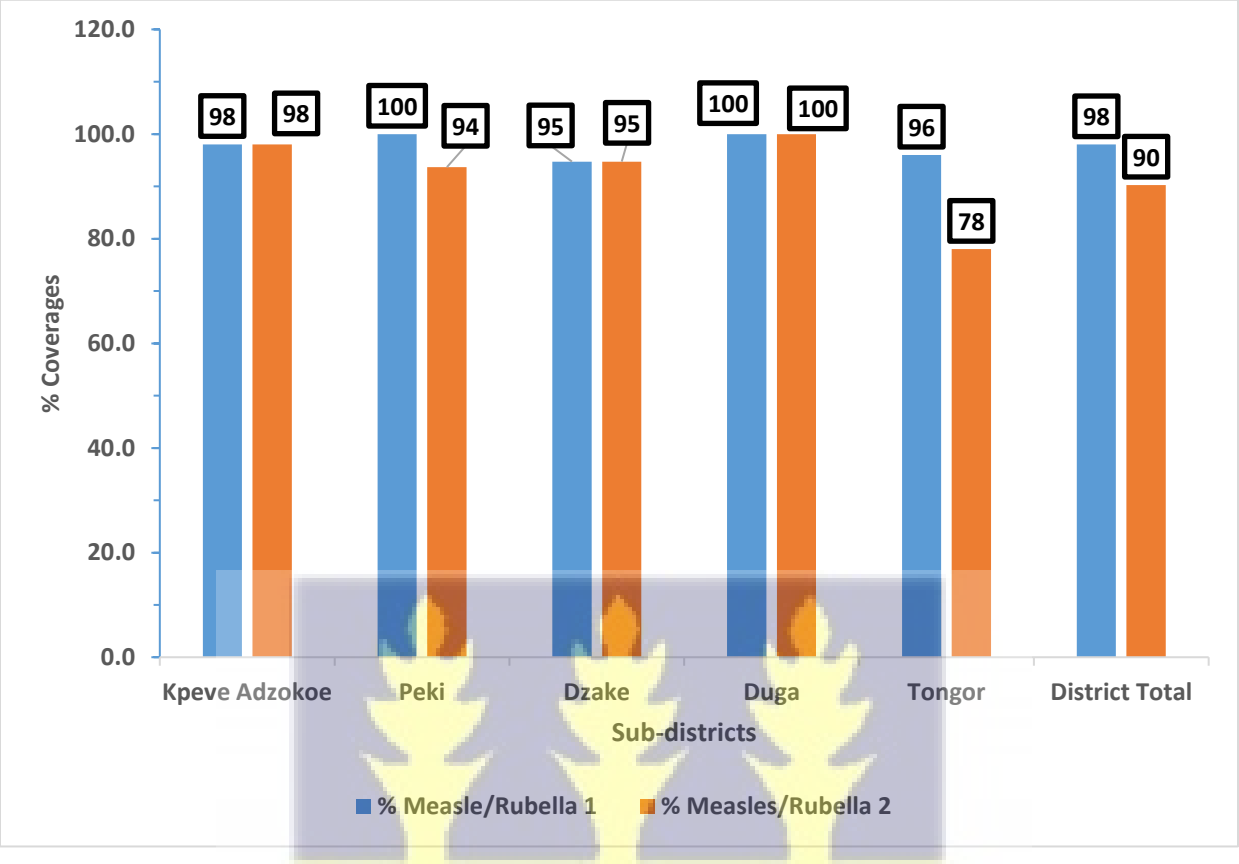


Figure 5: Measles vaccination coverages among children under 5 years by Sub-Districts

Figure 5 above shows that, out of the 298 children assessed, 98% and 90% had received first dose and second dose of measles vaccine respectively as against the 95% by WHO. The coverages from the study revealed that all the sub-districts coverages for first dose of measles vaccine was at least 95%, however, Peki and Tongor sub-districts recorded 94% and 78% respectively for second dose of measles vaccine which was lower than 95% WHO target.

4.4 Caregivers' Knowledge and Experiences with Vaccines

Results on caregivers' knowledge revealed that, 87.6% of them have heard of measles disease. Most (41.5%) of caregivers reported that measles disease causes rash, 22.7% said it can cause death and 10.8% reported it causes high temperature. With regards to measles vaccine, 86.6% reported they have heard about the vaccine and 96.9% reported that the vaccine prevents measles disease. Most (69.4%) of the caregivers reported that the recommended number of measles doses to be received was two doses. Overall, 70% of the caregivers had good knowledge about measles. With respect to adverse event following immunization (AEFI), 73.5% of the caregivers reported that their children had not experienced AEFIs whereas, the rest did. Among those who had experienced AEFI, fever was the most common event (84.8%). Almost all (99.3%) the caregivers reported that the measles vaccines are safe as shown in Table 5.

Table 5: Caregivers' Knowledge and Experiences with Vaccines

Variable	Frequency [N=298]	Percentage (%)
Heard of Measles Disease		
Heard	261	87.6
Not Heard	37	22.4
Harm Causes to the Child		
Death	63	22.7
Fever	25	9.0
High temperature	30	10.8
Rash	115	41.5
Weakness	8	2.9
Others	36	13.0
Heard of Measles Vaccine		
Heard	258	86.6
Not Heard	40	13.4
What does it do [N=258]		
Prevents measles	250	96.9
Others	8	3.1
Number of Measles Doses to Receive [N=258]		
1	17	6.6
2	179	69.4
3 or more	62	24.0
Child Experience AEFI Before		
Experienced AEFI	79	26.5
Not experience AEFI	219	73.5
What AEFI Experienced [N=79]		
Diarrhea	2	2.5
Fever	67	84.8
Headache	3	3.8
Lumps at site of injection	3	3.8
Pains in limps	1	1.3
Swelling	3	3.8
Are Vaccines Safe		
Vaccines are safe	296	99.3
Vaccines are not safe	2	0.7
Knowledge Score		
Poor Knowledge	90	30.2
Good Knowledge	208	69.8

4.5 Health Service-Related Factors

Almost all (99.0%) the caregivers had ever sent their children to child welfare clinic (CWC) for immunization services. Among the caregivers who had sent their children to CWC for immunization services, 98% of them reported that the clinic site was convenient. Most of the caregivers (79.7%) spent less than one hour at the child welfare clinic when they visited for immunization services. Regarding the attitude of the health workers, almost all (99.7%) of the caregivers reported that they had a good attitude towards them.

It was revealed that, 91.9% of the caregivers reported that health workers regularly give health education on benefits on vaccines when they visit the child welfare clinics. Majority (93.6%) of the caregivers reported that they have not been denied vaccination services for their children whiles 6.4% of respondents reported that they had ever been denied vaccination services. Reasons for not receiving vaccination services were; no vaccines or devices (84.2%) and child was sick (15.8%). Almost all (97.0%) the caregivers reported that they had never paid for vaccination services as shown in Table 6.

Table 6: Health Service-Related Factors

Variable	Frequency [N=298]	Percentage (%)
Caregiver sent Child to CWC		
Sent child to CWC	295	99.0
Did not send child to CWC	3	1.0
Vaccination Centre Convenient [N=295]		
Convenient	289	98.0
Not convenient	6	2.0
Average time spent to be vaccinated (hours) [N=295]		
<one	235	79.7
1 – 2	57	19.3
> 2	3	1.0
Attitude of Nurses [N=295]		
Good	294	99.7
Bad	1	0.3
Nurses give Education on Vaccination [N=295]		
Education on vaccination	271	91.9
No education on vaccination	24	8.1
Child ever been denied Vaccination [N=295]		
Child denied vaccination	19	6.4
Child never denied vaccination	276	93.6
Reason for Child not Vaccinated [N=19]		
No vaccine and or the other logistics	16	84.2
Child was sick	3	15.8
Paid for any service at CWC		
Paid	9	3.0
Did not pay	289	97.0

4.6 Community Related Factors

Majority (93.3%) of the caregiver reported that the distance to the vaccination centers was near (less than 30 mins). Almost all (99.7%) the caregivers reported that the days scheduled for vaccination services were convenient. Only a few caregivers (7.7%) reported that their cultural or religious beliefs are against vaccination as shown in Table 7.

Table 7: Community Related Factors

Variable	Frequency [N=298]	Percentage (%)
Distance to nearest Vaccination Centre		
Near [< 30mins]	278	93.3
Not too far [30mins-1hr]	18	6.0
Far away [> 1hr]	2	0.7
Day(s) scheduled for vaccination convenient		
Vaccination days convenient	297	99.7
Vaccination days not convenient	1	0.3
Culture or religion against vaccination		
Against vaccination	23	7.7
Not against vaccination	275	92.3

4.7 Association between Caregivers' Demographic Characteristics and Vaccination Status of Child

In the bivariate analysis, only number of children of caregivers has a significant association with vaccination status of the children. Caregiver's age, sex, marital status, religion, level of education, occupation, place of delivery and place of residence were all not significantly associated with vaccination status of a child.

The proportion of female caregivers who have had their children fully vaccinated was not significantly different from the proportion of female caregivers who have not been fully vaccinated their children (χ^2 = 0.04; p=0.839). A higher proportion (51.7%) of the caregiver who attained secondary education were not fully vaccinated as compared to the 46.5% who were fully vaccinated. However, the difference was not statistically significant (χ^2 = 3.0; p=0.381).

The proportion of fully vaccinated children whose caregivers reside in rural settings were 61% and higher than the 44.8% among those who were not fully vaccinated. However, the difference was not statistically significant (χ^2 = 2.8; p=0.093) as shown in Table 8.

Table 8: Association between Caregivers' Demographics and Vaccination Status of Child

Variable	Not Fully vaccinated [n=29 (%)]	Fully vaccinated [n=269 (%)]	Total [N=298 (%)]	Chi-square (p-value)
Age group				3.2 (0.357)
<20	3 (10.3)	13 (4.8)	16 (5.4)	
20-29	18 (62.1)	152 (56.5)	170 (57.1)	
30-99	6 (20.7)	91 (33.8)	97 (32.6)	
40+	2 (6.9)	13 (4.8)	15 (5.0)	
Sex				0.04 (0.839)
Male	2 (6.9)	16 (6.0)	18 (6.0)	
Female	27 (93.1)	253 (94.1)	280 (94.0)	
Level of education				3.0 (0.381)
None	3 (10.3)	33 (12.3)	36 (12.1)	
Primary	11 (37.9)	87 (32.3)	98 (32.9)	
Secondary	15 (51.7)	125 (46.5)	140 (47.0)	
Tertiary	0 (0.0)	24 (8.9)	24 (8.1)	
Employment Status				0.09 (0.757)
Employed	15 (51.7)	131 (48.7)	146 (49.0)	
Unemployed	14 (48.3)	138 (51.3)	152 (51.0)	
Other	5 (33.3)	42 (32.1)	47 (32.2)	
Marital Status				2.2 (0.322)
Single	7 (24.1)	51 (19.0)	58 (19.5)	
Married	15 (51.7)	115 (43.0)	130 (43.6)	
Co-habiting	7 (24.1)	103 (38.3)	110 (36.9)	
Religion				1.4 (0.479)
Christian	28 (96.5)	242 (90.0)	270 (90.6)	
Muslim	1 (3.5)	20 (7.4)	21 (7.0)	
None	0 (0)	7 (2.6)	7 (2.4)	
Number of Children				**8.1 (0.042)**
One	3 (10.3)	91 (33.8)	94 (31.5)	
Two	9 (31.0)	80 (29.7)	89 (29.9)	
Three	6 (20.7)	40 (14.9)	46 (15.4)	
Four or more	11 (37.9)	58 (21.6)	69 (23.2)	
Birth Order				7.6 (0.054)
First	6 (20.7)	108 (40.2)	114 (38.3)	
Second	7 (24.1)	76 (28.3)	83 (27.9)	
Third	6 (20.7)	39 (14.5)	45 (15.1)	
Fourth more	10 (34.5)	46 (17.1)	56 (18.8)	
Place of Delivery				1.6 (0.201)
Health Facility	23 (79.3)	236 (87.7)	259 (86.9)	
Home	6 (20.7)	33 (12.3)	39 (13.1)	
Place of Residence				2.8 (0.093)
Urban	16 (55.2)	105 (39.0)	121 (40.6)	
Rural	13 (44.8)	164 (61.0)	177 (59.4)	

