VACCINATION COVERAGE AND ITS ASSOCIATED FACTORS AMONG CHILDREN AGED 2-5 YEARS IN ELDAS SUB COUNTY, WAJIR COUNTY

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Vaccination Coverage and its Associated Factors among Children Aged 2 - 5 Years in Eldas Sub County, Wajir County

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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DADICATION

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ABBREVIATIONS AND ACRONYMS

BCG	Bacille Calmette and Guerine
CDC	Centre for Disease Control and Prevention
DPT	Diphtheria, Pertussis and Tetunus
EPI	Expanded Program on Immunization
GIS	Geographical Information System
KDHS	Kenya Demographic Health Survey
KEMRI	Kenya Medical Research Institute
KNBS	Kenya National Bureau Statistics
MOH	Ministry of Health
MVS	Mothers' Vaccination Score
OPV	Oral Polio Vaccine
PCV	Pneumococcal Vaccine
PPS	Probability Proportionate to Size
SPSS	Statistical Package for Social Science
UNICEF	United Nation Children Fund
VPDs	Vaccine Preventable Diseases
WHO	World Health Organization

ABSTRACT

Childhood vaccination is crucial intervention to reduce the morbidity and mortality of vaccine-preventable diseases. It has been estimated that vaccination campaigns prevent almost 3 million deaths globally each year. However, in 2018, 19.4 million children worldwide missed all necessary vaccinations. In Africa, routine vaccination coverage remains particularly low. In Kenya, the North Eastern region has the lowest vaccination coverage; (41%). The study aimed to establish vaccination coverage and its associated factors among children aged between 2 and 5 years in Eldas Sub-County, Wajir County. The specific objectives entailed establishing individual level factors associated with complete vaccination coverage, assessing status of routine vaccination and to determine health system level factors associated with complete vaccination coverage among children aged 2 to 5 years in Eldas sub county, Wajir County. A cross-sectional design was employed on sample size of 367 caregivers. Respondents were chosen using probability proportion to size and systematic random sampling strategies. A structured questionnaire and key informants' guide were deployed for data collection. Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 25.0 with descriptive and inferential statistics generated. Chi-square test examined the relationship between categorical variables at confidence interval of 95%. Demographic findings showed that households were majorly male led with majority practicing Islami religion (98.1%) and 8.37% never attended school. A considerate percentage (40.1%) was in monogamous marriage arrangement, with only 23.2% in polygamous marriage. Sixty seven percent (67.9%) were unemployed while 23.2% earned between Ksh 6,001 and 12,000 a month. Radio ownership among caregivers was quite low. More than 21% (78 caregivers) attended to non-biological children. Caregivers with formal education were 3.47 times more likely to comply and have their children complete vaccination schedule (95% CI = 1.18 – 9.57, P = 0.032). Children of those earning more than Kshs 24000 a month were 3.18 times more likely to complete vaccination (95% CI = 1.27 – 11.67, P < 0.001) while those earning g between Kshs. 12000 - 24000 per month were 2.96 times more likely to complete vaccination (95% CI = 1.15 - 10.39, P = 0.002). Children with caregivers aware of vaccination's purpose were 4.51 and 2.57 times more likely, respectively, for complete vaccination (95% CI = 1.36 – 12.75, P < 0.001; 95% CI = 1.18 – 8.62, P = 0.031). Children born with skilled birth attendants were 5.36 times more likely for complete vaccination (95% CI = 2.15 – 13.21, P < 0.001). Children from places 1 – 5 km or 5 – 10 km from the hospital were 4.28 and 2.57 times more likely, respectively, for complete vaccination (95% CI = 1.28 – 14.87, P = 0.009; 95% CI = 1.54 – 6.88, P = 0.024). Content analysis was adopted in summarizing qualitative findings. More than ninety six percent (96.2%) of the children had been vaccinated atleast once. Distant location and lack of knowledge on immunization time were cited as major barriers to complete vaccination. Around 78.5% of the studied children reported experiencing a medical issue, 42.9% opined that atleast they were late on immunization schedule. Absence of personal issues among caregivers was associated with 2.29 increased likelihood of completing vaccination (95% CI = 1.41 - 3.75, P < 0.001). Knowledge on immunization further improved completion of immunization schedule by 5.53%. Qualitative findings also revealed a considerably high coverage attributed to strong community engagement and healthcare team dedication. The high coverage implied

increasing level of access, awareness and system strength in delivering immunization solutions to the children. The notable health system factors included lifestyle, information, access and logistics, income level, education and awareness. However, misinformation, societal beliefs, low economic capacity, language barrier and nomadic lifestyle contributed to vaccine hesitancy among caregivers. The study concluded that individual level factors associated with complete vaccination status were education, occupation, income level, and ownership of electronic devices significantly influenced complete vaccination status among children aged 2 to 5 years in Eldas sub-county, Wajir County. However, vaccination completeness performance was below the recommended set target by WHO and the Ministry of Health. Health system related predictors that explained complete vaccination status included availability of skilled healthcare professional, presence of well-equipped public healthcare facilities and caregivers' proximity to those facilities. It was suggested that the County Health Department should implement education outreach programs, support caregivers, enhance vaccination accessibility for lower-income families, use media for awareness campaigns, and address clinic shortages to improve vaccination coverage. It also recommends implementing subsidies or incentives to bridge economic gaps, leveraging electronic devices for vaccination knowledge, and enhancing healthcare infrastructure.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Vaccination coverage involves proportion of the targeted population that received recommended vaccines in the region as envisioned in the nationwide immunization schedule. The information on vaccination coverage is vital in identifying sub-populations with lower vaccination rates. It thus enables health authorities and stakeholders to targeted interventions while reducing the risk of outbreaks of vaccine-preventable diseases outbreaks (CDC, 2016). Childhood vaccination is a cost-effective critical primary health care intervention to protect children against childhood illnesses. It is proven to be the most successful public health intervention in reducing morbidity and mortality yearly (Odusanya *et al.,* 2015).

Globally, 19.7 million children (14%) had incomplete vaccination in 2020, 13.5 million (70%) of those who had incomplete vaccination, status did not receive Diphtheria Tetanus Toxoid and Pertussis (DTP) doses (UNICEF, 2020). Overall, DTP3 performance by the 194 WHO member states who achieved >90% coverage increased from 123 (63%) countries in 2017 to 129 (66%) in 2018(WHO, 2019). From 89% in 2010 to 90% in 2018, the global coverage of the first dose of the diphtheria, tetanus, and pertussis vaccination (DTP1) stayed largely steady. The third dosage (DPT3) recorded slight growth reaching 86% in 2018 compared to 84% in 2010. There was noticeable decline in dropout rate of DTP1 to DTP3, from 6% to 4% in the same period. The first dosage of measles vaccine (MCV1) recorded a 2% increment from 84% to 86% in the same period. However, countries that provided second MCV dose (MCV2) dose reported significant growth from 19% to 54% between 2017 and 2018. The MCV2 coverage in children aged 3–14 years, improved almost by a half, from 36% in 2007 to 69% in 2018. The worldwide difference in MCV1 and MCV2 coverage was 17% in 2018. The global coverage for completed Rotavirus 35%, four times increase from in 2018. Similarly, there was an increase in coverage for Pneumococcal Conjugate Vaccine (PCV) from 11% to 47%, rubella vaccine increased by almost a half from 35% to 69%, Hib also increased by 32%

(40% to 72%), and Hep B birth dose increased from 28% to 42% while third dose series increased from 73% to 84%.

Worldwide, an approximately 3 million deaths are averted through vaccination intervention activities annually. It is projected that improvement in vaccination coverage could reduce the number of related deaths by 1.5 million (WHO-UNICEF, 2019). Globally, vaccine preventable diseases are responsible for more than 29,000 daily deaths of children below age of five (Animaw *et al.,* 2014). In developing countries, nearly 8 million children die annually prior to their 5^{th} anniversary of birth, majority of whom at the initial year after birth (Animaw *et al*., 2014). In 2018 alone, of children in Brazil, Angola, the Democratic Republic of the Congo, Pakistan Ethiopia, Indonesia, Nigeria, Iraq, India, and South Africa did not receive recommended immunizations doses (Andre et al, 2018). In 11 nations, including Angola, Guinea, Chad, Samoa, Equatorial Guinea, Nigeria, Somalia, the CAR, South Sudan, Ukraine and Syrian Arab Republic, the DTP3 coverage was less than 60%. Through 2030, it is expected that there will be more births in ten of these eleven countries, overstretching vaccines delivery and vaccination coverage lower.

If vaccination coverage exceeds 90%, full protection against diseases that can be prevented by vaccine is reached. Immunizations have proven to be the most effective public health initiative in history, despite reaching 86% of children. There has been a rising trend in coverage by only 5% in the past ten years and then it plateaued out. While vaccination rates in the Western Pacific and the Americas are dropping, there is a significant disparity between the European and African regions, with the European region having a coverage rate of 18% and the African region having a coverage rate of only 12%. The variation implies relatively higher uptake in Europe but overall low coverage in both regions as Western Pacific and Americas signal a broader downward trend globally. The Southeast Asian Region and the African Region, in particular, have over 20 years of such performance (Dao & Brieger, 2017).

Africa continues to record low rates of routine immunization. The prevalence rate has remained relatively low for the past years with 79% of countries failing to attain

the 2015 target. Over 15.5 million children lacked access to a single immunization dose. The number was quite high that it surpassed the cumulative total of all the other members affiliated to the WHO. The situation is worsened by the statistics that 20% of the children have no access to basic vaccine coverage. The skewed immunization in the region explains the rise in deaths associated to vaccinatable diseases among children; 42% of global measles deaths can be traced to Africa.

The continents demographic growth continues to outperform other regions despite weak healthcare systems and absence of a robust immunization program to guarantee safety of the newborn. The current status point to the drive for African countries to amplify their efforts in the quest to fill gaps in the recent past. This is inline with the 2007 declaration on reduction of vaccine preventable diseases deaths. The realization of immunization targets has been derailed by the systemic gaps and structural bottlenecks (CDC, 2016).

The leading countries with under-immunized children include South Sudan, Guinea, Nigeria, Ethiopia and Democratic Republic of Congo (UNICEF, 2020). Countries such as Chad, characterized with frequent security instabilities, have persistently recorded low coverage with only 335 of children vaccinated by 2018. Analysis showed no sex variations; however, inequality was evident in birth order, age of the mother during birth, sex of the head of the household as well as place of residence. The mother's level of education has also been found to be significant in various regions, wealth quintiles established a huge deprivation outline, whereas vaccination coverage was consistently low in quintiles 1 to 4 and improved abruptly in quintile 5. When subjected to further adjustment for other variable, the odds of immunization changed to 2.5 times higher in the wealthy than the underprivileged quintile and twice as high in mothers with secondary education. (WHO/UNICEF, 2019).

The health system factors such as staffing levels, service attitudes, service integration, cold chains and distance, shape outcomes in immunization coverage. Studies have cited failure in health system factors such as ineffective communication, support, or follow-up as major causes of low uptake of immunization services (Bhanot et al., 2004). In South Sudan, out of stock vaccines

for antigens defined weak accessibility for immunization among children (Kunjok *et al.,* 2021). Other studies have reported lack of national wastage rates which could result in inaccurate forecasting, leading to vaccine shortages or overstocking and expiration of vaccines at service delivery points (Bol *et al.,* 2021).

Two fifth of one-year old children in Nigeria are receiving DTP 3 vaccine. Females and males showed identical levels of coverage. However, considerable variations were detected in all other studied variables. Vaccination coverage among first-born children was even better at as twice higher compared to coverage among sixth born children. In household headed by females, coverage was 24 percent higher, and then there was an increase in coverage by mother's Age at birth by 20 percent from 22% in 15–19-year-olds to 42% in 20–34-year-olds. Mother's level of education was a significant factor for immunization; it was 2.5 times more prevalent among urban dwellers compared to those residing in rural areas. Children in richer backgrounds also exhibited better coverage and mothers of higher education level. Vaccination coverage was weakly associated birth order, place of residence after adjusting. However, child's sex was not a significant factor. On the hand strong associations were obvious among the education level of mothers, household income levels and sub national areas (WHO/UNICEF, 2019).

The Kenya national Expanded Programme on Immunization's (EPI) recommends that at birth, Bacillus Calmette-Guerin (BCG) and Oral Polio Vaccine (OPV) are administered alongside subsequent dosage of pentavalent vaccine and OPV which are given at intervals of 6^{th}, 10^{th} and 14^{th} weeks of age respectively. The measles vaccine is recommended at the ninth month after birth (Diekema, 2014). In Kenya, vaccination coverage has improved from 70% in 2017 to 82% in 2018 (ministry of health, 2018). However, even with improvements in vaccination coverage, under-five remain not fully immunized. Despite the impressive gains in child survival, further gains will be difficult without increasing vaccination coverage (KEPI, 2018). In Kenya, nine out of 10 one-year-olds were covered by immunization; The; under-5 mortality rate is 52 deaths per 1,000 in the five years preceding 2014 (KNBS, 2014), of the which majority are due to vaccine-preventable diseases. The Northeastern

region (41%) had the lowest coverage, and the highest coverage was reported by the Central region to have been fully vaccinated (96%) (KDHS, 2022).

1.2 Statement of the Problem

All nations were urged by the Global Vaccine Action Plan 2011-2020, which was convened in 2012, to achieve >90% vaccination coverage for all vaccines on the national routine immunization schedule by 2020.The routine vaccination coverage among children in developing countries is below the WHO and UNICEF targets. The vaccination coverage is above the target in most developed countries but way below the target in developing countries. Globally, only 40% world health assembly member states achieved 90% national full vaccination coverage in 2015. In the African region, 79% of the countries had not achieved the targets by 2015 (UNICEF, 2016). The vaccination in Kenya improved from 70% in 2017 to 82% in 2018 however, it is still below the target. (Ministry of health, 2018) and world health organization target of 90% (WHO, 2020) and in Northeastern region only 41% of children in the region are fully vaccinated (KDHS, 2022).

Globally of the 3 million people who pass away from lack of vaccination, about 1.5 million are children under the age of five (WHO, 2019). Routine vaccination remains out of reach for many children in less developed regions. The limited access to recommended immunization schedule tends to worsen the chances of contracting vaccine preventable diseases, yet this category of infections has been linked to high morbidity and mortality rates frequently witnessed in poor countries (UNICEF, 2018). Due to a lack of vaccination, infant mortality and life expectancy differ greatly in underdeveloped nations (WHO, 2017). The low-income nations are at varying phases of healthcare development and the frequent low budgetary commitments often translates into limited immunization coverage.

The WHO reported the incidence of circulating vaccine-derived poliovirus type 2 (cVDPV2) on July 11th 2023 in Hagadera refugee camp, the world's second-largest, with 100,000 refugees. Genetic analysis linked four cVDPV2 cases, two AFP patients, and two asymptomatic children from Garissa County. All cases were from Hagadera, a region with close ties to Somalia. Kenya's polio vaccine coverage in

2021 was 91%, but Hagadera's was 77% in May 2023 (Makokha *et al.,* 2023). Tuberculosis is a major issue in Kenya, with Turkana County's 18% prevalence exceeding WHO recommendations. In 2019, Mandera reported two TB cases and 20 TB-related deaths. Hepatitis B is a growing concern, with Mandera County reporting 13.9% prevalence and Garissa 14.1%.

Immunization varies across Kenyan counties, with Vihiga at 96% and Wajir as low as 6.6% (Kahenda, 2023). HPV vaccination campaigns target thousands of girls, and research suggests early sexual activity among children in low-income settlements (Astariko, 2019; Karanja, 2022; Makong, 2020). The recent measles outbreaks in multiple Kenyan counties are attributed to South Sudanese refugee influx (Mamuti *et al.,* 2022). Yet nomadic communities in Wajir face significant challenges in accessing immunization healthcare services. In some cases, they must walk between 15 and 30km to access a health facility (Wamuswa, 2025). The County leap from the dire immunisation coverage of about 48.6% as currently stand and strives to meet the 90% target for the country (Kenya Demographic Health Survey).Vaccine-preventable illnesses are a significant contributor to childhood disability. The widespread eradication of paralytic polio in children represents the archetypal case of immunizations averting catastrophic disability. Prior to widespread use of the measles vaccine, measles was the leading cause of blindness in children in developing countries, accounting for an estimated 15,000-60,000 cases every year, its has also been associated with severe neurological disabilities including post-infectious encephalitis and subacute sclerosing panencephalitis (SSPE). The health complications associated with lack of vaccination could lead to 40% higher chances of developing lifelong neurological defects. These complications also increase the risk of recurrent morbidities in children.

Vaccinations are the bedrock of developing nations' public health initiatives because they are essential to their economies. Economic growth has been demonstrated to be slowed by poor health, whereas both social and economic development can be boosted by excellent health. The annual return on investment for vaccinations has been estimated to be between 12% and 18%, although the financial advantages of better health are still frequently ignored. Funding is needed for infrastructure (such as

cold-chain maintenance), the acquisition of vaccinations, and sufficient staffing for immunization programs. However, the reduction in mortality and morbidity also results in long-term financial savings and future economic growth. The direct cost saving benefits of a fully vaccinated population translates to $540 billion with enormous social gains (UNICEF, 2017).

Immunization has a positive impact on individual and community health, thus by keeping children healthy, immunization lengthens life expectancy and the time spent on productive activity. Healthy children perform better at school and healthy adults are both more productive at work and better able to attend to the health and education of their children (UNICEF, 2017). Despite the numerous strategies to increase the coverage of childhood immunization, there has been low uptake among the residents in Wajir County (KDHS, 2022). The study therefore sought to establish drivers of vaccination coverage among children below age of five in Eldas Sub County, Wajir County.

1.3 Justification for the Study

Vaccination is considered an essential health service, and its coverage is central to the realization of the sustainable development goal on promoting health lives while advancing wellbeing of all at all ages (United Nations General Assembly, 2015). This therefore implies that real-time monitoring of coverage prevalences inform policy interventions and decision making at top level. In addition, the findings directly support the Bottom-Up Economic Transformation Agenda’s (BETA's) goals and the broader health sector objectives. The study has the potential to inform evidence-based policies and resource allocation, ultimately contributing to improved healthcare access, reduced financial burdens, and better health outcomes for the population, aligning with the overarching aim of socioeconomic development in Kenya. The findings of this study will be of importance since it will cover the gap of the limited studies done in the study area. The findings may also be of help to the health department in Wajir County in establishing the levels of vaccination coverage in the county especially in Eldas Sub County. The choice of Eldas was informed by its low and poorly documented vaccination coverage in a pastoral and hard-to-reach

settings. The study will also be of importance to policy makers and other stakeholders in health in establishing those determinants that influence successful coverage among the children in pastoral communities. The findings could provide the basis for seeking alternative and customized interventions in addressing identified gaps in underlying determinants. This could hence give strategic direction on specific approaches that could be adopted in enhancing implementation of vaccinate coverage in areas such as Eldas Sub County.

1.4 Objectives of the Study

1.4.1 General Objective

To establish vaccination coverage and its associated factors among children aged 2 to 5 years in Eldas sub county, Wajir County.

1.4.2 Specific Objectives of the Study

1. To establish individual level factors associated with complete vaccination coverage among children aged 2 to 5 years in Eldas sub county, Wajir County.
2. To assess the status of routine vaccination among children aged 2 to 5 years in Eldas sub county, Wajir County.
3. To determine health system level factors associated with complete vaccination coveraged among children aged 2 to 5 years in Eldas sub county, Wajir County

1.5 Research Questions

1. What are the individual level factors associated with the attainment of complete vaccination coverage among children aged 2 to 5 years in Eldas sub county, Wajir County?
2. What is the status of routine vaccination among children aged 2 to 5 years in Eldas sub county, Wajir County?
3. What are health system level factors associated with complete vaccination among children aged 2 to 5 years in Eldas sub county, Wajir County?

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

According to WHO, a child is considered completely vaccinated if s/he has been recipient of atleast one of the BCG doses, three DPT doses, polio vaccine, as well as a dose of measles vaccine. It recommends the administering of BCG vaccine at birth or during the first visit to the clinic. The BCG vaccine is crucial in preventing Mycobacterium tuberculosis, a bacterium responsible for tuberculosis. It also strengthens the child's immunity against diphtheria, tetanus, and pertussis inflections. The administering of polio and DPT vaccines should be done in three visits, at sixth, tenth and fourteenth week while measles should be administered just after the age of nine months. The WHO further advises that children complete their vaccine program before they attain the age of 12 months.

Since the establishment of Expanded Programme on Immunization in 1974, there have been international initiatives to increase the benefits of vaccines for all - populations and nations. National vaccination programs have been implemented all over the world, and since their inception, they have been impacted by cutting-edge technological advancements, evolving vaccine delivery techniques, and innovative business models. Past and contemporary global campaigns and activities have helped vaccinations become more widely available and more beneficial to a variety of geographic locations and demographic groupings. However, not all children receive the same chance to benefit from vaccinations (WHO, 2015).

The Strategic Advisory Group of Experts lists five considerations that are necessary to realizing results in vaccination coverage campaigns. This involves quality utilization of data, degree of community involvement, better access to immunization services for marginalized and displaced populations, strong health systems, and access to vaccines in all locations at all times. In order to overcome immunization gaps and provide everyone with lifesaving vaccines, it is imperative that

governments prioritize and adjust their vaccination policies and operational plans (Arsenault, *et al*, 2017).

Four out of every five children worldwide receive vaccination against several deadly diseases. Childhood immunization is a key intervention to promote children's health, well-being, and survival. Childhood immunization is the most effective and economical public health measure in terms of averting mortality.

Childhood immunization is the most efficient and cost-effective public health measure in terms of the annual number of deaths prevented (Odusanya *et al.*, 2015). Annually, out of 3 million people that die from vaccine preventable diseases, half are children below 5 (WHO, 2017). For the case of developing countries, the situation worsens as more than 8 million deaths are recorded among children in their earlier stages of growth (Animaw *et al.*, 2014). From 1999 to 2003, Kenya recorded 115 fatalities per 1,000 live births; from 2004 to 2008, 74; and from 2009 to 2014, a further 30% decrease to 52 fatalities per 1,000 persons (KNBS, 2014).

Following successful elimination of measles in the United States in 2015, global concerted efforts under the stewardship of Pan American Health Organization (PAHO) brought together critical stakeholders and partners including state and non-state actors such as UNICEF, Bill & Melinda Gates Foundation and Rotary International. The collaboration has been central to achieving vaccination coverage; the campaign has resulted in a 99% decrease in measles cases and a reduction of measles cases worldwide. In many developed nations, PAHO was able to eradicate tetanus in pregnant women and newborns due to improved hygiene during childbirth. Since 2000, more than 128 million women of reproductive age in at-risk countries have gotten two doses of the tetanus toxoid vaccination, which, according to UNICEF (2014), has significantly contributed to this drop.

Eighty two percent of infants worldwide have received the DTP3 vaccine; nevertheless, 23.5 million children did not have the chance to do so in 2008 (WHO & UNICEF, 2008). Even though 90% of DTP3 vaccinations were administered in 120 countries in 2008, areas of under-vaccination have been noted in some sub-Saharan African countries (WHO, 2009). In Kenya, 77.4% of 12- to 23-month-old children

have gotten all advised immunizations (KNBS & ICF Macro, 2009). However, this percentage fluctuates; in Northeastern Province, it was 48.3%, while in Central Province, it was 85.8%. This provincial difference in Vaccination coverage reflects variation in vaccination determinants of complete vaccination (Mutua *et al.,* 2011).

The Kenyan government is committed to enhancing both equity and access to basic health care services and ensuring that the health sector fulfils its crucial role in achieving the goals of both Vision 2030 and the Medium-Term Plan (MTP) 2008-2012. Kenya pledged to meet these goals by 2015 as a signatory to the Millennium Declaration and its internationally agreed-upon Millennium Development Goals (MDGs). These and other international objectives have been incorporated by Kenya into its national objectives. To inform and direct local priority setting and resource allocation, these are further translated into county and sub-county level targets as part of the MOH's yearly operational plan. The achievement of the aims by Vision 2030's specific results represents MOH putting the annual operational plans into practice (MOH, 2019). The Division of Vaccines and Immunization (DVI) is tasked with executing vaccination program in the country. The division was founded in 1982 under the supervision of the Department of Preventive and Promotive Health Services. The establishment was part of the wider initiative to transform the Ministry of Health under the umbrella of Kenya Expanded Programme on Immunization (KEPI). To concentrate on managing vaccines and immunization programs in Kenya, it was renamed the Division of Vaccine and Immunization (DVI) in 2008 (DVI, 2018).

The Division of Vaccine and Immunization's mission is to decrease morbidity, mortality, and disability brought on by infections that may have been prevented through vaccination. The Kenyan government provides free vaccinations against diseases that can be prevented by vaccines through DVI. Measles, yellow fever, pneumococcal illness, diphtheria, whooping cough, tetanus, hepatitis B, and *Haemophilus influenza* type B have been given priority over the time period. The Government has previously stated their intention to introduce the rotavirus vaccine to GAVI. However, the introduction of the rotavirus vaccination was scheduled for 2013, subject to GAVI support being available.

2.2 Vaccination Coverage for the Routine Vaccines among Children Under Five Years of Age

The Global Vaccine Action Plan 2011-2020 (GVAP) laid down the framework for countries to attain 90% coverage 2020. The target was to be realized through concerted efforts geared towards adherence to routine immunization schedule by 2020. Estimates from the WHO and UNICEF (2010) reveal varying coverage between 84% and 86% for the third doses of polio, diphtheria, tetanus, and pertussis vaccines as well as the initial dose of the measles-containing vaccine (M-CV1). Despite the population of surviving infants dropping, there have been considerable improvements in routine vaccination coverage globally since 1974. In 2016, almost 123 million children, equivalent to the 91% of the global infants population, received at least one dose of the DTP vaccine during infancy, while nearly 117 million (or 86%) completed the series. However, 71 countries (37%) have not attained the 2012-2020 Global Measles and Rubella Strategic Plan aim of 90% national MCV1 coverage, and 64 (33%) countries have not yet attained the GVAP target of 90% national DTP3 coverage. Additionally, since 2010, the rates of DTP3 and MCV1 coverage have remained unchanged.

Kenya Expanded Immunization Program (KEPI) aimed to provide tetanus toxoid vaccinations and immunizations against six deadly childhood diseases. It covered diseases such as tuberculosis, polio, diphtheria, whooping cough, tetanus, and measles to the children prior to reaching 1 year. Prior to 1980, need based model was employ-ed in providing access to immunization services across primary learning institutions and larger health centres. The National Public Health Laboratories (NPHL) under the stewardship of the MoH was actively involved in producing cholera and smallpox vaccines-. They also conducted surveillance to detect any outbreaks of these diseases to inform swift stakeholder intervention. Due to its function in monitoring and responding to diseases of public health importance, all emergency vaccines, including those for cholera, hepatitis B, typhoid, rabies, and anti-snake venom, were kept in the NPHLs. The NPHLs was central to coordinating the adoption of additional emergency vaccines with the exception of cholera. In the 1980s, cholera had been discontinued due to low efficacy levels. In the 1970s,

smallpox had been eradicated as a result of demands from international travel regulations which mandated compulsory immunization for cross-national travelers.

The performance of routine immunization services has been declining over the last three years. Tetanus toxoid, Pentavalent, measles, and BCG vaccine uptake have been below average. The ineffective performance is caused by difficulties that have emerged within immunization programs, the healthcare system, and areas beyond the public health sector. Inadequate funding for the purchase of vaccines and immunization operations, cash flow issues of the allocated funds from Treasury to Ministry of Health resulting in an untimely flow of funds despite the timely plans of financial requirements, poor road network, poor caregiver health-seeking behaviour, and inaccessibility of immunization services due to distant health facilities, particularly among nomadic communities.

Lack of vaccine supplies at the locations where services are needed, and little community involvement in the design of health services. Lack of sufficient human resources because of an extreme shortage, an uneven distribution of the current health workers, a lack of the necessary skills, lack of knowledge, low motivation-, poor support from management at all levels, and insufficient transportation to supply vaccines and support health facilities are some contributing factors (WHO, 2023). Support supervision has been irregular, poorly organized, unplanned, and not data driven. Opportunities have been lost because of the health care workers' poor attitudes and limited knowledge of immunizations. Additionally, due to a lack of necessary expertise, social profiling, and insufficient human resources at service delivery points to provide immunizations, the health workers are not proactive in looking for missed opportunities, and the number of districts has increased leading to insufficient funds and resources for programmatic management, including the purchase and maintenance of cold chain equipment and lack of communication strategy and plan to create demand for immunization services due to lack of necessary expertise, inadequate human resources at service delivery points to provide immunization services (KDHS, 2022).

2.3 Childhood Immunization Schedule in Kenya

KEPI was established in June, 1980 by the Kenya government to oversee and monitor vaccinations to all children in the Republic of Kenya. Initially, it targeted the five common diseases, however, the scope has been expanded to include additional vaccine as a result of changing child health dynamics. Kenya Expanded Programme Immunization Schedule.

Table 2.1: Kenya Expanded Program on Immunization Schedule

VACCINE	SCHEDULE
BCG	At birth
OPV	At birth, 6, 10 and 14 weeks
PNEUMOCOCCAL VACCINE	6, 10 and 14 weeks
DPTHIBHEPB	6, 10 and 14 weeks
ROTAVIRUS	6 and 10 weeks
MEASLES	9, 18 months
YELLOW FEVER	9 months (Available in Isiolo, Garissa, Mombasa, Kisumu and Nairobi Counties)

(KDHS, 2022)

2.4 Common Vaccine-Preventable Diseases

Vaccine-preventable diseases present a formidable challenge to public health, with each posing distinctive threats and symptoms. Tuberculosis, an infectious illness transmitted through droplets, manifests with symptoms such as fever, wasting, and a deep chesty cough. Beyond its potential lethality, tuberculosis weakens the immune system, heightening susceptibility to other diseases. Similarly, acute poliomyelitis, or Infantile Paralysis, is a rapidly contagious disease transmitted through droplets and faeces. This illness can lead to pain, flaccid paralysis of the limbs, fever, and vomiting, potentially resulting in death and permanent deformities. The urgency of vaccination against poliovirus is underscored by its highly contagious nature and the severe consequences it inflicts.

Pertussis often spread through droplets, often trigger severe cough, distinctive whoop or vomiting among children. Whooping cough has become so prevalent among

children aged below one, posing serious threat of malnutrition or triggering serious negative health outcomes. Vaccination is vital in breaking the vicious cycle of transmitting this infection among the exposed populations. Under the same category, poliomyelitis and tuberculosis form the basis of early childhood vaccination efforts moreso in vulnerable communities. Other life-threatening infections include Diphtheria characterized with breathing and swallowing difficulties among the victim. Furthermore, tetanus impairs the central nervous systems, as a result, mothers should be vaccinated to prevent exposure to tetanus toxins. This prevents both the expectant mother and the unborn child from the disease. Measles attack the respiratory track then spread to the rest of the body, triggering blindness, undernourishment and in severe cases or if left unchecked could easily lead to death. The current vaccines are also tailored to safeguard populations against Rotavirus, Yellow Fever, Hepatitis B and Haemophilus Influenza B which equally pose life threatening implications among the victims, including under age children.

2.5 Immunization Awareness

The World Immunization Week in April of every year is marked with the aim of encouraging adoption of immunization services as mechanism to protect the population against vaccine preventable infections. The rising innovations and continued research have enhanced efficacy of these vaccines while reducing the burden of affordability. Despite the remarkable progress towards global vaccination coverage, the gap among children remain significant with upto 20 million remain either under or unvaccinated at all. The campaign honours vaccination heroes from across the world, including parents, community members, health professionals, and innovators, who work to guarantee that we are all protected thanks to the effectiveness of vaccines. This year's theme is Protected Together: Vaccines Work. The campaign's major objective is to increase awareness of the crucial importance of receiving all recommended immunizations throughout one's life. Increasing access, the elimination of poverty and the attainment of universal health care are all dependent on immunization. Every child has a chance to have a healthy life from the time they are born until they are old due to routine immunization, which offers a point of contact for health care at the beginning of life. Additionally, immunization is

a key strategy in addressing other health concerns, such as reducing antimicrobial resistance, controlling viral hepatitis, promoting adolescent health, and enhancing prenatal and neonatal care.

2.6 Factors that Influence Vaccination Coverage

How frequently people use vaccination services may depend on a variety of variables, including maternal characteristics, the child's gender and birth order, the hospital where the baby was delivered, the antenatal care (ANC) follow-up, the family's income and financial status, and awareness. The primary determinants influencing vaccination coverage and service usage among children are knowledge of vaccines, vaccine-preventable diseases, and residence.

2.6.1 Age of the Mother or Caregiver

Since the mother's health affects the baby's health both before and after delivery, maternal health and child health are strongly related (UNICEF, 2017). The age of mothers has an impact on services for prenatal care that are used and younger women were 2.26 times more likely than older mothers to fully immunize their children (Odusanya et al, 2015).

2.6.2 Marital Status

Various studies have sought to establish the connection between marital status of the caregiver and completion of vaccination among children. Some studies have established that marital status significantly predict successful implementation of expanded immunization initiative (Yomi, 2012). Wealthier mothers are more likely to attend the first visit than poorer mothers. The education and wealth level of women have a major influence on their health-seeking behaviour as well as on child survival. Children from more affluent communities have access to better housing and healthcare. According to reports, urban young children consistently have greater immunization rates than those who live in rural areas (Doctor, 2012).

2.6.3 Level of Education

For the good utilization of healthcare services, parental education is beneficial. The education of the mother is a significant independent factor in lowering the under-five mortality rate (Breiman, 2014). Compared to mothers with no education at all, mothers who completed primary school had a lower likelihood that their children will receive all recommended vaccinations (Jamil et al, 2016). In Nigeria, it was reported that parents who had acquired formal education were more likely engage their children in vaccination program compared to those without formal education (Babalola, 2005). Formal education plays an important role towards adherence to vaccination schedules. It informs aspects such as time intervals and the entire procedure that drives high acceptance and compliance among caregivers. Educated women are more likely to marry and have their first child during their reproductive years than uneducated women, who give birth before and after their reproductive years, which results in lower birth weight and poorer health status for the child. Children born to educated mothers have a lower mortality risk (Darlene, 2013).

Education gives a woman the capacity to obtain necessary health care services, such as antenatal care, prenatal care, and infant immunization (Becker, 2016). Education increases a mother's chances of immunizing her children by three times (Breiman, 2014). Because educated women are more likely to marry and have their first child during their reproductive years than are uneducated women, who give birth before and after their reproductive years, which results in lower birth weight and poorer health status for the child, children born to educated mothers have a lower mortality risk (Darlene, 2013) Children from more affluent communities have access to better housing and healthcare. According to reports, urban young children consistently have greater immunization rates than those who live in rural areas (Doctor, 2012).

2.6.4 Religion

The research does not provide a clear explanation of how religion affects a child's ability to receive all recommended vaccinations. Religious ideas and values may have an impact on health outcomes. In a study on religious affiliation and immunization rates in Sub-Saharan Africa, children of Christian households often

had higher immunization rates than children of Muslim families, although a small number of Muslim communities also had higher immunization rates (Costa *et al.,* 2020). Nigeria, Ethiopia, and Chad all had poor immunization rates. This may indicate a higher coverage when immunization services are made available to both Christian and Muslim groups (Costa *et al.,* 2020). In other studies, it has been ascertained that religion has no significant influence on children's complete vaccination. Low vaccination coverage among different religious groups could be due to a lack of awareness of immunization services (Costa *et al.,* 2020).

2.6.5 Birth Order

Birth order and vaccination coverage are highly connected. According to Ethiopia Demographic and Household Survey (2005), uptake for vaccines tend to decline with rise in birth order. Only 27% of first born children and 28% of the six and above birth orders reported full vaccination status. In rural Mozambique, a study by Jagrati *et al.* (2008) home-born children reported a 2.27 times higher probability of not finishing their vaccination regimen. The variables that are connected to children's immunization status are maternal health service use, including prenatal care, mother's TT status, and place of delivery. Studies further indicate that mothers who adhere to ANC schedule and manage to give birth in health facility have higher likelihood of fully vaccinating their children. The study further claims that a child's immunization history is impacted by the presence of a delivery attendant.

2.6.6 Knowledge, Attitude, and Practices of Caregivers

Another element that influences the child's immunization status is knowledge. These include one's understanding of vaccinations and one's perspective on diseases that can be prevented by vaccines. Lack of information with mothers and caregivers is common, according to a qualitative study on the factors that contribute to poor utilization and low accessibility to immunization undertaken in South Sudan (Kunjok *et al.,* 2021). In another study conducted in Saudi Arabia, most mothers had a very positive attitude and 95% of them thought that vaccination was beneficial. They were also knowledgeable about the symptoms of vaccine-preventable diseases (Almutairi *et al.,* 2021). These factors depend on effort and commitment to a robust

immunization program by the ministries of health in different countries and vaccination coverage differs from country to country. In a systematic review on barriers to childhood immunization in sub-Saharan Africa, caregivers several cited, trust, long waiting time, providers' hostility, parent's forgetfulness, inconvenient time, and language barrier as impede accessing and utilizing immunization services (Bangura *et al.,* 2020).

2.6.7 Lost or Forgotten Health Cards

Health cards are essential for parents to monitor the provision of immunization services for their children. They serve as a reminder for parents to schedule prompt immunization appointments. Findings in Africa and Asia suggested that missing or lost cards were common and hindered vaccine uptake. Some women become frightened, and dread being shouted at by healthcare professionals when they are requested to go home and retrieve the forgotten card after losing their cards (Brown, 2021).

2.6.8 Fear of Side Effects

There are typically mild side effects like rash, fever, or redness. The fear of side effect is influenced by various factors including stereotypes, first-hand experience or social influence. A poorly administered vaccine or unreceptive immune system of the child could have significant side effects. Studies reveal that parents in Somalia and Liberia declined vaccination of their children largely due to concerns associated with the vaccine side effects (Bender & Macauley, 1988). Parents refuse to vaccinate their younger children since an older sibling experienced ill effects (Bhanot *et al.,* 2004).

2.6.9 False Contra-Indications

Due to a variety of anxieties, false contraindications, and erroneous beliefs, such as being underweight and receiving numerous vaccinations in one visit, health care workers may fail to immunize children. The measles vaccine is "too old" for children over the age of one (WHO, 2009). Many countries experience vaccination sessions that are cancelled, delayed, or cut short in certain health facilities. This happens

because of a lack of per diem, vaccines, or other supplies (WHO, 2009). The absence of suitable immunization services supplied on limited days and hours hinders service delivery in Kenya, as women delay or skip immunization days and lose faith in the health care services offered (Kisiangani *et al.,* 2020). In Indonesia and Somalia services were available early in the day before mothers' busy schedules of activities.

2.6.10 Accessibility to Health Facility/Health System Factors

Health facility is an important component that helped the child receive all of his or her vaccinations. Numerous studies have demonstrated the significance of health facilities' accessibility and availability for vaccination coverage. Communities that are closer to the medical center have a higher rate of immunization completion than those that are farther away. Inherent obstacles in the health system, such as poor cold chains, vaccine and supply shortages, and extensive travel times to the nearest medical facility, prevent last-mile distribution of vaccines to beneficiaries.

In Kenya, it was found that children that had to travel 2 hours or more to the nearest immunization centre were less likely to miss out on immunization schedule (Jama, 2020). An Indian study on the effect of sociodemographic factors on children's immunization rates revealed a strong correlation between place of residence and the percentage of children who received all recommended vaccinations (Islam *et al*., 2021). Children drawn from rural areas were associated with higher complete coverage compared to those from urban regions (Islam e*t al.,* 2021). This could be explained by increased awareness among rural parents and access to social inclusion measures in developing facilities in low-income rural areas. Contradictory results were found in Ethiopia where urban children recorded better complete vaccination adherence (Tamirat & Sisay, 2019). The discrepancy could be explained by different demographics, culture and policy interventions between India and Ethiopia. In South Sudan, a qualitative analysis of antecedents of weak accessibility and poor utilization of immunization initiatives, respondents indicated being turned away due to out-of-stock vaccines in the health facilities and beyond-limit vaccination days for antigens, such as BCG and measles vaccines. Vaccine stock and other supplies and cold chain breakdown were also identified to contribute to low coverage. The vaccine stocks

discouraged caregivers or mothers to return their children for subsequent doses (Kunjok *et al.,* 2021).

2.6.11 Waiting Time

Even though public health centres with poorly structured healthcare services have a small workforce, most children receive their vaccinations in these health facilities (Kanja *et al.,* 2021). While waiting for hours to receive the immunization in Uganda, almost 30% of women in Liberia complained about the inconvenience (Bender &Macauley, 1988; Africare, 2005). Low immunization uptake was caused by ineffective communication, support, or follow-up (Bhanot *et al*., 2004).

2.7 Conceptual Framework

Figure 2.1 shows the conceptual framework which explains the relationship between the independent variables such as, occupation, education, religion e.tc) and the outcome/dependent: variable vaccination status.

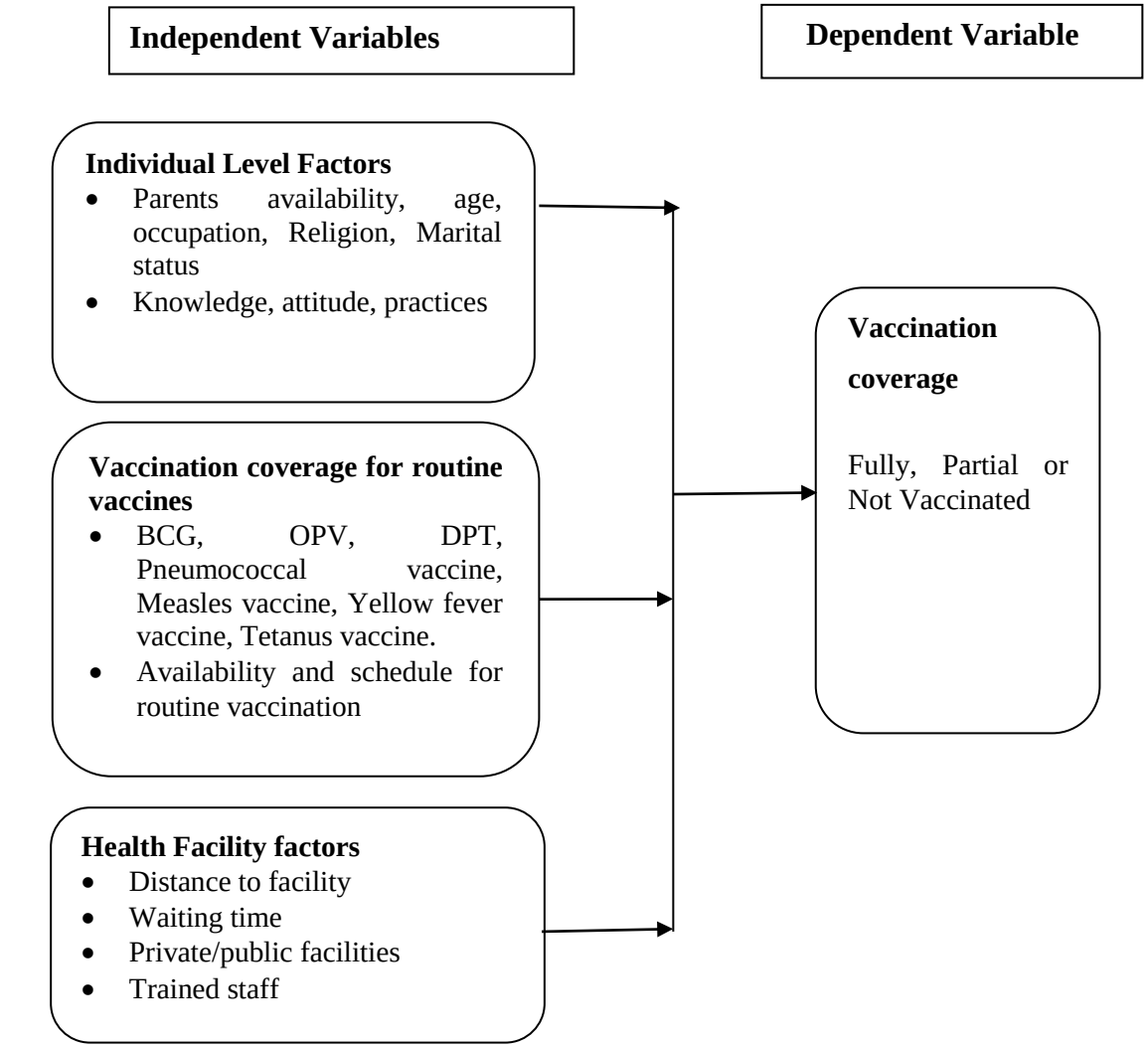

Figure 2.1: Conceptual Framework

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Design

The study adopted cross sectional design. The design is a research method that collects data from a specific population at a single point in time, providing a snapshot of that population's characteristics (Setia, 2016). This design was suitable for the study as it allowed assess vaccination coverage and associated factors among children aged 2 to 5 in Eldas sub-county within a defined timeframe. It offered a cost-effective and efficient way to gather information, making it ideal for the research objectives (Zangirolami-Raimundo, Echeimberg, & Leone, 2018). Furthermore, both qualitative and quantitative approaches were used to undertake the study.

3.2 Study Site

The study was carried out in Eldas Sub County in Wajir County, Kenya. Eldas is located 608km from Nairobi and 115 km from Wajir town and the County is bordered to the north by Ethiopia, to the northeast by Mandera County, to the east by Somalia, to the south by Garissa County, to the west by Isiolo County and to the northwest by Marsabit County. The County covers approximately an area of 55,840.8 Km^2 and Eldas Sub County has an area of 3,324.2 km^2. The Eldas Sub-County coordinates were N 2° 28' 30.036", E 39° 29' 25.404 on a map. Figure 3.1 shows the geographical map of this region.

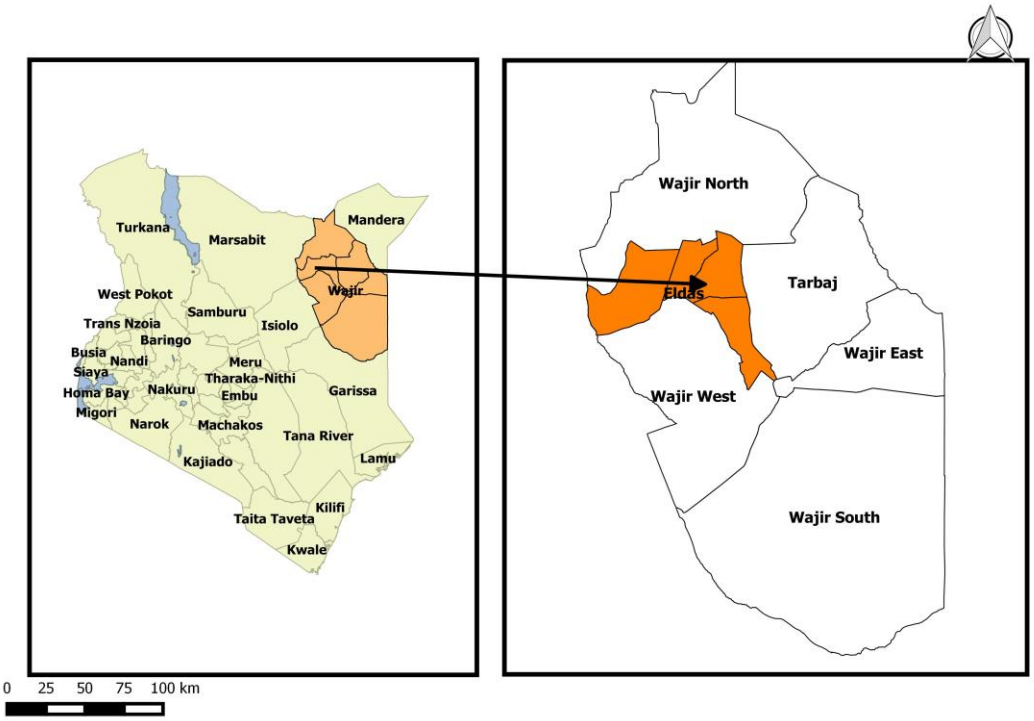

Figure 3.1: Map of Eldas Sub County, Wajir County

Source: Survey of Kenya (SOK) (2021)

The total population of Wajir County is 781,263 while Eldas Sub County has a total population of 80,807. The study site was selected purposively among the six Sub Counties that make up Wajir County. The total number of households in Eldas subcounty with children aged 2-5 years are 8,176 based on recent Sub-County health records (Table 3.1). The subgroup represented exact eligible population for childhood vaccination assessment. It provided accurate estimation of coverage and relevant determinants within the study area.

Table 3.1: Distribution of Population of Children between 2-5 Years in Eldas Sub County

Wards	No of households with children 2-5 years	Ward area in Sq. Km	Population of children 2-5 years
Eldas (081)	3,062	767.30	4,413
Della (082)	2,217	708.0	3,871
Lakoley/Basir (083)	1,697	1,292.10	2,068
Elnur/Tula Tula (084)	1,200	1,310.40	1,366

Source: Eldas sub county headquarters and county department of health, Wajir County.

3.3 Study Variables

3.3.1 Independent Variables

Individual factors such as age, occupation, education level, availability of feedbacks, knowledge, religious beliefs, attitudes and feelings. Routine vaccines among children under five years, BCG, OPV, DPT, Pneumococcal vaccine, Measles vaccine, Vitamin A. Health system factors such as distance, availability of trained health workers (number of qualified staff, Attitudes and communication), availability of Cold Chain Storage Facilities (Functioning vaccine refrigerators, Vaccine thermometers, Building facilities**)**, Availability of the Vaccine & Supplies (Number of vaccines, Syringes, Carriers).

3.3.2 Dependent Variables

The dependent variable was vaccination coverage. It was examined in two groups; fully vaccinated which implied complete immunization as per the recommended age schedule; and incomplete vaccination which includes partially vaccinated and not vaccinated for the 2-5-year children who did not receive any form of vaccination. The dependent variable was important in establishing the correlation with the determinants (independent variables) which served as the basis for analysing the study objectives.

3.4 Study Population

The target population considered of children aged between 2-5 years (caregivers were the respondents) and the healthcare workers in licensed immunizing health centres.

3.4.1 Inclusion Criteria

The study involved caregivers aged 18 and above of children aged 2-5 years. They were vital for ensuring day to day wellbeing of these children. They were also required to be of age, that is, 18 years and above which is the legal capacity to provide the necessary informed consent and make binding decisions. This enabled exclusion of minors and those households that lacked eligible respondents were not included, hence lowering the total sample. As a result, their maturity level informed responsible and willingness to participate in the study on vaccination coverage among children aged 2-5 years in Eldas sub-county. These group of caregivers were therefore provided with written informed consent.

3.4.2 Exclusion Criteria

The caregivers who declined to give the mandatory written informed consent were excluded. Due to accessibility concerns and varying healthcare provisions, caregivers from security setups such as police camps and military barracks were excluded. The mentally unfit individuals were also excluded for the purpose of ensuring homogeneity and reliability in participating groups.

3.5 Sample Size Determination

The study's sample size was determined based on Cochran's (1977) formulae as follows;

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where

e is the margin of error

p is the (estimated) proportion of the population which has the attribute in question,

q is 1 – p.

The z-value was derived from the Z table

The p of 39.3% was derived from a study done in Lagdera Sub County (Unshur, 2017) which justified a locally relevant context and context-specific estimate of vaccination coverage in a similar pastoral setting.

$((1.96)^2 (0.393) (0.607)) / (0.05)^2 = 366.5$

$= 367$

3.6 Sampling Technique

The Sub-County central operations office provided ideal the list of total households for every ward, outlining those with children aged 2 to 5 years. The sampling strategy was probability proportion to size which was employed in obtaining the number of households, that was to be sampled from each of the 4 wards. Systematic random sampling was employed, in which the first household was randomly selected and then at an interval of 22 participants who met the inclusion criteria was selected in each household. The sampling frame is shown in Table 3.2.

3.7 Sampling Frame

Table 3.2: Sampling Frame

Blocks	No of households	Households to be sampled.	Intervals.
Eldas	3,062	$\frac{3062}{8176}$*367=137	22
Della	2,217	$\frac{2217}{8176}$*367=100	22
Lakoley/Basir	1,697	$\frac{1697}{8176}$*367=76	22
Elnur/Tula Tula	1,200	$\frac{1200}{8176}$*367=54	22

3.8 Data Collection Tools

The study used semi-structured questionnaires for quantitative data and key informants' interview and focused group discussion guides for qualitative data.

The questionnaire had the following parts:

PART A Questions involving individual level factors associated with complete vaccination coverage among children aged 2 to 5 years in Eldas sub county, Wajir County.

PART B Questions linked to status of routine vaccination among children aged 2 to 5 years in Eldas sub county, Wajir County.

PART C Questions about the health system level factors associated with complete vaccination coverage among children aged 2 to 5 years in Eldas sub county, Wajir County

The key informants interview, convenience sampling approach was used. The adoption of convenience sampling approach was informed by the need to identify the most suitable health care workers that participated in the study. It was utilized on a sample of 14 vaccination health facilities distributed in wards across Eldas Sub-County. The inclusion criteria was based on one staff from each vaccination clinic was included and thus 13 key informants were interviewed as per the guide in appendix.

3.9 Pre-Testing of the Questionnaire

To ensure the validity and reliability of the data, the questionnaire was pretested in Wajir south sub county, where 10% (37/367) of the questionnaires were administered. This was important to allow for the detection issues, such as confusing phrases, sensitive questions or a lengthy administration of the questionnaire.

3.9.1 Validity of Research Instruments

The study ensured content validity by checking on the responses from the questionnaires, to see if they gave the intended answers to the research questions. After the pre-test, the researcher was able to make corrections, adjustments and additions to the research instruments. Consultations and discussions with the supervisors were done to establish content validity.

3.9.2 Reliability of Research Instruments

To establish the reliability of the research instruments, a test and retest method was employed, with a three-week interval between the two administrations. The study employed the Cronbach's α (Alpha) reliability coefficient, which measures reliability on a scale from 0 to 1. It is noteworthy that all variables in the study met the required threshold of 0.7 for reliability with average score of 0.849. This score indicated that the research instruments consistently produced dependable results over time.

3.10 Data Collection

Data collection for the study involved the utilization of both primary and secondary data sources. The primary data was collected through interviewer-administered questionnaires, offering an efficient means of gathering comprehensive information directly from the study participants. Through the adherence of ethical requirements, children's health records and Maternal and Child Health (MCH) booklets were also accessed for additional secondary data on vaccination status. The key informant interviews were crucial for providing insights on compliance drivers on recommended immunization schedule.

3.11 Data Entry

Data was entered in MS –Access database then exported to statistical package for social sciences (SPSS version 25.0) for analysis**.**

3.12 Data Processing and Analysis

Data analysis entailed descriptive statistics including frequencies and proportions. Pearson's Chi-Square test of association was important in establishing the connection between various categorical variables and completion of vaccination status at 95% confidence interval, $p<0.05$. The odds ratio estimates of 95% confidence interval for every model were used for comparison of strength of relationship between the variables as in multivariate regression. Data was be presented in tables and bar charts. Content analysis was used for qualitative data where thorough scrutiny of words or phrases mentioned in open-ended questions and categorized into thematic areas based on the study variables.

3.13 Data Presentation and Dissemination

The results were expressed as frequencies and percentages and presented in tables, graphs and charts**.** The obtained results and findings were presented to the school of public health at the JKUAT University. The Ministry of Health and the Wajir County's Department of Health were also updated on the major findings for consideration.

3.14 Ethical Considerations

The JKUAT Institutional Ethics Review Committee (IERC) provided clearance to conduct the study. This was necessary in seeking approval of the Wajir County, Health Department. Prior to engaging participants in the study, consent was sought and emphasis on voluntary participation done. The respondents were also notified that they could exit the study at any stage, any time, at will. There were also elaboration and assurance that the study did not pose any significant risk to the participants. Throughout the entire process, participants remained anonymous and their input was regarded with highest level of confidentiality. The researcher also ensured confidentiality and anonymity of the respondents' identities by not asking participants to write their names on the questionnaires.

CHAPTER FOUR

RESULTS

4.1 Socio-Demographic and Economic Characteristics among Caregivers of Children Aged 2 to 5 Years in Eldas Sub-County, Wajir County

Three hundred and sixty-seven caregivers participated in the study. The age of caregivers ranged from 18 to over 59 years. Most (41.7%) of the caregivers were in the age group 18 to 29 years. However, there was a small representation (0.3%) of caregivers aged above 59 years, which indicates a relatively youthful caregiver population. The household were predominantly headed by men (68.4%) and majority were Muslims (98.1%).

A substantial (40.1%). of the caregivers' marriages was monogamous in nature. More than twenty three percent (23.2%) were in polygamous arrangement. More than sixty seven percent (67.8%) of the caregivers (67.8%) were unemployed. Slightly more than a third (38.1%) of the respondents earned between Ksh 6.001 and 12,000.00 per month while only 8.4% earned above Kshs 24,000.00. Similarly, a limited number of caregivers (15.0%) owned a radio. More than half (52.9%) of the children were males (Table 4.1). Lastly, it is important to note that a portion of the caregivers (21.3%) takes care of non-biological children. Majority (83.7%) of the respondents had never attended school. Only about 3% and 2 % had attended primary and adult education respectively (Fig 4.1).

Table 4.1: Socio-Demographic and Economic Characteristics among Caregivers of Children Aged 2 to 5 Years in Eldas Sub-County, Wajir County

Variables	n=367	%
Age of the respondent/caregiver		
18 – 29 years	153	41.7%
30 – 39 years	104	28.3%
40– 49 years	65	17.7%
50 -59 years	44	12.0%
Above 59 years	1	0.3%
Sub--Total	367	100.0%
Head of the household		
Husband	251	68.4%
Wife	114	31.1%
Other	2	0.5%
Sub--Total	367	100.0%
Religion		
Christian	6	1.6%
Muslim	360	98.1%
Hindu	1	0.3%
Sub--Total	367	100.0%
Current marital status		
Single	68	18.5%
Married monogamous	147	40.1%
Married polygamous	85	23.2%
Divorced	67	18.3%
Sub--Total	367	100.0%
Occupation		
Employed	44	12.0%
Self-employment	39	10.6%
Casual laborer	35	9.5%
Unemployed	249	67.8%
Sub--Total	367	100.0%
Level of income per month		
Below Ksh 3000	51	13.9%
Ksh 3000 - 6000	101	27.5%
Ksh 6001 - 12000	140	38.1%
Ksh 12001 - 24000	44	12.0%
Ksh 24001 and above	31	8.4%
Sub--Total	367	100.0%
Own radio or television		
Yes	55	15.0%
No	312	85.0%
Sub--Total	367	100.0%
Gender of your child		
Female	173	47.1%
Male	194	52.9%
Sub--Total	367	100.0%
Take care of non-biological children		
Yes	78	21.3%
No	289	78.7%
Sub--Total	367	100.0%
Ever attended school		
Yes	60	16.3%
No	307	83.7%
Sub--Total	367	100.0%

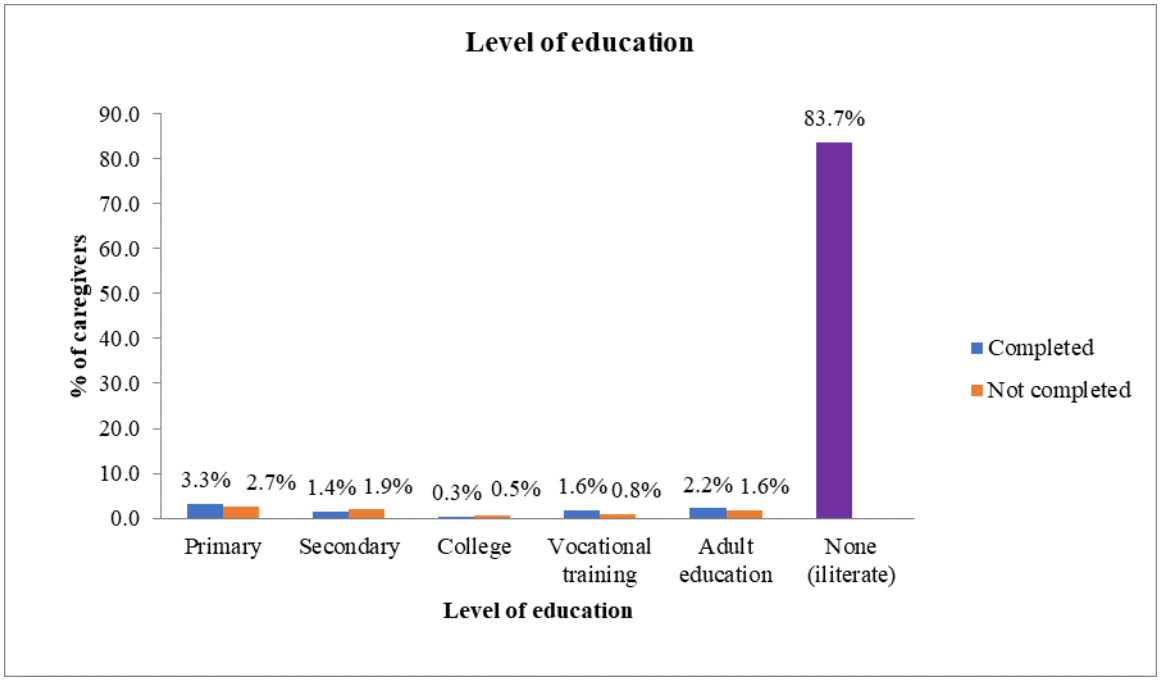

Figure 4.1: Highest Level of Education

4.1.1 Individual Level Factors Associated with Complete Vaccination Status among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County

Results summarized in Table 4.2 indicates that four of the ten socio-economic factors that were assessed had significant influence on the vaccine completion status in the studied population. Caregivers who had completed school had better chances of complying with vaccination schedule ($p<0.001$, 56;93.3%) compared to those who did not attend or complete school (200; 65.1%). Further analysis revealed that children from such households had 7.49 higher increased of completing the required vaccination dosage [95%CI = 2.64 – 21.21, $P<0.001$].

Occupation was significantly associated with complete vaccination of the child, $P<0.05$. Higher proportion of complete vaccination coverage was observed among children of caregivers who were employed (36; 81.8%) or self-employed (32; 82.1%) as compared to children from caregivers who were unemployed (163; 65.5%). Caregivers with employed status had 2.73 were 2.37[95%CI = 1.05– 5.33, P=0.032]

better chances of adhering to vaccination schedule than those who lacked formal employment. A relatively lower likelihood of 2.41[95%CI = 1.02– 6.11, P=0.039] was associated with self-employed caregivers against the totally unemployed caregivers.

The caregivers who earned Kshs. 12000 - 24000 (35; 79.5%) or above Kshs. 24000 (26; 83.9%) were highly likely to have their children complete vaccination status relative to those who earned below Kshs 3000 (30; 58.8%). Children from caregivers who indicated that they earned Kshs. 12000 - 24000 were 2.72[95%CI = 1.08 – 6.83, P=0.030] had higher chances of completing vaccination coverage than those earning below Kshs 3000 a month. Likewise, children from caregivers who indicated that they earned Kshs. 24000 and above were 3.64[95%CI = 1.21 – 11.02, P=0.018] times highly likely to have adhered to full vaccination schedule when compared to those whose income fell below Kshs 3000.

Caregivers with ownership of a radio or television had higher probability of ensuring their children completed required vaccination dosage (P<0.05). Radio or television ownership had higher chances of completing vaccination status (47; 85.5%) than those without ownership of the same (209; 66.9%). This translated into odds of 2.89[95%CI = 1.31 – 6.35, P=0.005] in favour of those with radio or tv ownership.

Table 4.2: Socio-Demographic Factors Associated with Complete Vaccination Status among Children Aged 2 to 5 Years in Eldas Sub-County, Wajir County

	Complete		Incomplete/not immunized		95%CI			
Variables	**n=256**	**%**	**n=111**	**%**	**OR**	**Lower**	**Upper**	**P-value**
Age of the respondent								
18 – 29 years	115	75.20%	38	34.80%	1.72	0.85	3.54	0.13
30 – 39 years	72	69.20%	32	30.80%	1.28	0.61	2.7	0.506
40– 49 years	40	61.50%	25	38.50%	0.91	0.41	2.02	0.824
50 -59 years	28	63.60%	16	36.40%	Ref			
Above 59 years	1	100.00%	0	0.00%	UD	UD	UD	UD
Head of the household								
Husband	180	71.70%	71	28.30%	2.53	0.16	41.08	0.498
Wife	75	65.70%	39	34.30%	1.92	0.11	31.58	0.641
Other	1	50.00%	1	50.00%	Ref			
Religion								
Christian	5	83.30%	1	16.70%	2.17	0.25	18.8	0.471
Muslim	251	69.70%	109	30.30%	Ref			
Hindu	0	0.00%	1	100.00%	UD	UD	UD	UD
Current marital status								
Single	44	64.70%	24	35.30%	Ref			
Married monogamous	110	74.80%	37	25.20%	1.62	0.87	3.02	0.125
Married polygamous	59	69.40%	26	30.60%	1.24	0.62	2.43	0.537
Divorced	43	64.20%	24	35.80%	0.98	0.48	1.98	0.949
Ever attended school								
Yes	56	93.30%	4	6.70%	7.49	2.64	21.21	<0.001
No	200	65.10%	107	34.90%	Ref			
Occupation								
Employed	36	81.80%	8	18.20%	2.37	1.05	5.33	0.032
Self employment	32	82.10%	7	17.90%	2.41	1.02	6.11	0.039
Casual laborer	25	71.40%	10	28.60%	1.32	0.6	2.99	0.484
Unemployed	163	65.50%	86	34.50%	Ref			
Level of income per month								
Below Kshs. 3000	30	58.80%	21	41.20%	Ref			
Kshs. 3000 - 6000	65	64.40%	36	35.60%	1.26	0.63	2.52	0.505
Kshs. 6000 - 12000	100	71.40%	40	28.60%	1.75	0.89	3.41	0.098
Kshs. 12000 - 24000	35	79.50%	9	20.50%	2.72	1.08	6.83	0.03
Kshs. Above 24000	26	83.90%	5	16.10%	3.64	1.2	11.02	0.018
Own radio or television								
Yes	47	85.50%	8	14.50%	2.89	1.31	6.35	0.005
No	209	66.90%	103	33.10%	Ref			
Gender of your child								
Female	118	68.20%	55	31.80%	0.87	0.55	1.36	0.542
Male	138	71.10%	56	28.90%	Ref			
Take care of non-biological children								
Yes	57	73.10%	21	26.90%	1.23	0.7	2.14	0.471
No	199	68.90%	90	31.10%	Ref			

n=number of subjects, OR=Odds Ratio, Ref=Reference, P-value = Probability value, UD=Undefined, CI=Confidence interval

4.2 Vaccination Status among Children Aged 2 to 5 Years

Majority (353; 96.2%) of the caregivers reported that their children had ever received at least one of the vaccinations against immunizable diseases. Seventy three percent (268; 73.0%) of the caregivers knew that vaccination was for protecting their children from certain diseases. One hundred and seventy (46.2%) caregivers had vaccination card. a BCG scare was observed in (332; 90.6%) of the children (Table 4.2).

The high vaccination coverage rate of 96.2% (353) is a positive outcome, indicating that a significant portion of caregivers in Eldas Sub-County are actively participating in immunization programs. Among the caregivers surveyed, 73.0% (268) reported that they understood that vaccination is meant to protect their child from certain diseases. However, it is important to note that 19.6% revealed that they did not know the purpose of vaccination.

Of the caregivers surveyed, 46.2% (170) possessed vaccination cards and presented them during the interview, while 8.0% (29) did not have vaccination cards. Additionally, 45.8% reported having vaccination cards, although they were not seen by the interviewers. A substantial proportion, 90.6% (332) of the children had a BCG scar, indicating a successful immunization program for tuberculosis.

Table 4.3: Vaccination Status among Children Aged 2 to 5 Years

Variables	n=367	%
Proportion of children who had ever received any vaccinations against immunizable diseases		
Yes	363	98.9%
No	4	1.10%
Purpose of vaccination		
Protect a child from certain diseases	268	73.0%
Help child grow	27	7.4%
Don't know	72	19.6%
Have the child's vaccination card with you		
Yes Seen	170	46.2%
Yes not seen	168	45.9%
No	29	8.0%
BCG scar present		
Yes	332	90.6%
No	35	9.4%

According to the results in Table 4.3, high coverage of BCG vaccination (96.2%) against tuberculosis, which typically leaves a scar on the arm or shoulder. The coverage of Pentavalent vaccination (86.1%) administered on the thigh, sometimes in conjunction with polio. The high coverage of polio vaccination (97.8%) administered orally indicates widespread participation in the polio vaccination program. The substantial coverage of measles vaccination (94.8%) at 9 months of age, typically administered as a shot in the right upper arm.

Table 4.4: Vaccinations Received by the Children Aged 2 to 5 Years

Vaccines	n=367	%
BCG vaccination against TB that is injected on the arm or on the shoulder that usually causes a scar		
Yes	353	96.2%
No	14	3.8%
First dose of pentavalent vaccine at six weeks		
Yes	310	84.5%
No	57	15.5%
Second dose of pentavalent vaccine at 10 weeks		
Yes	289	84.5%
No	69	18.8%
Do not know	9	2.5%
Third dose of pentavalent vaccine at 10 weeks		
Yes	272	74.1%
No	51	13.9%
Don't know	44	12.0%
Rota virus vaccine at 6 weeks		
Yes	159	43.3%
No	208	56.7%
Rota virus vaccine at 10 weeks		
Yes	132	35.9%
No	235	64.1%
First polio vaccine received at after birth or later		
Yes	340	92.6%
No	17	4.6%
Don't know	10	2.7%
Second dose at six weeks		
Yes	330	89.9%
No	37	10.1%
Third dose of polio at 10 weeks		
Yes	325	88.6%
No	42	11.4%
Fourth dose of polio at 14 weeks		
Yes	301	82.0%
No	37	10.1%
Don't know	29	7.9%
Measles injection that is a shot in the right upper arm at the age of 9 Months against measles		
Yes	346	94.8%
No	19	5.2%
Measles booster at 18 months		
Yes	258	70.3%
No	101	27.5%
Don't know	8	2.2%

About seventy percent of the children (69.8%, 256), were reported as fully vaccinated while 29.2% (107), of the were reported as partially vaccinated (Figure 4.2).

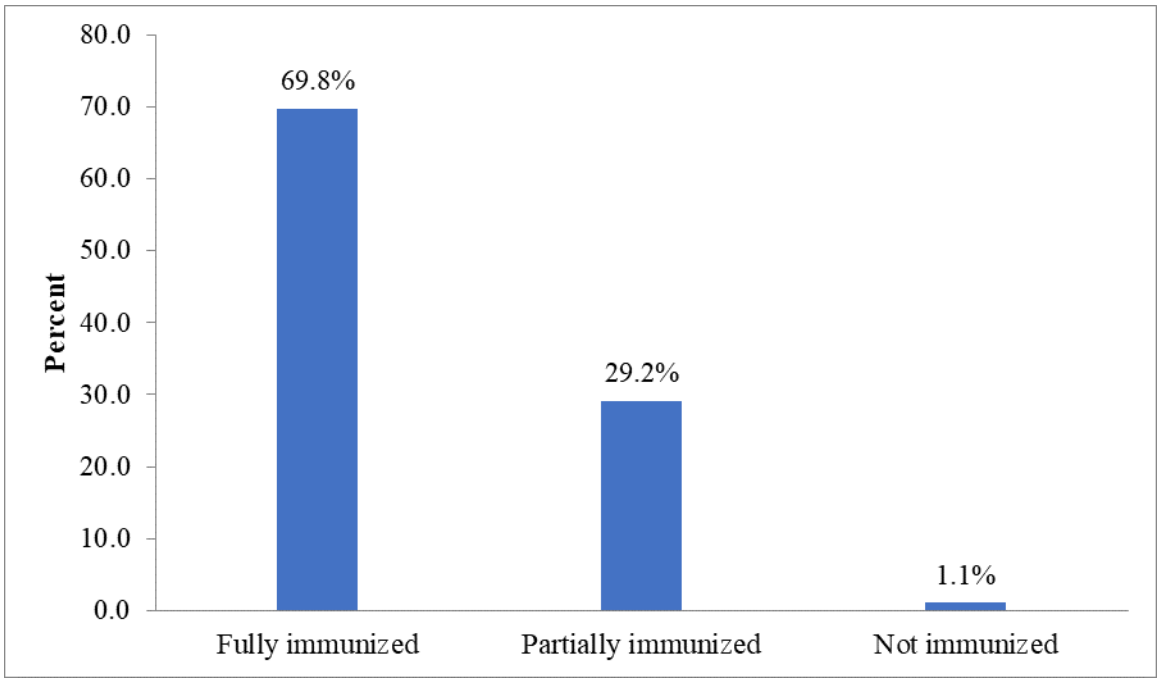

Figure 4.2: Vaccination Status Coverage

4.2.1 Reasons for Non-Completion of Vaccination

According to Table 4.4, among the one hundred and eleven children who had incomplete vaccination coverage, more than half of the respondents (54.1%) cited that the place of immunization was the best possible justification for the non-completion of vaccination in children aged 2 to 5 years. 52.3% indicated that either the tie or place of ionization was unknown. 39.6% lacked faith in the ionization exercise. 34.2% feared side effects, and a third indicated that they were unaware of the need to return for a second dose. Additionally, 23.4% stated that they were unaware of the need for immunization. Another 23.4% stated that the mother was too busy. 15.3% indicated that their exercise had been postponed until further notice. Finally, 13.5% had wrong ideas about contradictions such as sick children or HIV infection.

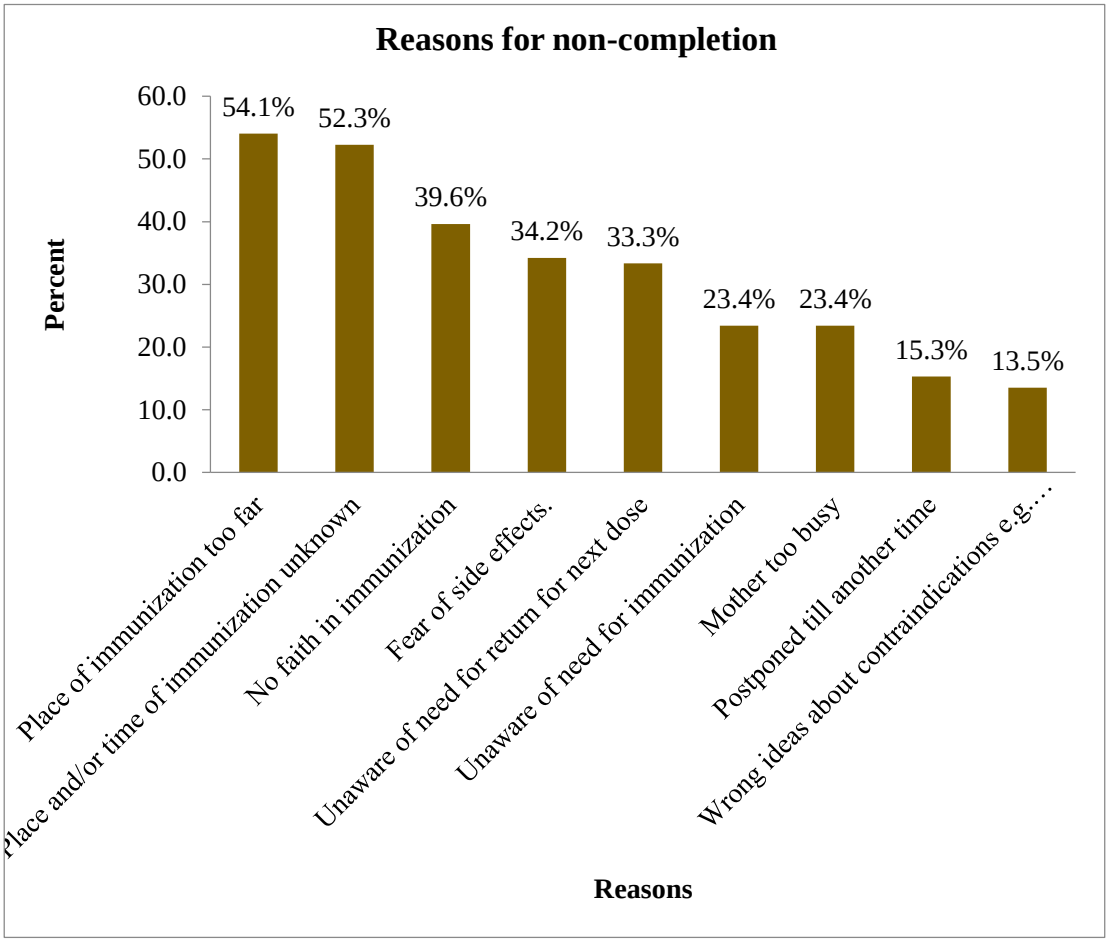

Figure 4.3: Reasons for Non-Completion

Slightly more than three quarters (288; 78.5%) of the caregivers reported that their child had been ill. All the caregivers revealed that their child had breastfed for at least a period of 0 – 6 months. The universal practice of breastfeeding for at least 0-6 months is a positive indicator of infant nutrition and health. Only a small proportion (93; 25.4%) of the caregivers had personal issues that limited them from taking the child for immunization. Similarly, a small proportion (18; 4.9%) had heard of rumors that affect the immunization uptake immunization. Almost half (180; 49.2%) of the caregivers revealed that they had ever taken a child for late immunizations. Interestingly, 4.6% of the caregivers did not know if they took the child for late immunizations or not. Majority (308; 83.9%) reported that they considered child immunization very important. A small proportion (17; 4.6%) reported that child immunization was not really important and were not interested in immunizing their

child. Almost three quarters (65; 72.2%) of the caregivers indicated that they were aware of vaccine preventable diseases. 25.7% and 54.6% of the caregivers felt that the vaccination is very safe and safe respectively. Most of the respondents indicated that they preferred an appointment when going to take a child for the immunizations. 39.6% indicated that it did not matter. Most (292; 79.6%) of the caregivers had received any information/education on immunization.

Table 4.5: Other Reasons Attributable to Vaccination Status

Variables	n=367	%
Child been ill		
Yes	288	78.50%
No	79	21.50%
How long has the child breastfed		
0-6 months	347	94.50%
7-12 months	16	4.40%
Over 12 Months	4	1.10%
Personal issues that limit you from taking the child for immunization		
Yes	93	25.40%
No	274	74.60%
Rumors that affect the immunization uptake immunization		
Yes	18	4.90%
No	308	83.90%
Don't know	41	11.20%
Ever taken the child for late immunizations		
Yes	180	49.20%
No	170	46.20%
Don't know	17	4.60%
How important is it that your child is immunized		
Very important	308	83.90%
Don’t know if it’s important	42	11.40%
Not really important/ Not interested in immunizing his/her child	17	4.60%
Aware of the vaccine preventable diseases		
Yes	265	72.20%
No	102	27.80%
Feel vaccination is safe		
Very safe	95	25.70%
Safe	200	54.60%
Somewhat safe	2	0.50%
Don't know	70	19.10%
When going to take your child for his/her immunization do you prefer		
An appointment	171	46.60%
To sit and wait your turn	52	14.20%
Doesn’t matter	144	39.20%
Received any information/education on immunization		
Yes	292	79.60%
No	75	20.40%

Table 4.5 demonstrates that a considerable number of respondents (186; 50.7%) reported that their most recent childbirth was attended by a traditional birth attendant, while the remainder (181; 49.3%) opted for a skilled birth attendant. Moreover, the study emphasizes that the majority of caregivers (346; 94.4%) sought immunization services in public hospitals. However, the data also shed light on the travel experiences of caregivers to access healthcare services. Notably, around one-third (122; 33.3%) reported taking 30 minutes to 1 hour to reach the nearest hospital, while a significant proportion (26.0%) had to travel more than 2 hours.

The distance to the nearest hospital appears to be reasonably manageable for most respondents, with over half stating that the hospital is within 1 to 5 kilometers. The means of transport to reach the nearest hospital is primarily on foot, as reported by the vast majority (354; 96.5%) of caregivers. In the realm of immunization, a notable proportion (128; 34.9%) disclosed that they had been turned away from the clinic. Nevertheless, the study offers hope as a majority of those turned away (89; 69.5%) were informed about when to return for their child's immunization. Among those who faced being turned away, a significant portion (21.9%) were told that immunizations were out of stock. A smaller fraction (6.3%) received another appointment. A few caregivers (2.3%) were provided with different reasons for being turned away.

Table 4.6: Other Factors Attributable to Vaccination Coverage

Variables	n=367	%
Who facilitated the last delivery		
Skilled health attendant	181	49.3%
Traditional birth attendant	186	50.7%
Place the child receive the immunization n=353)		
Public hospital	333	94.4%
Outreach	20	5.6%
Time to reach to the nearest hospital		
Less than 30minutes	93	25.4%
30minutes - 1Hour	122	33.3%
1 - 2 Hours	56	15.3%
More than 2 Hours	96	26.0%
Distance to the nearest hospital		
1 - 5 km	214	58.4%
5 - 10 km	65	17.8%
10 - 15 km	24	6.6%
15 - 20 km	64	17.3%
Means of transport do you use to get to the nearest hospital		
Foot	354	96.5%
Public means	13	3.5%
Ever been turned away from the clinic		
Yes	128	34.9%
No	239	65.1%
Reason for been turned away (n=128)		
Was told when to come back for child's immunization	89	69.5%
Immunization stock-outs	28	21.9%
Appointment date was given	8	6.3%
Others	3	2.3%

Knowledge on the purpose of vaccination was significantly associated with complete vaccination coverage, $p<0.05$. This implied that knowing vaccination protects against disease significantly increased odds of complete vaccination (OR=5.03, $p<0.001$). Caregivers who acknowledged the role of vaccination in protecting wellbeing of the child reported better adherence levels (207; 77.2%) or help the child grow (20; 76.2%) compared to children whose caregivers did not know the purpose (29; 74.1%). Therefore believing vaccines help child growth also significantly improved completion rates (OR=4.17, p=0.002). Children whose caregivers indicated that the purpose of vaccination is to protect a child from certain diseases had 5.03[95%CI = 2.9 – 8.73, $p< 0.001$] better chances of completing vaccination schedule than those

with limited knowledge on the objective of vaccination program. Acknowledgement of the contribution of vaccination towards child growth and development predicted higher compliance levels of 4.17[95%CI = 1.59 – 11.3, p = 0.002] increased likelihood than those who did not appreciate this role.

High proportion of vaccinations coverage was observed among children who had BCG scar present (240; 72.2%) compared to children who did not have BCG scar present (19; 54.3%). This suggests that the presence of a BCG scar may serve as a visual reminder for caregivers, contributing to better adherence to vaccination schedules. Ensuring that BCG vaccinations are administered correctly and consistently can further enhance this effect. Presence of BCG scar among the children was attributed to 2.19[95%CI = 1.08 – 4.46, p = 0.026] increased likelihood of completing vaccine coverage than those without BCG scar. The absence of personal challenges was an important determinant to ensuring complete vaccination coverage (204; 74.5%) to those were often confronted with personal concerns which constrained caregivers' ability to take their children for immunization services (52; 55.9%). This further explained 2.29[95%CI = 1.41 – 3.75, P < 0.001] increased chances of adhering to the vaccination schedule.

Table 4.7: Individual Level Factors Associated with Complete Vaccination Status among Children Aged 2 to 5 Years

	Complete		Incomplete			95%CI		
Variables	**n=256**	**%**	**n=111**	**%**	**OR**	**Lower**	**Upper**	**P-value**
Your child ever received any vaccinations against immunizable diseases								
Yes	248	70.2%	105	29.8%	1.77	0.59	5.23	0.294
No	8	57.1%	6	42.9%	Ref			
Purpose of vaccination								
Protect a child from certain diseases	207	77.2%	61	22.8%	5.03	2.9	8.73	<0.001
Help child grow	20	74.1%	7	25.9%	4.17	1.59	11.3	0.002
Don't know	29	40.3%	43	59.7%	Ref			
Have the child's vaccination card with you								
Yes Seen	138	81.2%	32	18.8%	3.50	1.53	8.00	0.001
Yes not seen	102	60.7%	66	39.3%	1.25	0.57	2.78	0.573
No	16	55.2%	13	44.8%	Ref			
BCG scar present								
Yes	240	72.2%	92	27.8%	2.19	1.08	4.46	0.026
No	19	54.3%	16	45.7%	Ref			
Child been ill								
Yes	201	69.8%	87	30.2%	1.04	0.60	1.79	0.876
No	55	69.6%	24	30.4%	Ref			
How long has the child breastfed								
0-6 months	243	70.0%	104	30.0%	2.33	0.32	16.81	0.385
6-12 months	11	68.8%	5	31.3%	2.2	0.23	20.39	0.481
Over 12 Months	2	50.0%	2	50.0%	Ref			
Personal issues that limit you from taking the child for immunization								
Yes	52	55.9%	41	44.1%	Ref			
No	204	74.5%	70	25.5%	2.29	1.41	3.75	<0.001
Rumors that affect the immunization uptake immunization								
Yes	6	33.3%	12	66.7%	Ref			
No	230	74.7%	78	25.3%	5.89	2.14	16.24	<0.001
Don't know	20	48.8%	21	51.2%	1.9	0.59	6.05	0.271

n=number of subjects, OR=Odds Ratio, Ref=Reference, P-value = Probability value, CI=Confidence interval

Based on findings in Table 4.8, larger proportions of vaccinations coverage were observed among children who were never taken for late immunizations (129; 75.9%) relative to those whose caregivers were often late for immunization schedules (8; 47.1%). The results further implied that promptness with immunization schedule explained 3.54[95%CI = 1.28 – 9.77, P = 0.010] better chances of completing vaccination coverage.

High proportion of vaccinations coverage was observed among children whose caregivers indicated that child immunization is very important (230; 74.3%) compared to children whose caregivers thought that immunization is not important and were not interested in immunizing their child (8; 47.1%). Appreciating the value of timely immunization was a crucial factor towards complete vaccination. Attaching relevance and significance to immunization attracted 5.27[95%CI = 1.89 – 14.72, P < 0.001] increased chance for the child completing necessary vaccination schedule compared to caregivers who demonstrated limited interest.

Better vaccination completion status was reported among children whose caregivers understood the threat of vaccine preventable infections (198; 74.7%) in comparison to the caregivers who demonstrated limited awareness (58; 56.9%). This meant 2.41[95%CI = 1.48 – 3.91, p < 0.001] higher chances of adhering to full vaccination coverage among the caregivers with better awareness of these infections.

Receiving or gaining access to relevant information on immunization campaign significantly influenced complete vaccination coverage, p <0.05. Higher percentage was reported among children whose caregivers had access to high quality information on immunization (227; 77.7%) than those with limited access to such educational opportunities (29; 38.7%). This led to 5.53[95%CI = 3.22 – 9.51, P < 0.001] better chances for such children to complete vaccination schedule among the children associated with well-informed caregivers.

Table 4.8: Other Selected Factors Associated with Complete Vaccination Coverage

Variables	Complete		Incomplete		95%CI			
	n=256	%	n=111	%	OR	Lower	Upper	P-value
Ever taken the child for late immunizations								
Yes	119	66.1%	61	33.9%	2.19	0.81	5.97	0.117
No	129	75.9%	41	24.1%	3.54	1.28	9.77	0.010
Don't know	8	47.1%	9	52.9%	Ref			
How important is it that your child is immunized								
Very important	230	74.2%	78	25.8%	5.27	1.89	14.72	<0.001
Don't know if it's important	20	47.6%	22	52.4%	1.67	0.52	5.34	0.387
Not really important/ Not interested in immunizing his/her child	6	35.3%	11	64.7%	Ref			
Aware of the vaccine preventable diseases								
Yes	198	74.7%	67	25.3%	2.41	1.48	3.91	<0.001
No	58	56.9%	44	43.1%	Ref			
Feel vaccination is safe								
Very safe	68	71.6%	27	28.4%	1.89	1.01	3.79	0.042
Safe	147	73.5%	53	26.5%	2.08	1.17	3.67	0.010
Somewhat safe	1	50.0%	1	50.0%	0.75	0.04	12.48	0.840
Don't know	40	57.1%	30	42.9%	Ref			
When going to take your child for his/her immunization do you prefer								
An appointment	123	71.9%	48	28.1%	1.36	0.84	2.21	0.205
To sit and wait your turn	39	75.0%	13	25.0%	1.59	0.78	3.26	0.198
Doesn't matter	94	65.3%	50	34.7%	Ref			
Received any information/education on immunization								
Yes	227	77.7%	65	22.3%	5.53	3.22	9.51	<0.001
No	29	38.7%	46	61.3%	Ref			

n=number of subjects, OR=Odds Ratio, Ref=Reference, P-value = Probability value, CI=Confidence interval

4.3 Health System Level Factors Associated with Complete Vaccination Status among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County

The person who facilitated the last delivery was significantly associated complete vaccinations coverage, P<0.05. As displayed in Table 4.9, high proportion of complete vaccinations coverage was observed among children whose birth was

facilitated by a skilled birth attendant (146; 80.7%) compared to children whose birth was facilitated by traditional birth attendant (110; 59.1%). This emphasizes the role of skilled health professionals in ensuring not only safe childbirth but also comprehensive vaccination. Children whose birth was facilitated by a skilled birth attendant were 2.88[95%CI = 1.80 – 4.61, P < 0.001] better chances of completing vaccination compared to those who relied on traditional birth attendant.

Public health facilities were associated with higher vaccine completion rates (246; 71.7%) compared to children who receive immunizations from outreach facilities (10; 50.0%). This finding underscores the importance of the source of immunizations in ensuring complete vaccination coverage. Children who receive immunizations from public hospital were 2.71[95%CI = 1.11– 6.57, P = 0.022] highly likely to comply with vaccine completion than those who received immunizations from outreach. The results reflect the significant contribution of government led interventions in promoting immunization in communities.

Larger proportion of complete vaccinations coverage was observed among children whose time to reach to the nearest hospital was less than 30 minutes (74; 79.6%) or 30 minutes to 1 hour (92; 76.2%) compared to children whose time to reach to the nearest hospital was more than 2 hours (55; 57.9%). This indicates that proximity to healthcare facilities plays a crucial role in ensuring complete vaccination coverage. Children whose time to reach to the nearest hospital was less than 30 minutes were 2.83[95%CI = 1.48 – 5.41, P < 0.001] times more likely to have complete vaccination coverage as compared to children whose time to reach to the nearest hospital was more than 2 hours. Likewise, children whose time to reach to the nearest hospital was 30 minutes to 1 hour were 2.23[95%CI = 1.24 – 3.98, P = 0.006] times highly likely to attain complete vaccination status compared to children whose time to reach to the nearest hospital was more than 2 hours, underscoring the importance of reasonable travel times to healthcare facilities.

The caregivers who had never been turned away from the immunization centres had higher chances of their children completing scheduled vaccination program (176; 73.6%) compared to those (80; 62.5%) who had history of being turned away. This

implied 1.68[95%CI = 1.06 – 2.65, P = 0.026] higher chances of completing vaccination status. The results emphasize the importance of smooth healthcare service access. Moreover, as revealed by Interviewee 01, a considerable challenge persists in the number of clinics, forcing mothers to undertake lengthy journeys to reach hospitals. Furthermore, Interviewee 02 emphasized that children often go back home crying after such journeys. Additionally, as reported by Interviewee 03, shortages in vaccine dosages pose another significant challenge.

Table 4.9: Other Selected Factors Associated with Complete Vaccination Status

	Complete		Incomplete			95%CI		
Variables	**n=256**	**%**	**n=111**	**%**	**OR**	**Lower**	**Upper**	**P-value**
Who facilitated the last delivery								
Skilled health attendant	146	80.7%	35	19.3%	2.88	1.80	4.61	<0.001
Traditional birth attendant	110	59.1%	76	40.9%	Ref			
Place the child receive the immunization								
Public hospital	246	71.7%	100	28.3%	2.71	1.11	6.57	0.022
Outreach	10	50.0%	11	50.0%	Ref			
Time to reach to the nearest hospital								
Less than 30 min	74	79.6%	19	20.4%	2.80	1.47	5.43	<0.001
30min-1Hr	92	76.2%	30	23.8%	2.18	1.22	3.89	0.007
1 - 2 Hrs	34	60.7%	22	39.3%	1.13	0.57	2.21	0.715
More than 2 hrs	56	58.3%	40	41.7%	Ref			
Distance to the nearest hospital								
1 - 5 km	181	84.5%	33	15.5%	9.77	5.20	18.37	<0.001
5 - 10 km	43	66.2%	22	33.8%	3.48	1.68	7.18	<0.001
10 - 15 km	9	37.5%	15	62.5%	1.06	0.40	2.83	0.892
15 - 20 km	23	35.9%	41	64.1%	Ref			
Means of transport do you use to get to the nearest hospital								
Foot	246	69.5%	108	30.5%	0.68	0.18	2.53	0.566
Public means	10	76.9%	3	23.1%	Ref			
Ever been turned away from the clinic								
Yes	80	62.5%	48	37.5%	Ref			
No	176	73.6%	63	26.4%	1.68	1.06	2.65	0.026

n=number of subjects, OR=Odds Ratio, Ref=Reference, P-value = Probability value, CI=Confidence interval

4.4 Multivariable Logistic Regression on Predictors of Complete Vaccination Status among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County

Multivariable binary logistic regression was employed to predict the relationship between various antecedents and completion of vaccination status among children aged 2 to 5 years in Eldas Sub County. The significance level was set at 5% with all predictors meeting this threshold included in the model. Backward conditional approach was employed at P<0.05 in order to ensure that only most relevant predictors were retained in the final model, while ensuring the overall accuracy. Table 4.10 shows the six predictors that met this threshold. Attending school or formal learning was associated with 3.47[95%CI = 1.18 – 9.57, P=0.032] better chances of ensuring the child completed the vaccination schedule. This underscores the critical role of caregiver education in ensuring comprehensive vaccination for children, indicating that education programs targeting caregivers may significantly improve vaccination coverage.

Children from caregivers who earned Kshs.12000 – Kshs.24000 per month or more than Kshs.24000 per month were 2.96[95%CI = 1.15 – 10.39, P=0.002] and 3.18[95%CI = 1.27 – 11.67, P<0.001] respectively, had better chances of adhering to vaccination scheduled than caregivers earned below 3000 per month. The positive association between higher caregiver income and complete vaccination coverage highlights the need for economic empowerment to improve immunization rates. Similarly, children from caregivers who knew the purpose of vaccination as protect the child from preventable diseases reported 4.51[95%CI = 1.36 – 12.75, P<0.001] better chances of completing vaccination status. Those who believed in the role of immunization towards child growth reported 2.57[95%CI = 1.18 – 8.62, P=0.031] better chances of ensuring their children had full adherence to vaccine completion.

Awareness of preventable diseases among caregivers explained 3.68[95%CI = 1.12 – 9.65, P=0.007] likelihood of their children completing vaccination. Facilitation by skilled birth attendant was associated with 5.36[95%CI = 2.15 – 13.21, P<0.001] higher chances of their children completing vaccination status than those who relied on traditional birth attendant. Proximity to the nearest immunization centre, in the

range of 1-5 kilometers had 4.28[95%CI = 1.28 – 14.87, P=0.009] better predictability of completing vaccination coverage than those within a range of 5-10 kilometers 2.57[95%CI = 1.54 – 6.88, P=0.024].

Table 4.10: Predictors of Complete Vaccination Coverage among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County

		95%CI		
Variables	**aOR**	**Lower**	**Upper**	**P-value**
Ever attended school				
Yes	3.47	1.18	9.57	0.032
No	Ref			
Level of income per month				
Below Kshs.3000	Ref			
Kshs.3000 - Kshs.6000	1.12	0.87	4.61	0.721
Kshs.6000 - Kshs.12000	1.98	0.94	6.12	0.098
Kshs.12000 - Kshs.24000	2.96	1.15	10.39	0.002
More than Kshs.24000	3.18	1.27	11.67	<0.001
Purpose of vaccination				
Protect a child from certain diseases	4.51	1.36	12.75	<0.001
Help child grow	2.57	1.18	8.62	0.031
Don’t know	Ref			
Aware of vaccine-preventable diseases				
Yes	3.68	1.12	9.65	0.007
No	Ref			
Who facilitated the last delivery?				
Skilled health attendant	5.36	2.15	13.21	<0.001
Traditional birth attendant	Ref			
Distance to the nearest hospital				
1 - 5 km	4.28	1.28	14.87	0.009
5 - 10 km	2.57	1.54	6.88	0.024
10 - 15 km	1.31	0.77	2.65	0.251
15 - 20 km	Ref			

4.5 Qualitative Findings

The results on the level of vaccination coverage revealed a considerably high vaccination coverage which implied proportion of children who completed all vaccines in the region. Vaccination coverage estimates range from 85-90%, attributed to strong community engagement and healthcare team dedication: According to the first respondent:

> "Approximately 90% of children aged 2 to 5 years in Eldas sub-county have received all their routine vaccinations. This high coverage rate is attributed to our strong community engagement efforts and the dedication of our healthcare team. We measure vaccination coverage using the MCH booklets and clinic registers and this empowers us in tracking protection against diseases and infections" (Informant 01)

The findings also indicated improvement in the level of adherence to immunization schedule. According to the feedback by the second respondent:

> ‘‘The county has deployed follow-up visits and defaulter tracing through the integration of mobile phone technology that we are able to send SMS reminders to the caregivers and parents. However, in some instances, some children dropout after 6^{th} to 10^{th} week of immunization. The challenge had also been previously observed among caregiving who could miss some visits due to migration and logistics barriers."

According to the fourth respondent, the high coverage reflects increasing level of access, awareness and system strength in delivering immunization solutions to the children:

> ‘‘The county's ministry of health guides us on how to compute the coverage ratio by comparing fully immunized children against the targeted population. This comparison is vital in establishing service effectiveness. ‘’

For the health system factors associated with vaccine coverage in Eldas Sub-County, respondents revealed varied insights, ranging from lifestyle, information, access and

logistics, income level, education and awareness among others. According to the fourth informant, nomadic lifestyles challenge vaccination schedules:

> "Nomadic pastoralism, which is 70% source of livelihood, is another reason for failed adherence to vaccine schedules. The caregivers have to cover atleast 15 to 30 kilometeres for every visit to the facility. The language distance is key in reducing possibility for return visits hence the risk of missing the next dose (Informant 04)

Misinformation about vaccine side effects contributed to hesitancy among caregivers:

> “Misinformation and rumors about vaccine side effects can create hesitancy among some caregivers. The caregivers often link infertility to these vaccines leading to avoidance of completing the schedule. Some also argue that the vaccines are responsible for making the children weak hence vulnerable to infections, they misunderstand mild fever as danger. Interestingly, there are those who assert that immunization is reserved for urban children and not a necessity for rural or nomadic children, whose immunity is inherently strong due to their harsh nomadic way of life" (Informant 01)

The concerns involving societal beliefs were also emphasized by the sixth important, affecting vaccine acceptance among the Eldas residents:

> “In our community, some caregivers believe that vaccines are not necessary because they trust traditional healing methods more. I have encountered instances whereby a spend a lot of time debunking the myth that traditional herbs are better than WHO administered vaccines. However, atimes it becomes difficult to convenience parents who strongly prefer local remedies for their children. Another challenge is that some caregivers believe that once a child looks healthy, then there is no need for additional or completion of required dosage. Such complacency triggers high dropout rate after initial visits" (Informant 06)

Furthermore, language barrier emerged as a major predictor of missed vaccine schedules. According to the third informant:

> "Not all caregivers speak Swahili fluently. This often leads to misunderstandings about instructions or vaccine information as they predominantly express themselves in local languages – Somali, Borana. The misunderstood medical terms imply limited clarity of immunization schedule hence the risk of caregiver missing subsequent visits. The low-income levels and busy nomad life make it difficult to hire or be accompanied by a relative or friend for translation services support. On the side of the facility, there is no structured way for local translation of vaccine names which triggers confusion on doses. In addition, if caregivers are not well trained, then they increase the risk misinterpreting instructions thus incomplete doses" (Informant 03)

The economic factors were also cited as critical determinant for access to vaccination services.

> "Many families in our community struggle financially and taking time off work to bring their children for vaccination can mean losing a day's income, which averages Kes. The transportation costs which rely on matatu or motorcycles is relatively high, atimes taking upto Kes 500 which makes it unaffordable to many hence threatening repeated visits. The low-income level is complicated by high poverty rates, compelling caregivers to prioritize food to fend for their families over clinic visits. Others factor the hidden costs related to supplies and time spent hence the tendence towards avoidance. Similarly, the polygamous culture and large family sizes put constraint on resources available per child triggering selective vaccination among children." (Informant 09)

The discussion revealed that challenges exist in reaching every child. Based on the comments by the fifth respondent, with factors like nomadic lifestyles and cultural beliefs posing barriers:

> "Despite our best efforts, there are still struggles in reaching every child with vaccines. Factors such as nomadic lifestyles and cultural beliefs about vaccines pose significant barriers. The threat of dependence on seasonal income is also manifested in postponed clinic visits during drought and flooding periods." (Informant 05)

The health system gaps were also cited by various respondents including third, fourth and seventh informants. They alluded that:

> “The stock out in level two facilities triggers missed doses and this discourages caregivers from following up on subsequent or rescheduled visits. The low staff coverage is also a concern as most of these facilities you will either find one or two nurses or clinicians. This often risks emotional exhaustion and threatens delivery of quality immunization healthcare. Overall, the weak healthcare infrastructure system plays a major role in reducing the prospects of attaining 100% immunization coverage among children under five years” (Informants 04, 05 and 07).

The respondents argued that strategies to overcome vaccine hesitancy should focus on education and awareness campaigns. According to the eight informant,

> "For vaccine-hesitant caregivers, I emphasize the messaging around the safety and efficacy of vaccines. There is urgency for strengthened community sensitization through household education and digitized reminders. This is because studies have shown that enhanced knowledge improves vaccine uptake by upto 15.5%. It is possible for the county government to empower CHV to carry out follow-ups and reduce missed schedules. However, lack of phones by some households significantly widen the gap to access caregivers through targeted digitized messaging strategies" (Informant 08)

Respondents also noted strengthening of outreach services as a vital boost to increased immunization coverage in Eldas Sub-County:

“The county government should seek partners in bridging the financial gap, acquire mobile clinics in remote areas to reduce distance barrier. The use of outreach services through adoption of mobile clinics is instrumental in increasing uptake in nomadic settlements and during endemics such as drought and floods. Moreover, system strengthening is necessary through improvement in staffing levels and supply chain for pharmaceutical distribution for consistent vaccine availability” (Informant 03).

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

5.1.1 Individual Level Factors Associated with Complete Vaccination Status among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County.

Most of the caregivers were of the age group of 18-29 years. This agrees with previous research underscores the influence of the caregiver's age on vaccination coverage. Younger women were found to be more likely than older mothers to fully immunize their children (Odusanya et al, 2015). The age factor is an important determinant of mother's mental wellness which is strongly correlated with child health (UNICEF, 2017).

Level of education of the caregiver significantly influenced vaccination status of the children. The proportion of children with complete vaccination status was higher among the educated caregivers compared to those without or with limited formal education. The findings align with previous observation which contended that Kenyan mother's education is a useful determinant of awareness and importance attached to child immunization. (Allan *et al.*, 2021). The findings are also supported by analysis in Nigeria which established that parents with formal education were inclined towards vaccinating their children on time (Babalola, 2005). Education bridges the knowledge gap on vaccine related issues and significance attached to it.

In addition, occupation was identified as a significant factor affecting vaccination coverage. Children of employed or self-employed mothers or caregivers exhibited a higher rate of complete vaccination. However, these finding contrasts with a study conducted in Bangladesh, which suggested that employed mothers often struggled to find time for seeking immunization services for their children (Subhani et al., 2015). The results of the current study indicate that employed caregivers may have the means to ensure their children's timely vaccination, emphasizing the role of economic stability.

Besides, the study associated the income level of caregivers with vaccination coverage, with higher income earners showing a larger share of complete vaccination schedules. These results are in line with a study in Kenya, which emphasized the significance of household wealth in complete vaccination coverage. This implies that children born in high income families which can manage to afford vaccines and necessary supporting factors stand better chances of completing vaccination status (Allan et al., 2021). In low income populations, as the case with pastoralist communities, caregivers find it difficult to afford enabling factors such as transport and communication costs which tend to inhibit and disrupt recommended vaccination schedules (Calhoun et al., 2014).

However, religion was not a significant factor in the current study, but existing research presents varying perspectives on its impact on children's vaccination status. In Sub-Sahra Africa, it was found that children of Christian households often had higher immunization rates than children of Muslim families, indicating a possible correlation between religion and vaccination coverage (Costa et al., 2020). However, it is important to note that low vaccination coverage among different religious groups might result from a lack of awareness of immunization services (Costa et al., 2020). Meanwhile, birth order emerged as an important factor, with vaccination coverage decreasing as birth order rises, as evidenced in studies from Ethiopia and rural Mozambique (Central Statistics Agency, ORC Macro, 2005; Jagrati *et al*., 2008). This suggests that the order in which a child is born can affect immunization practices and highlights the importance of maternal health service use, including antenatal care, and the presence of a delivery attendant in vaccination outcomes.

The role of information sources for immunization services was examined. The analysis revealed a significant association between receiving immunization information through radio or television and complete child vaccination. The results agree with previous study in Saudi Arabia that knowledge about symptoms vaccine-preventable diseases by mothers thought them that vaccination was beneficial (Almutairi *et al.*, 2021). A higher proportion of children whose caregivers received information on immunization through radio or television demonstrated complete vaccination coverage compared to those without access to this information. This

finding demonstrates the importance of information dissemination in promoting vaccination. However, contradicts another study Masters, Tefera, Wagner, and Boulton (2018), where the majority of mothers or caregivers reported a lack of information about the benefits of immunization and vaccination schedules, underscoring the critical role of information accessibility in immunization uptake.

The study also found that knowledge of the purpose of vaccination was significantly associated with complete vaccination coverage. A substantial percentage of participants recognized the importance of childhood immunization in protecting children from illnesses and fostering their healthy growth. This finding aligns with Almutairi et al., (2021) where a high percentage of mothers and caregivers perceived vaccination as beneficial. However, it contrasts with findings by Kunjok *et al*. (2021), where lack of information commonly contributed to poor utilization and low accessibility of immunization services, suggesting that different countries exhibit varying levels of awareness and understanding regarding vaccination.

BCG scar presence was another factor associated with complete vaccination coverage in the study. A visible BCG scar among children was a major predictors of the ability to complete recommended vaccination status. Negussie *et al*. (2016) supported these results by indicating that early BCG vaccination was linked to higher completion rates, likely due to increased contacts with the healthcare system during the antenatal period. Early BCG vaccination was associated with antenatal care utilization and hospital deliveries, thus contributing to timely initiation of the vaccination schedule.

The possession of a child's health card was identified as a significant factor in vaccination completion. Children who possessed health card indicated better chances of completing vaccination status. The ability of caregivers to effectively document and manage health records of their children demonstrates the degree of seriousness and awareness in tracking vaccination status of their children. This finding is in line with studies conducted in Senegal and Ghana by Nsubuga et al., (2019), where not having an immunization card was associated with incomplete immunization. Health

education and the importance of retaining health cards were highlighted as key factors in these contexts.

5.1.2 To Assess the Status of Routine Vaccination among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County.

The study attained immunization prevalence of 69.8%. This is below the national average of 80%. However, it rates significantly above peer pastoralist regions such as West Pokot which lags at 36.6% of fully immunized against 62.4% of the children that are partially immunized while 1.1% are yet to receive any form of vaccination. The results demonstrate the disparities and significant gaps in vaccination coverage among pastoralist and semi-arid regions. The same pattern was observed in Ethiopia which showed that most regions' vaccination coverage fell below the WHO recommended level (Girmay & Dadi, 2019).

The analysis demonstrated that out of 90.6% of the children that manifested BCG scars, only 86.1% had received recommended Pentavalent. Oral Polio vaccine reported 97.8% coverage with measles immunization translating to 94.8% of the targeted children. The disparities in vaccination coverage reflect the global patten moreso in the developing countries whose healthcare system remain largely fragile and scarce resources which leave many out of reach of essential vaccination services (Mamuti *et al*., 2022). Despite the disparities, countries such as Chad, occasioned by frequent conflicts and harsh climatic conditions, are yet to record remarkable breakthrough as only 33% of the child population has been fully vaccinated (WHO/UNICEF, 2019). Such discrepancies in vaccination rates can be attributed to various factors, including geographical location, birth order, maternal age, and place of residence.

The study found that children in Eldas Sub County had varying rates of vaccination for different vaccines. The findings emphasize the benefits derived from realizing equitable vaccine coverage across all forms of recommended vaccines. The initiatives such as Global Vaccine Action Plan 2011-2020 outline the framework for bolstering global efforts towards realization of this goal. Despite significant milestone in some countries, most of developing countries are yet to demonstrate the

potential to realize the recommended 90% coverage for all categories of vaccines on the routine immunization schedule (WHO/UNICEF, 2019). This gap is largely evident in African Countries which demonstrate complex and multifaceted challenges that ranges from limited healthcare infrastructure, social end economic exclusions and constrained political drive.

The findings reveal significant barriers that could justify the inability of developing countries to realize the recommended targets. The skewed vaccine supply chain, funding constraints, human resource limitations, fragile infrastructure and weak community engagement are fundamental inhibitors observed in the analysis. The inequalities in vaccine coverage is also evident across a wide spectrum of factors such as birth order, age of the mother, sex of the household health and place of residence. These are challenges that are not only unique to Eldas Sub-County by a reflection of national and regional African crisis. Similar findings have been reported in Nigeria which consistently report varying levels of immunization coverage, reflecting the need for targeted interventions to bridge these gaps (WHO/UNICEF, 2019).

The study underscores the critical role of vaccinations in public health, not only in preventing diseases but also in promoting economic growth. Poor health, especially in children, can impede economic development and productivity. Vaccinations have a significant return on investment, with estimated annual returns ranging from 12% to 18%. While funding is required for infrastructure, vaccine procurement, and staffing, the long-term financial savings and future economic growth resulting from reduced mortality and morbidity far outweigh the costs. The economic implications of vaccination are a driving force behind global immunization efforts (UNICEF, 2017).

5.1.3 Health System Level Factors Associated with Complete Vaccination Status among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County

The study also emphasized the role of travel time to the nearest hospital in vaccination coverage. Shorter travel times to the nearest facility predicted higher rates of complete vaccination coverage. Workina *et al*. (2018) also identified travel

times of more than one hour to a health facility as a significant barrier to receiving pentavalent vaccination. Longer travel times, especially exceeding two hours, were associated with lower vaccination coverage, emphasizing the impact of travel on immunization accessibility.

With reference to the distance to the nearest health centre, caregivers who stayed within 1-10 kilometres of from the facility had higher chances of completing vaccination coverage compared to those who stayed more than 10 kilometres away. In low-income regions such as Eldas Sub- County, affordability of means of transport is an important predictor as many mothers and caregivers rely on walking as the most affordable mode of transport to the facility. The findings demonstrate the significance of closeness to the health facility as a motivation to adhere to the necessary vaccination schedule. This observation aligns with the study by Agócs et al., (2021) conducted in Nakuru, Kilifi, and Mathare, which reported that proximity to health facilities significantly influenced complete vaccination schedules. It is worth noting that the availability of transportation means, such as motorcycles, could also affect the ease of reaching healthcare facilities, which differs from rural Eldas Sub-County.

The source of immunization services also played a role in vaccination completion. Children who received immunizations from public hospitals possessed higher chances of completing required vaccination schedule than those who received vaccinations through outreach services. The accessibility to public hospitals may have influenced this difference, and it echoes findings from a study in Uganda where most children received immunization services from health units, reinforcing the importance of healthcare provider accessibility (Nsubuga *et al.,* 2019).

Children whose mothers received accurate information were more likely to have a complete vaccination schedule. This finding aligns with a study in Nigeria by Adeyanju *et al*. (2022), which indicated that healthcare providers played a role in providing accurate information about immunization. Misinformation and rumors can erode public confidence in vaccination, highlighting the need for accurate and complete information dissemination (Olson *et al*., 2020).

5.2 Conclusions

1. The individual level factors associated with complete vaccination status were education, occupation, income level, and ownership of electronic devices significantly influenced complete vaccination status among children aged 2 to 5 years in Eldas sub-county, Wajir County. Caregivers with school attending history, employed or self-employed status, predicted better vaccination coverage among their children. High income households and access to relevant media information led to improved vaccination outcomes.Caregivers in Eldas sub-county are dominated by the youth aged 18-29, who practice Islam religion with low education level and remain largely unemployed. They rely on cattle herding and camel rearing for livelihood and this affects convenience to attend to recommended vaccination schedules.
2. The vaccination completeness performance was below the recommended set target by WHO and the Ministry of Health, with some partially immunized and the rest not immunized at Eldas Sub-County
3. Health system related predictors that explained complete vaccination status included availability of skilled healthcare professional, presence of well-equipped public healthcare facilities and caregivers' proximity to those facilities. However, factors such as clinic shortages highlight the need for systemic improvements.

5.3 Recommendations.

1. The study recommends that County Health Department should implement targeted education outreach programs to raise awareness about vaccination benefits among communities, emphasizing the positive impact of school attendance on children's vaccination coverage.
2. Introduce initiatives supporting employed and self-employed caregivers, addressing potential barriers to accessing vaccination services, and promoting vaccination as an integral part of childcare responsibilities.
3. Develop strategies to enhance vaccination accessibility for lower-income families, considering subsidies or incentives to bridge economic gaps and ensure that financial constraints do not hinder vaccination coverage.

4. Train CHPs who travel with these nomadic communities to offer basic healthcare services. The CHPs can identify children who have never received any immunization or defaulted and reconnect them to immunization services.
5. Leverage media channels for awareness campaigns, emphasizing the role of electronic devices in facilitating vaccination knowledge and reinforcing the importance of media access in improving vaccination rates.
6. Address clinic shortages and enhance healthcare infrastructure to ensure the availability of skilled health professionals and reduce potential barriers to vaccination, contributing to improved overall vaccination coverage.
7. Finally, further research should investigate the influence of specific beliefs, myths, and misconceptions shape vaccination decisions in pastoral populations. Additional research could investigate the role of digital communication strategies in enhancing immunization uptake in nomadic settings. Research could also examine the role of regulatory and environmental factors in influencing vaccine coverage among children in arid and semi-arid areas.

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APPENDICES

Appendix I: Questionnaire

Participants number|__|___|___|

PART 1: INDIVIDUAL LEVEL FACTORS ASSOCIATED WITH COMPLETE VACCINATION STATUS AMONG CHILDREN AGED 2 TO 5 YEARS IN ELDAS SUB COUNTY, WAJIR COUNTY.

1. How old are you?

i. 18 – 29 years
ii. 30 – 39 years
iii. 40– 49 years
iv. 50 -59 years
v. Above 59 years

2.Who is the head of this household?

i. Husband.....
ii. Wife.....
iii. Other (specify).....

3.Which religion do you practice?

i. Christian.....
ii. Muslim .....
iii. Hindu
iv. None.....
v. Any other(specify).....

4.What is your current marital status?

i. Single.....
ii. Married (monogamous).....

iii. Married(polygamous).....

iv. Divorced.....

v. Widowed.....

vi. others

5.Have you ever attended school?

i. Yes.....

ii. No.....

6.What is the highest level of education you attended?

Highest education level attained (Tick one)	**Completed**	**Not completed**
Primary		
Secondary		
College		
Vocational training		
Adult education		
None (illiterate)		

7. Occupation:

i. Self-employment

ii. Unemployed

iii. Employed

iv. Casual labourer

v. Other (Specify)_____

8. Level of income per month?

i. Below 3000

ii. 3000 –6000

iii. 6000 -12000

iv. 12000-24000

v. 24000-48000

vi. 48000-96000

vii. Above 96000

9. Do you own radio or television?

i. Yes...

ii. No...

10. What is the child's date of birth? dd mm yy |_____|____|____|

11. Gender of your child?

i. F ()

ii. M ()

12. Anthropometric measurements

i. Length……

ii. Weight……...

13. Number of children:

i. < 5 years _____

ii. 5-15 years _____

14. What is the age of the child?

i. 24-30 months

ii. 30-36 months

iii. 36-40 months

iv. Over 46 months

15. How many children of your own do you live with

i. 1…
ii. 2...
iii. 3…
iv. 4…
v. 5..

16. Do you take care of non-biological children

i. Yes.....
ii. No…

17 . What are the reasons why the child is not fully immunized

i. Mother too weak to visit the health facility
ii. High costs for travel
iii. No cards supply
iv. Card got lost
v. Don't know
vi. Others (Specify)

18. Has the child been ill of any of the following?

i. Yes.....
ii. No....
iii. Don't know....

If yes, what was the duration of illness

Illness	Fever	Cough and Rapid breathing	Cough	Convulsions	Diarrhea	Others (Specify)
Duration in weeks						

Was the child hospitalized? 1.Yes.....2. No.... 3. Don't know....

If yes, how many ……...days

19. Was the child breast-fed?

i. Yes.....
ii. No....
iii. Don't know....

If Yes, how long has the child breastfed

i. 0-6 months.....
ii. 6-12 months...
iii. Over 12 Months.

20. Are there personal issues that limit you from taking the child for immunization

i. Yes.....
ii. No....
iii. Don't know....

If Yes name the issues If the child is partially or not immunized what are the, reasons for non-completion.

i. Unaware of need for immunization
ii. Unaware of need for return for next dose
iii. Place and/or time of immunization unknown
iv. Fear of side effects.
v. Wrong ideas about contraindications e.g. sick child, HIV etc.
vi. Postponed till another time
vii. No faith in immunization
viii. Place of immunization too far
ix. Time of immunization inconvenient e.g. rainy season, planting season.
x. Mother too busy

xi. Family problem including illness of mother.

xii. Others(Specify)……...

21. Are there rumours that affect the immunization uptake immunization

i. Yes.....

ii. No....

iii. Don’t know....

If yes name, the rumors ----------

22. Have you ever taken the child for late immunizations

i. Yes

ii. No

iii. Don’t know

If yes, what do you do?

a. Return to clinic even if immunization is late

b. Wait until the next immunization is to be given.

c. Didn’t know immunizations can be given at a later date

d. Others (specify)

23. How important is it that your child is immunized?

i. Very important

ii. Not really important/ Not interested in immunizing his/her child

iii. Don’t know if it’s important

24. What are the benefits/importance of immunization

i. Childhood immunization is very important

ii. Not really important/ Not interested in immunizing his/her child

iii. Don’t know if immunization is important.

iv. Others (specify)

25. Are you aware of the vaccine preventable diseases?

i. Yes
ii. No

If yes which ones?

26. Do you feel vaccination is safe

i. Not safe
ii. Somewhat safe
iii. Safe
iv. Very safe
v. Do not know

27. What is your feeling towards immunization-associated fever

i. Go straight back to the clinic if child has a fever after immunization
ii. Give “panadol” syrup until the fever goes away
iii. Never take child back for any immunizations again after developing fever from immunization
iv. Don’t know what to do if child has fever after immunization
v. Others (specify)
vi. What are your feelings on multiple immunization administration?
vii. Multiple immunizations are a good idea.
viii. Multiple immunizations are too much for child’s body at one time
ix. Don’t know if child gets multiple immunization
x. Others (specify)

PART 2: TO ASSESS THE STATUS OF ROUTINE VACCINATION AMONG CHILDREN AGED 2 TO 5 YEARS IN ELDAS SUB COUNTY, WAJIR COUNTY.

(COVERAGE)

28. Did your child ever receive any vaccinations against immunizable diseases?

i. Yes.....
ii. No.....
iii. Don't know...

29. Purpose of vaccination

i. Help a child grow
ii. Protect a child from certain diseases
iii. Gives the child strength
iv. Don't know
v. Others

30. Please tell me if your child has received the following vaccinations

Vaccination	Yes	No	Do not know
BCG vaccination against TB that is injected on the arm or on the shoulder that usually causes a scar?			
Did your child receive first dose of pentavalent vaccine at six weeks?			
Did your child receive second dose of pentavalent vaccine at 10 weeks?			
Did the child receive third dose of pentavalent vaccine at 14 weeks?			
Did the child receive first dose of Rota vaccine at 6 weeks?			
Did the child receive second			

dose of Rota vaccine at 10 weeks?			
Was the first polio vaccine received at after birth or later?			
Did your child receive the second dose at six weeks?			
Did your child receive third dose of polio at 10 weeks?			
Did your child receive fourth dose of polio at 14 weeks...?			
Has your child received a measles injection that is a shot in the right upper arm at the age of 9 Months against measles?			
Did your child receive measles booster at 18 months?			

31.Immunization Status?

i. Fully immunized.....
ii. Age appropriately vaccinated
iii. Partially immunized
iv. Not immunized.....
v. Others (Specify)

32. Do you have the child's vaccination card with you?

i. Yes..... (seen)
ii. Yes..... (not seen)
iii. No

33. BCG scar present

i. Yes
ii. No

PART 3: HEALTH SYSTEM LEVEL FACTORS ASSOCIATED WITH COMPLETE VACCINATION STATUS AMONG CHILDREN AGED 2 TO 5 YEARS IN ELDAS SUB COUNTY, WAJIR COUNTY

34. When going to take your child for his/her immunization do you prefer

i. An appointment
ii. To sit and wait your turn
iii. Doesn't matter

35. Have you received any information/education on immunization?

i. Yes
ii. No

If yes, from where?

i. Health worker
ii. Provincial administration
iii. CHW
iv. Neighbor.
v. Friend
vi. Radio
vii. Television
viii. Others(Specify)

36. Who facilitated the last delivery?

i. Skilled health attendant....
ii. Traditional birth attendant...
iii. Relative....
iv. Self.....

37. Where did your child receive the immunization.

i. Public hospital.....
ii. Private hospital.....
iii. Faith based hospital.
iv. Outreach...
v. NGO.....
vi. Others(Specify)…….....

38. How long do you take to reach to the nearest hospital.

i. 1.Less than 30 min....
ii. 30min-1Hr .....
iii. 1 hour 2Hrs.....
iv. More than 2 hrs....

39. How far is the nearest hospital?

i. 1-5 km
ii. 5-10km
iii. 10-15 km
iv. 15-20km
v. Ove 20 km

40. Which means of transport do you use to get to the nearest hospital?

i. Foot.....
ii. Bicycle.....
iii. Public means.....
iv. Personal car.....
v. Others(Specify)…….....

41. Have you ever been turned away from the clinic

i. Yes

ii. No

If yes, what were the reasons

a. Was told when to come back for child's immunization.

b. Appointment date was given

c. Immunization stock-outs.

d. Others (specify)

Appendix II: Participants' Informed Consent Form

I, [Participant's/Caregiver's Full Name], have read and understood the information provided above regarding the research study titled "Determining Vaccination Status and Associated Factors Among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County."

Consent to Participate:

I voluntarily agree to participate in this study and understand that my involvement will include:

Providing information about the socio-demographic and economic profiles of caregivers.

Disclosing the vaccination status of my child aged 2 to 5 years.

Answering questions related to individual and health system level factors associated with complete vaccination status.

Confidentiality:

I understand that my personal information will be kept confidential. All data collected will be anonymized and stored securely.

Right to Withdraw:

I have the right to withdraw from the study at any time without facing any consequences.

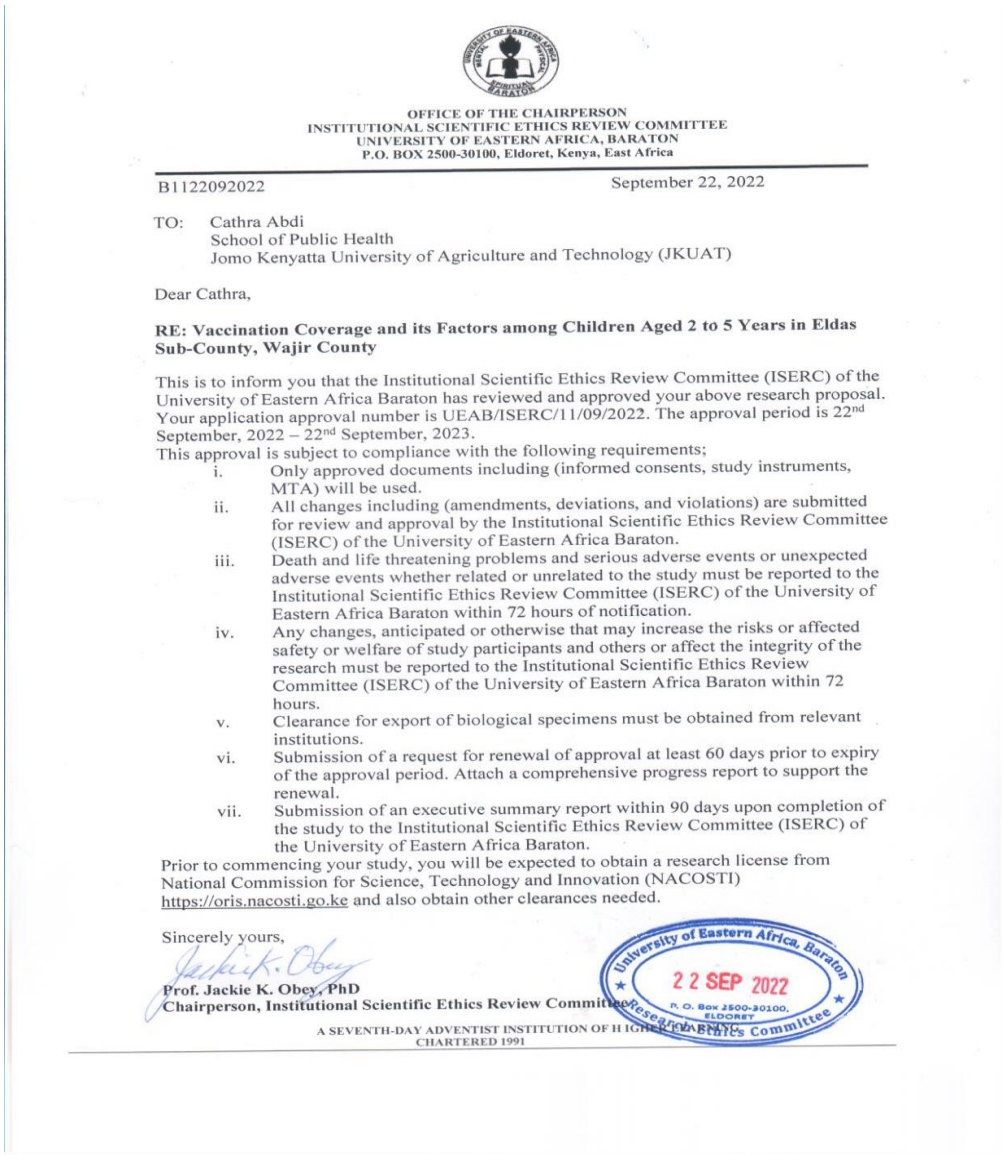
Contact Information:

If I have any questions or concerns about the study, I can contact Dr Cathra Deymaan at +254 728 125680

Appendix III: Key Informants Interviews Guidelines

1. How can you explain vaccination coverage?
2. What are some of the factors that affect vaccine coverage in Eldas Sub County?
3. Do you think these problems can be overcome?
4. What are some of the best solutions to these problems?

Appendix IV: Ethical Approval



OFFICE OF THE CHAIRPERSON
INSTITUTIONAL SCIENTIFIC ETHICS REVIEW COMMITTEE
UNIVERSITY OF EASTERN AFRICA, BARATON
P.O. BOX 2500-30100, Eldoret, Kenya, East Africa

B1122092022 September 22, 2022

TO: Cathra Abdi
School of Public Health
Jomo Kenyatta University of Agriculture and Technology (JKUAT)

Dear Cathra,

RE: Vaccination Coverage and its Factors among Children Aged 2 to 5 Years in Eldas Sub-County, Wajir County

This is to inform you that the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton has reviewed and approved your above research proposal. Your application approval number is UEAB/ISERC/11/09/2022. The approval period is 22nd September, 2022 – 22nd September, 2023.
This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to the Institutional Scientific Ethics Review Committee (ISERC) of the University of Eastern Africa Baraton.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Sincerely yours,

Prof. Jackie K. Obey, PhD
Chairperson, Institutional Scientific Ethics Review Committee

University of Eastern Africa, Baraton
22 SEP 2022
P. O. Box 2500-30100, ELDORET
Research Ethics Committee

A SEVENTH-DAY ADVENTIST INSTITUTION OF H IGHER LEARNING
CHARTERED 1991

Appendix V: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **426000**

Date of Issue: **19/October/2022**

RESEARCH LICENSE

This is to Certify that Ms.. Cathra - Abdi of Jomo Kenyatta University of Agriculture and Technology, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Wajir on the topic: Vaccination Coverage and Its Factors among Children Aged 2 to 5 Years in Eldas Sub County, Wajir County for the period ending : 19/October/2023.

License No: **NACOSTI/P/22/20840**

426000

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions