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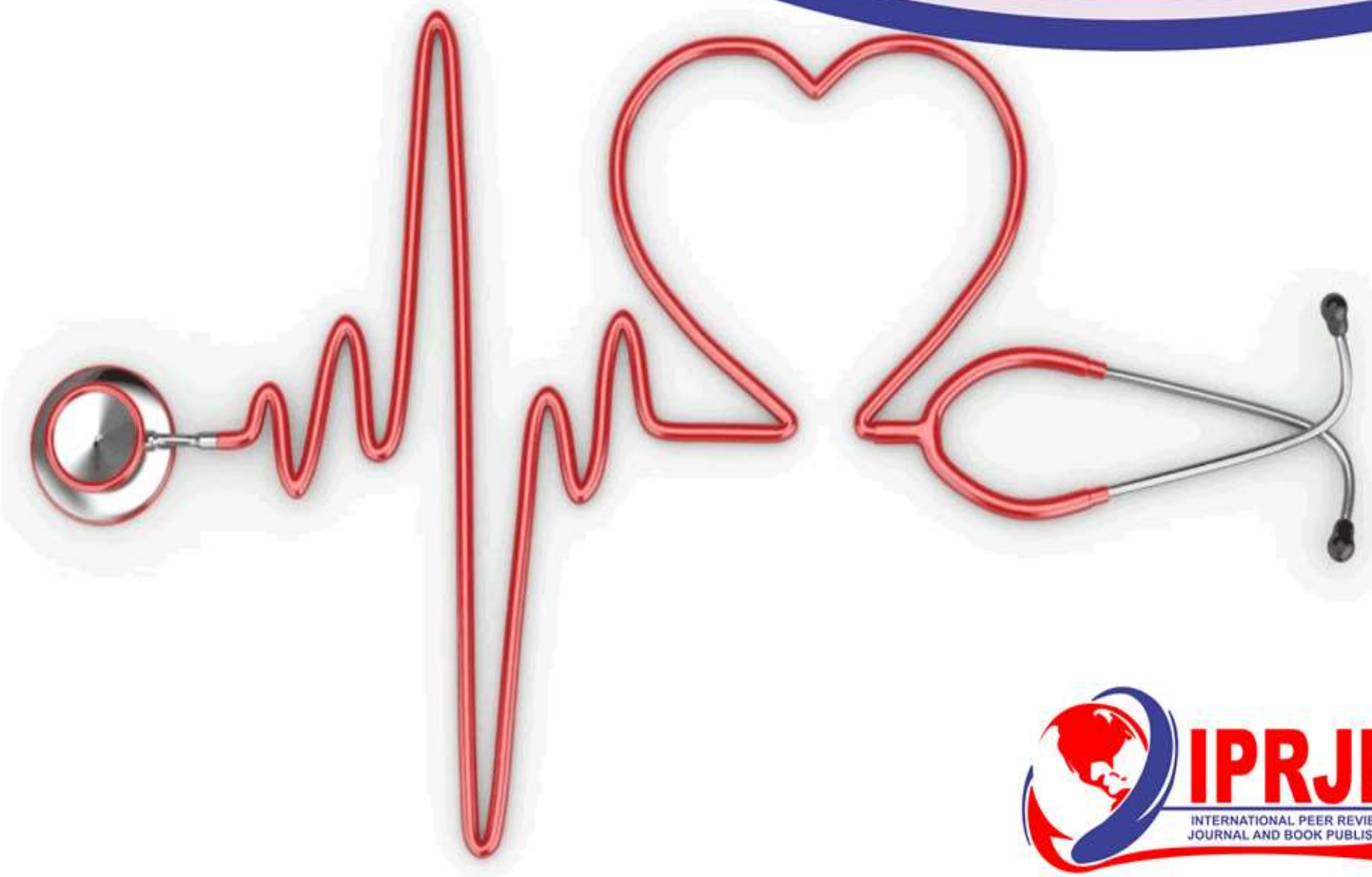

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Vaccination Coverage and Its Associated Factors among Children Aged 2 - 5 Years in Eldas Sub County, Wajir County

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Abstract

Purpose: The purpose of the study was to determine determinants of vaccination coverage and its associated factors among children 2-5 years of Age in Eldas Sub-County, Wajir County.

Methodology: This study used a cross-sectional design with a sample size of 367 participants, selected using probability proportion to size and systematic random sampling. Data was collected using pretested semi-structured questionnaires and a key informants' guide. In the study, Pearson's Chi-square test was used to test the association between complete MR coverage and independent categorical variables. The significance level was fixed at 0.05 (p=0.05) with a 95% confidence interval. Qualitative data was analyzed through content analysis. MS Access database was used to store the data, which was then exported for analysis to SPSS version 21.0. The results were presented in tables, graphs and charts.

Findings: The vaccination coverage was 69.8%. The most common reasons for incomplete vaccination coverage were the far location of immunization centers and the unknown place/time of immunization. About 78.5% of the children had experienced illness, while 49.2% of the caregivers had ever taken their child for late immunization. The study found that children whose caregivers did not have personal issues limiting their ability to take their child for immunization were 2.29 times more likely to have complete vaccination coverage (95% CI = 1.41 - 3.75, P < 0.001). Additionally, children whose caregivers had information or education on immunization were 5.53 times more likely to have complete vaccination coverage (95% CI = 3.22 - 9.51, P < 0.001). Other significant predictors of complete vaccination coverage included the importance placed on immunization by the caregiver and the person who facilitated the last delivery. The study concludes that Eldas Sub-County vaccination completeness falls below WHO's recommended target of 85%, with 29.2% partially immunized and 1.1% not immunized. Demographic factors affected completion.

Unique Contribution to Theory, Practice and Policy: The study suggested that equipping healthcare providers, providing health education, planning outreach services with community participation, engaging community leaders to address misinformation and designing targeted messages will improve vaccination behavior.

Keywords: *Vaccine Coverage, Children, Wajir County*

INTRODUCTION

Vaccination coverage is the proportion of target population who have received recommended vaccines in the national immunization schedule. Vaccination coverage information is important in identifying subsets of population with lower vaccination coverage for intervention by health authorities, health care stakeholders to improve vaccination coverage for vaccine-preventable disease 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 annually (Odusanya, *et al*,, 2008).

In the global context, 19.7 million children (14%) had incomplete vaccination status in 2020 and 13.5 million (70%) of those who had incomplete vaccination status did not receive 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. From 84% in 2010 to 86% in 2018, coverage with the third dosage of DTP (DTP3) rose. Dropout rates (DTP1 to DTP3) globally decreased noticeably from 6% in 2010 to 4% in 2018. The initial dosage of the measles vaccine (MCV1) increased by 2% from 84% in 2010 to 86% in 2018. In countries, which offer second MCV dose (MCV2) during the second year of life, there had been a large margin increase in coverage from 19% in 2007 to 54% in 2018; 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 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 the third dose series increased from 73% to 84%.

Worldwide, approximately 3 million deaths are averted through vaccination intervention activities annually. An increase in vaccination coverage could raise protection, curbing additional 1.5 million deaths (WHO-UNICEF, 2021). Globally, almost 29,000 children below the Age of five years die every day from Vaccine preventable Diseases (Animaw, *et al*, 2014). In developing countries, nearly 8 million children die annually prior to their 5th anniversary of birth, majority of whom die in their first year of life (Animaw *et al*., 2014). In 2018, 60% of children were not given doses of recommended immunizations in Brazil, Angola, the Democratic Republic of the Congo, Pakistan, Ethiopia, Indonesia, Nigeria, Iraq, India, and South Africa (Andre et al, 2018). In 11 nations, including Angola, Guinea, Chad, Samoa, Equatorial Guinea, Nigeria, Somalia, the Central African Republic, South Sudan, Ukraine and the 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 vaccine delivery and lowering vaccination coverage.

If vaccination coverage exceeds 90%, full protection against diseases that can be prevented by vaccines 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 of 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 Southeast Asian Region and the African Region, in particular, have over 20 years of such performance (Dao & Brieger, 2017).

In Africa, Routine immunization; coverage remains particularly low, it has stagnated over the last three years, where 79% of the countries had not achieved the target by 2015, and nearly 15.5 million children never received any vaccine dose or unvaccinated worldwide are found in the African Region. This is way over the unvaccinated children in other WHO regions combined. It is estimated that one in every five children in Africa does not receive a basic vaccine, and 42% of global measles mortality in 2014 was reported in Africa. Africa has witnessed progressive demographic growth while other regions are in demographic downward trend, coupled with weak health systems and lack of a robust immunization program. Therefore, countries in Africa essentially need to reach more children for vaccination to preserve the gains made in the recent past. The progress toward reducing vaccine preventable disease deaths and attaining elimination targets has decelerated since 2007, in sub-Saharan Africa due to Immunization gaps and bottlenecks (CDC; 2016). Most under-immunized children in Africa are found in Guinea, Nigeria, the Democratic Republic of Congo, Ethiopia, and South Sudan (UNICEF, 2020).

For instance, Immunization coverage was low and only one third of children were vaccinated in Chad in 2018. There were no sex differences in terms of immunization coverage, but inequality arose in birth order, mother's Age at birth, sex of household head and place of residence. Immunization coverage demonstrated variability in mother's level of education and across continents and subregions; 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 variables, 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).

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. Immunization coverage among first-born children was even better, at as twice the rate compared to coverage among sixth born children. In households 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 higher in urban compared to rural setup. Immunization coverage was higher in children of richer households and mothers of higher education levels. Immunization coverage was weakly associated with birth order and place of residence after adjustment. However, child's sex was not a significant factor. On the other hand, strong associations were evident 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 Bacillus Calmette-Guerin (BCG) and Oral Polio Vaccine (OPV) be administered to at birth; the subsequent doses of pentavalent vaccine and OPV should be given at 6, 10 and 14 weeks of age respectively; and measles vaccine at nine months of age (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 was 52 deaths per 1,000 in the five years preceding 2014 (KNBS; 2014), of which the majority were due to vaccine-preventable diseases. The Northeastern region (41%) had the lowest coverage, and the highest coverage

was reported by the Central region (96%). In the Northeastern region, only 41% of children are fully vaccinated (KDHS, 2014).

Statement of the Problem

The Global Vaccine Action Plan 2011-2020, initiated in 2012, called on nations worldwide to achieve over 90% vaccination coverage for all vaccines on the national routine immunization schedule by 2020. However, in developing countries, routine vaccination coverage among children remains below the targets set by the World Health Organization (WHO) and UNICEF. While most developed countries surpass the targets, globally, only 40% of World Health Assembly member states attained 90% national full vaccination coverage in 2015. The situation is more concerning in the African region, where 79% of countries had not reached the targets by 2015 (UNICEF, 2016).

In Kenya, although vaccination improved from 70% in 2017 to 82% in 2018, it still falls below the WHO and Ministry of Health's target of 90%, particularly evident in the Northeastern region, where only 41% of children are fully vaccinated (KDHS 2014). The consequences of inadequate immunization are grave; globally, 3 million people die due to lack of immunization, with 1.5 million being children under five (WHO, 2019). This deficiency in routine immunizations in developing countries elevates the risk of infectious parasitic and vaccine-preventable diseases, major contributors to morbidity and mortality (UNICEF, 2018).

In July 11, 2023, WHO confirmed circulating vaccine-derived poliovirus type 2 (cVDPV2) in Kenya, sourced from Hagadera refugee camp, the second-largest globally, with 100,000 refugees. Despite Kenya's overall polio vaccine coverage being 91% in 2021, Hagadera's was only 77% in May 2023, leading to a polio outbreak (Makokha et al., 2023). Tuberculosis prevalence in Turkana County exceeds WHO recommendations, and Hepatitis B is rising, with Mandera County reporting 13.9% prevalence and Garissa 14.1%. HPV vaccination campaigns face challenges, with varying rates across Kenyan counties (Kahenda, 2023).

Vaccine-preventable illnesses contribute significantly to childhood disability. Polio eradication and widespread measles vaccination have prevented catastrophic disability, and complications from diseases like measles, rubella, and hepatitis B can have lasting impacts on children's health. Despite the challenges, vaccinations remain the cornerstone of public health initiatives, with an estimated 12% to 18% annual return on investment. Immunization positively impacts individual and community health, lengthening life expectancy and enhancing productivity (UNICEF, 2017). However, challenges persist, with low uptake observed in Wajir County (KDHS 2014), prompting further studies to understand the determinants of vaccination coverage in Eldas Sub County.

Objective of the Study

Broad Objective

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

Specific objective

1. To determine the 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 coverage among children aged 2 to 5 years in Eldas sub county, Wajir County

LITERATURE REVIEW

Vaccination Coverage for Routine Vaccines among Children Two to Five Years of Age

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 the 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. 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.

Immunization Awareness

The goal of World Immunization Week, which is observed in the final week of April, is to encourage the use of immunization services to protect people of all ages against vaccine-preventable diseases. Every year, vaccinations save millions of lives, making them one of the most effective and affordable health treatments ever. However, there are still about 20 million children worldwide who are either under or unvaccinated. 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 for addressing other health concerns, such as reducing antimicrobial resistance, controlling viral hepatitis, promoting adolescent health, and enhancing prenatal and neonatal care.

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.

Birth Order

Birth order and vaccination coverage are highly connected. The Ethiopia Demographic and Household Survey (EDHS, 2005) found that vaccination coverage normally decreases as birth order rises; 27% of first-born children and 18% of children with birth orders of six and above have gotten all of the recommended immunizations. (Central Statistics Agency, ORC Macro, 2005). A study by Jagrati *et al.* (2008) in rural Mozambique revealed that home-born children have a 2.27 times higher likelihood 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. The scientists claim that mothers who follow ANC and give birth in a hospital are more likely to adequately immunize their offspring. The study further claims that a child's immunization history is impacted by the presence of a delivery attendant.

Knowledge, Attitude and Practices of Caregivers

Another element that influences a 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 among 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 immunization coverage differs from country to country. In a systematic review on barriers to childhood immunization in sub-Saharan Africa, caregivers cited, trust, long waiting times, providers' hostility, parents' forgetfulness, inconvenient times, and language barriers as impede accessing and utilizing immunization services (Bangura *et al.*, 2020).

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 (Millimouno *et al.*, 2006).

Fear of Side Effects

There are typically mild side effects like rash, fever, or redness. Parents in numerous countries, like Liberia and Somalia, refused to vaccinate their children because they were afraid of the side effects (Bender and Macauley, 1988). Parents refuse to vaccinate their younger children since an older sibling experienced ill effects (Bhanot *et al.*, 2004).

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 (Abilla & Munguti, 1993; PATH-Kenya, 1992). In Indonesia and Somalia, services were available early in the day before mothers' busy schedules of activities.

Accessibility to Health Facility/Health System Factors

Health facility is an important component that helps the child receive all of his or her vaccinations. Numerous studies have demonstrated the significance of health facilities' accessibility and availability for immunization 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 a study conducted in Kenya on childhood immunization coverage by socioeconomic, geographic, maternal, child, and place of birth characteristics, children travelling two hours or more from the nearest health facilities providing immunization are less likely to miss out on the 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). The complete vaccination coverage was higher in rural children compared to that of urban children (Islam e*t al.,* 2021). This could be attributed to health infrastructure and immunization awareness among the rural population. However, in a study conducted in Ethiopia, complete vaccination was higher in urban centres (Tamirat & Sisay, 2019). In a qualitative study conducted in South Sudan on determinants of poor utilization and accessibility of immunization services, participants stated 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, other supplies and cold chain breakdown were also identified as contributing to low coverage. The vaccine stocks discouraged caregivers or mothers from returning their children for subsequent doses (Kunjok *et al.,* 2021).

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 (Gambia's Department of State of Health, 2004). 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).

Conceptual Framework

It is the set of broad ideas that are used to explain the relationship between the factors (independent variables such as, occupation, education, religion e.tc) and the outcome

(dependent variables, i.e. vaccination or no vaccination) being studied, as shown in Figure 1 below.

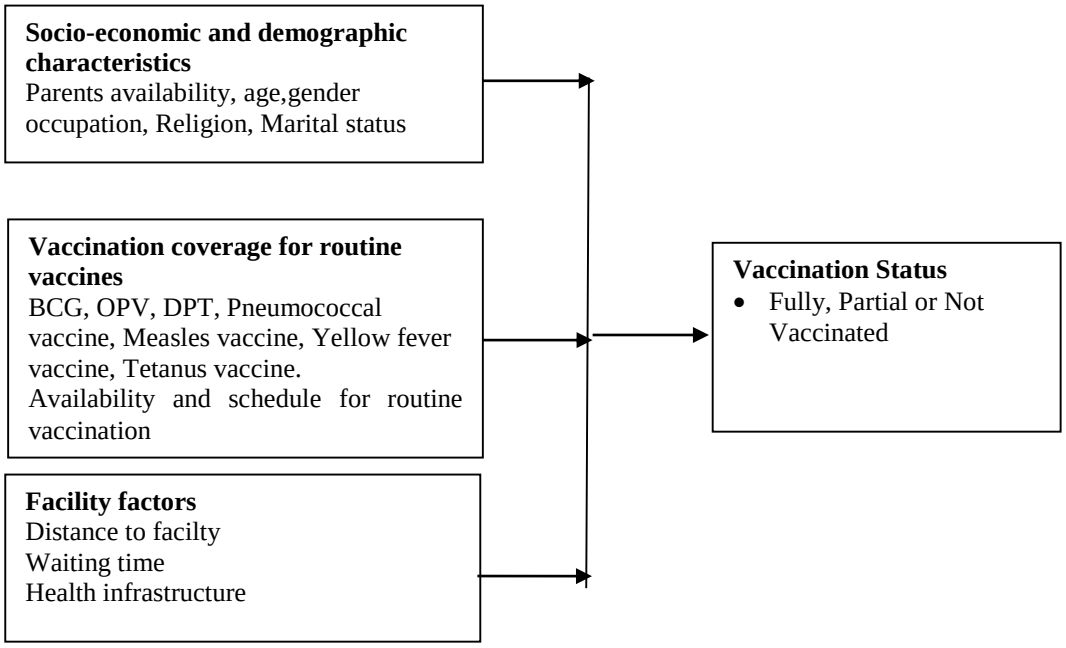

Figure 1: Conceptual Framework

METHODOLOGY

The study was carried out in Eldas Sub County in Wajir County, Kenya. The study was carried out using cross-sectional design. The target population of this study consists of all mothers or caretakers of children aged 2-5 years of age and health workers in the immunizing health facilities. The study used semi-structured questionnaires as the main instruments; key informants' interviews and focused group discussions were used. Both primary and secondary data were used in the study. The information will be collected using interviewer administered questionnaires. As for the vaccination coverage, secondary data was collected from the health records of the clients. Key informant interviews were also be used. This study collected information from MCH booklets and the respondents. Data was entered in MS –Access database then exported to statistical package for social sciences (SPSS version 21.0) for analysis**.** Analysis involved descriptive statistics such as frequencies and proportions. The results were presented in tables, graphs and charts.

RESULTS

Individual Level Factors

Three hundred and sixty-seven caregivers participated in the study. The mean age of the caregivers was 30 to 39 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%). Most (40.1%). of the caregivers were in monogamous marriages. However, it is important to note that a substantial proportion (23.2%) were in polygamous marriages. 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 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 (Table 1).

Table 1: Individual Level Factors

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%
Head of the household		
Husband	251	68.4%
Wife	114	31.1%
Other	2	0.5%
Religion		
Christian	6	1.6%
Muslim	360	98.1%
Hindu	1	0.3%
Current marital status		
Single	68	18.5%
Married monogamous	147	40.1%
Married polygamous	85	23.2%
Divorced	67	18.3%
Occupation		
Employed	44	12.0%
Self-employment	39	10.6%
Casual laborer	35	9.5%
Unemployed	249	67.8%
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%
Own radio or television		
Yes	55	15.0%
No	312	85.0%
Gender of your child		
Female	173	47.1%
Male	194	52.9%
Take care of non-biological children		
Yes	78	21.3%
No	289	78.7%
Ever attended school		
Yes	60	16.3%
No	307	83.7%

Vaccination Status among Children Aged 2 to 5 Years

According to the results in Table 4.2, 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 2: Vaccination Status among 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	35.97.3%
No	235	64.03.7%
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%

Other Factors Attributable to Vaccination Status

According to Table 3, among the one hundred and eleven children who had incomplete vaccination coverage, the caregivers indicated place of immunization being far (54.1%), place/time of immunization unknown (52.3%), no faith in immunization (39.6%), fear of side effects (34.2%), unaware of need to return for next dose (33.3%), unaware of need for

immunization (23.4%), mother too busy (23.4%), postponed till another time (15.3%) and wrong ideas about contractions (13.5%) as the reasons. 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. 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. Greater proportion (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 they 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 was 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 3: Other Factors 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%
6-12 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%

Health System Factors Associated with Complete Vaccination

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] times more likely to have complete vaccination coverage as compared to children whose birth was facilitated by traditional birth attendant.

Complete vaccinations coverage was observed among children who received immunizations from public hospital (246; 71.7%) compared to children who receive immunizations from outreach (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] times more likely to have complete vaccination coverage as compared to children who receive immunizations from outreach, emphasizing the role of healthcare facilities in promoting immunization.

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 more likely to have complete vaccination coverage as 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.

High proportion of complete vaccinations coverage was observed among children whose caregivers had never been turned away from the hospital (176; 73.6%) compared to children whose caregivers had ever been turned away from the hospital (80; 62.5%). . Children whose caregivers had never been turned away from the hospital were 1.68[95%CI = 1.06 – 2.65, P = 0.026] times more likely to have complete vaccination coverage as compared to children whose caregivers had ever been turned away from the hospital. Children whose caregivers had never been turned away from the hospital were 1.68 times more likely to have complete vaccination coverage, highlighting 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: Health System 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

Reasons for Non-completion of Vaccination

According to Table 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 ionization was the best possible justification for the non-copulation 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.

Table 5: Reasons for Non-completion of Vaccination

Reasons for Low Immunization Rates	Percentage
Place of immunization being far	54.1%
Place/time of immunization unknown	52.3%
No faith in immunization	39.6%
Fear of side effects	34.2%
Unaware of need to return for next dose	33.3%
Unaware of need for immunization	23.4%
Purpose of Immunization	Percentage
Disease protection	73.0%
Child growth	7.4%
Don't know	19.6%
Evidence of Vaccinations Done	Percentage
Vaccination card: Yes Seen	46.2%
Vaccination card: Yes Not Seen	45.9%
Vaccination card: No	8.0%
BCG Scar	Percentage
Yes	90.6%
No	9.4%

Multivariable Logistic Regression

Multivariable binary logistic regression was used to model predictors of complete vaccination coverage among children aged 2 to 5 years in Eldas sub county, Wajir County. All factors identified to be significant at P<0.05 at bivariate analysis were included in the model. Backward conditional method was specified with removal set at P<0.05. Six independent predictors of complete vaccination coverage were retained and presented in Table 4.10. Children whose caregivers had ever attended school were 3.47[95%CI = 1.18 – 9.57, P=0.032] times more likely to have complete vaccination coverage as compared to children whose caregivers had never attended school. 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, times more likely to have complete vaccination coverage as compared to children whose 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 or help the child grow were 4.51[95%CI = 1.36 – 12.75, P<0.001] and 2.57[95%CI = 1.18 – 8.62, P=0.031] respectively, times more likely to have complete vaccination coverage as compared to children whose caregivers did not know the purpose of the vaccination.

Children whose caregivers were aware of vaccine preventable diseases were 3.68[95%CI = 1.12 – 9.65, P=0.007] times more likely to have complete vaccination coverage as compared to children whose caregivers were not aware of vaccine preventable diseases. Likewise, children whose delivery had been facilitated by skilled birth attendant were 5.36[95%CI = 2.15

– 13.21, P<0.001] times more likely to have complete vaccination coverage as compared to children whose delivery had been facilitated by traditional birth attendant. Children from places where the distance to the nearest hospital was 1 – 5 kilometers or 5 – 10 kilometers were 4.28[95%CI = 1.28 – 14.87, P=0.009] and 2.57[95%CI = 1.54 – 6.88, P=0.024] respectively, times more likely to have complete vaccination coverage as compared to children from places where the distance to the nearest hospital was 15 – 20 kilometers.

Table 6: 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			

aOR=adjusted Odds Ratio, Ref=Reference, P-value = Probability value, CI=Confidence interval

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

Discussion

Individual Level Factors among Caregivers of Children Aged 2 to 5 Years in Eldas Sub-County, Wajir County.

The current study revealed majority of the participants were aged 18-29 years (41.7%;153) , the finding are similar to findings of a study where The age of mothers/ caregiver 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, 2017).

This current study revealed that the level of education was significantly associated with the complete vaccination status of a child. A significant proportion of complete vaccination coverage was observed among children whose caregivers indicated that they had ever attended school (93.3%). This is consistent with a study conducted in Kenya on childhood immunization coverage, which reported that mothers and caregivers with some education levels were more aware of the importance of immunization through formal education or exposure to school-based immunization programs (Allan *et al.*, 2021). In another study in Nigeria, Mothers and

Caregivers who had formal education were more likely than parents without formal education to vaccinate their children (Babalola, 2005). Education enables mothers and caregivers to seek antenatal, prenatal, and infant immunization services as earlier as possible (Becker, 2016).

The study indicated that occupation is associated with the complete vaccination of children at $p< 0.05$. A significant proportion (81.4%) of children of employed mothers or caregivers were observed to have completed their vaccination schedule. Children of employed mothers or caregivers were also associated with complete vaccination. In comparison, a study conducted in Bangladesh on the impact of Mother's employment on child vaccination reported that lack of time of employed mothers or caregivers never allowed them to seek immunization services for their children (Subhani et al., 2015). The findings of this current study suggest that children of employed and self-employed mothers completed the vaccination schedule, and this could be due to the fact that the mothers and caregivers could easily fund their transport to the health facility for immunization compared to their unemployed counterparts.

A child's health card is important for immunization completion. This current study revealed that having a child's health card is associated with vaccination completion 3.5(95%CI = 1.53 – 8.00, P=0.001) as compared to mothers or caregivers who did not have a child's health card. The findings of this study concur with the study conducted in Senegal which reported not having an immunization card was associated with incomplete immunization (aOR: 8.27; 95% CI 4.18–16.50) and in Ghana (aOR: 50.30; 95% CI 14.40–175.92). Health education lowers the risk of losing a child's health card.

In addition, the findings indicated that the level of income per month was associated with the complete vaccination of the child, $P<0.05$. A significant proportion (79.5%) of complete vaccination schedules was observed among children of caregivers who earned Kshs 12000 and Kshs 24000 respectively. This current study concurs with a study conducted by Allan *et al.* (2021) on childhood immunization coverage in Kenya based on socioeconomic factors, which revealed household wealth is a significant factor in complete vaccination. Children of richer mothers or caregivers are more likely to be fully immunized than children of poorer households. Vaccines are free in public health facilities in Kenya. However, the cost of transport to the health facilities could be the reason for mothers or caregivers of lower income levels missing vaccination schedules. This is further consistent with previous studies, which observed that mothers or caregivers of lower income levels face challenges in accessing immunization services due to transportation to health facility-related challenges (Calhoun *et al.,* 2014).

The source of information for immunization services was also explored, and this current study revealed that receiving immunization services information through radio or television was significantly associated with the complete vaccination of a child. A high proportion of complete vaccination coverage was observed among children whose caregivers indicated receiving immunization information on a radio or television (227; 77.7%) as compared to children whose caregivers did not receive information on radio or television (29; 38.7%). Lack of information is a frequent problem in accessing immunization services. The findings disagree with a study where the majority of mothers or caregivers reported lacking information on the benefits of immunization, and vaccination schedules in a study conducted in South Sudan on determinants of poor utilization and accessibility of Immunization Services by Kunjok *et al.* (2021).

This study revealed that the participants reported the purpose of vaccination was to protect children from childhood illnesses and the knowledge of Vaccination was significantly associated with complete vaccination coverage, $P<0.05$. 77.2% indicated the importance of childhood immunization to help the child grow healthy. This is comparable to another study

conducted in Saudi Arabia, where 95% of mothers and caregivers thought that vaccination was beneficial (Almutairi et al., 2021). Kunjok et al. 2021 reported mothers' and caregivers' lack of information commonly contributed to poor utilization and low accessibility of immunization services in South Sudan which differs from this current study. These factors can be influenced by vibrant and robust immunization programs in different countries and immunization which vary from country to country (Bangura et al., 2020). Mothers who do not understand the benefits of immunization are likely to default. Mother's awareness of the importance of immunization is a factor in a complete vaccination schedule as they follow health providers' instructions (Boke et al., 2022).

Status of Routine Vaccination Among Children Aged 2 to 5 years in Eldas Sub County, Wajir County.

The proportion of fully immunized children in this current study was 69.8% (256/367), and 29.2% (107/367) were partially immunized whereas four (1.1%) were not immunized. In contrast, in West Pokot County, the coverage among children 12-23 months was estimated to be 36.6% fully immunized and 62.4% partially immunized, while 1.1% had not immunized their children (Mamuti et al., 2022). Similarly, a study conducted in Ethiopia by Girmay and Dadi. (2019) observed that immunization coverage was lower than the target set by the World Health Organization (Girmay & Dadi, 2019).

According to the current results, 96.2% of the children had received BCG vaccination, while 86.1% of them received the Pentavalent (DPT-Hep-HiB). Oral Polio vaccine coverage was estimated at 97.8% and measles stood at 94.8%. (Mamuti et al., 2022).

In this study, a high proportion of vaccination coverage was observed among children who had BCG scar present (240; 72.2%) who were 2.19(95%CI = 1.08 – 4.46, P = 0.026) times more likely to complete the vaccination schedule. As compared to those who had no BCG scar present (19; 54.3%). This is comparable to a study conducted by Negussie *et al.* (2016) in Southern Ethiopia, which revealed children who received the BCG vaccine earlier were more likely to complete immunization. The early BCG vaccination could be associated with more contacts for immunization with the health system during the antenatal period leading to hospital delivery (Negussie *et al.*, 2016). Mothers who attend antenatal clinics earlier and more than once during pregnancy will likely deliver in the health facility. Furthermore, good ANC utilization boosts attachment between clients and healthcare providers, which fosters confidence in the system and enhanced hospital deliveries and consequently timely initiation of the vaccination schedule (Negussie *et al.*, 2016).

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

In this current study, a complete vaccination schedule was observed among children whose time to reach the nearest hospital was less than 30 minutes and who were 2.80[95%CI = 1.47 – 5.43, 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. Mothers of children whose time to the nearest hospital was 30 minutes to 1 hour were 2.18(95%CI = 1.22 – 3.89, P = 0.007) times more likely to have complete vaccination coverage as compared to children whose time to reach the nearest hospital was more than 2 hours. This agrees with a study conducted by Workina *et al.* (2018) which stated that travel times of more than one hour to a health facility were significantly associated with reduced odds of receiving pentavalent vaccination (AOR = 0.84 (95% CI 0.74 – 0.94), and travel times of more than two hours were

associated with a Pentavalent coverage ratio of 62.1%, which is below the set target (Workina *et al*., 2018). Several studies have shown that time to the nearest health facility in Sub-Saharan Africa is the primary reason for the inaccessibility of immunization services. This study estimated the travel time to the nearest health facility by motorcycle, matatu and bicycle that provided immunization services. Time influences the uptake of child immunization services.

In regard to the distance travelled by mothers or caregivers of children to the nearest health facility, was 1 – 5 kilometres or 5 – 10 kilometres were 9.77(95%CI = 5.20 – 18.37, P < 0.001) and 3.48(95%CI = 1.68 – 7.18, P < 0.001) respectively, times more likely to have complete vaccination coverage as compared to mothers or caregivers of children travelling more than 10 kilometres to reach the nearest health facility. Studies conducted in Nakuru, Kilifi and Mathare, showed that the distance to the nearest health facility was significantly associated with a complete vaccination schedule (Agócs *et al*., 2021). In the rural Eldas sub-county, there could be a scarcity of transport means such as motorcycle or services vehicle, unlike the study in Nakuru, Kilifi and Mathare which reported immunization completion was not associated with physical distance and was attributed to the availability of motorcycle-making transport easier (Agócs *et al.,* 2021). Mothers or caregivers of children living more than 10 Kilometre from the health facility could not afford transport to the facility especially if they have a low income as well as challenges related to childcare costs for other children, and the opportunity cost of taking time off work.

The current study revealed that children who completed their vaccination received immunizations from public hospital schedules (246; 96.09%) in comparison to children who received immunizations from outreach (10; 3.91%). Children who received immunizations from the public hospital were 2.53(95%CI = 1.02 – 6.29, P = 0.038) times more likely to have a complete vaccination schedule as compared to children who received immunizations from outreach. The findings of this study agree with those of the study conducted by Nsubuga et al. (2019) in Uganda, most children aged 12-23 months who took part in the study, 68.1% received immunization services from a health unit or and 10.6% from outreaches. The likely factor is accessibility which could also be explained by most children residing within a 5km radius of health facilities and a few could be accessed by outreach only or live more than 5km from the health facility (Nsubuga et al., 2019).

The study revealed that children who completed their vaccination schedule did not express any misinformation or rumours about the vaccines (230;74.7%) in comparison to children who did not complete their schedule (78; 25.3%). Mothers of children who received accurate information about immunizations were 5.89(95%CI = 2.14 – 16.24, P = 0.001) times more likely to have a complete vaccination schedule as compared to children who received rumours. A study in Nigeria found that healthcare providers provide incorrect and inadequate or exaggerated information about immunization which could also be carried by the general public and therefore give false impressions about the role of vaccines in preventing diseases. This creates a lack of confidence among the public leading to hesitancy (Adeyanju et al., 2022). The information provided is not enough to help caregivers or mothers decide about vaccinating their children (Olson *et al.,* 2020). Drawing conclusions based on incorrect or incomplete facts and disinformation can spread false information to promote an agenda (Olson *et al.,* 2020). Children of mothers with fear of vaccine side effects are at risk of defaulting and therefore incomplete vaccination schedule (Nsubuga *et al*., 2019).

Healthcare providers form an important factor in vaccination schedule completion. The study showed that delivery in the health facility by a skilled healthcare worker was associated with complete vaccination. Complete vaccination was observed among children whose birth was

facilitated by a skilled birth attendant (146; 80.7%) and while children whose birth was facilitated by a traditional birth attendant (110; 59.1%) showed incomplete vaccination. In a study conducted by Kyprianidou *et al*. (2021), healthcare providers contribute to some extent to vaccination completion by advising mothers and caregivers about vaccine schedules, side effects, diseases they prevent, the importance of child cards and time for the next visit (Kyprianidou *et al.*, 2021). Healthcare providers influence mothers by effectively communicating issues related to immunization misinformation, and this is dependent on their knowledge of immunization (Kyprianidou *et al.*, 2021).

Conclusions

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. Children with school-attending caregivers had higher vaccination coverage, while those with employed or self-employed caregivers had higher vaccination rates. Economic well-being and media access also contributed to better vaccination outcomes.

The caregiver population in Eldas sub-county is predominantly youthful, with a majority aged 18-29, majority of whom are Muslims, having low education and unemployed hence religious practices and economic challenges impact on child caregiving. High complete vaccination status among children aged 2 to 5 years in Eldas sub-county supports herd immunity.

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

The health system level factors associated with complete vaccination status were skilled health professionals, public hospitals, and proximity to healthcare facilities. However, factors like clinic shortages highlight the need for systemic improvements.

Recommendations

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.

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.

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.

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.

Finally, 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. Further Research could focus on assessment of vaccine demand and zero dose or impartially vaccinated children mapping.

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