4.8 Association between Child's Demographic Characteristics and Vaccination Status

The proportion of fully vaccinated among children aged 31-36 months was 34.6%, which was higher than the 17.2% among those who were not fully vaccinated. However, the difference was not statistically significant ($\chi^2 = 3.5$; p=0.059). Among the children who were aged 24-30 months, a higher proportion (82.8%) were not fully vaccinated as compared to 65.4% who were fully vaccinated. A higher proportion (58.6%) of female children were not vaccinated as compared to 47.9% that were fully vaccinated but the difference was not statistically significant (1.1; p=0.275) as shown in Table 9.

Table 9: Association between Demographic Characteristics of Child and Vaccination Status

Variable	Not Fully vaccinated [n=29 (%)]	Fully vaccinated [n=269 (%)]	Total [N=298 (%)]	Chi-square (p-value)
Age of Child (months)				**3.5 (0.059)**
24 – 30	24 (82.8)	176 (65.4)	200 (67.1)	
31 – 36	5 (17.2)	93 (34.6)	98 (32.9)	
Sex of Child				1.1 (0.275)
Male	12 (41.4)	140 (52.0)	152 (51.0)	
Female	17 (58.6)	129 (47.9)	146 (48.9)	

4.9 Association between Caregivers' Knowledge, Experiences and Child's Vaccination Status

A higher proportion (88.5%) of caregivers who had heard of measles disease were fully vaccinated as compared with the 79.3% who were not fully vaccinated, but the difference was not statistically significant ($\chi^2 = 1.1$; p=0.275). There was no statistically significant difference in the proportion of caregivers who had good knowledge and were vaccinated as compared to those with good knowledge and not vaccinated. The proportion of caregivers whose children experienced AEFI and were fully vaccinated was lower (24.2%) compared with caregivers whose children

experienced AEFI and were not fully vaccinated (48.8%), the difference was statistically significant ($\chi^2 = 7.8$; p=0.005) as shown in Table 10.

Table 10: Association between Caregivers' Knowledge, Experiences and Child's Vaccination Status

Variable	Not Fully vaccinated [n=29 (%)]	Fully vaccinated [n=269 (%)]	Total [N=298 (%)]	Chi-square (p-value)
Heard of Measles Disease				2.0 (0.155)
Heard	23 (79.3)	238 (88.5)	261 (87.6)	
Not heard	6 (20.7)	31 (11.5)	37 (12.4)	
Harm Causes to the Child				6.4 (0.266)
Death	8 (29.6)	55 (22.0)	63 (22.7)	
Fever	0 (0)	25 (10.0)	25 (9.0)	
High temperature	1 (3.7)	29 (11.6)	30 (10.8)	
Rash	14 (51.9)	101 (40.4)	115 (41.5)	
Weakness	0 (0)	8 (3.2)	8 (2.9)	
Others	4 (14.8)	32 (12.8)	36 (13.0)	
Heard of Measles Vaccine				1.4 (0.227)
Heard	23 (79.3)	235 (87.4)	258 (86.6)	
Not heard	6 (20.7)	34 (12.6)	40 (13.4)	
No. of Measles Doses to Receive				2.9 (0.230)
1	0 (0)	17 (7.2)	17 (6.6)	
2	15 (65.2)	164 (69.8)	179 (69.4)	
3 or more	8 (34.8)	54 (22.9)	62 (24.0)	
Level of Knowledge				0.0 (0.918)
Poor Knowledge	9 (31.0)	81 (30.1)	90 (30.2)	
Good Knowledge	20 (69.0)	188 (69.9)	208 (69.8)	
Child Experience AEFI				**7.8 (0.005)**
Experienced AEFI	14 (48.3)	65 (24.2)	79 (26.5)	
Not experience AEFI	15 (51.7)	204 (75.8)	219 (73.5)	
AEFI Experienced				6.8 (0.231)
Diarrhea	0 (0)	2 (3.0)	2 (2.5)	
Fever	12 (85.7)	55 (84.6)	67 (84.8)	
Headache	0 (0)	3 (4.6)	3 (3.8)	
Lumps at site of injection	2 (14.3)	1 (1.5)	3 (3.8)	
Pains in limps	0 (0)	1 (1.5)	1 (1.3)	
Swelling	0 (0)	3 (4.6)	3 (3.8)	
Are Vaccines Safe				0.2 (0.641)
Vaccines are safe	29 (100.0)	267 (99.3)	296 (99.3)	
Vaccines are not safe	0 (0)	2 (0.7)	2 (0.7)	

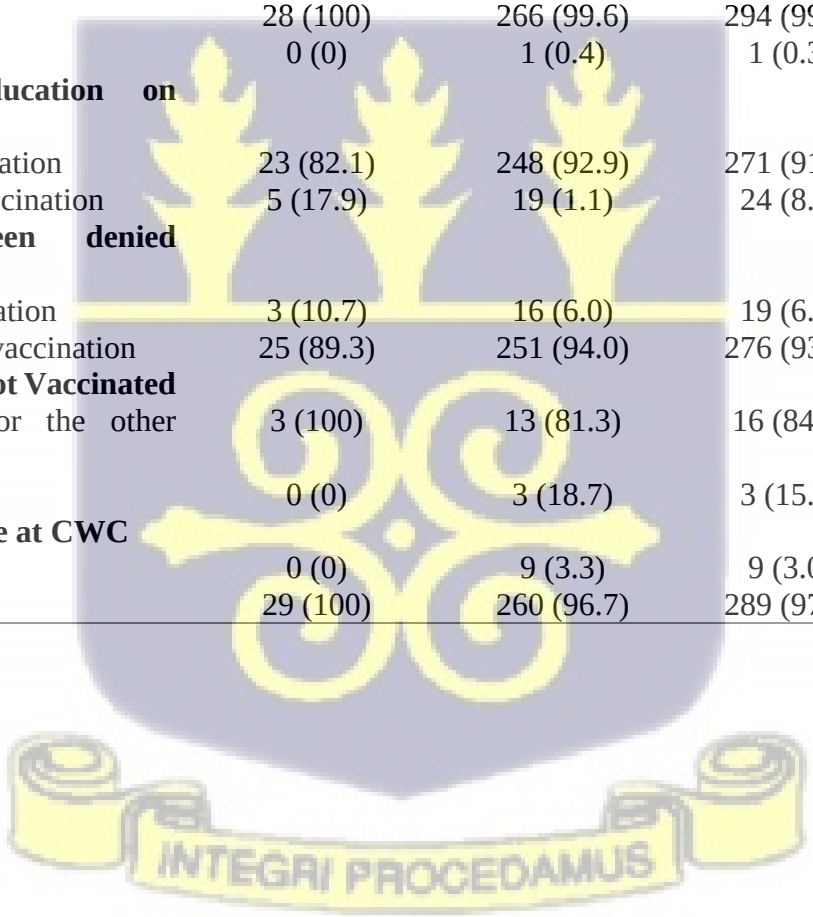
4.10 Association between Health Service-Related and Vaccination Status of a Child

The proportion of caregivers whose children were fully vaccinated among those who sent their children to child welfare clinic was 99.3% and higher than the 96.6% who were not fully vaccinated. However, the difference was not statistically significant ($\chi^2 = 1.9$; p=0.166). A higher (92.9%) proportion of the caregivers who received education on vaccination had their children fully vaccinated as compared to 82.1% whose children were not fully vaccinated and the difference was statistically significant ($\chi^2 = 3.9$; p=0.048).

With respect to vaccination denial, caregivers who reported that their children had never been denied of vaccination, a higher (94.0%) proportion of them had their children fully vaccinated as compared to 89.3% whose children were not fully vaccinated. However, the difference was not statistically significant as shown in Table 11.

Table 11: Association between Health Service-Related and Vaccination Status of a Child

Variable	Not Fully vaccinated [n=29 (%)]	Fully vaccinated [n=269 (%)]	Total [N=298 (%)]	Chi-square (p-value)
Caregiver sent Child to CWC				1.9 (0.166)
Sent child to CWC	28 (96.6)	267 (99.3)	295 (99.0)	
Did not send child to CWC	1 (3.4)	2 (0.7)	3 (1.0)	
Vaccination Centre Convenient				0.3 (0.545)
Convenient	27 (96.4)	262 (98.1)	289 (98.0)	
Not convenient	1 (3.6)	5 (1.9)	6 (2.0)	
Average time spent to be vaccinated (hours)				0.8 (0.650)
<one	24 (85.7)	211 (79.0)	235 (79.7)	
1 – 2	4 (14.3)	53 (19.9)	57 (19.3)	
> 2	0 (0)	3 (1.1)	3 (1.0)	
Attitude of Nurses				0.1 (0.746)
Good	28 (100)	266 (99.6)	294 (99.7)	
Bad	0 (0)	1 (0.4)	1 (0.3)	
Nurses give Education on Vaccination				**3.9 (0.048)**
Education on vaccination	23 (82.1)	248 (92.9)	271 (91.9)	
No education on vaccination	5 (17.9)	19 (1.1)	24 (8.1)	
Child ever been denied Vaccination				0.9 (0.333)
Child denied vaccination	3 (10.7)	16 (6.0)	19 (6.4)	
Child never denied vaccination	25 (89.3)	251 (94.0)	276 (93.6)	
Reason for Child not Vaccinated				0.6 (0.414)
No vaccine and or the other logistics	3 (100)	13 (81.3)	16 (84.2)	
Child was sick	0 (0)	3 (18.7)	3 (15.8)	
Paid for any service at CWC				1.0 (0.317)
Paid	0 (0)	9 (3.3)	9 (3.0)	
Did not pay	29 (100)	260 (96.7)	289 (97.0)	



4.11 Association between Community Related Factors and Vaccination Status of a Child

The findings show that a higher proportion (93.7%) of caregivers who reported that the vaccination center was near, had their children fully vaccinated as compared to the 89.7% whose children were not fully vaccinated. However, the difference was not statistically significant ($\chi^2 = 1.2$; p=0.536). Among the caregivers who reported that vaccination days was convenient, all of them (100%) were not fully vaccinated as compared to 99.6% whose children were fully vaccinated, but the difference was not statistically significant ($\chi^2 = 0.1$; p=0.742). The proportion of fully vaccinated children was higher (92.9%) than the 86.2 percent of children who were not fully vaccinated among caregivers who reported that their culture or region was not against vaccination. However, the difference was not statistically significant ($\chi^2 = 1.6$; p=0.197).

Table 12 : Association between Community Related Factors and Vaccination Status of a Child

Variable	Not Fully vaccinated [n=29 (%)]	Fully vaccinated [n=269 (%)]	Total [N=298 (%)]	Chi-square (p-value)
Distance to nearest Vaccination Centre				1.2 (0.536)
Near [< 30mins]	26 (89.7)	252 (93.7)	278 (93.3)	
Not too far [30mins-1hr]	3 (10.3)	15 (5.6)	18 (6.0)	
Far away [> 1hr]	0 (0)	2 (0.7)	2 (0.7)	
Day(s) scheduled for vaccination convenient				0.1 (0.742)
Vaccination days convenient	29 (100)	268 (99.6)	297 (99.7)	
Vaccination days not convenient	0 (0)	1 (0.4)	1 (0.3)	
Culture or religion against vaccination				1.6 (0.197)
Against vaccination	4 (13.8)	19 (7.1)	23 (7.7)	
Not against vaccination	25 (86.2)	250 (92.9)	275 (92.3)	

4.12 Multivariable Analysis of Level of Vaccination and Independent Variables

The goodness of fit test of the model shows that p=0.566 implying that the model of fit. The multivariable logistic regression analysis shows that, caregivers' age, and number children of mother were the significant factors associated with full vaccination. Caregivers who were aged 20-29 years, 30-39 years, and 40 years and above were 7.3, 43.4 and 23.22 times more likely to have their children fully vaccinated compared to those aged less than 20 years and the difference was statistically significant [AOR=7.33 (95% CI: 1.24 - 43.34) p=0.028], AORs=43.49 (95% CI: 5.68 - 332.76) p<0.001] and [AOR=23.22 (95% CI: 1.51 - 354.90) p=0.024] respectively.

Caregivers who had two children were 86% less likely to have their child fully vaccinated compared to those who had one child and the difference was statistically significant [AOR=0.14 (95% CI: 0.02 - 0.86) p=0.035]. However, the post estimation test analysis shows that, number of children of a caregiver was not statistically associated with full vaccination (p=0.154). Caregivers who had three children and those who had four and more children were 86% and 61% less likely to have their child being fully vaccinated compared to those who had one child, however, the difference was not statistically significant [AOR=0.14 (95% CI: 0.01 - 2.17) p=0.162] and [AOR=0.39 (95% CI: 0.01 - 12.39) p=0.600] respectively.

Caregivers who reside in urban areas were 50% less likely to have their child fully vaccinated compared to those who reside at the rural setting. However, the difference was not statistically significant [AOR=0.50 (95% CI: 0.21-1.19) p=0.118]. Caregivers whose child did not experienced AEFI were 2.2 time more likely to have the child fully vaccinated compared to those whose children did experience AEFI. However, the difference was not statistically significant [AOR=2.2 (95% CI: 0.84 - 5.92) p=0.109]. Caregivers' religious and cultural belief are not against vaccination were 1.6 time more likely to get their children fully vaccinated compared to those

whose beliefs are against vaccination. However, the difference was not statistically significant [AOR=1.57 (95% CI: 0.47 - 5.23) p=0.456] as shown in Table 13.

Table 13: Multivariable Analysis of Level of Vaccination and Independent Variables

Variable	COR (95% CI) p-value	AOR (95% CI) p-value
Age group		
<20	Ref	Ref
20-29	1.32 (0.46 - 3.72) 0.598	7.33 (1.24 - 43.34) **0.028**
30-99	3.66 (1.19 - 11.19) **0.023**	43.49 (5.68 - 332.76) **<0.001**
40+	3.11 (0.62 - 15.48) 0.166	23.22 (1.51 - 354.90) **0.024**
Number of Children		
One	Ref	Ref
Two	0.29 (0.07 - 1.11) **0.073**	0.14 (0.02 - 0.86) **0.035**
Three	0.21 (0.05 - 0.92) **0.038**	0.14 (0.01 - 2.17) 0.162
Four or more	0.17 (0.04 - 0.64) **0.009**	0.39 (0.01 - 12.39) 0.600
Birth Order		
First	Ref	Ref
Second	0.60 (0.19 - 1.86) 0.380	1.14 (0.22 - 5.84) 0.873
Third	0.36 (0.10 - 1.18) 0.093	0.36 (0.02 - 4.74) 0.441
Fourth more	0.25 (0.08 - 0.74) **0.012**	0.07 (0.00 - 1.84) 0.112
AEFI Experience		
Experienced AEFI	Ref	Ref
Not experience AEFI	2.92(1.34 - 6.39) **0.007**	2.2 (0.84 - 5.92) 0.109
Place of Residence		
Rural	Ref	Ref
Urban	0.52 (0.24 - 1.12) 0.097	0.50 (0.21 - 1.19) 0.118
Distance to nearest Vaccination Centre		
Near [< 30mins]	Ref	Ref
Not too far [30mins-1hr]	0.51 (0.14 - 1.89) 0.320	0.52 (0.11 - 2.39) 0.408
Culture or religion against vaccination		
Against vaccination	Ref	Ref
Not against vaccination	2.10 (0.66 - 6.67) 0.206	1.57 (0.47 - 5.23) 0.456
Knowledge		
Poor Knowledge	Ref	
Good Knowledge	1.04 (0.45 - 2.39) 0.918	

CHAPTER FIVE

5.0 Discussion

5.1.1 Measles vaccination coverage

In this present study, 98% and 90% of children under-five had received first dose and second dose of measles vaccine respectively. Overall, 90% of the children were fully vaccinated against measles in South Dayi District which was lower than the 95% WHO target. These findings were similar to findings documented in a community-based cross-sectional study in Kenya by Mamuti and colleagues. The authors observed 96.6%, and 56.6% coverages for Measles Vaccine dose one (MCV 1) and MCV dose two (MCV 2) respectively based on the Maternal and Child Health (MCH) booklet. However, for verbal report a coverage of 98.2% for MCV 1 and 51.6% for MCV 2 were reported (Mamuti et al., 2022). The findings of this study also agree with what was reported in a study by Adokiya and colleagues in Techiman Municipality. The authors found that 92% of children under-five were fully vaccinated (Adokiya et al., 2017). The reasons for high drop-out (8.1%) between measles vaccine dose one and two could be because the second dose is given at 18 months of age, where caregivers assume that the children are old and do not need more vaccines. Also at that older age, the children are sent to school and caregivers prioritise their jobs and other activities over vaccination of their children.

The rate of fully vaccination in this present study was higher when compared to the findings in Armenia by Kantner and colleagues. The authors analysed a demographic health survey data two (DHS VII) in Armenia and found that only 79.6% of the children in their study population were vaccinated against measles (Kantner et al., 2021). Also, the rate of second dose vaccination coverage and fully vaccination coverages in this present study were higher than what was reported globally by the WHO. According to WHO as at the end of 2021, only 81% of children had received

one dose of measles vaccine by their second birthday, and 71% of children had received two doses of measles vaccine based on national immunization schedules (WHO, 2021). Additionally, the rate of immunization coverage in this present study is higher than the administrative coverage of 58.1% in the district in 2021. The higher rate of immunization coverage in this present study could be due to differences in the study populations and sampling methods. The administrative coverages use estimated 4% of projected population from the population and housing census, which may not reflect the true population of the target group in the geographical location.

5.1.2 Caregiver related Factors Associated with Measles Vaccine Uptake

This present study found that, age as a caregiver related factor was significantly associated with measles vaccine uptake in South Dayi District. Older adults were more likely to have their children fully vaccinated compared to younger adults. This finding is similar to report by Sheikh and colleagues. The author also found that children of younger mothers (<20, and 20–34 years) were at higher risk of incomplete vaccination than those of older mothers aged >34 years respectively (Sheikh et al., 2018). Age of caregiver has been one of the consistent predictors of childhood immunization programs in literature. Several studies have documented that younger adults are less likely to have their children immunized as compared to older adults.

In this study, association between caregivers' religious and cultural beliefs and complete vaccination was not statistically significant. This finding is different from what has been documented in previous studies in Ghana (Budu et al., 2020), Ethiopia (Lakew et al., 2015), and 15 other countries in Sub-Saharan Africa (SSA) (Costa et al., 2020) as well as in India (Weiss et al., 2013). These studies have established that mother's religious affiliation is statistically significant predictor of complete vaccination coverage of children. The authors further recommend that enhanced engagement and involvement of religious leaders in vaccine promotion has proven

to be effective and may be an important strategy for reaching parents whose children are not vaccinated or have not received complete vaccination (Costa et al., 2020).

This current study found a higher rate of fully vaccinated children among caregivers who had good level of knowledge about measles vaccine and vaccinations program. Also, the odds of fully vaccination were higher among caregivers who had good knowledge. However, knowledge about vaccine was not a significant predictor for fully immunization. This finding contradict what was observed by Mamuti and colleagues who found that caregiver's knowledge on the number of MCV scheduled doses and children whose birth order was below 5th born were significantly associated with MCV uptake (Mamuti et al., 2022). Knowledge of vaccine preventable disease can serve as both a hindrance or enabling factor to immunization uptake. Vaccine knowledge is critical for vaccine acceptance and utilization by parents. Low vaccination coverage in children is largely due to healthcare providers' and parents' lack of vaccine knowledge. Parents with low level education and socioeconomic status are more sceptical of immunization (Bangura et al., 2020). Several studies have documented parents' lack of vaccine knowledge as a barrier to immunization. Caregiver's with adequate or sufficient knowledge about vaccines are more likely to get their children vaccinated as compared to those with inadequate knowledge (Akwataghibe et al., 2019; Bangura et al., 2020; Bugvi et al., 2014; Matsumura et al., 2005).

In this present study, higher rate of fully vaccinated were reported among mothers who had higher education than those who have never attained education. However, education was not a significant predictor of vaccination uptake. This finding differs from what has been reported in the literature. According to a study by Budu and colleagues, mothers' educational attainment significantly affects how many children in Ghana receive all of their recommended vaccinations (Budu et al., 2020). The authors found that, compared to children whose mothers had no formal education, children

whose mothers have at least a secondary education had better probabilities of receiving a full course of immunization. Also, other studies in different African countries have shown the association between educational level and complete vaccination coverage (Hu. et al., 2013; Kamau & Esamai., 2001; Tamirat & Sisay, 2019). Similarly, children of lower level educated mothers (primary level) were at increased odds of incomplete vaccination than those of mothers with a higher level of education (Sheikh et al., 2018). This conclusion could be explained by the fact that mothers with secondary education may have sufficient knowledge and information about immunization and child welfare and may routinely send their children to get immunized. In comparison to those with no formal education, they are also more likely to comprehend the health education and the significance of adhering to the vaccine schedule that healthcare professionals preach during child welfare clinic (Budu et al., 2020).

5.1.3 Community related factors associated with Measles vaccine uptake among

In this present study, place of residency was not a significant predictor of measles vaccination. However, the caregivers who reside in urban areas were 50% less likely to have their child fully vaccinated as compared to those who reside at the rural setting. This finding differ from what was reported in a previous study by Budu and colleagues. In comparison to children whose mothers are from urban areas, the authors discovered that children born to women in rural areas had reduced probabilities of receiving a full course of vaccination. (Budu et al., 2020). Also the finding in this present study contradicts studies from Ethiopia where place of residence was an important determinant of full child vaccination (Tamirat & Sisay, 2019; Ushie et al., 2013). There is a claim that urban areas have more access to healthcare resources and personnel than rural areas (Tsawe & Susuman, 2014) , which may help to explain why the majority of children who had a full course of immunization had caregivers who lived in urban areas. In a similar vein, other earlier research

found that children in urban areas continuously report better likelihood of receiving all recommended vaccinations than those in rural areas.

The high proportion of incomplete measles vaccination among children leaving in urban areas compared to rural areas revealed in this study could be explained that, caregivers or mothers in the urban areas prioritise their work and other engagements over sending their children for vaccination services.

5.1.4 Health care system factors associated with Measles vaccine uptake among

This study revealed that 92.9% of the caregivers who received education on vaccination had their children fully vaccinated and was statistically significant. This conforms with Several studies that highlighted inadequate information about immunization as a health system related barrier contributing to non-completion of immunization sessions (Bangura et al., 2020; Tadesse et al., 2017). Another study by Bosu et all, suggests that caregivers lack of knowledge about benefits of vaccination could lead to incomplete vaccination (Bosu et al., 1997).

Vaccine shortage at health facility level has been widely documented as a health systemic factor that significantly hinder immunization services (Bangura et al., 2020; Ismail et al., 2014; Mekonnen et al., 2019; Tadesse et al., 2009; Tefera et al., 2018). This present study found that out of respondents who reported that they had ever been denied vaccination services, the main reasons for not receiving vaccination services was no vaccines or devices, although not statistically significant. A study in South Africa, Mthiyane and colleagues found that the most common reason (58.1%) given by caregivers for their children having missed or delayed receiving any vaccinations was that the clinic had ran out of the relevant vaccines (Mthiyane et al., 2019).

The findings from the study would provide stakeholders with the relevant information to develop tailor-made strategies to address gaps in the routine immunization programme.

5.2 Limitations of the study

The study should have included a qualitative aspect which would have thrown more light on the factors affecting uptake. It would have also helped to capture comprehensively the perceptions, ideas, experiences and challenges parents/caregivers face in getting their children the vaccine.

The study design used for the study may present with selection bias during data collection because all households may be selected within a specific area in the cluster.

CHAPTER SIX

6.0 Conclusions and recommendations

6.1 Conclusions

In conclusion, out of the 298 children assessed, 90% were fully vaccinated with measles vaccine as against the 95% target recommended by the WHO. The coverages from the study revealed that all the sub-districts coverages for first dose of measles vaccine was at least 95%, however, Peki and Tongor sub-districts recorded 94% and 78% respectively for second dose of measles vaccine which was lower than the 95% WHO target.

Caregivers who were aged 20-29 years, 30-39 years, and 40 years and above were 7.3, 43.4 and 23.2 times more likely to have their children fully vaccinated compared to those aged less than 20 years. Also, caregivers who had two children were 86% less likely to have their child fully vaccinated compared to those who had one child.

6.2 Recommendations

The following recommendations are made based on the findings of this study.

The South Dayi District health directorate should:

i. Intensify public education on the benefits of childhood vaccination and completing the required doses. Emphasis should be placed on the second dose uptake which is administered when the child is older.

ii. Ensure monthly vaccination services are organised at creches (nursery schools) to vaccinate children who are due for vaccine and catch-up missed children especially in the urban areas.

iii. Conduct qualitative research into factors that may be associated with low vaccine uptake among young mothers of in the district.

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APPENDIX 1: QUESTIONNAIRE

FACTORS ASSOCIATED WITH MEASLES VACCINE UPTAKE AMONG CHILDREN IN SOUTH DAYI DISTRICT, VOLTA REGION

IDENTIFICATION

UNIQUE RESPONDED ID: ..... SUBDISTRICT……..

COMMUNITY:…….CLUSTER NUMBER: ……..

HOUSEHOLD NUMBER……. DATE……/……/…….

SECTION A: Parent/Caregiver's Socio-Demographic Information

NO.	QUESTIONS	RESPONSE
1	How old are you (age at last birthday)	[ ][ ]
2	What is the sex of Parent/ Caregiver	1) Male ( ) 2) Female ( )
3	What is your highest level of education	1) None ( ) 2) Primary ( ) 3) Secondary ( ) 4) Tertiary ( )
4	What is your employment status	1) Employed ( ) 2) Unemployed ( )
5	What is the type of employment	1) Self-employed ( ) 2) Government worker ( ) 3) Other (Specify) …….. 4) N/A
6	What is your marital status	1) Single ( ) 2) Married ( ) 3) Co-habiting ( ) 4) Divorced ( ) 5) Widowed ( )

7	What is your religion	1) Christian ( ) 2) Muslims ( ) 3) Traditional ( ) 4) None ( )
8	How many children do you have, including this child	☐☐
9	Birth order of child	☐☐
10	Place of delivery	1) Health facility ( ) 2) TBA Centre ( ) 3) Home ( ).
11	Place of Residence	1) Rural 2) Urban

SECTION B: Caregiver's Knowledge & Experiences with vaccination:

NO	QUESTIONS	RESPONSE
	Knowledge	
12	Have you heard of measles disease?	1) Yes ( ) 2) No ( ) If no, skip to Q 14
13	What harm does it cause to children?	……..
14	Have you heard of measles vaccine?	1) Yes ( ) 2) No ( ) If no, skip to Q 17
15	What does it do?	1) Prevents Measles ( ) 2) Other(specify)…….
16	How many times should your child receive the measles vaccine	1) One ( ) 2) Two ( ) 3) Don't Know ( )

	Experiences	
17	Has your child experience any AEFI before	1) Yes ( ) 2) No ( ) If no, skip to Q 19
18	If yes, what was it?	……..…… ……...
19	Do you believe vaccines are safe	1) Yes …… 2) No ……. If Yes, Skip next ques
20	If no, why are they not safe	……

SECTION C: Health Service-Related Factors

	QUESTIONS	RESPONSE
21	Have you sent the child for CWC before	1) Yes ( ) 2) No ( ) If no, skip to Q 26
22	Is the place of waiting at the vaccination centre convenient	1) Yes ( ) 2) No ( )
23	What is the average time you spend for your child to be vaccinated at the health facility	1) Less than 1 hour ( ) 2) 1-2 hours ( ) 3) More than 2 hours ( )
24	How do you rate the attitude of nurse/vaccinators	1) Good ( ) 2) Poor ( )
25	Do nurse give education on importance of vaccination	1) Yes ( ) 2) No ( )
26	Has your child ever been denied vaccination	1) Yes ( ) 2) No ( ) If no, skip next quest.

27	What was the reason for your child not being vaccinated	1) No vaccine and or the other logistics ( ) 2) Staff not present ( ) 3) Child was sick ( ) 4) Other(Specify)……
28	Have you ever paid for any service at CWC	1) Yes ( ) 2) No ( )

SECTION D: Community Related Factors

29	Distance to the nearest health facility or vaccination centre	1) Near [< 30mins] ( ) 2) Not too far [30mins-1hr] ( ) 3) Far away [> 1hr] ( )
30	Is the day (s) scheduled for vaccination in your community convenient	1) Yes ( ) 2) No ( )
31	Is your culture or religion against vaccination	1) Yes ( ) 2) No ( )

SECTION E: Child's Details and Immunizations Status

NO	QUESTIONS	RESPONESES
32	Age of Child (in months) Check from weighing card if available (Verify date of birth)	
33	What is the sex of child	1) Male ( ) Female ( )
34	Do you have a weighing card where child's vaccinations are written in? If yes, may I see it please	1) Yes ( ) 2) No ( ) If no, skip to Q 35

i. Copy dates vaccine was given from the card

	DD	MM	YYYY
BCG			
POLIO 1			
POLIO 2			
POLIO 3			
DPT/HepB/Hib 1			
DPT/HepB/Hib 2			
DPT/HepB/Hib 3			
PCV1			
PCV2			
PCV3			
Rota1			
Rota2			
Rota3			
MR			
Yellow Fever			
MEN A			
MR 2			

35	Did child ever have any vaccinations to prevent him/her from getting diseases?	1) Yes ( ) 2) No ( ) 3) Don't know ( )
36	Has child received Measles /MR injection-that is, a shot in the left upper arm at the age of 9 month or older	1) Yes ( ) 2) No ( ) 3) Don't know ( )

37	Has child received Measles /MR injection-that is, a shot in the left upper arm at the age of 18 month or older	1) Yes ( ) 2) No ( ) 3) Don't know ( )
38	Measles vaccination status of child	1) Fully vaccinated [2 Doses] ( ) 2) Partially vaccinated [1 Dose] ( ) 3) Not vaccinated ( )

APPENDIX 2: PARTICIPANTS INFORMATION SHEET

Title:

FACTORS ASSOCIATED WITH MEASLES VACCINE UPTAKE AMONG CHILDREN UNDER 5 YEARS IN SOUTH DAYI DISTRICT, VOLTA REGION

It is important that you carefully read or have it read to you and understand the various parts of this statement concerning the study. It describes the purpose, procedures, benefits, risks, and your rights throughout the study.

Purpose of study:

To determine factors associated with Measles vaccine uptake among children under 5 years in South Dayi District. **The findings from this research will enable the Ghana Health Service at national, regional and district levels, together with other stakeholders to develop appropriate plans and policies that will improve immunization coverage in children under 5 years.**

Explanation of procedure:

A structured questionnaire will be used to collect information on your socio-demographic details, knowledge and experiences with vaccination, health service-related factors and community related factors to uptake of measles vaccine among children under 5 years. The interview will not take more the 20 minutes to complete. About three hundred (300) participants will be recruited to participate in the study.

Benefits:

There is no direct benefit for participating in this study but the results will enable us to make recommendations to improve on measles vaccination and other vaccine coverages.

Risks

There is no anticipated risk during the interview except that we will take part of your time for the day.

Confidentiality:

Your identity as a participant will not be disclosed to any unauthorized persons and all information gathered will remain confidential.

Withdrawal from study:

Taking part in this study is completely voluntary. You have every right to refuse this consent. If you should refuse, you will not suffer any consequences, all services you receive at the health facilities will continue as usual. You are free to withdraw consent and discontinue participation in this study at any time if you so wish.

Costs and/or Payments for Participation:

There will be no costs to you and will not be paid either for participating in this study.

Funding source:

There is no external funding for this study. All the cost is being borne by Mr. Emmanuel Yaw Bonsu as part of his MPH study at the School of Public Health, University of Ghana.

Sharing of information from the study:

Findings from this study will be presented to the school of Public Health, University of Ghana as part of partial fulfillment of an MPH program. It will be shared with the management of South Dayi District Health Directorate, participants of the study and the scientific community worldwide.

At the community levels, we will integrate the dissemination of outcome into community meetings organized by the health professionals at the health facilities. The dissemination meeting will enable us share the outcome of the study with the community members and the caregivers.

Declaration of conflict of interest:

There is no conflict of interest.

Questions

In case of any questions concerning this study, call Mr. Emmanuel Yaw Bonsu, student at School of Public Heath, University of Ghana (SPH-UG) on 0248407520.

Questions regarding ethical approval for this study should be directed to the administrator of the Ghana Health Service Ethics Review Committee, Nana Abena Apatu on 0503539896 or email: ethics.research@ghs.gov.gh

APPENDIX 3: CONSENT FORM

TITLE: Factors Associated with Measles Vaccine Uptake Among Children Under 5 Years in South Dayi District, Volta Region.

PARTICIPANTS' STATEMENT

I acknowledge that I have read the purpose and contents of the Participants' Information Sheet or have had it read and satisfactorily explained to me in a language I understand (English □/ Ewe □/ Twi □). I fully understand the contents and any potential implications as well as my right to change my mind (i.e. withdraw from the research) even after I have signed this form.

I voluntarily agree to be part of this research.

Name of Participant…….

Participants' Signature ……...OR Thumb Print…….

Date: …….

INTERPRETERS' STATEMENT

I interpreted the purpose and contents of the Participants' Information Sheet to the afore named participant to the best of my ability in the (English □/ Ewe □/ Twi □) language to his/her proper understanding. All questions, appropriate clarifications sort by the participant and answers were also duly interpreted to his/her satisfaction.

Name of Interpreter…….

Signature of Interpreter……..

Date: ……..

Contact Details: ……..

STATEMENT OF WITNESS

I was present when the purpose and contents of the Participant Information Sheet was read and explained satisfactorily to the participant in the language he/she understood (English □/ Ewe□/ Twi □).

I confirm that he/she was given the opportunity to ask questions/seek clarifications and same were duly answered to his/her satisfaction before voluntarily agreeing to be part of the research.

Name: ……

Signature…… … OR Thumb Print …….....

Date: ……

INVESTIGATOR STATEMENT AND SIGNATURE

I certify that the participant has been given ample time to read and learn about the study.

All questions and clarifications raised by the participant have been addressed.

Researcher's name……

Signature ……

Date……

APPENDIX 4: ETHICAL APPROVAL

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

My Ref. GHS/RDD/ERC/Admin/App/23/119
Your Ref. No.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-681109
Email: ethics.research@ghs.gov.gh
20th February, 2023

Emmanuel Yaw Bonsu
P. O. Box LG 13
Legon, Accra

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 047/01/23**
Study Title	Factors Associated with Measles Vaccine Uptake among Children Under 5 Years in South Dayi District, Volta Region
Approval Date	20th February, 2023
Expiry Date	19th February, 2024
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Dr. Naa-Korkor Allotey
(Ag. Head, Ethics & Research Management Department)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra