GUIDELINES FOR IMPROVEMENT OF CHILDHOOD IMMUNISATION PROGRAM IN PASTORALIST COMMUNITIES OF SOMALI REGION, ETHIOPIA

By

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SIGNATURE **DATE**

Melaku Tsehay Ayalneh

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ABSTRACT

Background: The current Ethiopian health service delivery system is structured into three-tier systems. This includes primary, secondary, and tertiary-level healthcare tier systems. The administrative structure of the immunisation program in Ethiopia is based on the administrative structure of the country from the federal and down to the district and primary health care unite level.

Purpose: The purpose of this study was to develop guidelines to optimize childhood immunisation programs in the pastoralist community of Somali Region, Ethiopia.

Methods: The researcher employed an explanatory sequential mixed method technique combining quantitative and qualitative research designs. Three hundred (300) respondents and 64 health facilities were chosen from the quantitative designs at Shebele zones in Somali region using multi-stage cluster sampling and simple lottery methods respectively, while 12 participants in the qualitative designs were selected through purposive sampling methods. For quantitative and qualitative approaches, data were analysed using the Statistical Package for Social Sciences (SPSS) 25.0 version and Atlas ti 8, respectively.

Results

Quantitative results: Overall, 285(94.9%) of the 300 respondents had ever heard of immunisation. Less than half, 139(46.3%) the average value of knowledge indicators was below that of the respondents. Among children who had ever been vaccinated for regular vaccination, 184(79%) of parents/caregivers had child vaccination cards. The overall proportion of children, who received valid full vaccination was 81(27%), partially vaccinated 39(13%) and not vaccinated 180(60%). The findings revealed long distances to the place of immunisation 56(19%), bad rumours 89(30%), and long waiting time 55(18.3%) as some of the major barriers to not vaccinating children. From the observed 64 health facilities, 46%, 67%, and 64% have at least one trained health staff, available to reach every district or community (RED/C) and Micro-plan to provide specific vaccines respectively. Almost half 30(47%) of healthcare facilities have an equal number of Auto-Disable (AD) and re-constitution syringes, and more than three quarter 51(80%) of refrigerator temperatures were monitored twice daily.

Qualitative results: Four themes emerged from the data including challenges with immunisation system, low immunisation coverage, low knowledge of parents/caregivers on vaccination, and low community involvement on vaccination service.

Conclusion The qualitative findings were used to create a concrete understanding of the study topic. The investigator developed immunisation guidelines to improve childhood immunisation programs in pastoralist communities and guided healthcare professionals and immunisation implementing partners in improving immunisation coverage and reducing the number of unimmunised children.

Key terms:

Awareness; children; fully vaccinated; guidelines; healthcare worker; immunisation program; immunisation service readiness; knowledge; parents/caregiver, pastoralist community; vaccination by card; vaccination coverage by history.

ISICATSHULWA

IZIKHOKELO ZOKUPHUCULA INKQUBO YOGONYO LWABANTWANA KULUNTU LWASEZIFAMA/ LWASEMAPHANDLENI KUMMANDLA WASESOMALI, ETHIOPIA.

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Imeko-bume/Imvelaphi : Inkqubo yangoku/ yanamhlanje yokunikezelwa kwenkonzo yezempilo yase-Ethiopia inamanqanaba amathathu esakhiwo, oko kukuthi ukhathalelo lwezempilo olusisiseko, ukhathalelo olukwinqanaba lesibini kunye nelesithathu. Ubume bolawulo benkqubo yokugonywa e-Ethiopia busekwe kubume bolawulo belizwe ukusuka kumdibaniso/kubufederali ukuya kutsho kwinqanaba leyunithi yokhathalelo lwempilo esisiseko.

Injongo: Injongo yolu phononongo yayikukuphuhlisa izikhokelo zokuphucula iinkqubo zokugonywa kwabantwana kuluntu lwasezifama/lwasemaphandleni kuMmandla waseSomalia, e-Ethiopia.

Iimethodi/ iindlela zokuqhuba uphononongo:Umphandi usebenzise ubuchule bendlela yolandelelwano echazayo nexubileyo edibanisa uyilo lobungakanani kunye noyilo olusemgangathweni lophando. Abaphenduli abangama-300 kunye namaziko ezibonelelo zezempilo ezingama-64 zakhethwa kuyilo lobungakanani ngokwenani kwiindawo yommandla owenzelwe injongo ethile (zones) eShebele kwiNgingqi yaseSomalia kusetyenziswa ingqokelela yeesampulu zamaqela ezinezigaba ezininzi kunye neendlela ezilula kukhethwa ngokwamanani abawanikiweyo ngokungakhethiyo. Abathathi-nxaxheba aba-12 kuyilo olusemgangathweni bakhethwa ngeendlela zesampulu ngokunenjongo. Kwiindlela zobungakanani kunye nezisemgangathweni, idatha yahlalutywa kusetyenziswa uhlobo lwe 25.0 lwe-SPSS kunye ne-ATLAS.ti 8, ngokulandelanayo.

Iziphumo

Iziphumo zobungakanani: Kukonke, ama-285 (94.9%) kwabangama-300 abathe baphendula baye beva ngogonyo. Ngaphantsi kwesiqingatha, i-139 (46.3%), umyinge wezalathisi zolwazi kwinani elimelweyo lalingaphantsi kwelo lababphenduli. Kubantwana abakhe bagonywa ngokugonywa rhoqo, i-184 (79%) yabazali/abanonopheli babenamakhadi okugonya abantwana. Inani lilonke labantwana abafumene ugonyo olupheleleyo ngama-81 (27%), abangama-39 (13%)

baye bagonywa ngokuyinxenye(ngokungaphelelanga) kwaye abangama-180 (60%) abazange bagonywa .Iziphumo zityhila imigama emide ukuya kwindawo yogonyo (56; 19%), amarhe amabi (89; 30%) kunye nexesha elide lokulinda (55; 18.3%) njengeminye yemiqobo ephambili ekungagonyweni kwabantwana. Ukusuka kuqwalaselo lwamaziko ezempilo angama-64, ii-46%, 67% kunye nama-64% ubuncinane abe nalo ilungu elinye lomsebenzi wezempilo oqeqeshiweyo, ebefumaneka ukuze afikelele kuzo zonke izithili okanye uluntu kwaye ebenesicwangciso esincinane sokubonelela ngezitofu ezithile ngokwahluka kwazo. Phantse isiqingatha (i-30; i-47%) samaziko ezibonelelo zezempilo zinenani elilinganayo zeesirinji I-auto-disable (AD) iisirinji ezingasebenzi ngokunokwazo emva kokusetyenziswa kanye. ii-*Auto-Disable* (AD) kunye neesirinji ezinokubuyiselwa kwisimo sazo sangaphambili/ ezinokuvuselelwa (reconstitution), kwaye ngaphezu kweekota ezintathu (51; 80%) zamaqondo obushushu ezikhencezisi zazihlolwa kabini ngemini.

Iziphumo zohlobo olusemgangathweni: Imixholo emine yavela kwidatha: imingeni kwinkqubo yokugonya, ubuncinane beendawo ezifikekekwayo yokugonya, ulwazi olusileleyo /oluphantsi lwabazali / abanonophelo ngokugonya, kunye nokubandakanyeka okuphantsi koluntu kwinkonzo yokugonya.

Isiphelo: Iziphumo ezisemgangathweni zisetyenziselwe ukuphuhlisa ukuqonda okubambekayo kwesihloko sophando. Umphandi wenze izikhokelo zokugonya ukuze kuphuculwe iinkqubo zokugonywa kwabantwana kwiindawo zasefama/ zasemaphandleni kunye nokukhokela iingcali zezempilo kunye namaqabane aphumeza ugonyo ekuphuculeni ukufikelela kwiindawo ezininzi zokugonya kunye nokunciphisa inani labantwana abangagonywanga.

Amagama angundoqo:

Awareness;Ukwazisa

children; abantwana

fully vaccinated; ugonywe ngokupheleleyo

guidelines; izikhokelo

healthcare worker; umsebenzi wezempilo

immunisation programme; inkqubo yogonyo;

immunisation service readiness; ukulungela inkonzo yogonyo;

knowledge;ulwazi

parents/caregiver, abazali/abanonopheli

pastoralist community;uluntu lwasezifama/lwasemaphandleni

vaccination by card; ukugonywa ngekhadi

vaccination coverage by history. Ukufikelela kwiindawo ezininzi zokugonya ngokwembali.

IMIHLAHLANDLELA YOKUTHUTHUKISA UHLELO LOKUGONYWA KWABANTWANA EMIPHAKATHINI YABAFUYI BESIFUNDA SASESOMALI, ETHIOPIA

Umfundi: Melaku Tsehay Ayalneh

Iziqu zobudokotela empilweni yomphakathi

Inombolo Yomfundi: 67126898

OKUCASHUNIWE

Isizinda: Uhlelo lwamanje lokulethwa kwezinsiza zezempilo lwase-Ethiopia lunezinhlaka ezintathu, okungukuthi ukunakekelwa kwezempilo okuyisisekelo, okwesibili kanye nokwemfundo ephakeme. Isakhiwo sokuphatha sohlelo lokugoma e-Ethiopia sisekelwe esakhiweni sokuphatha sezwe kusukela kuhulumeni wesifundazwe kuya ezingeni lesifunda kanye neyunithi yokunakekelwa kwezempilo okuyisisekelo.

Inhloso: Inhloso yalolu cwaningo kwakuwukwenza imihlahlandlela yokuthuthukisa izinhlelo zokugoma izingane emphakathini wabafuyi besiFunda saseSomali, e-Ethiopia.

Izindlela: Umcwaningi usebenzise indlela yamasu exubile yokuqoqa imininingwane ehlanganisa echazayo kanye neyezinombolo. Kwakhethwa abaphenduli abangu-300 kanye nezikhungo zezempilo ezingama-64 ezinhlelweni zokuthola indlela abantu abacanga futhi abazizwa ngayo ezindaweni zaseShebele esiFundeni saseSomali kusetshenziswa amasampula ezigaba eziningi nezindlela ezilula zokwabela ilungu ngalinye inombolo; abahlanganyeli abayi-12 ekunikezeni imininingwane ejulile ngokuziphatha kwabantu bakhethwa ngezindlela zesampula ezihlosiwe. Mayelana nezindlela zocwaningo ezichazayo neyezinombolo, imininingwane yahlaziywa kusetshenziswa inguqulo ye-*SPSS 25.0* kanye ne-*ATLAS.ti 8*, ngokulandelana.

Imiphumela

Imiphumela yezinombolo: Sekukonke, abangama-285 (94.9%) kwabangama-300 abaphendula babezwile ngokugonywa. Ngaphansi kwengxenye, 139 (46.3%), inani elimaphakathi lezinkomba zolwazi belingaphansi kwalaba abaphendulile. Phakathi kwezingane ezake zagonyelwa ukugonywa njalo, abazali/abanakekeli abayi-184

(79%) babenamakhadi okugoma izingane. Isamba sesisonke sezingane ezithole ukugonywa okugcwele okusebenzayo kwaba ngama-81 (27%), ama-39 (13%) agonywe ingxenye kanti eziyi-180 (60%) azigonyiwe. Okutholakele kuveza amabanga amade lapho okugonywa khona (56; 19%), amahlebezi amabi (89; 30%) kanye nesikhathi eside sokulinda (55; 18.3%) njengezinye zezithiyo ezinkulu zokungagomi izingane. Ezikhungweni zezempilo eziqashiwe ezingama-64, ama-46%, 67% kanye nama-64% okungenani anelungu elilodwa labasebenzi bezempilo abaqeqeshiwe, ezitholakalayo ukuze zifinyelele kuzo zonke izifunda noma umphakathi futhi zibe nohlelo oluncane lokuhlinzeka ngemithi yokugoma ethile, ngokulandelana. Cishe ingxenye (30; 47%) yezikhungo zokunakekelwa kwempilo inenani elilinganayo lemijovo yokugoma enesici sokuvimbela ukusetshenziswa kabusha nemijovo yokuvuselela kabusha, futhi ngaphezu kwezingxenye ezintathu (51; 80%) zamazinga okushisa esiqandisi aqashwe kabili nsuku zonke.

Imiphumela echazayo: Izindikimba ezine zavela emininingwaneni: izinselele ngohlelo lokugoma, ukutholakala okuphansi kokugoma, ulwazi oluncane lwabazali/abanakekeli mayelana nokugoma, nokubamba iqhaza okuncane komphakathi ensizakalweni yokugoma.

Isiphetho: Okutholwe ngocwaningo oluchazayo kusetshenziswe ukuthuthukisa ukuqonda okuphathekayo kwesihloko socwaningo. Umseshi wenze imihlahlandlela yokugoma ukuze kuthuthukiswe izinhlelo zokugoma kwezingane emiphakathini yabafuyi kanye nokuqondisa ochwepheshe bezempilo kanye nabalingani abasebenzisa ukugoma ukuze kuthuthukiswe ukutholakala kokugoma nokunciphisa inani lezingane ezingagonyiwe.

Amagama asemqoka:

Awareness

ukuqwashisa

children

izingane

fully vaccinated

ukugoma ngokugcwele

guidelines

imihlahlandlela

healthcare worker

umsebenzi wezempilo

immunisation programme

uhlelo lokugoma

immunisation service readiness

ukulungela insizakalo yokugoma

knowledge

ulwazi

parents/caregiver

abazali /umnakekeli

pastoralist community

umphakathi wabafuyi

vaccination by card

ukugonywa ngekhadi

vaccination coverage by history

ukutholakala kokugonywa ngomlando

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LIST OF ABBREVIATIONS

ACIP	Advisory Committee on Immunisation Practice
AFP	Acute Flaccid Paralysis
AOR	Adjusted Odds Ratio
AIDS	Acquired Immuno-deficiency Syndrome.
ANC	Antenatal Care
BCG	Bacillus Calamite Guerin
BCC	Behavioral Change Communication
CC	Community Conversation
CSO	Civil Society Organization
CV	Community Volunteers
CDC	Centre for Disease Control
CI	Confidence Interval
DPT	Diphtheria-Pertussis-Tetanus
EFMHACA	Ethiopia Food Medicine Health Administration and Control Authority
EPI	Expanded Program on Immunisation
EPHI	Ethiopian Public Health Institute
EVM	Effective Vaccine Management
FMoH	Federal Ministry of Health
GAVI	Global Alliance for Vaccine and Immunisation
HCPs	Health Care Providers
HEW	Health Extension Workers
Hib	Hemophilus influenza type b
HIT	Health Information Technology
HI	Hemophilus Influenza
HO	Health Officers
HP	Health Post
HPV	Human Papilloma Virus
iSC	immunisation Supply Chain
iSCM	immunisation Supply Chain Management
IPC	Inter-Personal Communication
IEC	Information Education Communication
IPV	Inactivated Polio Vaccine
MDGs	Men Development Groups
MMR	Measles Mumps Rubella
MPH	Master of Public Health
MOH	Ministry of Health

NIHW	National Institute of Health & Family Welfare
NGO	Non-Governmental Organisation
NID	National Immunisation Day
NIP	National Immunisation program.
NRA	National Regulatory Agency
OPV	Oral Polio Vaccine
OR	Odds Ratio
PATH	Planning Alternative Tomorrows with Hope
PC	Principal Component
PCA	Principal Component Analysis
PHCU	Primary Health Care Unite
PYDGs	Positive Youth Development Groups
PV	Pharmacovigilance
RIO	Regional Immunisation Officer
SPSS	Software Package for Social Sciences
SDGs	Sustainable Development Goals
Td	Tetanus diphtheria toxoid
TRA	Theory of Reasoned Action
TV	Television
UK	United Kingdom
UHC	Universal Health Coverage
UNICEF	United Nation Internationals Children Fund
UNISA	University of South Africa
USA	United States of America
VAERS	Vaccine Adverse Events Reporting System
VHLs	Village Health Leaders
VPD	Vaccine-Preventable Diseases
VSS	Vaccine Safety Surveillance
WDGs	Women Development Groups
WHO	World Health Organization
ZHD	Zonal Health Department

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Vaccination is broadly recognized as one of the foremost cost-effective open well-being mediations for the reduction of childhood morbidity and mortality. Moreover, it benefits the social and financial well-being of communities. The chapter starts by providing orientation of the whole inquiry about the research thesis on the problem statement, study objectives and research questions, the null hypothesis, a philosophical assessment, and ethical issues. The significance of the study, as well as the definitions of key terms, the scope of the inquiry, and a brief description of the research process were described.

1.2 BACKGROUND INFORMATION ABOUT THE RESEARCH PROBLEM

In 1974, the World Health Organisation (WHO) developed the Expanded program on Immunisation (EPI) with the goal of ensuring that every child in the world has exposure to prescribed life-saving immunisation for illnesses, regardless of socioeconomic or demographic background (Rodrigues & Plotkin 2020). In this connection, immunisation is the most well-known public health indicator and supporter of global health security as it prevents and controls numerous communicable diseases as well as death from vaccine-preventable diseases (VPDs), especially in children (WHO 2021b). WHO (2021a) indicates that immunisation has drastically lowered the number of people who die from infectious illnesses, by expanding the use of current vaccinations, introducing novel vaccines and technologies, and speeding up the control, elimination, and eradication of VPDs in children (Alemu 2021:2). Therefore immunisation is the cornerstone of a productive and healthy population (Hu, Zhang, & Chen, 2016:2).

According to the WHO and the Centres for Disease Control (CDC), the words "immunisation" and "vaccination" are frequently used interchangeably. Vaccination is the process of making a person immune or resistant to an infectious disease by administering a vaccine (WHO 2021a:4). Vaccines work in conjunction with the body's natural defences to reduce the risk of developing a disease (CDC 2019). When a person receives a vaccination, the immune system responds (CDC 2019). Vaccines for above 20 existence illnesses are already available, helping people of all ages to live much longer and have better health. It is worth noting that every year, vaccination protects approximately 2-3 million lives from diseases such as diphtheria, tetanus, pertussis, influenza, and measles (WHO 2022:6).

Vaccination covers a greater number of people than any other health or government welfare and is an important element of basic health care (WHO 2021b:31). Between 2000 and 2019, vaccination was predicted to have prevented at least 37 million fatalities and a 45% decrease in deaths owing to vaccine-preventable diseases (Lindstrand, Cherian, Chang-Blanc, Feikin, & Brien 2021). Furthermore, there has been much innovation in vaccine development. Malaria, Dengue Fever, COVID-19 and Ebola virus vaccines and potential antibodies against the breathing syncytial virus, TB, and all flu virus subtypes are available (WHO 2021a:6). Vaccines are increasingly protecting people's health beyond childhood in youth and parenthood, throughout gravidity, and for the elderly (WHO 2019a:7).

Vaccination is a universal fitness and growth achievement story, saving thousands and thousands of lives every year (Chikako, Seidu, Hagan, Aboagye & Ahinkorah 2021:282). The experience of the smallpox eradication program showed the world that childhood immunisation was the most powerful and lucrative community fitness intervention toward vaccine-preventable illnesses, reducing child mortality and morbidity (WHO 2018a:3). The success of EPI has significantly donated to the prevention of parental and child deaths, suffering, and disability (Kanu, 2019:96; Ducoffe & Precioso 2018:2).

The widely applied national and global immunisation performance indicator is a third dose of the combined Diphtheria, Tetanus, Pertussis-Hepatitis B and Haemophilus influenza type b (Penta 3). Coverage of Penta 3 vaccination was characterized as the rate of children aged 12–23 months who got three dosages of the combined Penta 3 antibody (WHO 2018b:4). The lower restrain of this age extend is the most youthful age by which children ought to have gotten three dosages, and the upper restrain is the most seasoned age by which they ought to have gotten three dosages (WHO 2018b:2). DTP3 around the world scope has remained steady between 84 and 86% since 2000 (Lindstrand, Cherian, Chang-Blanc, Feikin & O'Brien 2021:32). Around 85% (116 million) of children received three doses of DTP-containing vaccine in 2019 (Lindstrand *et al* 2021:33).

Universally, 19.4 million children (14%) were not completely immunised in 2018, and among them, 13.5 million (70%) did not get scheduled life-saving immunisations (Awol, Alemu, Moges & Jemal 2021:217). Nearly 30% of deaths among children under five years of age are the result of vaccine-preventable diseases (UNICEF 2018a:7). DTP3 was not given to an extra 6 million children in Sub-Saharan Africa for a year in 2010. Ethiopia launched its Expanded Program on Immunisation (EPI) in 1980, but immunisation coverage in Ethiopia remained low in the first 20 years. Gains were observed after the introduction of several health system initiatives, including the Universal Child Immunisation Program, the Health Extension Program, and Reaching Every District (RED). From 2000 to 2019, the national immunisation coverage rate for diphtheria, tetanus, pertussis dose 1 (DTP1) increased from 44.1% to 76.3%, and coverage of DTP3 increased from 21.1% to 61.1% (Ethiopian Public Health Institute and FMOH 2019:16). However, national coverage rates mask subnational disparities with coverage in Addis Ababa and Tigray regions more than three times higher than in Afar and Somali regions (Tesfaye 2018:3). In Ethiopia, 61% of children were partially/totally unvaccinated (Federal Ministry of Health Ethiopia 2019a:3). In this relation, the current Health Sector Transformation Plan (HSTP) in the Ministry of Heath Ethiopian aimed to realize full immunisation to 90% by 2015 (Tesfaye 2018:9); achievements are still far below the international standard (WHO 2017a:2).

According to the Ethiopian Mini-Demographic and Health Survey 2019, data, vaccination coverage among children aged 12 to 23 months displayed that 4 out of 10 children (43%) got all the basic immunisations, whereas 2 in 10 children (19%) within the indicated age never got any immunisations at all (EPHI & MOH Ethiopia

2019:17). Due to the above fact, Ethiopia is one of the least immunisation coverage performing countries to the MDG goal of reducing child morbidity and mortality rate (Tamirat & Sisay 2019:5). Worldwide, Ethiopia has one of the top numbers of under-immunised children and one of five nations with the highest amount of zero-dose children (Tefera, Wagner, Mekonen, Carlson, Boulton 2018:3). According to WHO and UNICEF estimates of national immunisation coverage, in 2019 the country missed 872,828 children from receiving the Penta-3 vaccine and 1,215,724 children from receiving the first dose of measles vaccines and 1.1 million unvaccinated children in Ethiopia (Federal Ministry of Health Ethiopia 2020; UNICEF & WHO, 2019). There are many determinants for such reduction of immunisation coverage in pastoralist and semi pastoralist community. Following is a list of distribution on the number of unvaccinated children by the regions of Ethiopia.

Table 1.1 Distribution of unvaccinated children by regions, EMDHS 2019 (EPHI and MOH Ethiopia, 2019)

Region	Live Birth 2019	Surviving Infants 2019	Penta 1 (Mini-DHIS 2019)	Penta-1 Vaccinated	Penta-1 Unvaccinated/zero dose	Penta3 (Min-DHIS 2019)	Penta-3 Vaccinated	Penta-3 Unvaccinated
Addis Ababa	85885	82450	96.3%	79399.35	3051	93.10%	76760.95	5689
Afar	55844	52270	45.5%	23782.85	28487	25.90%	13537.93	38732
Amhara	747888	691048	84.4%	583244.512	107803	80.20%	554220.496	136828
Ben-sh-Gumz	38918	34987	89.2%	31208.404	3779	81.20%	28409.444	6578
Dire Dawa	16314	15335	95.2%	14598.92	736	74.20%	11378.57	3956
Gambella	14493	13391	76.3%	10217.333	3174	65.00%	8704.15	4687
Harari	8147	7626	65.3%	4979.778	2646	52.80%	4026.528	3599
Oromiya	1324500	1227812	73.4%	901214.008	326598	53.60%	658107.232	569705
SNNP	862261	795005	72.7%	577968.635	217036	50.80%	403862.54	391142
Somali	196007	182091	42.2%	76842.402	105249	26.20%	47707.842	134383
Tigray	190636	178435	95.4%	170226.99	8208	84.40%	150599.14	27836
National	3540893	3280450	76.30%	2473683	806767	60.90%	1997794.05	1282656

1.3 THE RESEARCH SITES

Somali Region is one of Ethiopia's pastoralist areas, located around 632 km east of Addis Ababa, Ethiopia's capital city. It shares boundaries with adjacent Somalia, whose ethnicity Somalis exist, including Djibouti, wherever Somalis live. Formally Jijiga is a capital city of the Somali Region (EPHI & MOH Ethiopia 2019:27). More than 80% of the population has a pastoralist community (Wikipedia, 2012), which is a member of a social group with a long history of cattle raising, as well as regional, ethnic, religious, and "indigenous peoples" (Abdulahi 2019:42).

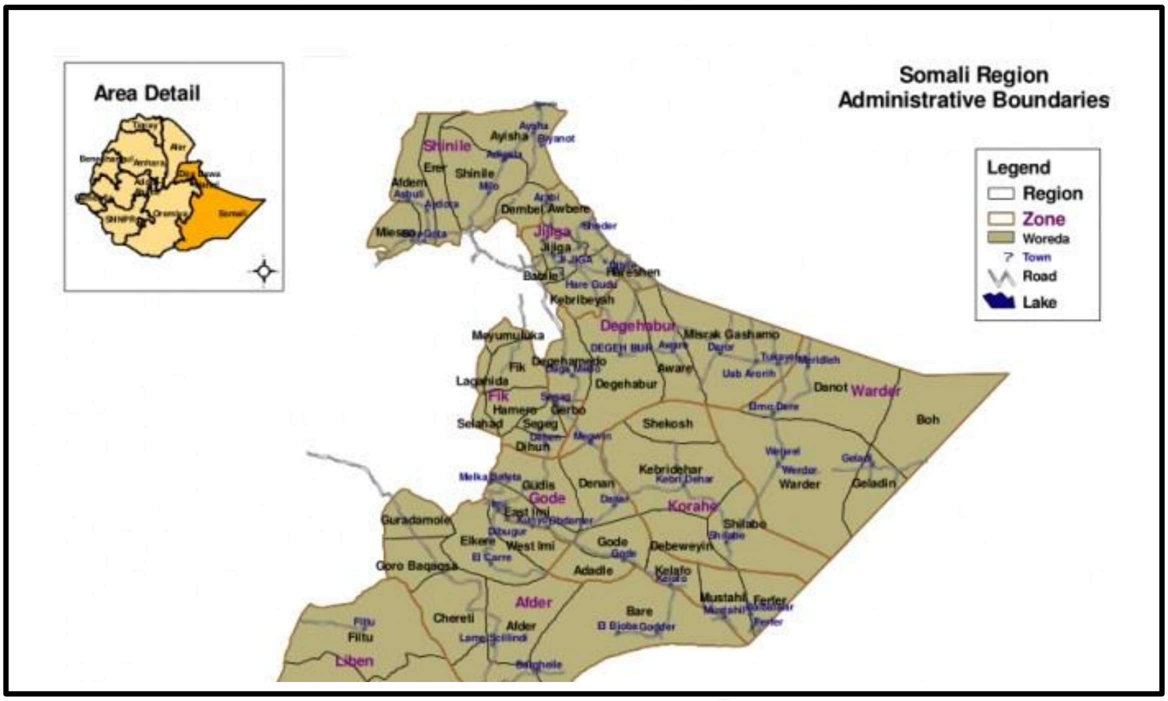

Figure 1.1: Map of Somali Region by district/Woreda (Wikipedia, 2012)

Worldwide, 200 million people live in pastoralist communities; the majority of which are found in Africa, with Sub-Saharan Africa accounting for approximately 16% of the population (MoH amed, 2019:4). Drought, food shortages, and poor health facilities have an indication of pastoralist communities (Gebeye 2016). Somali Region is one of the pastoralist regions with very low immunisation coverage rates (42.2% for Penta 1, 26.2% for Penta 3 and 18.2% for fully immunised) and has declined even more from previous years (EPHI & MOH Ethiopia, 2019:15-22). The Somali Region is distant, with limited transportation infrastructure, making travel difficult, and time-consuming, and several locations are completely unreachable by car. Secondly, since the majority of the population is without transport, mobile, and grazing cattle across long distances, rendering follow-up dosages is almost impossible (MoH amud et al, 2014; PATH Ethiopia, 2016).

Measles and vaccine-derived poliovirus outbreaks occurred in pastoralist areas of Ethiopia, which is a reminder that effective vaccination programs could keep the right coverage and eliminate illnesses. Good early screening is essential (WHO 2022a:2). Some parts of the country are hard to reach in the pastoralist community. These are unimmunised or are classified under the no immunized age category, and vaccination programs and overall primary health care systems are insufficient, suggesting that these areas require special attention and interventions (MOH Ethiopia 2021:3).

This research study focuses on maternal/household factors for immunisation coverage, immunisation monitoring systems, and health care workers challenge and recommendation on immunisation service delivery in pastoralist community to achieve the desired immunisation coverage because they lead accountable family members in bringing change in childhood immunisation. There are a few studies related to improving childhood immunisation programs and an insignificant number of studies in pastoralist or semi-pastoralist areas of the hard-to-reach communities. Therefore, this study aimed to develop guidelines, which would assist in the improvement of childhood immunisation in the pastoralist community of Ethiopia.

1.4 STATEMENT OF THE RESEARCH PROBLEM

Immunisation is a multi-sectoral activity with significant variation in coverage worldwide, owing to differences in demographic, socioeconomic, and political frameworks (Sanjeev, Damodar, Ashish & Dhaval 2019:1). In unstable, crisis contexts, certain groups, particularly the poorest, more marginalised, pastoralists, as well as the most disadvantaged, had restricted access of vaccination programs. Annually, 20 million newborns do not receive a full course of immunisations, and many more do not get new immunisations (WHO 2021a). About 13 million of them do not obtain immunisations from EPI programs.

Since the commencement of the EPI program, numerous research has found a rise in the incidence and mortality rates from VPD (Anya, Okeibunor, Mihigo, Poy & Zawaira 2018:56), and children are still unreached with primary childhood immunisation for several reasons (Kaufman, Tuckerman, Bonner, Durrheim, Costa, Trevena, Thomas & Danchin 2021:3). There are many explanations in different literatures for children not being vaccinated. In pastoralist communities, there is a paucity of knowledge about children's health, especially the vaccine system impediments to service access and vaccination utilization at health facilities and community level (Tomlinson, Jordans, Betancourt, XantheHun, Christopher & Mikton 2017:2). Most studies have concentrated on clinical and patient pathway frameworks rather than system constraints. Only a few fragmented research in Africa has focused on immunisation hurdles and bottleneck analysis at the district and service delivery levels (Yawson, Bonsu, Senaya, Yawson, Eleeza, Awoonor-Williams, Banskota & Agongo 2017:4). In Ethiopia, there is a lack of information on immunisation system and community level constraints that prevent pastoralist communities from receiving effective immunisation coverage (Unshur, Kikuvi & Karama 2016:3).

Governments must engage in tailored initiatives that address the least immunised children in hard-to-reach and pastoralist communities in order to achieve complete vaccination coverage and enhance equality (Nelin, Raaijmakers, Kim, Singh & Målqvist 2017:12). More than 15 million Ethiopians live in pastoralist communities, which have the largest number of zero-doze children and missing communities. A study done in 2019 in this community showed very low (36.2% of HCs and 11.7%) immunisation service delivery and service availability (Tadesse, Gelaw, Haile, Bisrat, Kidanne, Asres & Tessema 2019:6). To enhance coverage in hard-to-reach locations, Ethiopia's FMoH has adopted a Periodic Intensification of Regular Immunisation (PIRI) plan (Tsegaye 2022:3) but still, immunisation coverage is very low as shown in 2019 Mini DHS findings and it needs an additional spatial strategy for the improvement of immunisation in the pastoralist community. Immunisation partners are also assisting various areas of the country in improving immunisation coverage, equality, and system strength (Tilahun, Mekonnen, Sharkey, Shahabuddin, Feletto, Zelalem & Sheikh 2021:3).

Thus, this study was conducted to generate and document evidence on key immunisation service readiness and barriers at the community and health facility level that limit the achievement of desired results of immunisation coverage and proposed recommended activities in the pastoralist community. The findings of this research will contribute to developing the immunisation improvement guidelines, which would assist in the improvement of childhood immunisation in the pastoralist community of Ethiopia through auditing of maternal/household factors, immunisation coverage, immunisation monitoring systems, and healthcare workers recommended proposed activities on immunisation service delivery.

1.5 PURPOSE OF THE RESEARCH

The purpose of this research is to develop guidelines to optimise childhood immunisation programs in the pastoralist community of Somali Region, Ethiopia,

1.5.1 Research Objective

The study objectives were categorised depending on the study approaches:

Quantitative research objectives

- To evaluate vaccination coverage and its determinants among children aged 12 to 23 months in the Somali Region of Ethiopia's Shebele Zones.
- To assess knowledge and awareness of parents/caregivers on vaccine-preventable diseases and immunisation services in Shebele Zones of Somali Region, Ethiopia.
- To assess the readiness of the immunisation monitoring system of the health service facilities in Shebele Zones of Somali Region, Ethiopia.

Qualitative research objectives

- To explore and describe the perceptions and challenges of health care workers and immunisation focal persons on immunisation programs in Shebele Zones of Somali Region, Ethiopia.

Mixed-Method integrates quantitative and qualitative findings for the development of immunisation improvement guidelines.

- To develop immunisation improvement guidelines for HCPs.
- To recommend solutions for improving immunisation coverage.

1.5.2 Research questions

Quantitative research questions

- What are the vaccination coverage and its determinants among children aged 12 to 23 months?
- What is the level of knowledge and awareness on immunisation among parents/caregivers of children aged 12 to 23 months?
- What is the level of readiness of the immunisation monitoring system in the health care facilities in the Shebele Zones of Somali Region, Ethiopia?

Qualitative research questions

- What are the perceptions and challenges of health care workers working on immunisation programs in Shebele Zones of Somali Region, Ethiopia?

Mixed research questions

- What guidelines can improve immunisation programs in Shebele Zones of Somali Region, Ethiopia?
- What recommendations can improve immunisation coverage?

1.5.3 Null hypotheses

- Parents/caregivers in the study area have poor knowledge and awareness of immunisation.
- Immunisation improvement guidelines are not developed/updated in the specific local context.

1.6 SIGNIFICANCE OF THE STUDY

The findings of the research will have a substantial influence on parents'/caregivers' knowledge and awareness of vaccination coverage, and immunisation health facility readiness, and immunisation problems in pastoralist communities. Based on the 2018 Ethiopian birth cohort, the cost of fully vaccinating a child ($25-45), the cost of non-vaccinated children in Ethiopia was predicted to be between 485 and 873 million USD (Mihigo *et al.*, 2016). Decision-makers and immunisation implementing partners would use this information to take remedial action to improve children vaccination coverage and enhance immunisation healthcare readiness. As a result, the poor immunisation performance and service readiness would be improved. It would also serve as a foundation for policymakers, decision-makers, planners, and immunisation implementing partners in the pastoralist areas of the country. Furthermore, the researcher developed vaccination improvement recommendations that would be used for quick referral to resolve field concerns in the pastoralist community.

1.7 OPERATIONAL DEFINITIONS

Awareness: is a convenient and efficient way of explaining concepts or ideas in consistent patterns (Noviani 2020:15). The awareness of parents or caregivers of children aged 12 to 23 months on immunisation-related activities was identified and described. Every true response received a score of one, while the incorrect response received a score of zero. If the average score of all awareness variables were arbitrarily interpreted with a score of below the mean value called poor awareness and above the mean called good awareness (Gentle 2019:41). Based on a modified Bloom's cut-off point, awareness in this study refers to parents/caregivers of children aged 12 to 23 months who scored mean and above the mean level (>=7 or =>50% were considered as good awareness. while those who scored below the mean (<7 or <50%) level were considered as poor awareness (Lamiya, Mundodan and Haveri, 2019; Ashebir *et al.*, 2022).

Children: Someone under the age of 14 years, although the age of majority is 21 years. Children between the ages of birth and 14 years are in the vaccination period in the context of immunisation (UNICEF, 2019:16). The usual immunisation schedule begins at birth and continues until 12 months of age, with Human Papilloma Viruses (HPV) vaccine beginning at 14 years of age (UNICEF, 2018a). Following this study, children begin receiving immunisations at birth and continue up to the age of 14 years. Some of the children receive vaccines after 12 months, to include these children the starting age boundary is 12 months and to maximize recall up to 23 months are bordering.

Expanded Program on Immunisation (EPI): is a maternal and child health program that focuses on immunisation activities all over the world (FMOH, 2021:11).

Fully Vaccinated (Fully immunised child): Overall vaccination coverage of children who received BCG, Measles, and two doses of Rotavirus Vaccines, as well as three doses of each of the Pentavalent (Penta), Pneumococcal Conjugate vaccine (PCV), and Polio Vaccines by the age of 12 months (EPHI & MOH Ethiopia 2019:16).

Guideline: It is any information which guides the intended end-user (health care providers)on what they could or should do in a specific activity to achieve the health outcomes as a recommended public health policy (WHO 2014c:24). Immunisation improvement guideline is one immunisation research-based document that helps health care -providers and immunisation implementing partners to reach target objectives in the pastoralist context.

Healthcare workers: Are the ones who deliver care and services to the sick and other clients. These include health extension workers, midwives, nurses, health officers and doctors who serve in health posts, health centres and district health offices (Birhanu 2018:8) Health care workers also include those that work directly with the immunisation programs or at vaccination services of the children health posts, health centres and district health offices.

Immunisation: is the technique through which a human or animal develops antibodies to an illness and gets protected from it (WHO 2016a:1).

Immunisation service readiness: Staff and training, equipment, vaccination, consumables, and supplies are some of the essential aspects considered for preparedness rating in Primary Health Care Unites (PHCUs). A readiness score of 50 implies that, on average, half of the PHCUs that provided immunisation services, had all of the necessary inputs (WHO 2015). The preparedness of the immunisation service was judged based on the PHCUs ability to offer the service and the availability of tracer materials (Zemedu 2020:17).

Knowledge: is a dynamic blend of defined experience, beliefs, conceptual understanding, and expert opinion that includes provisions for assessing and assimilating new information and experiences (Bolisani, & Bratianu 2018:13; Moustaghfir & Schiuma 2013). Knowledge is arbitrarily interpreted for the average value of all the knowledge variables (Valente *et al.*, 2018), that have scored below the mean (poor knowledge) and above the mean (good knowledge) level of the variables (Gentle 2019:41). In this research study, knowledge refers to the score of parents' or caregivers' of children aged 12 to 23 months who scored mean and above the mean level. Good vaccination-relevant knowledge is regarded as a score above the mean of >=6 or =>50%, whereas poor vaccination-relevant knowledge is regarded as a score below the mean of <6 or <50% (Dikienoo 2021:5).

Monitoring system: is a process of activities to measurable events and/or outputs of the immunisation system to maintain the current specific immunisation activities (Paessler 2021). In this research, immunisation monitoring systems were assessed on the current immunisation service readiness, using immunisation service tracers' tool for the availability of service delivery equipment, planning and coordination of immunisation program, vaccine supply and cold-chain management etc.

Pastoralist communities: are primarily migratory ethnic groups that travel from place to place in search of grass and water for their livestock, and are well-suited to harsh terrain and high weather (Abdulahi 201:9168).

Parents/caregivers: it can be the mother or father, or another family member who provides daily care to the child (UNICEF, 2018a:25). It could also be the one who supports or give care for a child in providing immunisation services

Vaccines: are antigens found in injections (shots), liquids, tablets, or nasal sprays that activate the immune system to protect a person from future illness or disease (WHO 2021a:6). Vaccine in this study refers to antigens used in current national regular immunisation programs to protect children against a variety of common but potentially fatal childhood illnesses.

Vaccination: is the practice of giving weakened or dead vaccinations to generate protection towards antigens inside the body (Obanewa 2019:98). In this research study, vaccination refers to giving weakened or dead vaccines to generate protection against childhood antigens to children aged 12 to 23 months.

Vaccination Coverage: the percentage of a population that has been immunised in a specific period. It is calculated for each vaccination and, in the context of multi vaccines, for each dosage (WHO 2018e:2). Based on the WHO recommendation, information on vaccination coverage was obtained in three ways: from the vaccination card, verbal reports of the parents/caregivers (Vaccination History), and health facility records (WHO 2018a:3).

Vaccinated by card only: Only doses that were documented on immunisation card or facility EPI registration book for a specific date were considered. The date was primarily taken from the vaccination card, and if the vaccination card did not have a date, the date from the facility register was used (CARD + REGISTER**)** (WHO 2019b).

Vaccinated coverage by history: Vaccination status report only depends on the parents' or caregivers' recall (HISTORY) (UNICEF,2018a:2). The number of children aged 12–23 months vaccination status was calculated from parents' or caregivers' recall on several vaccines.

Vaccinated by card plus history: Both verified doses are in the registered document and reported by the parents’ or caregivers’ information (CARD, REGISTER & HISTORY) (WHO 2019b:2).

1.8 FOUNDATION OF THE STUDY

1.8.1 Research Paradigm

Pragmatism avoids arguing complicated philosophical ideas such as truth and facts as a research approach (Kaushik & Walsh 2019:2). As per pragmatists, all information in society is publicly generated, while certain kinds of those societal creations better fit specific occasions than others (Kivunja, Ahmed & Kuyini 2017:8). Pragmatists believe that reality is not static; it changes at every turn of event and needs the identification of the underlying problem as well as appropriate solutions (Kaushik & Walsh 2019:2).

Therefore, the researcher identified the current status of immunisation coverage in the pastoralist areas, knowledge, and awareness of the parents or caregivers regarding vaccine-preventable diseases, time of vaccination, place of vaccination, and the importance of vaccination. In addition, the immunisation monitoring systems were assessed in the health facility for the current immunisation service readiness, using immunisation service tracers’ tool for the availability of service delivery equipment, planning, and coordination of immunisation program, vaccine supply, and cold-chain management and community engagement in the immunisation activities. The research findings guided the researcher during the development of strategies to improve the immunisation program in the pastoralist community.

1.8.2 Theoretical framework

The researcher used the Change Theory(CT) to guide this research study. The Change theory addresses the causes of the existence of an issue and drives the creation of health remedies (Barbara, & Karen 2005:315). It depicts the logical sequence by which program inputs result in changes in outcomes. It directs the search for contributing elements including inadequate knowledge, personality, social protection, or resources (Barbara & Karen 2005:5). Also, the ChangeTtheory focuses on the development of health promotion interventions and guides the development and implementation of programs (Guiu 2018:7). A Change Theory has three key concepts, which are; behaviour (what individuals know and feel impacts how they behave), knowledge is necessary but insufficient to cause most behavioural changes and views, while motives, skills, and the social environment all have a significant impact on behaviour (Barbara & Karen 2005:7). This multi-dimensional approach promotes healthy behaviours (Wambaire 2018:63). They encourage positive behaviour change by combining educational techniques with attempts to modify the social and physical environment (Barbara & Karen 2005:5).

This study employed the Change Theory. Factors that negatively contribute to immunisation coverage such as gaps in parents/caregivers' knowledge, perceptions, immunisation monitoring system, and specific challenges of immunisation focal persons on childhood immunisation are indicated in Figure 1.3. To address such challenges, designing an appropriate solution was essential for sufficient knowledge and behavioural change on immunisation. Solutions included a strong immunisation monitoring system, availability of adequate demand generation activity to influence community members with practical evidence, consistent access and quality of immunisation service, availability of immunisation planning, management of resources and improvement of health workers' motivation on immunisation (Teklehaimanot & Edna 2019:13). This research study investigated the knowledge, perceptions, immunisation service, readiness, monitoring system, and specific challenges of immunisation. Following is the Figure that represents the Change Theory for optimising childhood immunisation

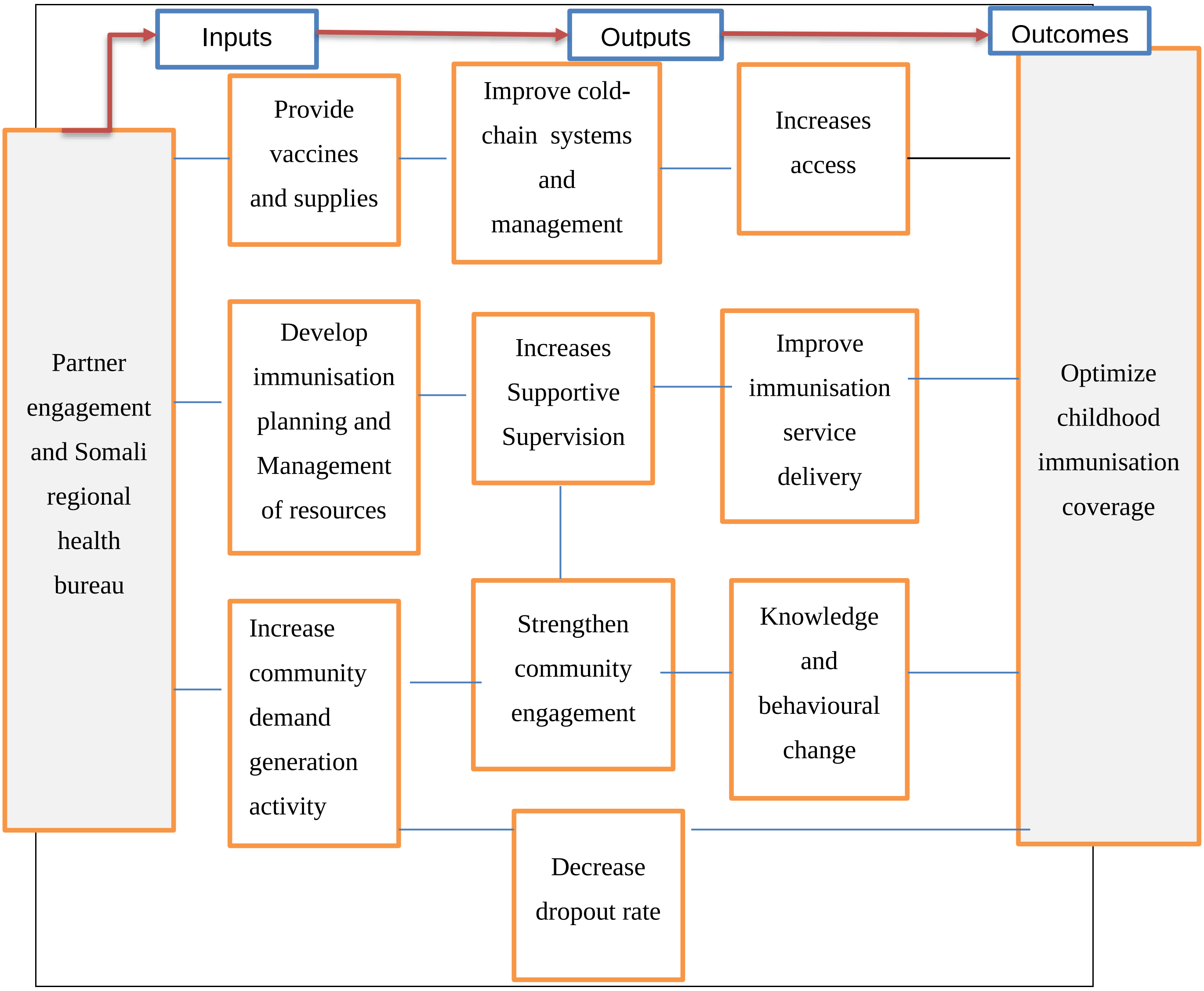

Figure 1.2: Change Theory for optimising childhood immunisation (Teklehaimanot & Edna 2019:13).

1.9 RESEARCH DESIGN AND METHODS

1.9.1 Research design

This study employed an Explanatory Sequential Mixed method approach comprising quantitative and qualitative research designs, which were used progressively (Creswell 2018:154). Following the quantitative data gathering and analysis, qualitative data collection and analyses were undertaken to explain the first quantitative data results (Birhanu 2018:15). As a result, researchers in qualitative research are expected to use a varied range of data from numerous sources. An eclectic style of mixed-method research design was utilised in this study, with the quantitative component being used to triangulate and reinforce the qualitative section (Creswell 2018:157).

Two distinct study populations (parents/caregivers and healthcare professionals), as well as three distinct sample and data collection procedures, were used to meet the research objectives and to ensure that the research plan was sound (Denegetu 2012:66). This has been conducted to accomplish data triangulation, which assured the results' validity and reliability (Birhanu 2018:15). A brief methodology and study design are discussed in Chapter Three.

Table 1.2: Data sources, data gathering methods, data types, and sample procedures

Data Sources	Data Collection Method	Type of data	Sampling techniques
Parents/caregivers	Interviewer administered questionnaire	Quantitative	Simple random sampling
Health care provider	Observational checklist	Quantitative	Simple random sampling
Health care provider	Interview guide	Qualitative	Non-probability purposive sampling

1.9.2 Research Method

A research method is the research process as well as the instruments and processes employed (Birhanu 2018:15). Research Methodologies refer to the modes of data collection, processing, and analysis that investigators suggest for their studies to build a deeper knowledge of a topic. (Creswell 2018:16). The data was collected from the parents or caregivers and health facilities using a combination of research approaches (O'Toole 2013).

1.9.3 Sampling

1.9.3.1 Samples for a quantitative design

A sample is a subset of the population whose results may be applied to the complete population (Showkat & Parveen, 2017:5). As a result, sampling is the method of selecting a subset of the populace from which discoveries are pertinent (Creswell 2018:200). The researcher applied the probability sampling technique to select parents/ caregivers in the quantitative design from households.

Sample for parents or caregivers of children aged 12 to 23 months

The sample size was used 30 by ten modified WHO EPI cluster sampling procedures, involving a selection of 30 primary sampling units or clusters (WHO, 2005:58; WHO 2012b:16). The total number of children to be surveyed directly was calculated as follows: the expected coverage, p, and the desired width of the confidence interval, d. the normal distribution for the desired confidence level (α). For α = 0.05, z1-α/2 = 1.96.

$$\boxed{n_{\min} = DE \times \frac{z_{1-\alpha/2}^{2} \times p \times (1-p)}{d^{2}}}$$

Since the minimum expected immunisation coverage at a national and regional level is 90% (p = 0.9) and the desired precision is ± 5% with 95% confidence (d = 5) and a non-response rate of 10%. Then p = 9 and d = 5, and assuming a design effect of 2:

$$n_{\min} = 2 \times \frac{1.96^{2} \times .9 \times (1 - .9)}{5^{2}} = 277$$

According to the WHO cluster sampling, the expected sample size (n) considering 30 clusters will need a minimum of 277/30 = 9.2 children per cluster. Hence, a total of 9 children per cluster was included for a sample size of 30 × 9 = 270. This calculation was based on the modified WHO Non-response rate (NRR) calculation (WHO 2012b:22).

$$\text{Final N} = \frac{\text{Number of HH needed}}{1\text{-NRR}} = \frac{270}{1-0.1}$$

$$\mathbf{\underline{300}}$$

The final sample size for parents or caregivers of children aged 12 to 23 months was 300.

Sample for the health facilities

The preparedness of vaccination services on system monitoring was assessed at all health center and chosen districts/Woreda s, although the selection of health posts was based on the study kebeles/clusters at household sampling procedures and the number of HPs proportions. The distribution of health facility in the Shebele zones are as follows:

- Hospitals = 1
- Health center (HCs) = 33
- Health posts (HPs) = 159

A total of **64** (1 Hospital + 33 HCs + 30 HPs) health facilities considered 5% as the level of precision were included in this study for record review for immunisation service readiness on system monitoring in the study areas (see Table 1.3 below).

Table 1.3: The proportion of health facilities in Shebele Zone

#	Woreda	Total Population	Health Facilities			Kebeles/ Centers
			Hosp	HC	HP	
1	Gode City	61,994.00	1	2	4	10
2	Abakorow	27,747.00	0	2	7	9
3	Beercano	74,300.00	0	3	14	18
4	Adadle	120,269.00	0	4	22	15
5	Denan	18,501.00	0	3	12	15
6	Elele	11,845.00	0	3	6	7
7	Ferfer	56,878.00	0	3	15	8
8	Kelafo	111,763.00	0	5	29	15
9	Gode Woreda	13,197.00	0	3	15	15
10	Mustahil	68,127.00	0	2	17	13
11	East-emay	84,072.00	0	3	18	14
	Total	**648,693.00**	**1**	**33**	**159**	**139**

1.9.4.1 Sample for qualitative design

Based on the distance from the designated town, all the districts of the Shebele Zones were formed into two groups (close and far). In each category, one district was chosen. In each district, purposive sampling was applied with a total of 12 immunisation focal persons selected (6 focal persons per district).

1.9.4 Data collection and analysis

Using a digital voice recorder, semi-structured in-depth interviews were conducted with HCPs working on immunisation foals at health facilities and district health offices, and field notes tackers manually recorded and transcribed the data on the evaluation of their perceptions, challenges, and experiences with the proposed solutions for immunisation programs in the pastoralist community. The data was organized into topic groups and thematic analysis was performed using the ATLAS ti 8 software. Detailed descriptions were reflected in chapter three.

1.10 ETHICAL CONSIDERATIONS

Ethical issues were addressed both before and during and after the study to preserve the participants' rights. UNISA (Annexure A) and the Somali Region Shebele Zone (Annexure C) health office both provided written ethical approvals. The right to provide informed consent, consideration for the human being who has the right not to be harmed or manhandled, single consent to participate in a specific area of the auditing, proper security, and the right to privacy are all examples of moral standards of independence, equity, usefulness, and non-maleficence (WHO, 2019:6).

1.11 SCOPE OF THE STUDY

Geographically, the research was conducted in the Shebele Zone of Somali, Ethiopia. It focused on the parents' or caregivers' knowledge and awareness of vaccine-preventable diseases, current immunisation status and dropout rate, and immunisation service readiness of monitoring systems. HCPs working in immunisation focals were provided with information and recommendations on the specific activities to improve immunisation coverage in the pastoralist community.

1.12 STRUCTURE OF THE THESIS

Table 1.4 Listed chapters, major topics, and information on the thesis

Chapter	Topics	Information's included
One	Orientation to the study	Research orientation including, introduction and background, aims, objectives and research questions, research sites, research design and methods, the significance of the research study, definitions of terms and theoretical foundations,
Two	Literature Review	Introduction, history of vaccines, how the vaccine works; the importance of vaccinations, immunisation schedule and service delivery, factors associated with immunisation coverage etc…
Three	Research Design and Methodology	Research method, design, setting, population, sampling, data collection and analysis, ethical related issues, internal and external validity, guideline development, scope and limitations etc.
Four	Presentation and discussion of the research findings	Quantitative and qualitative study findings, analyses and discussions of both research designs.
Five	Triangulation and integration of quantitative and qualitative findings	Triangulating quantitative and qualitative variables, and integration of research results.
Six	Proposed Guidelines	Findings of the study, guidelines developed and validation of guidelines, are presented.
Seven	Conclusion, limitations, and recommendations	The study summary, conclusion, limitations, and suggestions are presented.

1.13 SUMMARY

The key research elements were briefly discussed in this chapter. The Chapter emphasised the Ethiopian pastoralists and the world's vaccination achievements. The study objectives, goals, research questions, research sites and significance of the research study were discussed. The research design and methods were also discussed. The chapter outline of the thesis was provided. The next Chapter reviews the relevant literature.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The orientation to the research study was presented in Chapter 1. This chapter reviews the literature review to collect relevant data from a variety of resources to fully understand how to develop guidelines for improving childhood immunisation programs in Pastoral Communities. Based on relevant literature and research findings on immunisation (Obanewa 2019), especially the low coverage levels in Ethiopia, the factors of parents/caregivers ‘knowledge and awareness of immunisation, cultural and religious beliefs, health facility distance from the households, Anti Natal Care (ANC), service follow-up in community demand sides, and immunisation monitoring system and service delivery in supply-demand sites were reviewed and described. References from the chosen publications to identify research not detected in initial literature searches were one of the main techniques for gathering and reviewing the papers that were used (Snyder 2019:334). More than 200 references (published and unpublished articles and titles) were reviewed and cited from Google Scholar journal articles, library books, WHO working documents, and various global and national strategic documents. In addition to topic relevance, language (English), and article publication date were used as inclusion criteria.

This literature review distinguishes between three types of review methodologies: systematic, semi-systematic, and integrative methods, arguing that depending on the research scope and objective of the study, each style of methodology may be very helpful in identifying, selecting, evaluating and synthesising relevant literature from various sources such as academic journals, books, conference proceedings, and online databases.

2.2 HISTORY OF IMMUNISATION AND VACCINATION

The modern history of immunisation and vaccination started in 1796 firstly by the British physician Edward Jenner, in the practice of smallpox vaccination in China and India (Santos, Tenorio & Eslava 2022:6). He successfully immunised people against smallpox, which was caused by a virus similar to cowpox pustules (WHO 2013:11). Vaccines were developed in the laboratory for the first time in the late 18th and early 19th centuries. They were developed in the 20th century as immunologic markers and molecular biology now permit vaccine manufacture that was before unreachable (Paul 2019:1). Childhood immunisations were started in the late 1940s and completed in 1977 with smallpox eradication (WHO 2004:6). The Ethiopian EPI program began in 1980 with six antigens: BCG, Diphtheria, Pertussis, Tetanus, Polio, and Measles, withthe goal of achieving 100% immunisation coverage for all children under the age of two years by 1990 (WHO 2018a). However, the coverage target was raised to 75% in 1986, and the primary targets for vaccination programs in Ethiopia were newborns, children in their second year of life for MCV2, females 9-14 years old for HPV, and women of reproductive age. Currently, the standard vaccination schedule includes a total of 12 antigens (Federal Ministry of Health Ethiopia 2021:3).

2.3 HOW THE VACCINE WORKS

To understand how vaccines work, how the body fights illness needs to be first considered. When germs such as bacteria or viruses enter the body, they attack the body and multiply. The disease is caused by this invasion, known as an infection. To fight infection, the immune system employs white blood cells which are primarily composed of B lymphocytes, and T lymphocytes (CDC 2022). By imitating an infection, vaccines could help protect against childhood diseases. This type of simulated infection teaches the immune system how to combat a future infection. After receiving a vaccine, the imitated infection can occasionally cause minor symptoms such as fever which are normal and should be expected as the body develops immunity (CDC 2022). Once vaccinated, the body will have a supply of T-lymphocytes and B-lymphocytes that remember how to fight the disease. B-lymphocytes and T-lymphocytes are defensive white blood cells that produce antibodies to fight infection (CDC 2022).

2.4 IMPORTANCE OF VACCINES

Immunisation is among the most effective public health measures, having resulted in the abolition of smallpox and the near abolition of poliomyelitis (Shazly, Khalil, Ibahem & Wahed 2016:1018). Furthermore, the incidence of several other deadly infectious illnesses, such as Diphtheria, Measles, Hemophilus Influenzae Type b (Hib), Meningococcal, Pneumococcal, and Rotavirus Infections, have decreased dramatically (Isaacs 2012:111). Vaccines save more than 2.5 million infant deaths worldwide each year (Okueso & Oke 2017:24, WHO 2013a:10). Vaccines have reduced disease and disability, prevented 2.5 million deaths every year, reduced the worldwide incidence of Polio by 99%, and entirely eliminated Smallpox (SmartSense 2019:2).

Notwithstanding immunisations enormous impact, most of those world children do not profit from it. Approximately 19.3 million children (almost 20% of children born each year) are not immunised (Kyere 2014:2). This is identified by a collaboration of supranational organisations that have designated the time frame from 2011 to 2020 as the "Decade of Vaccines," with the goal of trying to extend the full benefit of immunisation to all people by 2020 and beyond, irrespective of where there were born, who they are, or where they live (WHO: 2013c; Hardt *et al* 2013:207). Increasing vaccination distribution dramatically by releasing novel vaccines and encouraging governments to attain 90% coverage, might save the lives of 8.7 million children under the age of five, over the next decade (Hardt et al 2013:206).

2.5 IMMUNISATION SCHEDULE

The Expanded Program on Immunisation (EPI) is the most widely used systematic technique for reducing morbidity and mortality among children from vaccine-preventable diseases (WHO 2017a:11). Despite a global rise in vaccination use from the early years (since the original worldwide vaccination schedule was established), the global vaccination schedule (i.e. 6, 10, and 14 weeks for DTP-OPV and nine months for measles vaccine) were devised as part of the EPI more than 25 years ago (WHO 2018c; CORE Group Polio Incentives 2005:2). Over the last four decades, the quantity and variety of vaccinations included in the EPI schedule have expanded

(Obanewa 2019:143). A large number of new vaccinations are now introduced into the global healthcare program (Baudouin, Nadia, Olivier, Oleksandr & Yoriko 2017:2). Among these are vaccinations for Streptococcus Pneumonia, Rotavirus, Human Papillomavirus, Neisseria Meningitides, Varicella-zoster Virus (responsible for herpes zoster), Dengue, and Novel Influenza Viruses (Baudouin, et al 2017:3), but other new vaccines like Ebola and Malaria are coming soon (Choi & Hong 2015:11-12).

The recommended dosages of immunisations provided to children varied slightly around the globe (Argaw 2019:77). According to 2019 WHO Immunisation Guidelines, Children are considered fully immunised when they have received one dose of Bacillus Calmette Guerin (BCG), three doses of DPT plus Hep B and Hib, four doses of Polio Vaccines, three doses of Pneumococcal Conjugate Vaccine (PCV), two doses of Rota Vaccine, one dose of Inactivated Polio Vaccine, and one dose of Measles Vaccination by the age of 9–12 months, according to 2019 WHO Immunisation guidelines (Girmay & Dadi 2019:2). The current EPI vaccinations in Ethiopia including BCG, Measles, DPT-HepB-Hib or Pentavalent, Rotavirus, Pneumococcus Vaccine (PCV), OPV, HPV (Human papillomavirus vaccine) and Tetanus Diphtheria (Td) Vaccine, are aimed at children under one year old, children in their second year of life, teenage females (9-14 years), and women of reproductive age (15-49 years) (Ministry of Health Ethiopia 2020:2). In Ethiopia, the vaccination schedule for the vaccines mentioned below adheres precisely to WHO guidelines for poor countries (WHO 2019a:24). The following WHO-recommended vaccines should be received in the routine immunisation schedule (Ministry of Health Ethiopia 2021:19).

Table 2.1: Immunisation antigens, site administration and schedule

S/No.	Vaccine/drug	Target diseases	Age	Route/Site of administration
1	BCG	Severe forms of Tuberculosis	At Birth or as soon as possible after birth	Intradermal (ID), Rt deltoid
2	PCV	Meningitis and pneumonia associated with Streptococcus Pneumoniae bacteria	Weeks 6,10 & 14	Intramuscular(IM),Rt anterolateral thigh
3	OPV	Poliomyelitis	Birth (OPV0), weeks 6,10 & 14	Oral
4	IPV	Poliomyelitis	Week 14	IM, Rt anterolateral thigh 2.5 cm below the injection site from PCV
5	DPT-Hib-HepB	Diphtheria, Pertussis, Meningitis, and pneumonia are associated with *Hemophilus influenzae bacteria and* Liver disease due to Hepatitis B virus.	Weeks 6,10 & 14	IM, Lt anterolateral thigh
6	TT/Td	Tetanus/diphtheria	Months 0, 1 and 6; Year 1 and 2 for TT 1st dose Early as possible 2nd dose 4week after 1st dose 3rd dose 6 months after 2nd dose 4th dose 1 year after 3rd dose 5th dose 1 year after 4th dose	IM, Lt Deltoid
7	Measles containing vaccine	Measles	9 and 15 months	Subcutaneous (SC), Rt deltoid
8	Rotavirus vaccine	Rota virus associated gastro-enteritis.	Weeks 6 & 10	Oral
9	HPV	Human Papilloma virus, associated with cervical cancer and anogenital wart	0, 6 months for Quadrivalent	IM, Deltoid muscle of upper arm

10	Hep B Vaccine Birth dose	Hepatitis B Virus Infection	At birth or within 24 hours of birth. If a child is born out of HFs or at home, track the baby and vaccinate until the age of 14 days.	IM, left anterolateral thigh

2.6 GENERAL HEALTH STATUS AND SERVICE DELIVERY IN ETHIOPIA

Ethiopia's health policy was formed in 1993 with the goal of providing all sections of the population with access to a basic set of good primary healthcare services (Federal Ministry of Health Ethiopia 2020:13). Ethiopia has designed and executed four consecutive Health Sector Development Plans (HSDP) and later the Health Sector Transformation Plan (HSTP, since the policy's inception (MOH Ethiopia 2019:27). Approximately 80% of illnesses are caused by avoidable communicable diseases, such as Vaccine-Preventable ChildhoodInfections and Nutritional Deficiencies (Federal Ministry of Health Ethiopia 2019b:3; Ministry of Health Ethiopia 2020:7). Ethiopia's primary aim is to improve the provision of fair vaccination service delivery (Federal Ministry of Health Ethiopia 2020:12).

The frequency and quality of EPI service delivery techniques have a significant impact on vaccination coverage and program cost-effectiveness (Primary, Care & Agency 2020:36). In Ethiopia, vaccination services are delivered in three ways: static, mobile, and outreach (Federal Ministry of Health Ethiopia 2015:22). Ethiopia's healthcare system is divided into three stages of care: basic, intermediate, and tertiary (Annis & Ratcliffe 2020). National and regional referral hospitals in each of the regions provide general referral services at the tertiary and secondary levels of healthcare, respectively and essential well-being care units work at the Woreda (district) and kebele (lowest administrative level) to provide primary healthcare services to communities (Annis & Hannah 2018). The scheduled immunisations program is supported by the critical healthcare unit's well-being expansion program, which is an imaginative community-based method for offering preventative and limited time administrations at the community level (Ministry of Health Ethiopia 2020:17).

Immunisation is free in Ethiopia's healthcare system, and treatments are offered from the tiniest health post to the most advanced hospitals (Ministry of Health Ethiopia 2015:19).

Administrative and healthcare delivery systems make up Ethiopia's EPI healthcare framework (Amare 2013). The Federal Ministry of Health (FMoH) has developed the health administrative structure to Kebele levels in accordance with the country's administrative structure (MOH Ethiopia 2018:37). At all levels of the Maternal and Child Health (MCH) administrative organisation, an EPI unit has been formed. The EPI structures at various health administration levels are depicted in the organogram below (MOH Ethiopia 2020:15).

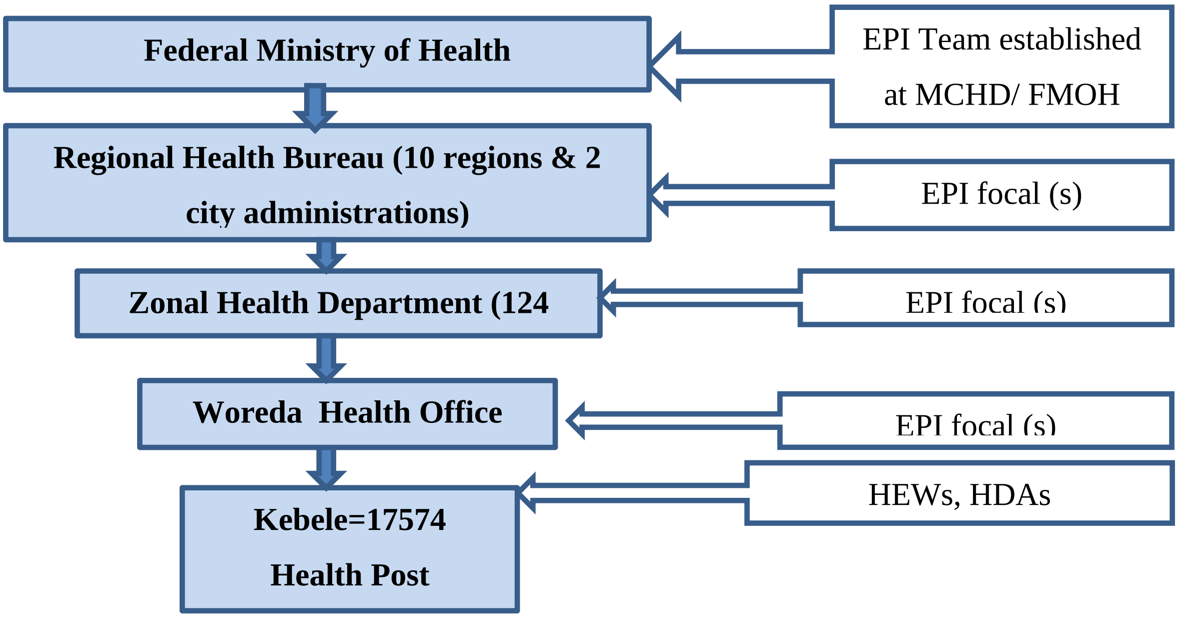

Figure 2.1: Organogram of Ethiopian Health Administrative and EPI unit (Ministry of Health Ethiopia, 2020:15).

All regions and city administrations have Regional Health Bureaus (RHB), most zonal and area well-being workplaces for the administration of open well-being services at their various levels (Federal Ministry of Health Ethiopia 2019:11). As a result of the delegation of authority to regional authorities, decision-making for service delivery has been transferred from the centre to the regions and down to the district level (Dikienoo 2021:25).

2.7 IMMUNISATION SERVICE READINESS

2.7.1 Immunisation Service delivery

The EPI program has benefited from the democratisation and decentralisation of the healthcare service because the implementing organisations (Woredas) are more capable of contributing in financial mobilisation for immunisation programs in their respective localities, both administratively and monetarily (The Vaccine Alliance 2020:20). Immunisation access in pastoralist settings remains difficult, with coverage rates varying widely between nations. Even inside countries, pastoralist populations have deteriorated in terms of fundamental indices of well-being over time due to a lack of access to social services (Tadesse et al 2019:2).

The success of the 2021-2025 Ethiopian Multi-Year Plan (EMYP) for providing interventions to reduce child mortality, is dependent on improved service delivery (MOH Ethiopia 2020). Service supply or delivery is the direct result of inputs into the health system, such as the health staff. A well-being framework's primary responsibilities include assuring the accessibility and availability of well-being administrations that satisfy the lowest quality standard. Acceptability is a complex notion that indicates how suitable a healthcare intervention is to persons who are providing or receiving treatment based on anticipated or experienced cognitive and emotional reactions to the intervention. The acceptance of the intervention by both intervention providers and customers is critical to its efficacy (Mandeep et al 2017:1). Vaccine distribution must be effective and efficient in order to save lives via immunisation, both for routine vaccination and the introduction of novel vaccines (Krishnaswamy, Lambach & Giles 2019:943). Access to maternal immunisations is improved through increasing availability at the country and programmatic levels, as well as prenatal care and vaccination within maternity care settings (Krishnaswamy, Lambach & Giles 2019:945). Currently, children in rural regions have more access to vaccination services because of the Basic Package of Health Services (BPHS) initiative (Mbaeyi, Kamawal, Porter, Azizi, Sadaat, Hadler & Ehrhardt 2017:275).

The physical accessibility of services may be used to help determine how service delivery could be enhanced (Vicki 2013:4; WHO 2018a:3). Distance is one of the most significant non-monetary obstacles to healthcare access, particularly in rural regions (Kumar, Dansereau & Murray 2014:). Wide spatial separations to a healthcare provider, along with a lack of transportation options, can have a detrimental impact on health benefits usage and outcomes (Santosh et al 2014:4092). Ethiopia's top priority agenda item is to improve the provision of fair vaccination services (MOH Ethiopia 2020:18). The immunisation strategic plan's main goal was to attain 90% national coverage and 80% coverage in every district with all vaccinations by 2020. It also aimed to reduce the occurrence of vaccine-preventable diseases by executing coordinated strategies that benefitted the whole health system (MOH Ethiopia 2019b:22). The frequency and quality of EPI service delivery tactics had a significant impact on vaccination coverage as well as the program's cost-effectiveness (Mbaeyi et al 2017:275).

2.7.2 Immunisation Service Delivery Monitoring System

The direct significance of service delivery monitoring for healthcare management separates this sector from other components of the healthcare system. Vaccine shortages, uneven healthcare distribution, as well as a lack of equipment or rules, must all be examined as part of basic benefit administration (William & Flora 2018:1-12). Monitoring is the systematic and ongoing examination of data, techniques, and practices. Monitoring of immunisation measure progress, vaccines administered, doses provided simultaneously, identify problems, develop solutions, and guide policies, interventions, and practices (Krishnaswamy, Lambach & Giles 2019:945) should be implemented A few ideas that are frequently used to assess healthcare remain relevant and are included among the essential qualities. For example, terms like access, accessibility, utilisation, and scope are frequently used to demonstrate whether or not people are getting the administrations they require (WHO 2018a:7).

Data ought to be in perfect wording, be assembled and made accessible at the area level, notwithstanding the source. The district level, in theory, should be the core of a system for monitoring health resources and, providing information needed for decision-making. As a result, the primary goal was to establish a district-based structure with assistance from the national, territorial, and common levels (Republic of

South Africa Department of Planning Monitoring & Evaluation 2017:10; WHO 2018a:7).

2.7.3 Vaccine supply and Cold-chain Management

Regular vaccination supply was critical in guaranteeing EPI program participation (Krishnaswamy, Lambach & Giles 2019:945). In 2010 WHO and UNICEF launched an Effective Vaccine Management (EVM) (Global Polio Eradication Initiatives (GPEI), 2020:41). All vaccines and their diluents were kept in a cold-chain system and dispensed at WHO-recommended temperature ranges (WHO 2014:2). Global polio eradication initiatives were strengthened in-country vaccine logistics and management and positively impacted the overall vaccine management for the routine immunisation program (UNICEF 2015:13).

As part of reforming and improving the Immunisation Supply Chain (SC) system, Ethiopia had prepared a five-year immunisation Supply Chain Management (iSCM) strategic (2018–2023) plan with the overall goal to strengthen the iSCM and ensure the availability of quality vaccines and related supplies for effective program delivery (Ethiopian Pharmaceutical Supply Agency (EPSA), 2020). In most African nations, including Ethiopia, key challenges included cold-chain management in resource-poor regions where energy was non-existent or sporadic, as well as a shortage of appropriately skilled employees to distribute vaccinations (Tadesse et al 2019:2). The most common obstacles in various studies of cold-chain vaccine management were transportation issues, refrigerator quality, storage method, too long storage at the health-unit, improper use of refrigerators, power outages, equipment failure, and a lack of trained personnel capable of handling the refrigeration (Lin, Zhao & Lev 2020:189). The majority of studies suggested that vaccine supply chain systems would be a bottleneck in the launch of novel vaccines (Planning Alternative Tomorrows With Hope (PATH) & WHO 2013:1). Forecasting, procurement, ordering, storage, transportation, and information systems were some of the suggestions in vaccine supply systems that were connected with other health product supply chains (PATH & WHO 2013:5).

Countries scored differently for effective vaccine management. The rural district in Ghana scored an average of 60% for temperature control, 32% for stock management and 27% for effective vaccine distribution in the district (Osei, Ibrahim & Amenuvegbe 2019:5). The performance of the cold-chain in Ethiopia and other countries of Sub-Saharan Africa had been a critical challenge for availing safe and potent vaccines (Ashok & Brison 2016:7). A study that assessed the cold-chain status for immunisation in central Ethiopia reported that for only 19% of the assessed, 116 health facilities had functional refrigerators and vaccine storage in the refrigerators was not proper in 54.5% of the facilities (Berhane & Bisrat 2013:9). A study conducted in Gambella Region in Ethiopia to assess facility preparedness for routine immunisation services indicated that only 25% of health facilities in the region were capable of providing routine EPI service regularly due to limitations on refrigerators, immunisation logistics and trained personnel (Asres & Fantahun 2013:67-19). Furthermore, a study on immunisation services in six regions of Ethiopia showed that more than 70% had adequate fridge tag at all levels; 79.3%, 65.8%, and 47.5% had vaccine requests and report formats at zonal Woreda and health center levels, respectively. In the last three months, there was no stock out in 59.3% of the health center, and more than 77% of health center had adequate water packs/Ice packs (Ethiopian Public Health Association 2017:18). According to a survey conducted in pastoralist and semi-pastoralist areas of Ethiopia, 152 (58.7%) of cold-chain frameworks were functional, and 266 (40.4%) of vital wellness care facilities recorded fridge temperatures twice daily on checking sheets (Tadesse et al 2019:4).

Another research in Ethiopia's Amhara region found that more than half (58%) of respondents properly evaluated the Vaccine Vial Monitor (VVM) reading, and nearly a third (38.3%) of respondents knew enough about Vaccine Cold-Chain Management (Bogale, Amhare & Bogale 2019:5). Furthermore, adequate storage space and professional qualifications were strongly linked to the practice of Cold-Chain Management (Amhare & Bogale 2019:4). In the 2019 Ethiopian Effective Vaccine Management (EVM) assessment results showed that there had been an improvement at the primary store at National and Sub-National level, whereas the Woreda and health facility level had shown a decline in the score. However, lack of proper documentation of temperature review activities and actions taken, no using freeze indicators during vaccine transportation, a lack of up-to-date temperature monitoring studies and mapping data, timely updating of transactions and archiving vaccines and supplies ledgers, and a lack of regular wastage monitoring were some of the gaps identified (MOH Ethiopia 2019b:15).

2.7.4 Planning and Management of Immunisation Program

Planning is harmonizing action with various actors, with a focus on garnering political and legal support for the EPI's aims and goals, as well as assistance for the technical and operational employees. TheImmunisation Program needs to be well–planned to reach every child individually (Pan African Health Organization & WHO 2020:13). Bottom-up Micro-plans for the Immunisation Program should ideally be a part of the planning involving other Health Programs and Services (National Institute of Health & Family Welfare (NIHW) 2018:11). Immunisation Program Management is a cross-cutting factor that enhances immunisation service delivery system in the respective jurisdiction or catchment area of health facilities and Woreda (Pan African Health Organization & WHO 2020:14). Program Management includes data quality reviews to identify areas and populations with low coverage and program/demand barriers, supportive supervision, review of Micro-plans, coordination, supply inventory, along routine program review and adjustments. Program Management is sub-optimal in most of Ethiopia's Woreda s and health facilities (NIHW 2018:11).

Despite all efforts, Vaccination Programs continue to have key leadership, management, and governance shortcomings at all levels. This is linked to issues such as health staff management, program execution, and a lack of ability to mobilise and absorb money in order to meet expanding consumer demands (Ministry of Health Ethiopia 2020:56). Preparation of Micro-plans including sessions, vaccines and supplies forecasting; capacity building; supportive supervision; review meetings; and coordination mechanisms should be included as part of Program Management activities and are critical to improving program outcomes (Umeh, Madubu, Korir, Loveday,Ishaku & Iyal 2018:7).

The deliverables for the Program Management would be a preparation of RED/C Micro-Plans, targeting the Unserved/Underserved Communities, providing Immunisation In Practice (IIP) training for Vaccinators and Mid-Level Management

(MLM) for Immunisation Managers/EPI focal persons at District and Primary Health Care Unit (PHCU). Other deliverables include conducting regular supportive supervision (monthly) from district to PHCU and PHCU to Health posts; conducting regular review meetings (quarterly) at PHCU and District level; establishing and revitalizing EPI technical working groups at all targeted Districts (Ali, Levin, Abdulkarim, Tijjani, Ahmed, Namalam, Oyewole & Dougherty 2020:5).

Each health facility is supposed to prepare annual/biannual session plans to reach eligible participants in their respective catchment areas and send them to Woreda health office. Alternate sessions would be planned in consultation with the community in case of vaccination session changes due to unavoidable situations (WHO 2016c:47). Revisiting the target population is one of the key challenges of effective immunisation micro-panning; this target population is mainly determined by using conversion factors from old census while there are anticipated changes in fertility, population movement, and other factors. This creates unrealistic coverage reports in some Woredas (Ethiopian Public Health Association 2017a:21). research in northern Nigeria found that excellent micro-planning techniques for regular Vaccination Program Management could enhance immunisation coverage in cost-effective ways, reduce disease burden, and save lives from vaccine-preventable illnesses (Ali, Levin, Abdulkarim, Tijjani, Ahmed, Namalam, Oyewole & Dougherty 2020:7).

The Ethiopian Public Health Association study in six regions of Ethiopia showed that 34.5% had Reached Every Community (REC) Micro-plan at zonal levels, and out of that 34.5%, 20% had posted the Micro-plan on the wall. Similarly, the existence of a Micro-plan at Woreda level to reach the community was less than 50%. it was nearly 28% at the health center level, of which 23.3% were verified for being posted on the wall (Ethiopian Public Health Association 2017:18). Agreeing to a comparable thought, as there were 34.5% of zonal well-being specialists, 45.9% of locale well-being centres, and 27.6% of we[l-being centres in Ethiopia, utilised the Coming to Each Community (CEC) Micro-plan to outline community areas and characteristics, as well as the assets required for scheduled inoculation (Manyazewal, Mekonnen, Demelew, Mengestu, Abdu, Mammo, Abebe & Tigabu 2018:7).

2.7.5 Healthcare Provider Capacity on Immunisation

Vaccination Programs need specialised training methods (EshaghI et al 2015:1), because of their critical role in preserving public faith in vaccinations, healthcare practitioners must be comfortable in giving advice and must be kept up to date when vaccine concerns occur (eHealth Ontario 2014:4). This would necessitate more time spent on vaccination in medical and nursing schools, as well as a greater emphasis on continuing medical education in this field (WHO African Region 2015:4). Community participation would be aided even more by better-tailored marketing collaterals sent through relevant channels (Hardt et al 2013:216-217). Primary healthcare practitioners give vaccination training to ensure effective service delivery, mobilise individuals to build vaccine demand and track program performance (Nicol, Turawa & Bonsu 2019:11).

It is worth noting that achieving high immunisation coverage requires a dedicated, confident, and capable vaccination team (Julie et al 2014:2601). Primary healthcare professionals who work at the grassroots level should have up-to-date information about immunisation on a regular basis, to keep them well-versed in the basics of immunisation and current practices pertaining to immunisation programs to provide effective immunisation services. Continuing education and in-service training may increase health professionals' knowledge and skill levels, modify their behaviours and attitudes, and improve health outcomes since their attitudes and actions would reflect their training and growth (Julie et al 2014:2601; Jelleyman & Ure 2015:1).

A study on improving immunisation capacity in Ethiopia showed a high shortage of healthcare provider capacity for administering immunisation services and programs; more than 82% of health departments and offices at the Zone and District levels lack certified specialists to conduct and administer Vaccination Programs (Manyazewal *et al* 2018:10). All health professionals should attend need-based in-service training to update their knowledge and skills to improve health service delivery and quality of care (FMOH 2021b). The Ministry of Health (MOH) had identified several key challenges associated with in-service Integrated Refresher Training (IRT), Immunisation In Practice (IIP) and Mid-Level Management (MLM). The training had adversely impacted

HCWs’ learning outcomes and skills proficiency. But, these training were conducted face-to-face over the course of many days without the use of technology, which made them less efficient and resource intensive (Manyazewal *et al* 2018).

2.7.6 Immunisation Healthcare Provider Guidelines for Capacity Development

According to WHO 2012 Handbook for Guideline Development, there are different types of guidelines and processes for guideline development (WHO 2014a:2). Guidelines are designed to help healthcare professionals, recipients, and other stakeholders make educated decisions (Bousquet *et al* 2019:4075). A suggestion tells policymakers, healthcare practitioners, or patients what they should do (WHO 2012a:1). According to WHO (2012a:3) the following types of products that best fit the purpose, should be considered when planning to produce a guideline:

Rapid advice guidelines

Fast advice guidelines are created in the event of a public health crisis (such as a pandemic Influenza Pandemic) in which WHO is called upon to give global support and direction quickly (Tesfaye 2020:8).

Standard guidelines

Standard guidelines are developed in response to a request for information on a change in practice or a point of disagreement in a specific clinical or policy area (WHO 2014a).

Full guidelines

Full guidelines are ones that cover all aspects of health issues or ailments.

A compilation of guidelines

It incorporates current WHO and other organisations' guidelines but does not include any new ones. Guidelines designed for one context may be modified for use in another, such as Immunisation Guideline in Pastoralist Communities. A well-designed comprehensive handbook could help resolve any disagreements about performance or duties to be accomplished. The first step in creating any handbook is to figure out what the manual's purpose is and who would be utilising it. This handbook would be arranged based on the findings of past studies and information gleaned from other sources. As a result, it may be thought of as a rapid reference guidebook.

The Department of Vaccines and Biologicals at WHO and UNICEF issued guidelines for required ongoing on-the-job training for health workers on vaccination to boost immunisation coverage at health facilities (Eze, Agu, Aniebo, Agu, Lawani & Acharya 2021:3). However, it was unclear if this part of the program were executed successfully at all levels of healthcare (Krishnaswamya, Lambachb & Gilesa 2019:2). Ethiopia currently has an immunisation implementation guideline in place to provide strategic guidance to health administrators and program managers at various levels, health service providers in health facilities, and the various partners and actors involved in the Immunisation Program's implementation throughout Ethiopia. However, this does not consider the specific geographical contexts, and the developed guideline does not focus on the specific improvement of the Pastoralist Community's Childhood Immunisation Program. This developed Immunisation Improvement Guideline is one Immunisation Research-based Document to help healthcare professionals and immunisation implementing partners to reach target objectives in the pastoralist context.

2.8 CHILDHOOD IMMUNISATION COVERAGE

Immunisation scope levels and patterns are utilised to track inoculation benefit execution locally, territorially, and universally, as well as to direct vaccine-preventable malady annihilation, end, and control programs (WHO 2018e:2). Administrative surveys and WHO/UNICEF immunisation coverage sources are used to report vaccination coverage. The national government reports on administrative coverage

(Obanewa 2019). It is based on data from vaccination program implementation, whereas WHO/UNICEF estimates are based on an assessment of all available data, which is often a mix of administrative data from regular immunisation programs and household surveys (UNICEF 2017:6). Administrative reports can be used to assess the performance of vaccination programs at the national level. Numerous countries' administrative coverage estimates are incorrect because of errors in the denominator (total target population), documentation of vaccinations at health facilities, and data collection for reporting to higher levels (WHO 2018e:2).

WHO and UNICEF employ annual country-by-country appraisals of all available data, including administrative and survey-based reviews, to establish national coverage estimates (Casey *et al* 2016). Countries were grouped by World Bank income categorization (poor, lower-middle, upper-middle, high) based on 2015 per capita gross national income to examine vaccine coverage fairness (CDC 2015). The Global Vaccine Action Plan 2011–2020 was adopted by the World Health Assembly in 2012 (WHO 2013c). By 2020, all nations should have realized 90% national coverage and 80% coverage in every district or similar administrative unit for all vaccinations in their national immunisation schedule. DTP3 coverage at 12 months is a good predictor of how well an immunisation program is working (UNICEF 2017:7).

The third dose of the combined Diphtheria Tetanus Pertussis-Hepatitis B Haemophilus influenza type b vaccine DPT, Hep B-Hib (Penta 3) coverage will be considered as a main indicator of immunisation performance in this study and has been widely applied for national and global monitoring (WHO 2018b:2). If the final primary immunisation occurs at nine months of age, children aged 12–23 months are the most typically chosen target population for regular vaccination coverage reviews (WHO 2018e:2). The percentage of children aged 12–23 months who had gotten three doses of the combination Penta 3 vaccination at the time of the research was used to determine coverage (WHO 2018b).

2.8.1 Global childhoo immunisation coverage

In terms of the global vaccination situation, 20% of children are now unprotected by the most basic immunisations, and 1.5 million children die each year from vaccine-preventable illnesses such as pneumonia and diarrheal sequelae (SmartSense 2019:3). Vaccination coverage varies a lot among WHO Regions, nations, and districts, as well as between different demographic groups and communities (Casey, Dumolard, Dumolard, Diallo, Hampton & Wallace 2016:1271). DTP3 was given to a total of 116 million children in 2018, with coverage ranging from 76% in the WHO African Region to 93% in the European Regions. Overall, 124 (65%) nations had 90% national DTP3 coverage, 34 countries had 805-89% coverage, 12 countries had 70%-79% coverage, and 22 countries had 70% coverage. Among the 19.4 million children (14%) who did not obtain complete vaccination during their first year of life, lower-income nations and children from poorer households have greater rates of under-immunisation (Casey et al 2016:1270, WHO 2017b:3, Peck, Diallo, Nedelec, Sodha & Wallace 2019:1). Vaccine-preventable illnesses account for over 30% of fatalities among children under the age of five (UNICEF 2018:7).

Globally, the number of children who do not receive DPT3 has increased from 18.7 million in 2014 to 19.4 million in 2018 (Obanewa 2019:15; Peck *et al* 2019:2). In 2019, 14 million babies were not given their first dose of DTP vaccination, and another 5.7 million were only partly immunized (WHO 2020:1). In 2010, more than 6 million children in Sub-Saharan Africa missed out on DTP3 by one year. The Vaccine Alliance has highlighted ten counters as the most important for children vaccination, particularly in Chad, Ethiopia, and Nigeria, where immunisation coverage is low. These nations have the worst vaccination problems, with more than 70% of children not receiving a full round of basic immunisations (WHO 2018b:2). Due to a shortage of access to vaccination and other health services, 14 million new-borns did not receive their first dose of DTP vaccine in 2019, while another 5.7 million were only partially vaccinated. Angola, Brazil, the Democratic Republic of the Congo, Ethiopia, India, Indonesia, Mexico, Nigeria, Pakistan, and the Philippines account for more than 60% of the 19.7 million children (Shikuku, Muganda, Amunga, Obwanda, Muga & Matete 2019).

According to statistics from the 2018 WHO Health Report on paediatric immunisation coverage in different countries, vaccination coverage was significantly connected to the parents' age at birth, parents' education, and household economic level (WHO 2018b:15). In Afghanistan, for example, a child of a woman with no education and teens had one-third the likelihood of getting vaccinated as a child of parents 20–49 years old with secondary or higher education. In Chad, a child born to teenage parents with no education had a 7.2 times greater likelihood of receiving DTP3 vaccine than a child born to parents with a secondary education or above. This suggests that teenage parents are more likely to receive information on immunisation other than education, and by nature, young parents are more likely to receive information into action without resistance. In Pakistan, compared to a child of a teen age parents with no education, a child of a woman aged 20–34 years with a higher than secondary education had a 28 times higher likelihood of getting vaccinated. When compared to children whose parents had at least a primary school education and were the wealthiest, Kenyan children had a 6.3 times higher likelihood of getting vaccinated (WHO 2018b:15). In Somalia, a child whose parents had a higher education was 1.8 times more likely than a child whose parents had no formal education to receive complete vaccination (Jama 2020:4).

2.8.2 Ethiopian childhood immunization coverage

The Ethiopian routine immunisation program targets more than 3 million birth cohorts annually with 11 antigens (Ministry of Health Ethiopia 2020:32). For the last 19 years, the immunisation coverage has risen; positive trends in Penta3 and MCV1 were observed over time. Penta3 from 21% in 2000 to 63% in 2019 and MCV1 from 27% to 62% (Ethiopian Public Health Association, 2017a:17, EPHI & FMOH 2019:16).

In the EPI program, administrative survey and WHO/UNICEF vaccination coverage sources are used to report immunisation coverage (UNICEF 2017:2). The administrative DPT3 coverage in Ethiopia was 97%, while the WHO/UNICEF estimates were 73% in 2017 (WHO 2018b:22). This coverage difference widened further from 24%, with the WHO/UNICEF always estimate lower. The administrative coverage data for both antigens are always high compared with other sources (WHO 2018b:25). Penta3 coverage data from health facilities for the last four years consistently reported around the mid-'90s while WHO/UNICEF *Estimates* of National Immunisation Coverage (WUENIC) estimates '70s and survey reveal in the 60's percentiles. The pattern is the same for MCV1 coverage too. The WUENIC estimates seem tallied with the survey and EDHS findings. The differences observed between the 2011 coverage with 2019 EMDHS are very high (32% and 27% differences for Penta3 and MCV1, respectively) (EPHI & FMOH 2019:16). The discrepancies in coverage have been attributed to data quality issues related to inaccurate population estimates, significant gaps in recording and reporting at all levels. Other challenges, including reaching the correct target population, contributed to increasing DHIS2 (WHO 2018b). Furthermore, the greater administrative coverage figures in Ethiopia compared to WHO/UNICEF estimates may be attributable to the under-estimated target population utilised.

In the 2011 Ethiopian Fiscal year (July 2018 to June 2019 GC), administrative coverage data showed that the national Penta3 coverage was 94.2% and MCV1 was about 89%, with large variations among regions. Specifically, pastoralist regions, namely, Afar Region, followed by Somali, Gambella and Diredawa reported <80% coverage of Penta3 and <70% of MCV1 coverage. The national Penta1 to 3 dropout rate was 6.5% among the region, the pastoralist region (Somali) has reported higher dropout rates (13.9%) while the other regions reported <10%. Penta 1 to MCV1 dropout rate was 12.0% at the national level and in the pastoralist region of Somali was a 24.3% higher dropout rate with other regions (Ethiopian Public Health Association, 2017a:17; EPHI & FMOH 2019:16). Nationally more than 207,000 children were reported unvaccinated for Penta 3, and 351,571 were unvaccinated for MCV1. Pastoralist regions like Somali Region had the highest unvaccinated children than other regions (Penta3, 50,715, MCV1 66,520) (EPHI & FMOH 2019:16). Several immunisation implementing partners (WHO, UNICEF, JSI, CORE Group etc.) working on the expanded program for immunisation (EPI) and different household surveys were carried out to analyses coverage and variables that contributed to poor vaccine coverage, but they did not meet the purpose of Ethiopia's national strategy of enhanced immunisation coverage (FMOH Ethiopia 2019:19).

2.9 PARTNER ENGAGEMENT IN THE IMMUNISATION PROGRAM

Partnerships and collaborations are strategic alliances between NGOs with the goal of achieving more impact than any one organization could achieve alone (Hardt *et al*

2013). Associations between all partners in the public health sector, such as health professionals, policymakers, national and sub-national associations, health experts, antibody producers, and others, are clearly required to ensure high immunisation take-up rates, recognize and permit the use of unused antibodies, and educate the public and others about the importance of immunisation and how immunisation security is constantly evaluated (Karin et al 2013:217).

Globally, the Bill and Melinda Gates Foundation, the Global Alliance for Vaccinations (Gavi), the United Nations Children's Fund (UNICEF), (Aires, Gil & Martinez 2017:10) the International Vaccine Access Centre (IVAC), and the WHO are major players in supporting global immunisations and vaccine delivery in countries such as Ethiopia, India, Nigeria, Pakistan, and Afghanistan, where the majority of the world's unvaccinated children live (SmartSense 2019:2). Therefore, it is essential that all stakeholders like NIP, EFMHACA, vaccine manufacturers, laboratories, healthcare providers, and development partners make concerted efforts to provide documented evidence through an effective immunisation system (Food Medicine Health Administration & Control Authority (FMHACA) of Ethiopia 2018:4).

In low- and middle-income countries the private good conveyance is widely regarded as more productive, dependable, and sustainable than state healthcare conveyance (WHO 2017a:12). The public sector, on the other hand, is usually seen to provide more equal and evidence-based care (Basu et al 2012:2). Private preventive care is primarily provided by FBOs, CSOs, and NGOs, often in collaboration with the open division on national immunisation programs (WHO 2017a:6). In some countries, NGOs and CSOs have umbrella organizations, which are systems that reflect multiple private-sector organizations and can play a variety of roles in national immunisation programs (NIPs), including education, advocacy, awareness-raising and demand creation, resource mobilization, immunisation disease surveillance, and immunisation service provision (WHO 2017a:13).

Sustaining national health systems is increasingly challenging for many governments in the developing world, including Ethiopia (SmartSense 2019). NGOs and the private sector are major partners in improving the immunisation programs of Ethiopians through participating in the procurement of vaccine supply, cold-chain management, and capacity building, awareness creation, and community-based surveillance, financial and technical support of the EPI programs. An example is the: CORE Group Polio Project (CGPP) Ethiopia which has one of non-profit umbrella organization building and strengthening effective partnerships between the Government, PVOs, NGOs, and bilateral and multilateral agencies at respective levels working in polio eradication/health sectors for exchange of information and experiences and avoid duplication of efforts (USAID 2019:17).

2.10 FACTORS ASSOCIATED WITH THE IMMUNISATION COVERAGE

Whether a person is immunized or not, is influenced by many factors (WHO 2019b:2). According to the growing vaccination rate, people's thoughts, and feelings, as well as societal factors, will impact vaccination motivation. The capacity to act on motivation and get vaccinated is influenced by practical variables (Obanewa 2019:44). Many factors in a community can influence a child's immunisation status for the better or for the worse, which may include parents/caregivers' knowledge and perception, cultural and religious believes, sociodemographic characteristics, health facility distance from the households and ANC service follow up.

2.10.1 Parents/caregivers' knowledge and awareness of immunisation

Knowledge is a harder notion to define (Alemu 2021:111). "Knowledge is a fluid amalgamation of organized experience, beliefs, contextual knowledge, and expert opinion that provides a framework for evaluation and assimilation of new information (Bolisani, & Bratianu 2018:13). Within the information systems literature, knowledge, and learning are two closely related ideas that are sometimes seen as two sides of the same coin (Ragab & Arisha 2016:7).

In different literatures, lack of knowledge, information and motivation can be limited or translated into skills. In an Iraqi study, 66% of parents had adequate knowledge-practice (KP) scores, meaning they scored more than 12 out of a possible 20 on the KP exam (Al-lela et al., 2014:6). Similarly, over half of those polled said they had enough KAP studies conducted in Italian and India (Brown, Oluwatosin & Ogundeji

2017). Of these except Polio, the majority of parents could not respond to the vaccine-preventable diseases and current immunisation schedule (Lamiya, Mundodan & Haveri 2019:1254).

Other two Indian studies indicated that the knowledge of parents or caregivers of children 12 to 23 months on vaccine prevention against measles is relatively high (71.9%) than other Vaccine Preventable Diseases (Sankar 2018:3-6) and the proportion of people knowing Polio, Measles, DPT and BCG were much lower as only 24.7%, 18.4%, 21.4% and 29.9% respectively (Akanksha & Meena 2017:2). In a survey of parental knowledge and attitudes on children immunisation, parents in Saudi Arabia had a strong understanding on issues linked to the overall function of vaccination in the protection of several infectious illnesses (Alamri, Horaib & Alanazi 2020:252). In another survey, a lot of parents had good or satisfactory awareness of immunisations. Furthermore, in India, 75% of parents were satisfied with their knowledge, attitude, and practice about vaccine-preventable illnesses (Sankar 2018:6).

In a research study conducted by Dadzie, the majority of Ghanaian parents/caregivers of children aged 12 to 23 months recognised the significance of vaccination activities (Dadzie 2019:14). In a similar study in Saudi Arabia on parental awareness and attitudes on childhood immunisation, 672 parents had good knowledge on vaccine-preventable diseases (Alamri, Horaib & Alanazi 2020:7). Three quarter (73%) of the parents on Chesnais parents have good knowledge about immunisations and associated facts (Kumar & Kavinprasad 2018:4847). Another study in the North Wollo District of Ethiopia found that nearly three-quarters (76.8%) of research participants were aware of EPI target illnesses, and 60.4% of the parents had “good knowledge” about childhood immunisation services (Gebereegziabher & Shiferaw 2020:5).

Children in Nigeria (Brown, Oluwatosin & Ogundeji 2017:5) are not vaccinated for a variety of reasons, including a lack of commitment to vaccination programs, a lack of information about immunisations, and an inability to communicate effectively with parents about immunisation (Anyabolu 2016; Victoria et al 2017:2). The most crucial element affecting parents vaccination awareness and habits is their degree of literacy

(Brown, Oluwatosin & Ogundeji 2017:3). When contrasted to fathers who had graduated from elementary school, educational status was independently linked with awareness of childhood immunisation with 285 (47%) university graduates having more knowledge about optional childhood immunisations (Kara, Polat, Yayla, Demirdag, Tapisiz, Tezer & Camurdan 2018:453). Another study in Malaysia on educational intervention in enhancing parents' knowledge of childhood immunisation revealed that if low levels of education and income are addressed, there is a favourable influence on parents' knowledge about immunisation (Awadh et al 2014:7). A research study conducted in Spain found that the higher educational level of parents positively influenced vaccination status (Mora 2018:2). However, according to a research conducted in Nigeria on parents attitudes, knowledge, and perceptions of paediatric vaccination, educational attainment has no bearing on parents' desire to immunize their children, and it also has no bearing on people's ideas about the aetiology of illnesses (Ojikutu, 2012:234, Hagan 2014:26).

In the 2016 Ethiopian Demographic and Health Survey (EDHS), it was found that children of parents with secondary education are more likely to obtain all basic immunisations than if their parents have just a primary education or no education (Ethiopian Central Statistical Agency 2016:164). In Ethiopia, women's vaccination knowledge, socioeconomic level, and household autonomy are all linked to children's immunisation status and the entire EPI program and services (Beyene, Worku & Bisrat, 2013:41; Ebot 2015:18). These factors are intrinsically linked to the efficiency and effectiveness of district health systems to manage EPI programs and services at lower-level and empower the community to integrate immunisation in their culture (Beyene, Worku & Bisrat 2013:50). Maternal/caregiver educational level was significantly increasing the immunisation status of children in different studies (Tech *et al* 2017:3). It seemed that literate parents are more likely to get their children vaccinated than illiterate ones (Lamiya, Mundodan & Haveri 2019:19).

According to research conducted in Ghana, the chances of receiving complete immunisation rose dramatically with the parents' educational degree, for example, immunisation of children in maternal secondary education had 3.7 times the number of vaccinated children, and tertiary education had eight times the number of vaccinated children, compared to those without education (Dadzie 2019:66). DPT3 coverage was 49% for infants born to parents who had never attended school, but 85% for children whose parents had completed grade 10 or above (Ghosh & Laxminarayan 2017:1089). Comparable research in Ethiopia's Amhara Region found that parents/caregivers with a secondary or higher level of education were 2.39 times more likely to have fully immunized children than uneducated parents (Girmay & Dadi 2019:4).

2.10.2 Cultural and Religious Beliefs about Immunisation

Some faiths contain anti-vaccination sentiments or outright prohibitions. However, other nations, such as Pakistan, Afghanistan, and Nigeria, have limits on immunisation in general, as well as Muslim religious beliefs, political concerns, and vaccines (USAID, 2018). Polio vaccine, for example, is believed to be an American plot to sterilize Muslim communities and defy Allah's decree in Afghanistan. Similar sentiments exist in Pakistan, where a number of religious and tribal leaders have expressed worry that the polio campaign is a Western plot to subjugate the Muslim people (Regmi, 2014). A study of caregiver perceptions in Nigeria, found that almost the majority of the parents/caregivers indicated that religion influenced their decision to bring their children to the health facility for vaccinations (Anyabolu 2016:87). Religious beliefs strongly impact parents' desire to increase children vaccination in a Nigerian study (Z2 = 44.192, p 0.05). About 89.03% of Christians were willing to immunise their children, compared to 76.9% of Muslims and 50% of non-religious persons (Ojikutu 2012:234).

There were considerable disparities in religious affiliation and vaccine coverage throughout Sub-Saharan Africa (15 nations) in research on religious affiliation and immunisation coverage. Children born to Muslim parents had not gotten any immunisations compared to children born to Christians in six countries (CaluCost, Weber, Darmstadt, Abdalla & Victora 2020:1163). In another study in Nigeria on the optimization of childhood immunisation, it was found that although Islamic religion has been highlighted as a barrier to comprehensive vaccination, the barrier of childhood immunisation tactics was substantially lower among urban Muslims (Obanewa 2019:27). According to a study conducted in Ghana, 84.7% of women selected

Orthodox (Hospital) care providers, which was substantially linked to complete vaccinations (Dadzie 2019:63). Another qualitative research in Nigeria discovered that caregivers with completely vaccinated children saw Christian beliefs as a powerful incentive, as opposed to a caregiver with a child who was not fully vaccinated and trusted in traditional healing (Anyabolu 2016:88).

2.10.3 Maternal Antenatal Care Attendance

Antenatal care, as per a UNICEF report, can help women plan for delivery and recognise danger signs throughout pregnancy and childbirth (Jones 2018:73). Women can also get vitamin supplements, hypertension therapy to prevent eclampsia and tetanus vaccination (Krishnaswamy, Lambach & Giles 2019). Women who present late in pregnancy may miss out on the chance to receive early immunisation and maximum protection for themselves rather than their babies (Krishnaswamy, Lambach & Giles 2019:946). According to a study conducted in Nigeria, maternal attendance at prenatal care is associated with a much higher likelihood that the child would be vaccinated than children whose parents did not attend ANC (Obanewa 2019:135). Children whose parents went to a prenatal clinic and were born at a health facility had a lower likelihood of not being completely immunised (Adedokun, Uthman, Adekanmbi & Wiysonge 2017:5). A similar study showed that parents of antenatal care users are significantly associated with maternal and childhood immunisation (Giles, Mason, Muñoz, Moran, Lambach, Merten, Diaz, Baye, Mathai, Pathirana, Rendell, Tunçalp & Hombach 2020:5282). During the previous pregnancy, Ante-Natal Care (ANC) visits provided healthcare workers with a chance to inform mothers about the importance of childhood immunisation.

The impact of distance and service quality on Antenatal Care (ANC) use in rural Zambia shows that both spacing to a facility and quality of ANC services have a significant influence; for the closest (10 km) health facility, distance was affiliated with a 54% increase in the odds of having received good quality ANC (Nicholas et al 2015:1). According to a study conducted in Wag-Himra Zone, Amhara Regional State, and Northern Ethiopia, women who had three or more ANC visits were 2.75 times more likely to have completely vaccinated infants than parents who had never had ANC visits (Girmay & Dadi 2019:5). In their Strategies to recover Child vaccination with Antenatal Care study in India, it was found that parents who visited ANC twice had a 43 percent greater likelihood of having their children vaccinated than those who did not (Nour, Farah, Ali, Osman, Aden & Abate 2020:6). A comparable research in southern Nigeria found that parents who visited a postnatal clinic attended more than 90% of their new-borns' vaccine appointments, increasing immunisation uptake by 13% (Egharevba, Pharr & Wyk 2017:86). In Ethiopia, a multi-level analysis research found that parents use of ANC services at the community level was a major determinant in children vaccination (Kinfe, Gebre & Bekele 2019:6).

2.10.4 Distance to the Vaccination Services

Researchers discovered that distance from houses, transit expenses, and insufficient transportation infrastructure all influenced the use of healthcare services in several studies (Anyabolu 2016:43). Distance, transportation costs, and lack of companionship have all been recognized as important barriers to women receiving vaccination services (Egharevba, Pharr & Wyk 2017:88). Geographical accessibility has an impact on the completeness of childhood vaccinations, according to a study conducted in Ethiopia on the relationship between travel time to health facilities and childhood vaccine coverage, which found a significant link between travel time to vaccination sites and Penta3 vaccine coverage (Okwaraji & Edmond 2012). Children living 60 minutes from a health post, children living 30 minutes away from a health post, for example, were substantially less likely to obtain the Penta3 immunisation (Okwaraji et al 2012:6). In a qualitative survey of Indian parents long waiting periods at health facilities were cited as a reason for their children not being properly immunised and defaulting (Boro & Saikia 2020:6).

Another research in Nigeria found that a one kilometre distance to the nearest health institution reduced children vaccine uptake by 5% (Kumar, Dansereau & Murray 2014:4092). A longer distance to the health institution is linked to decreased vaccine uptake, delayed vaccination schedule, and vaccination series dropout rates (Sato 2019:2). The explanation provided by 17.5% of parents of partly vaccinated infants for not completing their child's vaccines was a long walk to the health facility (Adedokun et al 2017:4). Long-distance walking (17.5%) and long waiting times at the health facility (15.2%), as well as parental resistance or fear about vaccine safety (38.8%), were reported as common reasons for inadequate vaccination in research on caregiver attitudes of children immunisation in Nigeria (Anyabolu 2016:87).

2.10.5 Place of Residence

Place of residence is an influential factor in the utilisation of primary health services. In general, urban areas have more health infrastructure, better transport and shorter distances, and better topography to services access and use compared to rural areas (Egbemudia & Andrew 2018:11). Rural children have more advantages to timely vaccination than urban children, which was probably due to the fact that outreach vaccination teams visited rural communities more than the urban (Dadzie 2019:66). In contrast, a research in Bangladesh found that urban children were 1.35 times more likely than rural children to be completely immunised (Sarker 2019:6). Another study in Nigeria indicated that among the total of 320 respondents, 118(37%) of them were not vaccinated due to far distance from the immunisation site (Lydia & Suleiman 2017:3). Another qualitative study in Nigeria found that distance to health facility from the living areas are major factor in vaccination of children as well as their parents and caregiver s stated that the immunisation facility is far away, takes a long time, and is a significant hardship (Anyabolu 2016:71). Children of non-educated fathers had greater rates of full vaccination coverage than those in urban regions, according to a research done in Burkina Faso's rural communities (Dadzie 2019:61), and 81.5% of parents living in urban areas had their children fully immunized.

According to formative assessment research conducted in Ethiopian pastoral villages, just above half of the households (51.9%) are within one-hour walking distance of the nearest health facility, while 15.3% travel for more than two hours (Teklehaimanot et al 2019:22). Although urbanisation is growing fast in Ethiopia, totally unvaccinated children increased from four percent to ten percent in urban areas and from 17 to 23% in rural areas between 2016 and 2019 DHS report. While the place of residence remains an influential determinant of equity in vaccination in Ethiopia, the gap is reducing (Ethiopian Central Statistical Agency 2016; EPHI & MOH 2019).

2.11 SUMMARY

This chapter discussed the history of immunisation and vaccination and defined important terms on immunisation programs and schedules. It also included a review of literature on the factors that influence vaccine uptake, such as parents/caregivers' knowledge and awareness of immunisation, cultural and religious beliefs, maternal antenatal care attendance, distance to the vaccination services etc. It also showed the importance of immunisation service readiness and availability, including immunisation service delivery, vaccine supply and cold-chain management, planning and management, healthcare provider capacity and the availability of immunisation guidelines. Research design and methods are presented in Chapter 3.

CHAPTER 3

RESEARCH DESIGN AND METHODS

3.1 INTRODUCTION

This broad chapter provides and discusses the research design, research methods, settings, study subjects, sampling, and sampling techniques data collection method, testing of the questionnaire, administration of the questionnaire for each research method, ethical considerations related to sampling, data analysis, and design quality, the internal and external validity of the study, guideline development and scope and limitations of the study.

3.2 RESEARCH DESIGN

The research design is the blueprint for every study since it allows many processes to flow smoothly, making the study more efficient. A design in which one form of data (for example, QUAN) serves as the foundation for the collecting of another type of data (for example, QUAL) (Creswell 2018:13). Several research methods texts confuse research designs with methods (Dubey & Kothari, 2015:18). It is not rare to see study design seen as a method of data collection rather than as a logical framework of the auditing(Dubey&Kothari,2015:18).Ascomputer innovation has expanded our capacity to examine and translate complicated models, the designs available to researchers have evolved throughout time. Individuals have developed novel methods for doing social science research (Creswell 2018:41). The researcher employed the mixed method research design.

3.2.1 Mixed Method Research Design

The term “mixed methods” refers to an emergent methodology of research that advances the systematic integration, or “mixing,” of quantitative and qualitative data within a single auditing or sustained program of inquiry (Gray JR, 2017:124). Mixed methods include collecting and "mixing" or integrating both quantitative and qualitative data in a study (Creswell 2018:65). Blended methods research, according to Creswell, Chains, and Ivankova, entails more than just collecting subjective and quantitative data; it also implies that data are connected, related, or mixed at some point during the research process (Creswell 2018:47).

The reason for utilising a mixed-method approach in this research study is because neither quantitative nor qualitative methods were sufficient to address the research issues (Adriana 2014:43). Furthermore, mixed-method designs aid in triangulating data sources to search for convergences between subjective and quantitative methodologies (Creswell 2018:45). While the two research approaches were founded on separate epistemological foundations, their respective strengths and flaws offered a solid basis for their combination. When combined in a single program of study for this thesis, the two approaches would be complementary rather than competitive (Plano Clark 2018:113). An Explanatory Sequential Mixed Method of quantitative and qualitative research designs was employed in this research study.

3.2.1.1 Advantages of Mixed Methods Research

There are various advantages to doing a mixed-methods study, as listed below (Grav, Grove & Suzanne 2017:607)

- Blended strategy auditing is very persuasive for unravelling discrepancies between quantitative and subjective results.
- Blended methods inquiry offers the researcher thoughts about participants' voice and ensures that thoughts about the results are founded on the participants' experiences.
- Mixed studies broaden transdisciplinary team research by encouraging quantitative, qualitative, and mixed methods experts to collaborate.
- Mixed techniques are very adaptable to a wide range of research designs.
- By combining quantitative and qualitative data, mixed approaches reflect how people get information.

3.2.1.2 Disadvantages of Mixed Methods Research

Wisdom and Croswell (2018:65) indicated several challenges including the following:

- Mixed methods studies are complex to design and carry out.
- For many investigators, integrating qualitative and quantitative data during analysis is a difficult stage.
- To conduct high-quality mixed methods studies, a multidisciplinary team of researchers is required.
- The resources required to manage Mixed Methods research are greater than those required to manage single design research.

3.2.2 Explanatory Sequential Mixed Method Research Design

Explanatory Sequential Mixed Method is employed when an analyst researcher does quantitative research, investigates the data, and then uses subjective inquiry to represent them in greater depth. It is considered illuminating since the subjective information clarifies the initial quantitative information (Creswell 2018:45).

Explanatory sequential mixed design is a mixed methods approach that involves QUAN phases. In the first phase, the researcher gathers quantitative data and analyses results. Based on the key findings from the first phase, the second phase (QUAL), which involves the collection and analysis of qualitative data, is planned and used to provide more explanation and interpretation of the quantitative results. For this research study, the researcher used the Explanatory Sequential Mixed Method in two phases as follows:

Phase 1: Quantitative

The first phase of the quantitative strand used a survey to generate some specific and generalisable results at the community households and health facilities level. The researcher used a designed questionnaire which was distributed and collected from the participants, to gather more information on the research questions to solve the research problem. Statistical analysis was then perfumed using the SPSS version 25.0 software program and the results were used to design the second strand of this study in the form of quantitative data (Plano Clark & Creswell 2018:113).

Phase 2: Qualitative

A semi-structured face-to-face interviews were used to collect the qualitative data in community households and health facilities to examine immunisation coverage, dropout rate, knowledge and awareness of parents/caregivers, and health facility immunisation monitoring systems in Pastoralist and - Semi -Pastoralist communities in Ethiopia's Somali Region (Manga, Mwenyenkulu, Nkoka & Ntenda 2021:5), to provide a further explanation for the qualitative data initially collected. The second strand of the data collection was analysed by using Atlas ti 8.

The healthcare professionals were selected using purposive sampling techniques depending on the demographic characteristics or distance from the central town of the zone (Purdie, Dunne, Boyle, Cook & Najman 2002). A semi-structured face-to-face interview was used to acquire qualitative data from health workers on the vaccination for individuals at health facilities and district health offices. and the qualitative phase collected data from healthcare providers working on immunisation programs using semi-structured interviews to provide a better explanation for the survey data collected. The analyses were then used separately in this phase. This analysis was used to evaluate qualitative aims, and the results aided in the interpretation of the quantitative data. Furthermore, the results of the qualitative research were used to explore the findings and explain them in greater depth (Plano Clark & Creswell 2018:113).

Phase 3: Analysis and integration of data

Separate analyses were performed on the quantitative and qualitative datasets. During this step, the two databases were integrated by linking the quantitative and qualitative results. The researcher investigated how quantitative outcomes aided to understand qualitative results.

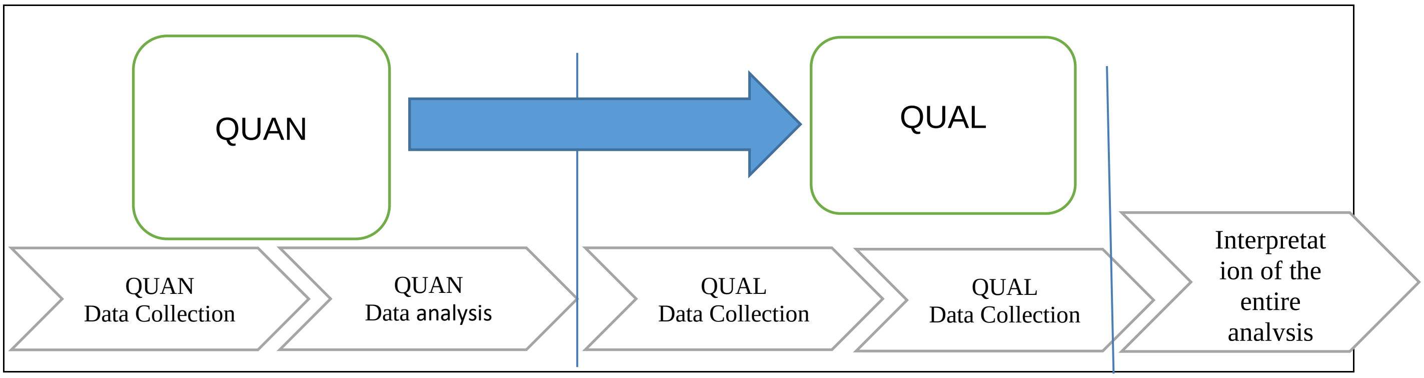

Figure 3.1 Flow of Explanatory Sequential Research Design (Plano Clark & Creswell 2018:113).

Phase 4: **Development of immunisation guidelines**

During this phase, standard community-based immunisation improvement guidelines were established using the standard guideline development methods outlined below (Zaman, Assir & Ali 2014:7). The rationale for the guidelines, guiding principles, objectives, scope, methodology, strategic objectives, development process, proposed activities, were included in the content of the guidelines (refer to chapter 6 for detailed discussion). It is drafted by the researcher and reviewed by the invited expert panels involved in the Delphi study. The stages of guideline development provided below are based on the WHO (2014) Handbook for Guideline Development (WHO, 2014c).

1. **Selecting a topic**

The title of this guideline is Guidelines for Improvement of Childhood Immunisation Programs in Pastoralist Communities. The Guideline is developed as an intervention to this research finding. The research study conducted has its concrete research question and stated problems. Therefore, the name is obtained from the research title.

2. **Forming guideline development group**

The researcher drafted the guidelines based on the research findings and shared them with the selected expert group for review.

3. **Scoping the guideline**

The guideline scoping is dependent on the defined objectives highlighted in this research. In addition, the guideline scope is determined by using different literature reviews and relevancy identified from the research findings.

4. **Identification, evaluation, and formulation of the evidence**

Major problems related to low immunisation coverage in pastoralist communities were identified and guidelines were developed.

5. **Writing the guideline**

The guideline included the executive summary, the main body, and appendices with specific recommendations to improve vaccination uptake.

6. **Consulting and peer-reviewing**

Reviewers included health professionals and specialists who work with immunisation around the country. Seven specialists reviewed the guidelines, and several insightful comments were compiled.

7. **Updating and reviewing**

All the comments received from the expert review team were considered and changes on the guidelines were affected by the researcher.

3.2.3 Quantitative Research Design

Data was collected from both parents/caregivers aged 12 to 23 months on the knowledge and awareness of vaccine-preventable diseases, current immunisation status and dropout rate at community levels and immunisation service readiness of monitoring systems at health facility levels using a quantitative study design. Creswell, (2018:41) defines quantitative design as "a plan for doing research that is focused on data collection, quantification and analysing numerical data and relationships." In quantitative research, evidence is gathered in accordance with a predetermined plan, utilising formal instruments such as surveys to obtain the necessary information, which is typically numerical and is analysed using statistical processes to improve objectivity. According to Creswell (2018:65), quantitative designs might be exploratory, quasi-experimental, or non-experimental, and used for realistic and inferential measurements. They might be cross-sectional or longitudinal. This research study is cross-sectional and non-experimental since data was gathered throughout a certain period inside the natural environment of the wellness workplaces and community level without testing the patients. As a result, the analyst utilised quantitative non-experimental cross-sectional design to distinguish and collect numerical information on the responsiveness of suitable immunisation programs in Pastoralist Communities from both health facility and community levels.

3.2.3.1 **Cross-sectional study d*esign***

Cross-sectional research investigates the relationship between variables of interest in a specified population at a particular moment in time or over a short period (Kesmodel 2018:388). The researcher described cross-sectional studies conducted at a single point in time that provided a detailed understanding of immunisation problems on parents/caregivers' knowledge and awareness of Vaccine-Preventable Diseases, Current Immunisation Status and Dropout rate, and Immunisation Monitoring Systems in the quantitative research design of phase one overviews but not detailed descriptions to support phase one quantitative research design.

Cross-sectional studies are classified into two types: descriptive and analytical. Analytical studies are used to study relationships, whereas descriptive studies are used to analyse distribution and frequency (Brandon 2018:1). Every study design has benefits and drawbacks. Here are the benefits and drawbacks of cross-sectional studies.

Brandon (2018:1) indicated the following advantages of a cross-sectional survey:

- It gives strong control over the measuring process.
- It delivers completeness with crucial data points.
- It improves accuracy in the sampling process.
- It enables anybody to analyse data and draw conclusions.
- It gives researchers access to a variety of outcomes and exposures.
- It gives data for descriptive analysis and lays the groundwork for future research opportunities.

The key disadvantages of the cross-sectional survey are:

- It is only useful if it reflects the entire population.
- A bigger sample size is required for accuracy.
- It provides no control over decisions or goals.
- It does not provide statistics on casual relationships; it requires a defined demographic group to be successful; and it cannot quantify incidence (Brandon 2018:2-3).

3.2.3.2 Descriptive research design

A descriptive research design describes the features of the group or phenomenon being studied, emphasising the "what" of the research topic rather than the "why." (Kesmodel 2018:388). In a descriptive study, the researcher observes, relates, and describes measurable attributes of the phenomenon in a natural environment as a starting point for hypothesis development (Manjunatha, N 2019:864). The basic purpose of descriptive research is to offer exact measures of the occurrences under auditing that can be explained statistically (Kesmodel 2018:388).

The researcher investigated and reported the knowledge and awareness of Vaccine-Preventable Illnesses, Current Vaccination Status and Dropout rate, and Immunisation

Service Readiness of Monitoring Systems among parents and caregivers aged 12 to 23 months. Furthermore, this enabled the identification of gaps and potential solutions in the Pastoralist Community's Immunization Program, which served as the foundation for the development of Guidelines for optimising Childhood Immunisation in the Pastoralist Community for the implementation of Healthcare Professionals and Implementing Partners on immunisation activities.

3.2.3.3 Survey research

The researcher used a research technique to collect both subjective and quantitative data. A survey is defined as "a research activity used to collect data from a sample of a population." (Abowitz & Toole 2010:116). In descriptive, explanatory, and exploratory research, a survey approach may be utilised. A survey research method is designed to gather information on the prevalence, distribution, and interrelationships of variables within a population.

The survey method was chosen by the researcher due to its low cost and ability to cover a vast population with a sample. Because responses were handled anonymously, this approach was an excellent way to determine current immunisation coverage and dropout rates, knowledge and awareness of Vaccine-Preventable Diseases among parents or caregivers of children aged 12 to 23 months, as well as Healthcare providers or Immunisation Focal Persons to answer service readiness on Immunisation Monitoring Systems.

3.3 RESEARCH METHOD

A research method is a broad framework that guides a research effort and the methodologies used to address various research issues (Haumba 2015:97). It refers to the precise methods of data collection, analysis, and interpretation proposed by researchers for their auditing (Creswell 2018:45). It comprises all the procedures and methods used in research. Schwedt defines research technique as a philosophy of how auditing should progress (Aires, Gil & Martinez 2017:12). Quantitative auditing might be a method of evaluating objective hypotheses by investigating the relationship between variables (Creswell 2018:65). Qualitative research is a process of an understanding based on a methodological tradition of inquiry that investigates an issue (Bacon-shone 2015:40).

3.3.1 Research setting

The Somali Region is one of Ethiopia's ten regional states. The research was carried out in the Somali region's Shebele zones, which are in northern Ethiopia, approximately 782 kilometres from Addis Ababa capital city. It is one of the regions with nine zones. The Shebele zone is divided into 11 Woreda s/districts (United Nations Development Program, 2020). Under the zone catchment area, there is one hospital, 30 health centres (HCs), and 159 health posts (HPs). All the health facilities provide immunisation services. Most of the people in the zone are pastoral nomadic and semi-pastoralists.

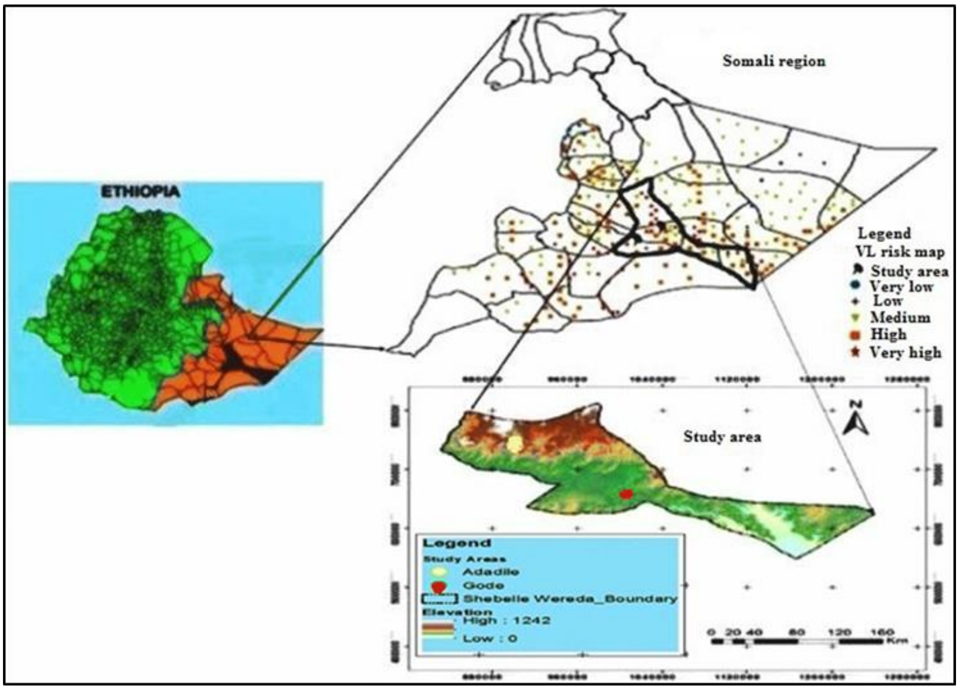

Figure 3. 2: Ethiopian map (left) and study area on the right – Shebele Zone, Somali Region (Somali Region Map data, 2021)

3.3.2 Quantitative Research Methods

Data was collected using quantitative approaches from both parents/caregivers and the health facility. The precise procedures used are given below.

3.3.2.1 Population

A community is a whole group of individuals who share a set of traits, whereas a sample is a subset of people (Banerjee & Chaudhury, 2010:63). In research, however, there are three sorts of populations that are inextricably linked: the study population, the respondents of the study, and the population sample. The following sub-sections explain the research population, which included all parents/caregivers and Health Care Professionals working and living in the Shebele Zone.

3.3.2.2 Study (accessible) Population

The available population for both qualitative and quantitative studies might be argued to be the same. Individuals from the study's open population are eligible to participate in both strategies (Asiamah, Mensah & Oteng-Abayie 2017:1613-14). Parents/caregivers of children aged 12 to 23 months living in selected Kebeles made up the population studied. According to the new WHO vaccination coverage surveys manual, all eligible research subjects, regardless of domicile (including permanent and temporary residents), were included in the assessment because excluding temporary residents might skew vaccination estimates higher (WHO 2018b). A Health Facility Assessment was conducted on all hospitals, district health centres, and selected health offices in the Shebele Zone.

3.3.2.3 Target Population

Target population is regarded as the entire set of individuals or units who meet the sampling criteria, as well as the parent population, from which the researcher wishes to generalise the results (Asiamah, Mensah & Oteng-Abayie 2017:1613-14). Due to the research designs that use practical reasons/resources and data management, it is not possible to investigate all parents/ caregivers and health care professionals on vaccination in the zone. The target population was done as follows:

- Shebele Zone residents who are parents/caregivers to children aged 12 to 23 months.
- Health facilities record review in the Shebele Zones.

3.3.2.4 Study population selection Criteria

A technique that allows researchers to infer information about a population based on the results of a subset of the population without having to investigate every individual. Based on the research design technique is as follows:

3.3.2.4.1 Quantitative Inclusion and Exclusion criteria

Reasons for inclusion and exclusion criteria are that variables selected as inclusion criteria should be related to answering the research question and that key variables should be described in the inclusion criteria to make a statement about the external validity of the study. Inclusion and exclusion criteria are used in research studies to ensure that the sample population is representative of the research question and that the results are valid and reliable

The reasons for inclusion criteria are to ensure that the sample population is relevant to the research question and that the study results can be generalized to the population of interest. The exclusion criteria were to minimise potential confounding variables that could affect the study results or participant safety.

Inclusion Criteria:

• All parents/caregivers of children aged 12 to 23 months who can able to give written consent and live within the inquiry area.

• All parents/caregivers with children aged 12 to 23 months, aged 18 to 55 years.

Exclusion Criteria:

- Parents/caregivers of children aged 12 to 23 months who are unable to give informed written consent and live out of the research area.
- Parents/caregivers of children aged 12 to 23 months who are not between the ages of 18 and 55 years.

3.3.2.5 Sampling and Sampling techniques

The process of selecting a group of respondents for research is known as sampling (Singh 2018:1). In other words, sampling is selecting a subset of a population or the complete population. Sampling can be used to draw conclusions about a population (Taherdoost 2020:20). The motivation for sampling is to pick a representative sample of the population because surveying the entire population is impracticable and expensive. As a result, the sample is chosen based on criteria (Haumba 2015:100). Multi-stage cluster sampling was used and 30 Woreda clusters were selected using Probability Proportional to Size (PPS) sampling approaches based on population size. In each of the clusters, 10 eligible children were targeted with a total sample size of 300 mothers/caregivers of children aged 12 to 23 months.

A theoretically simple random sampling process was used to choose one or two Kebeles from each Woreda /District cluster (WHO 2012:12). The research comprised 10 eligible children from each Kebele. Households were chosen at random from the Kebele's central direction in each of the selected Kebeles. The number of households in that direction to the Kebele's edge was tallied, and one household was picked at random to be the first. The following households were chosen by visiting the nearest nearby families until data from the caregivers of the ten eligible children were acquired (WHO 2018e:22).
In the health facility, the selection of health posts was determined on the selected study Kebeles/Clusters at household sampling procedures. In each Woreda Cluster, one or two health posts were randomly selected using a lottery method based on the availability of health posts. All hospitals and HC in the zones were included.

3.3.2.6 Sample Size

The number of elements in the sample is the sample size (Singh 2018:1). The purpose of estimating the appropriate sample size is to produce studies capable of detecting relevant differences (Alemu 2021:42) protection of human subjects and good stewardship of fiscal physical, and staff resources. The reasons for performing sample size calculations in the planning phase of a study are (Haumba 2015:109):

i) To assure confidence in the study results and conclusions.
ii) Ensure that the study is adequately powered because inadequately powered studies are wasted resources and have ethical considerations to the study respondents, given that they may not produce clinically meaningful results.
iii) Achieve adequate power to enable hypothesis testing.
iv) Facilitate the development of sound evidence for the best practice guidelines given that inadequately powered may produce results that are unable to alter clinical practice.

For this research study, the following two sample sizes were employed:

1. The sample size for the quantitative study
2. The sample size for the qualitative study.

Sample size for parents/caregivers of children 12 to 23 months

The sample size was calculated using the 30-by-ten modified WHO EPI cluster sampling approach involving the identification of 30 primary sample units or clusters (WHO 2012b:16, WHO, 2005:58).

The total number of children to be surveyed directly was calculated as follows: the expected coverage, p, and the desired width of the confidence interval, d. the normal distribution for the desired confidence level (α). For α = 0.05, z1-α/2 = 1.96.

$$n_{\min} = DE \times \frac{z_{1-\alpha/2}^{2} \times p \times (1-p)}{d^{2}}$$

Since the minimum expected immunisation coverage at a national and regional level is 90% (p = 0.9) and the desired precision is ± 5% with 95% confidence (d=5) and a non-response rate of 10%. Then p = 9 and d = 5, and assuming a design effect of 2:

$$n_{min} = 2 \times \frac{1.96^2 \times .9 \times (1 - .9)}{5^2} = 277$$

According to the WHO cluster sampling, the expected sample size (n) considering 30 clusters needed a minimum of 277/30 = 9.2 children per cluster, so a total of 9 children per cluster were included for a total sample size of 30 × 9 = 270.

To calculate the non-response rate, 277 HH as the sample size, and 10% of the non-response rate (NRR), then the final sample size calculation was done using the following formula (WHO 2012b:22):

$$\textit{Final N} = \frac{\textit{Number of HH needed}}{\textit{1-NRR}}$$

Final N = 270/ (1-0.1) = **300 HH**

The total sample size for the community was = **<u>300</u>**

Sample size for health facilities

To examine Vaccination System Monitoring, all health centres and chosen Districts/Woreda s were assessed, but the selection of health posts was determined on the selected study Kebeles/Clusters at household sampling procedures.

The distribution of health facilities in the Shebele Zones are:

Hospitals = 1, Health centres (HCs) = 32, Health posts (HPs) = 159.

A total of 64 (1 Hospital + 33 HCs + 30 HPs) health facilities were included in this study for record review and immunisation system monitoring in the study areas.

3.4 DATA COLLECTION

3.4.1 Quantitative Data collection method and Approaches

Data collection methods are processes for gathering, measuring, and evaluating reliable information for research purposes using standard verified approaches. Interviews, questionnaires and surveys, observations, documents, and records, focus groups, and oral histories are the top six data collection methods (Ainsworth 2020:2). The technique of gathering data from all significant sources to unravel the investigative issue, test the hypothesis, and survey the outcomes is known as information collection. There are two types of data collection strategies or techniques for gathering supplementary and critical information (Dudovsky 2019:1). In this study, a cross-sectional technique was used to collect important quantitative and subjective data.

Because of the benefits, the researcher employed structured interviewer-administered quantitative data-gathering procedures. As with face-to-face interviews, they demand the member to speak the same dialect as the respondents, as well as crucial linguistic and tuning-in ability (Abowitz & Toole 2010:117). Although face-to-face interviews are useful, they have their own limitations, as questionnaires are more expensive than other techniques and typically provide less assurance of anonymity than mailed ones. Furthermore, because the researcher and study assistants must contact individuals one by one, they cannot cover a larger geographical region.

The researcher employed interviewer administered questionnaires. The survey questions were mostly closed-ended with a few open-ended questions thrown in for good measure. The questionnaire was developed with the study's aims and conceptual model in mind (Saunders et al 2009:362). In this cross-sectional survey, data collection was conducted in households of parents/caregivers of children aged 12 to 23 months, based on the preceding concerns. Before genuine data collection began, a questionnaire was checked and validated on variables for socio-demographic factors, knowledge, and awareness of immunisation for parents/caregivers of children aged 12 to 23 months, and Childhood Vaccination status. Hard copy materials (Questionnaires) were used to acquire quantitative data.

3.4.2 Construction of the questionnaires

In the mixed study design, the researcher used different tools to collect data on the same topic. The researcher developed three separate tools, one for each level of the data collection process (quantitative and qualitative). For the quantitative strand, an interviewer-administered questionnaire was created, and for the qualitative strand, a semi-structured interview guide was formulated. A questionnaire must be clear, simple, and unambiguous, and it must be organized in such a way that data analysis is simple (Ratan, Anand & Ratan 2019:20). The questionnaire was developed using the reviewed literature on immunisation activities, research objectives, and conceptual framework (Birhanu, 2018). The researcher also examined other tools such as service availability in the pastoralist health facility used by researchers in similar studies and used some of the questions appropriate for this study. The questionnaires were interpreted in Somali, (Regional official language) by interviewers, and some words and phrases were clarified to facilitate understanding (Annexures F - H).

Structure of the questionnaire for parents/caregivers of children aged 12-23 months

For the quantitative portion of the study, two questionnaires were used: one for the community and the other for the health facility observational questionnaire for the Pastoralist Population. They were quite comparable except for the emphasis on the illness of interest, and the questions were pertinent to the respective community-based immunisation and observation of the health institution. The questions included the following aspects:

- The sociodemographic characteristics and relevant information on immunisation data, including respondents' age, gender, educational status, religion, marital status, and distance to immunisation services.
- Indicators/ variables of knowledge and awareness of parents/caregivers on childhood immunisation
- Indicators related to childhood immunisation status by card, history, and immunisation registrations books.
- Information related to parents' barriers and enabling factors to immunisation.

Section I: This section included 17 closed-ended questions about socio-demographic characteristics such as age, sexual orientation, marital status, religion, ethnicity, educational status, and occupation, partitioned to immunisation area, occupant, and a number of children, immediate older child immunisation status, and financial condition.

Section II: Knowledge and awareness of each Vaccine-Preventable Disease, when and where to begin immunisation, importance of vaccine, belief on vaccination, which children should not receive vaccination, source of information about immunisation, messages about immunisation, and so on were among the 25 closed-ended questions.

Section III: There were ten closed-ended questions concerning Childhood Vaccination status in this study. The portions were ordered as follows: ever vaccinated for routine immunisation, availability of vaccination card, number of vaccinated children by card, number of vaccinated children by registration, number of vaccinated children by history, number of vaccinated children by health facility's record/registrations and availability of BCG scar.

Section IV: This section was comprised of 20 closed-ended questions regarding parental obstacles to immunisation failure and enabling variables. All of the questions were closed-ended, with the following parts: unaware of the need for immunisation, unaware of the need to return for subsequent doses, place and/or time of immunisation, fear of side effects, incorrect ideas about contra-indications, location of immunisation, too far away, time of immunisation inconvenient, vaccinators absent, and so on, are some of the reasons for the child not to receive any vaccine (Legesse & Dechasa 2015).

Structure of the questionnaire for health facility observational and document review

The questions were designed to elicit information about immunisation planning and resource management, vaccine availability and cold-chain management, immunisation service delivery, and supportive supervision for immunisation activities were divided into four parts on the health facility quantitative observational checklists and document review.

Section I: This section consisted of 7 items of observational checklists questions about immunisation session schedule, defined catchment area map, qualified immunisation in practice trained health worker, management of the defaulter tracking system, monthly reports for the previous year dated and signed and implementation of planned immunisation sessions.

Section II: This section consisted of 16 items of closed-ended questions about vaccines received and issued recorded in a vaccine ledger book, vaccines available during the immunisation sessions, availability of BCG, Polio, Penta, PCV, Rota, IPV, and Measles Vaccine, Fridge- tag availability, Temperature Monitoring Chart completed twice daily, availability of Vaccines Diluents and Droppers, equal number of Auto Disposable (AD) and Re-constitution Syringes, Safety boxes to match the number of AD and Re-constitution Syringes, Checking stage 1 & 2 VVM and Vaccine Carrier availability.

Section III: This section consisted of ten closed-ended questions about using the proper diluents while reconstituting each vaccine, the use of one sterilised syringe/needle for reconstituting each vial, provision of adequate batch number, availability of a water bowl and stand for washing hands, child's next visit and explanation to the caregiver, discarding used syringe/needle in the sift box and register immunisation being used with correct entries.

Section IV: This section consisted of three closed-ended questions on higher-level support supervision in the preceding month, written feedback/reports supplied to the HC, and supervisory action items relevant to the HF carried out.

3.4.3 Pre-testing of the questionnaire

Pre-testing is a method for validating the research instrument and its measurements, pilot testing, research administration and procedures (Caspar, Peytcheva, Yan, Lee & Liu 2016:101). Pre-testing and pilot testing are valuable components of survey research because they provide researchers with an opportunity for reflection and revision of their research questions before the costs of errors begin to multiply. The questionnaires were pre-tested on 5% of the sampled parents/caregivers to reduce error. The consistency, clarity of guidance, confusing questions, substantial omissions in the questionnaires, identification of possible confounding factors that require control were identified, and modification of the questionnaire prior to the main research was done.

To find any gaps in the questionnaire, the researcher pre-tested it on 15 (5%) of the sampled parents/caregivers of children aged 12 to 23 months from the community and health facility levels, which were not among the designated study sites. There were no serious issues with the questionnaire that required adjustment before fieldwork. This exercise helped to estimate the time necessary to complete the questionnaire and identified items that were unclear or difficult to understand in terms of language and conceptualisation.

3.4.4 Data collection and Training of the data collectors

For data collection, eight quantitative and three qualitative experienced health professionals in the immunisation program who have prior experience in data collection at the community and health facility levels or provision of supportive supervision or mentorship to health facilities, at least a first degree in nursing or health officers, and who speak local language speakers were selected, trained, and deployed in the field. To assure the uniformity of the data gathering procedure, training of data collectors was done. They effectively learned both general interview processes and how to administer questions in the context of the present study, the objectives of surveys, the relevance of the study, confidentiality, structured interview, and the way to handle and approach study subjects, as well as the professional ethics for collecting data. Finally, data collectors were deployed to conduct pre-testing of data collection tools. The research instruments and amendments after any valuable comments were included after the pre-test.

3.4.5 Administration of the questionnaire

The data collectors used interviewer-administered questionnaires to interview the randomly selected respondents until the estimated sample size for parents/caregivers of children aged 12 to 23 months and health facilities were met. A total of 300 parents/caregivers and 64 health facility was reached in this study. Between July 25th and August 20th, 2021, qualitative data was gathered, including the training and pre-testing phases. Each interview followed a reasonable level of ethical formality. In general, the prospective respondents were educated about the research goal, risks, and benefits in a language they could comprehend, allowing them to make an informed decision about whether or not to join the study (Kashinka, 2017). After obtaining basic information, participants were able to provide informed consent.

3.4.5.1 Administered questionnaire for parents/caregivers aged 12 to 23 months

A questionnaire is a written tool used to collect data from research participants (Kashinka, 2017). In surveys, a questionnaire can be completed by the respondents themselves (self-administered). A researcher can perform individual (face-to-face) or phone interviews. Data collection can be done through face-to-face interviews, which allow the researcher to ask questions and clarify reactions, extra data can be tested, complex and open-ended questions can be explored, and cooperation can be expanded through individual contact (Blog 2020:2).
Face-to-face interviews can be time-consuming, require either the respondent or the investigator to travel, and are more costly than using mail or done online (Haumba 2015:115). The sample for each of the households was set for one parent/caregiver of a child aged 12 to 23 months at a community level. The greatest number of interviews permitted per day by each of the data collectors was set for two parents/caregivers of children aged 12 to 23 months at community levels and each meeting lasted for 40 minutes. This was done to ensure that the data was of high quality because the data collectors had enough time with the participants.

3.4.5.2 Administered observational checklist and document review questionnaire for Health facility

Data were obtained from health facilities using the document review and observation processes described above for each of the selected health facilities. Each data collector was limited to two interviews per day, with each health institution examined for 35 minutes and 64 health facility checklists was completed. This study was categorised under medium risk because there was direct contact with respondents during the interview but there was no intended harm to study participants or did not pose a risk above the everyday norm. To minimise this medium risk, both data collectors and study participants applied the intervention of COVID-19 prevention and control strategy that was both of data collectors and supervisors. The safety of study participants was ensured by wearing face masks, adhering to physical distancing during face-to-face interviews and applying hand-washing or hand -sanitisers before and after data collection in each household and health facility. The principal investigators provided facemasks and hand -sanitisers.

3.5 QUALITATIVE RESEARCH DESIGN AND METHOD

Qualitative research entails gathering and analysing non-numerical data to better understand concepts, phenomena, opinions, or experiences (Bhandari, 2022). A subjective auditing plan is characterized as "having graphic information" and is recognized by a point-by-point depiction of the marvel, an unequivocal portrayal of information collection and auditing, inductive thinking connected to proof obtained from sources, translation, and expansion of understanding by others (Yin 2016:165). A qualitative research design was used to collect data on immunisation focal persons from Healthcare Providers at the District and HF Levels.

In the second part of this study, semi-structured in-depth interviews were conducted using a narrative qualitative research approach to evaluate health workers' perceptions, obstacles, and potential solutions with vaccination-focal individuals at health facilities and district health offices. The qualitative data was generally stated in non-numerical ways, while it was occasionally translated into numerical variables (Tegegne *et al.*, 2018). Even if the description was highlighted, this did not exclude the usage of numerical numbers. In the qualitative approach, semi-structured data is often collected with the primary goal of producing themes from it. The qualitative data-gathering procedures employed were in-depth interviews, which had the advantage of providing depth to the data, allowing for probing and increasing the validation of quantitative data.

3.5.1 Population and Sampling

The qualitative study's research techniques for sampling and data gathering from Healthcare Practitioners were as follows:

3.5.2 Target population

In this research study, the target population was used by the researcher to answer the research questions (Haumba 2015:98). The target population for this research study were Healthcare Professionals assigned to the Shebele Zone Somali region.

3.5.3 Study (accessible) Population

For the qualitative section, the researcher selected a different group of samples from the quantitative samples. All Healthcare Professionals working on Immunisation Focal Persons in the Shebele Zone were the study population.

3.5.4 Sample Population

The researcher conveniently sampled two Immunisation Focal Persons from each of the six study district health offices (Adadle, Goda City, Ferfer, Beercano, East-May, Mustahil) and health centers or hospitals from close and far-off districts of the study areas. Therefore, participants of this category for the qualitative study were selected using purposive sampling techniques depending on their distance from the central town of the zone.

3.5.5 Study population selection criteria

When designing high-quality research protocols, it is standard practice to establish inclusion and exclusion criteria for study participants (Hornberger, 2020).

3.5.5.1 Inclusion and exclusion criteria

Inclusion criteria:

- Health care professionals assigned to health centres or hospitals for six months or longer, who have received IIP training and are able to provide informed written consent.
- Health care professionals assigned at the district/Woreda health office, working six months or longer, who have received IIP or MLM training and are able to provide informed written consent

Exclusion criteria:

- Healthcare professionals assigned to health centres or hospitals for less than six months, who have not received IIP training and are unable to provide informed written consent.
- Health care professionals assigned to Woreda /district health office for less than six months, who have not received IIP or MLM training and are unable to provide informed written consent.

3.5.6 Sample size

All locations within the zone were divided into two categories (close and far off) depending on their distance from the assigned town. A near group of six participants and a distant group of six participants were chosen. The research included a total of 12 (6 per site) participants from the two districts. However, the total sample size varied based on the information saturation.

3.5.7 Sampling techniques

Non-probability sampling is a sampling method that does not rely on randomisation or any likelihood that items in the universe have a chance of being included in the research sample (Syarifudin 2020:95). In non-probability sampling techniques, purposive sampling is often employed to select the sample to gain a more pertinent and useful data as per the intention of the study (Etikan & Bala 2017:215). One of the non-probability sampling strategies for unique situations is purposeful sampling. It selects instances using an expert's judgement, or situations with a specific aim in mind (Taherdoost 2020:25).

In this research study, all districts were divided into two groups (near and distant) depending on their distance from the designated town. In each category, three districts were chosen. As a result, two Healthcare Professionals per six districts were interviewed, who were working on Immunisation Focal Persons at district health offices, health centers or hospitals. The researcher typically selected the sample based on knowledge about the group to be sampled and the assumption that respondents had the necessary information on the immunisation program challenges and could propose solutions to the problems. The researcher further investigated the perceptions of healthcare workers who work as Immunisation Focal Persons.

3.5.8 Sampling

A non-probability sample might be based on the researcher's subjective judgement and does not rely on randomization or any probability that things within the universe have a chance of being included within the auditing (Syarifudin 2020:98). It focuses on small samples and is designed to investigate real-world phenomena rather than making statistical conclusions about the larger population (Etikan & Bala 2017:215).

Purposive sampling was used to select participants. Purposive sampling is a non-probability sampling method in which the researcher selects persons from whom data will be acquired at his or her discretion which was not prone to sampling bias and no sample size determination technique was applied (Taherdoost 2020:25). In this study, Healthcare Professionals working as HFs and district level immunisation focal persons were selected purposively in nearby and distant locations.

3.5.9 Data collection approach and methods

In qualitative research, data can be collected using a range of approaches, including observations, textual or visual analysis, and individual or group interviews (Gill, Stewart, Treasure & Chadwick 2008:291). Semi-structured individual interviews were conducted using a digital voice recorder, and interviewers were manually recorded and transcribed.

Using the probing questions in the guides, the major questions were asked and explored further. Participants provided informed consent for their voluntary and audio-recorded participation in this study. The researcher utilised semi-structured face-to-face interview questions for the qualitative strand (Gashi 2015:50), which helped to identify the topics to be studied while also enabling the interviewer or interviewee to diverge to follow a concept or response in further detail (Gill *et al* 2008:292).

3.5.9.1 Structure of the interview guide

One element of the semi-structured interview guide was integrated at the conclusion of the quantitative questionnaire for Healthcare Professionals on Vaccination Focal. The interview guide was developed based on the research objective, first phase quantitative result and the literature review. These semi-structured interview guide questions were aimed to elicit information regarding the Pastoralist Community's viewpoint, challenges, and possible solutions to the immunisation campaign.

The data collectors were responsible for administering semi-structured interview questions for the in-depth interview. This interview guide was prepared in English first, then translated into the local language. The data collector was trained, and the interview guide was pre-tested three days before the study in a non-study area to make relevant corrections based on the pre-test findings. Some of the questions were revised in response to the findings. The interview guide consisted of two parts, following the quantitative questionnaire.

Parts I and II of the Healthcare Provider Interview Guide consisted of qualitative semi-structured interview questions on Socio-demographic Characteristics, Perception of HCPs, Immunisation System, reasons for low Immunisation Coverage, knowledge regarding VPD, and HCPs Community involvement in vaccination service.

3.5.9.2 Data collection process in the qualitative in-depth Interview

An in-depth interview might be a beneficial subjective inquiry method in which the researcher gathers information, particularly from Healthcare Professionals. When used in conjunction with other research methodologies such as studies, focus groups, and so on, interviews are useful in eliciting findings, experiences, values, and other perspectives of the population under consideration (Showkat & Parveen, 2017:3). Interviews are classified into three types based on how information is extracted: structured, semi-structured, and unstructured (non-directive). The researchers conducted semi-structured in-depth interviews (Molapisi & Mogale 2012).

Semi-structured interviews were conducted with HCPs working on vaccination locales about their perceptions, challenges, and experiences with the proposed solutions for immunisation programs in the Pastoralist Community. Semi-structured interviews, according to Botma et al (2010:208), are used to acquire a thorough picture of a participant's thoughts, perceptions, or account of a certain issue, since an interviewer followed a list of planned questions. To ensure the safety of the study participants and data collectors during the interviews the following measures were applied to limit the spread of COVID-19:

- Hand wipes and sanitiser were utilised to decontaminate the hands frequently throughout the data collection process
- Face masks were worn by the participants, data collectors, and the researcher throughout the data collection.
- The social distancing of two meters was applied throughout the process.

- Sterile wipes were used to sanitize the equipment such as a tape recorder, pen, and other equipment that were used.

3.5.9.3 Administration of the in-depth interviews and conversations

The semi-structured interviewer-administered questionnaires used formal and written questions that were asked face to face with interactions between the interviewers and the study participants (Polit & Beck 2008:420). Data collectors were orally requested by the health facility and district health office managers to interview immunisation focal persons in a separate class, according to permission letters from the Somali region Zonal health office.

To manage the interview process, the interviewer must have a solid awareness of the study issues as well as a defined research plan. The accuracy of interview data is strongly dependent on the interviewer skill. The researcher took extra steps to ensure that the participants felt comfortable and relaxed during the study, which allowed them to express their thoughts and ideas without hesitation. Meanwhile, the interviewers made a concerted effort to work around the participants' availability and maintain an unbiased approach throughout the study. To maintain confidentiality, questions were asked orally in Somali (the official language of the Somali region) at hospital district health office, and health centre offices in a separate class. The responses to the qualitative interview questions were meaningfully reported using the participants' own words. For all in-depth interviews, audio recording and note-keeping were employed.

The interviewers sought to maintain a degree of knowledge of the participants' rate of response and, on occasion, had to repeat the questions to get extra useful information. Immediately after commencing the interviews, the interviewers clarified the reason and procedure, and they got composed and verbal assent to utilize a sound tape recorder (Polit & Beck 2008:386). Participants in the study were advised that any information they provided would be kept totally confidential. After receiving the informed written consent, the interviews commenced. The participants were informed that they might terminate the interview at any time, even if they had already consented (Haile & Molla

2020:56). All confidential information related to data on hard and soft copies were appropriately stored and password protected.

3.6 ETHICAL ISSUES RELATED TO SAMPLING

To preserve the respondents' rights, ethical concerns were followed both before and throughout the study. Regard for the human individual including ensuring that participants are not harmed or abused, providing information to participants, autonomy, the right to protection, and the right to privacy and/or secrecy, which are commonly summed up as the moral standards of independence, equity, usefulness, and non-maleficence were adhered to (WHO 2019:6). Some of the related ethical considerations are summarised below:

3.6.1 Research approval from the institutions

Following the completion of the proposal, the researcher obtained ethical clearance/approval for data collection from the Department of Health Studies at the University of South Africa (UNISA) under CREC Reference number 67126898_CREC_CHS_2021. Following receipt of an ethical clearance certificate from the College of Human Sciences Ethics Committee (CREC) the researcher requested and received a support letter to the Somali Region from the Ethiopian UNISA Regional Office with the reference number UNISA ET/KA/ST/29/16-07-2021, which was followed by the letter from the Shebele Zone. The zone permitted the student/researcher? To collect data from parents/caregivers in the community and Healthcare Professionals to its relevant catchment Woreda s and health facilities based on the benefit of the study and the medium risk for the study participants.

3.6.2 Respect for the human person

In this research study, the researcher and the research assistants took responsibility not to subject research participants to considerably onerous, unjustified, known, or predictable dangers (Galletta 2013:79). The researchers were responsible for informing the respondents about the study's aim, methods and rights, dangers, discomforts, and limits (Galletta 2013:79). The data collectors, eight for quantitative and three for qualitative, were trained to provide appropriate information to all the prospective eligible respondents. To assure the uniformity of the data-gathering procedure, training was necessary. The training addressed both general interview methods and how to administer questions in the context of this study's aims, depending on their existing experiences. The information sheet and permission form contained information about the researcher, the goal of the study, the benefits of participation, the assurance of withdrawal at any time, and the names of the people to contact if there were any questions (Haumba 2015).

3.6.3 Voluntary informed consent

Informed consent refers to respondents being completely informed of the research in which they are participating (Ryerson University 2017:5). Individuals have the right to make decisions about themselves and their lives since they are autonomous creatures. The research data gathered was entirely voluntary. The study participants were properly and suitably informed about the nature and extent of their intended participation in the study, including information that their participation was voluntary, and responses would be used exclusively for the objectives indicated in the study (Haumba 2015:107). In this study, each research respondent was requested to provide informed written and voluntary consent. The goal, hazards, and advantages of the research were often presented to parents or caregivers in a language they could understand, allowing them to make an educated decision about whether or not to participate in the study (Kashinka 2017:22). The accessibility of preparatory data empowered parents or caregivers to create choices. They were told that they were not required to take an interest if they did not wish to and that they could refuse to answer any question (s) they chose at any time.

3.6.4 Anonymity and confidentiality

To be safeguarded against the unnecessary danger of personal information becoming publicly available, research subjects must be aware that they were not identified via the research and that their information would be kept private and anonymous in a study. All studies conducted on humans have a duty to protect the privacy of their participants (Jaxena 2017:3). It is closely connected with the rights of beneficence, respect for dignity and fidelity. There are two ways to ensure the privacy of participants that is anonymity and confidentiality. In this research study, personal information was not disclosed (name, phone number and e-mail addresses) on the data collection tools. Computer passwords were used during data handling and storage processes to protect files when sending information via email. Parents or Caregivers and Healthcare providers' responses and identities were not disclosed beyond the research team unless they had agreed otherwise. The data collector, supervisor and those entering and analysing data signed confidentiality agreement forms.

3.6.5 Justice

The principle of justice has two components: I) reasonable treatment in research activities, including decency to the least advantaged who should be profited rather than overlooked, and ii) cooperation without avoidance based on helplessness or powerlessness of people abused with enrolment in research that is not responsive to their well-being needs (Galletta 2013:82). There were no grounds for discrimination or refusal of enrolment based on membership in one of the two groups. As a general guideline, the objectives of the research, risks, and rewards were stated. The risk of decision bias and error was reduced by describing the target population and including all occurrences that met the qualification requirements (WHO 2019:26). The study participants were chosen by using probability and non-probability sampling procedures to reap the benefits of study participants. The participants were chosen based on the study's inclusion criteria.

3.6.6 Beneficence and non-maleficence

The Hippocratic dictum "be of benefit, do no damage" is referred to as beneficence. The principle is to provide better service and improve the well-being of constituents (World Medical Association 2015:2192). Non-maleficence safeguards the individual from harm (Global Health Ethics and Unit & WHO 2019:26). Beneficence (do well) and non-maleficence (do not hurt) demand that health practice and research fulfil the obligation of doing good, preventing harm, and being watchful (Bishop 2017:2). This study did not pose significant discomfort, risk and burden on the respondents but minimised the risk of COVID-19 for both data collectors and study participants by adhering to COVID-19 prevention and control strategy.

3.7 DATA ANALYSIS AND DESIGN QUALITY

Data analysis is the process of obtaining solutions to problems by examining and interpreting data. The main processes in the analytic process are to identify issues, determine the availability of acceptable data, decide which methodologies are appropriate for addressing the questions of interest, apply the methods, and then evaluate, summarise, and communicate the results (International Organization for Migration (IOM) 2019:152). The data analysis was managed in accordance with the study's objectives, and the key analysis methodologies used were data analysis, interpretation, and presentation.

3.7.1 Quantitative data analysis

After entering quantitative data into a spreadsheet, it was used to generate information in answering the research questions. Statistics help in the transformation of quantitative data into useful information for decision-making by summarising data and describing patterns, relationships, and connections (IOM 2019:151).

3.7.1.1 Descriptive analysis

The first and main goal was achieved by using descriptive analysis to assess parents' or caregivers' knowledge, awareness, and vaccination service delivery readiness using measures of central tendency and variability obtained from numerical data (Creswell 2014:291). After data entry, recording, and cleaning were done, the SPSS software program version 26.0 was employed for this purpose. The mean value was used to measure knowledge and awareness of children vaccination and immunisation service delivery readiness, and these parameters were then dichotomized as excellent (mean and above value) and bad (below the mean value). Furthermore, descriptive statistics such as frequency, percentage, mean, and standard deviations were utilised to explain various socio-demographics, staff and guidelines, vaccinations and consumables, and service delivery variables.

3.7.1.2 Explanatory analysis

The first and second objectives were subjected to Explanatory Analysis. Analytic testing and statistical methodologies were utilised to establish or determine the link between parents'/caregivers' knowledge and vaccine coverage. Factors are characteristics in this study that impact either favourably or adversely parents/caregivers of unimmunised children in the study region. To discover correlations between the dependent variable and one or more independent variables, measures of association were applied. To assess the connection between socio-demographic features, ANC visits, and distance to the health facility, and independent variables, the Chi-square or bivariate logistic regression test was utilised. To reduce the confounding impact in assessing the relationship and identifying relevant components, calculated relapse (multivariable calculated relapse) was utilised. The odds ratio was used to report the results.

Explanatory variables having p-value < 0.2 during the crude analysis were included in the multivariable model. In the multivariable analysis, adjusted odds ratios (AORs) and 95% CI were estimated, and a p-value < 0.05 was used to declare the level of statistical significance (Dingeta *et al.*, 2019). Explanatory variables with p-value < 0.2 during the crude analysis were included in the multivariable model. In the multivariable analysis, adjusted odds ratios (AORs) and 95% CI were estimated, and a p-value < 0.05 was used to declare the level of statistical significance. The mentioned factors were tested for multi-collinearity by incorporating them into multivariable models with values less than 10. The analysis result was presented using appropriate tables and figures.

3.7.1.3 Principal Components and factor analysis

Principal Component Analysis (PCA) is a dimensionality reduction technique that reduces a larger collection of components to a smaller set that includes the most important data from the larger set. PCA is a scientific method that reduces many interconnected elements to a small number of detachable factors known as critical components (Jolliffe & Cadima 2016:1-12). The primary foremost component accounts for as much as attainable of the data's heterogeneity, and each progressive component accounts for as much as conceivable of the remaining heterogeneity 2016 (Central Component Auditing).

Factor analysis (FA) is a statistical procedure for identifying correlations that occur in a larger number of factors, with the goal of determining how sets of factors are correlated. Factor analysis can be used for both exploratory and confirmatory purposes. Factor analysis is used as an exploratory method to identify a possible causal structure within the components. In corroborative research, the agent evaluates how similar the true structure of the information, as revealed by the calculated study, is to the expected structure. The primary difference between exploratory and confirmatory factor analysis is that when using factor analysis for confirmatory purposes, the investigator has generated hypotheses regarding the causal structure of the components. Factor analysis, as an exploratory method, does not need many statistical assumptions. The sole actual assumption is that the elements have an association, as indicated by the correlation coefficient. There is no underlying structure if there are no relationships (Cosemans, Rosseel & Gelper 2022:3).

The PCA and FA were used to analyse the total variance explained by parents/care and gives reasons for not receiving and failed immunisation variables. This auditing directed the researcher on which factors for children of parents/caregivers not receiving and failing to receive vaccinations were included in the pastoralist community's immunisation improvement guideline.

3.7.1.4 Interpretation of quantitative data

Interpretation indicates that the researcher derives inferences from the results for the study questions, hypotheses, and overall significance of the findings. This interpretation consists of multiple phases (Creswell 2018:312). The thorough description, statistical significance testing, confidence ranges, and effect sizes provide a complete explanation of the data. The statistical significance testing determines whether the observed scores represent a pattern other than chance. A quantifiable test is regarded as crucial when the results are unlikely to have occurred by coincidence and the faulty hypothesis of "no influence" may be discarded. The researcher establishes a "no influence" dismissal threshold, such as $p = 0.05$, and then determines if the test measurement falls inside this level of dismissal.

There were two types of practical proof of the outcomes reported: (a) the effect magnitude and (b) the confidence interval. A confidence interval is a set of numbers (an interval) that reflects the amount of uncertainty surrounding a predicted observed score. A confidence interval indicates how accurate an estimated score may be. A confidence interval of 95%, for example, means that the observed score will fall inside the range of values 95 times out of 100 times (Creswell 2018:312).

3.7.2 Qualitative data analysis

Qualitative research uses non-numerical data, which is frequently presented in written words, videotapes, audiotapes, and images. The researcher performed 12 face-to-face interviews in which the participants' remarks were recorded verbatim and transcribed before analysis (Carmichael & Cunningham, 2017:64). Before the actual analysis, the recorded data in a digital recorder was transcribed and translated from the native tongue into English. The data were analysed using a thematic analysis and data were organized into topic groups, and thematic analysis was performed using the ATLAS ti eight software (Goldstein, Beringer & Morrow, 2017:101). Responses were coded after the transcripts were read. Then, depending on the research objectives and emergent concerns, individual codes are allocated to categories, and particular categories relating to those topics are formed. The assessment report was written in accordance with the final themes that had been determined. Each translated document was transferred to ATLAS ti 8 for analysis. The final coding, quotation, and recoding groups and analysis were done by using the ATLAS. ti 8. The researcher conducted a thematic analysis which is a procedure that entails locating, analysing, and reporting qualitative data (Kiger & Varpio 2020:3). The following are the phases of a thematic analysis in a qualitative study using ATLAS ti 8.

3.7.2.1 Getting to know the information

Field notes were used to prolong the validity of the discoveries, and any nonverbal communication signs detected throughout the interviews were recorded. Individual perceptions were provided taking after each interview to assist make sense of the field notes and to stress any subjectivity (the interviewer's) that should have advanced all through the discussion. All interviews were audio-taped and put away on a password-protected computer once members demonstrated their understanding. The analyst was permitted to tune in to the sound cassette recordings a few times some time recently composing them down.

3.7.2.2 Generating initial code

By listening to the audio recordings and reading the transcripts on a regular basis, the researcher grew familiar with the substance of the transcripts. Using Atlas. ti, version 8, the transcripts were then uploaded, and allocated preliminary codes.

3.7.2.3 Searching for themes

Atlas. ti version 8 was also used to create a code report, which was then manually reviewed to identify similarities and trends among the programs. These printed codes were also allocated preliminary categories manually. The categories were then sorted by the researcher into preliminary themes that could be distinguished from one another.

3.7.2.4 Identifying and defining themes

The themes were printed as a report with categories and codes before being integrated into a table format in Microsoft Word and evaluated by the supervisor. The researcher worked to revise and understand the preliminary themes, categories/subthemes, and codes after the supervisor reviewed the table.

3.7.2.5 Revision and refinement of codes

Later, the assigned codes were analysed and altered again to discover any further similarities and patterns and to corroborate the already defined categories and themes.

3.7.2.6 Creating a report

The analyst started composing up the elucidation of the well-being care professionals' information, conclusions, hones, and challenges amid immunisation security reconnaissance once the subjects, categories, subthemes, and codes were found.

3.8 INTERNAL AND EXTERNAL VALIDITY OF THE STUDY

3.8.1 Quantitative Data Quality

3.8.1.1 Internal validity of the research design

In scientific studies, researchers attempt to determine if the instrument's ratings can be used to make relevant and helpful conclusions (Creswell 2018:160). The validity of an instrument determines whether it properly measures the phenomena that it is designed to assess (Creswell 2014:19-20). Internal validity, according to Curtis and Drennan, refers to whether an instrument used in a study measures what it claims to measure (Taherdoost 2020b:29).

Internal validity refers to the approximate truth of conclusions about cause-and-effect connections. It allows us to rule out alternate explanations for discovery, and the lower the likelihood of "confounding" in a study, the greater the internal validity and the more confident we may be in the results (Cuncic 2020:2). Each interview team consists of two interviewers who verify each other's work throughout data collection and review to ensure an accurate and full recording.

3.8.1.2 External validity of the research design

The amount to which study findings may be generalised to other settings is referred to as external validity (Bacon-Shone 2015: 202). All relevant study participants were used in this study to pick a homogeneous group by stratification, obtaining a sufficient sample size using the scientific formula, and employing the random sampling approach. During the analysis, variables were controlled, and the study was triangulated with qualitative data.

The study also intended to address the following possible challenges to external validity that were likely to lead to generalization limitations (Haumba 2015:131):

- Sample characteristics: relevant respondents were recruited from the individual participants' applicable departments.
- To choose the suitable responders, inclusion and exclusion criteria were used.
- Setting characteristics: hospitals, health centres, and health posts, as well as both urban and rural settings, were chosen to represent the zone's overall settings.
- Research study awareness and pre-testing effects: a cross-sectional survey and immediate real data collection was followed by the pretesting of the data collection tool, which reduces the Hawthorne effect, or reactivity of participants being informed that they had participated in research. In addition, respondents having prior information about this study did not affect most of the variables.
- Response rates: revisiting and prior scheduling with respondents were done to improve response rates. Internal validity, in general, relates to the approximation to the truth regarding cause-effect conclusions or causal connections. The extent to which the findings of a study may be generalised to other settings is referred to as external validity (Bacon-Shone 2015: 202).

In this study, stratification was used to choose a homogeneous group, adequate sample size was calculated using the scientific formula, random sampling was used, and all relevant departments were considered. During the analysis, variables were controlled, and quantitative and qualitative data were triangulated.

3.8.2 Qualitative Data Quality

Measures to Ensure Trustworthiness

The reliability of qualitative research is its ability to accurately portray the respondents' practices (Stahl & King 2020:26). To ensure the credibility of this study, the researcher used Lincoln and Guba's five criteria: credibility, transferability, dependability, confirmability, and authenticity. This helped the researcher confirm whether the study accurately represented the aspects under consideration.

3.8.2.1 Credibility

Credibility is the quality of convincing or believable ideas (Korstjens & Moser 2018:121). It is analogous to internal validity in quantitative research and is concerned with the truth-value component (Korstjens & Moser 2018:121). The researcher used the audio recorder and took notes to ensure that all the data collected were accurate. Participants were assigned unique numbers for anonymity. For anonymity and confidentiality, the audio recorder and notes were locked in a locker at the researcher's home, and the consent forms were also locked but separately from the audio and the notes. These data will be kept by the PI for five years after the thesis is published.

3.8.2.2 Dependability

The consistency and reliability of the quality of information collection, information auditing, and hypothesis generation are judged by the advancement of belief between the interviewer and interviewee before starting data collection, and the interview guide was pretested (Stahl & King 2020:26). The information was gathered both with audio recording and note-taking.

3.8.2.3 Conformability

Conformability concerns the aspect of neutrality (Korstjens & Moser 2018:121). There was close supervision for proper data collection from the appropriate representative and transcription was checked by the investigator (Lemon and Hayes, 2020:606)The researcher kept field notes to ensure that all needed information was collected, both verbal and non-verbal.

3.8.2.4 Transferability

External validity and generalizability, on the other hand, are concerned with the amount to which the study's findings may be applied to different contexts and situations (Lemon and Hayes, 2020:606) In this study, provision of a detailed study setting, sample size, study design, inclusion and exclusion criteria was made (David 2020:123).

3.8.2.5 Authenticity

The researcher explained each of the criteria of trustworthiness proposed by Lincoln and Guba (Ezzat, Amin, Stig, Cavaco, Witry & Hillman *et al.*, 2020:8). Audiotape and verbatim transcription were utilised for data collection, and dense vivid description and a powerful evocative writing approach were used for analysis.

3.8.3. Quality Control

Other quality control methods were carried out at various points and stages during the auditing, including (Haumba 2015:137-8):

- Appropriate personnel recruiting standards.
- Appropriate training: data collectors were taught the fundamentals of research methodologies, including.
- Sampling procedures, research ethics, data collecting, and questionnaires.
- Questionnaire and interview guide pre-testing.
- After the pre-test, questions and interview instructions were reviewed.

- During the data collection process, close supervision, and daily check-ups of completed questionnaires were done.
- Random checks were done to ensure that interviews have taken place.

3.9 GUIDELINE DEVELOPMENT

This study assessed the knowledge, awareness, and immunisation statutes, perception, and challenges of health workers on immunisation focal at different levels of health facilities in pastoralist communities. The findings of the study were used to develop the guidelines. Guidelines are suggestions aimed at assisting healthcare professionals, beneficiaries, and other stakeholders in making informed decisions (Assir & Ali 2014:7). The steps are shown below, according to the WHO Handbook Guideline Development (2012).

3.9.1 Selecting a topic

The title of this guideline is named guidelines for Improvement of childhood immunisation programs in pastoralist communities. The guideline is developed as an intervention for this research finding. The researcher conducted the research study based on its planned concrete research questions and stated problems. Therefore, the name of the guideline is obtained from the research title.

3.9.2 Forming guideline development group

One of the key steps in the Delphi method is purposefully selecting an expert who is knowledgeable in accordance with the drafted guideline (Keeney et al 2011:7). As a result, the researcher initially drafted the guidelines based on the key research findings and literature reviewed to improve childhood immunisation guideline in pastoralist community. Following that, eight EPI experts were identified and chosen from the FMOH, RHBs, pastoralist EPI implementing partners, and professional associations as key experts and members of national and regional EPI technical working groups.

3.9.3 Scoping the guideline

The scope of the guidelines is determined by the research's declared objectives. In addition, the guideline scope is determined using different literature reviews and relevancy identified from the research findings.

3.9.4 Identification, evaluation, and formulation of the evidence

Based on the research findings, the researcher identified the major problems of low immunisation coverage in pastoralist communities and formulated evidence-based evaluations.

3.9.5 Writing the guideline

There is an executive summary, a main body, and appendices in these recommendations. The executive summary includes the guideline's important suggestions as well as the guideline's main content.

3.9.6 Validation of the guidelines

Health specialists and communication experts who worked on immunisation and monitoring throughout the country made up the reviewing expert panel. Independent consulting and peer reviewers were accepted and accredited the proposed guideline.

3.9.7 Updating and reviewing

The researcher gathered all the feedback and comments from expert reviewers and attended to all the recommendations.

3.10 CONCLUSION

Finally, this chapter provided a full overview of the study's research strategy and methods, with a focus on the Explanatory Sequential Mixed design and cross-sectional data-gathering approach. The structure of data collection instruments, as well as the methods utilised to assure the study's validity and reliability, were discussed. The researchers formulated Guidelines for Childhood Immunisation Programs in the Pastoralist Communities of Healthcare Professionals and other EPI collaborating partners.

CHAPTER 4

PRESENTATION AND DISCUSSION OF THE RESEARCH FINDINGS

The study "Guidelines for improving childhood immunisation programs in pastoralist communities" was conducted to generate and document of the evidence existing knowledge, awareness, and coverage among parents/caregivers of children aged 12 to 23 months from the general population in Pastoralist Communities. The study, serve as the foundation for developing Vaccination Improvement Guidelines to support parents immunisation requirements and focus (UNICEF 2020:3).

4.1 INTRODUCTION

The quantitative and qualitative study findings, as well as their discussions, are presented in Chapter 4. It details the numerous analytic tools, procedures, functions, and cut-off points that were examined and validated by using the external statistical analysis software. For the quantitative findings, SPSS version 25.0 was used to perform univariate, cross-tabulation, bivariate and multivariate binary logistic regression and factor analysis, Thematic Analysis using Atlas ti 8 was used to analyse qualitative data.

4.2 DATA MANAGEMENT AND ANALYSIS

Data management is an administrative activity that include gathering, verifying, storing, preserving, and operating essential data to assure the accessibility, dependability, and timeliness of its recipients (Nwabugwu and Godwin, 2020).

4.2.1 Quantitative data

Data cleaning was done before the data analysis utilising two different data cleaning procedures. The first was possible-code cleaning, which included inspecting the data file to ensure that only the codes allocated to each question's response choices (possible codes) show. This data cleaning approach was used to conduct cross-tabulations, frequency tables, and raw data inspections. The second type was contingency cleaning, which was the process of ensuring that only those situations that should contain data on a certain variable. Descriptive statistics including frequency, percentage, mean, and standard deviations were used to summarise the overall characteristics of the sample and show how they differed from what was predicted during the planning phase. To that end, the expected and observed numbers of completed responses were reported. Furthermore, crucial factors such as parents and caregivers' vaccination knowledge and perceptions, vaccination coverage, and dropout were utilised as a stratification variable.

Data analysis is the process of developing answers to questions through the examination and interpretation of data (Gillespie, Wagner III & Ruel 2016:434). Identifying issues, assessing the availability of relevant data, selecting which methods are acceptable for addressing the questions of interest, applying the methods, and evaluating, summarising, and disseminating the results are the fundamental processes in the analytic process. Data were entered into an EPI Data template that had been pre-designed and then exported to the SPSS 25.0 software program. Variables were tagged, cleaned, and converted after the data was verified for mistakes.

Descriptive and analytic statistics were used to examine the first three objectives. The descriptive analysis looked at the numbers, frequencies, and percentages of various socio-demographics, accessibility, knowledge and awareness, vaccine coverage, and dropout rates among the sampled respondents. It was used to figure out how many children aged between 12 to 23 months had been immunised. It was also used to evaluate parents' and caregivers' knowledge and awareness of Vaccine-Preventable Diseases and Vaccination programs.

The analytic statistics investigated sociodemographic and other variables of vaccination coverage (first aim) as well as parents' and caregivers' knowledge and comprehension (second objective). The third goal was to examine the impact of health facility-related variables on vaccination preparedness in the healthcare system by using descriptive statistics. The researcher divided children into two groups depending on their immunisation status: fully vaccinated (vaccinated for all childhood Vaccine-Prevented Diseases) and not immunised. For the second objective, the researcher dichotomized parents/caregivers into good knowledge and poor knowledge based on the number of item questions correctly answered. Similarly, the immunisation service readiness was assessed on the immunisation monitoring system at the health facility level.

In this research study, a Chi-square test statistic using binary logistic regression in SPSS to determine the sociodemographic and other factors which are correlated to the outcome variables (immunisation status (first objective) or knowledge/ awareness status of caregivers (second objective) were used. Also, for the third objectives health service readiness on monitoring systems among the health facility and other factors were correlated with data analysis of service readiness. The Chi-square test, which uses a crude odds ratio with a 95% confidence interval, was used to look for differences in outcome variables between sociodemographic, other factors, and health facility-related variables (Abebe 2022:5). Explanatory variables having a p-value < 0.2 during the crude analysis was included in the multivariable model. In the multivariable analysis, Adjusted Odds Ratios (AORs) and 95% Confidence Intervals (CI) was estimated, and a p-value < 0.05 was used to declare the level of statistical significance.

The multivariable model included explanatory factors with a p-value of less than 0.2 in the crude analysis. Adjusted Odds Ratios (AOR) and 95% Confidence Intervals (CI) were calculated in the multivariable analysis, and a p-value of 0.05 was utilised to establish statistical significance (Hernández and Esquivel-Santoveña, 2020)(Hernández & Esquivel-Santoveña, 2020:343). Model fitness was assessed using the Pearson Chi-squared and Hosmer–Lemeshow goodness-of-fit tests. Before integrating the explanatory variables into multivariable models, they were checked for multi-collinearity using the Variance Inflation Factor (VIF) values of less than 10. Tables and figures were used to present the findings of the analysis.

4.2.2 Qualitative data

Data collection was the first step in the preliminary analysis. Before the analysis, the data from a digital recorder was transcribed and translated into English from the native language. The data was analysed using a Thematic Analysis. The responses were coded after the transcripts were read. Then, depending on the research objectives and emergent concerns, individual codes were allocated to categories, and particular categories relating to those topics were formed. The assessment report was written in accordance with the final themes that had been determined. For the analysis, each translated text was submitted to ATLAS ti 8. The ATLAS ti 8 was used for the final coding, quoting, coding and recoding groups, and analysis.

4.2.3 Triangulation

Triangulation approach can be a one-phase technique in which the analyst employs both quantitative and qualitative procedures with weight or relevance increasing at different periods (Smith *et al.*, 2020). "Collect distinct but complementary information on the same issue with the purpose of bringing together the varied features and lessening the weaknesses of quantitative and qualitative research methodologies," according to the triangulation strategy (Pandey & Pandey 2015). Triangulation entails gathering and analysing quantitative and qualitative data at the same time but in different ways. The researcher then attempted to coordinate the two types of information by coordinating the clear outcomes amid translation or modifying information, allowing the two types to be analysed jointly.

4.3 QUANTITATIVE RESEARCH RESULTS AND DISCUSSIONS

A total of 300 parents/caregivers of eligible children aged between 12 to 23 months were screened for childhood immunisation in 30 clusters. The percent distribution of respondents (parents/caregivers) aged 12 to 23 months based on their background characteristics were shown.

4.3.1 Socio-demographic Characteristics of the Respondents

Socio-demographic s is a term that refers to the combination of social and demographic factors that define people within a specific group or population (Blog, 2021). The execution of health behaviours has a consistent relationship with demographic factors (Shin & Kang 2014:153).

4.3.1.1 Gender

Most of the respondents of parents/caregivers of children 12 to 23 months were females 274 (91.4%) and only 26 (8.6%) were males. This finding showed that more caregivers of children aged between 12 to 23 months were female dominant as in other similar studies (Alemu 2021:97).

4.3.1.2 Age

The participants varied in age from 18 to 55 years old. The mean age of the participants was 30 years + 6.9 standard deviations. Figure 4.1 shows that 92 (31%) of respondents were between the ages of 25 and 29, followed by 30-34 years 81 (27%). Those below the age of 30 were 147 (49%) and those who were 30 and above were 153 (51%). In general, as people get older, the percentage of the population in each age group dropped, reflecting the relatively youthful age structure that had resulted from high fertility in previous decades (Alemu 2021:97).

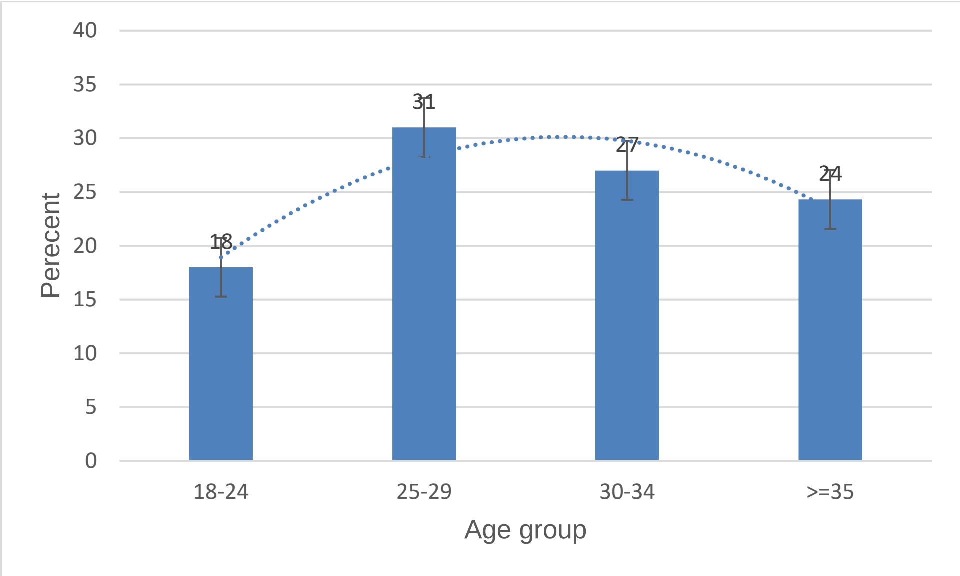

Figure 4. 1: Percentage distribution of respondents' ages (N=300)

4.3.1.3 Level of education

Education was an important factor that influence immunisation status. The majority, 223 (74%) of the respondents were unable to read or write for formal education. Only 77 (26%) of parents/caregivers had completed formal and informal education as shown in Figure 4.2. Of those who completed formal education 32 (11%) had completed Grade 9, while 27 (9%) had completed between 9-12 Grades and only 18 (6%) of parents/caregivers had completed college and above.

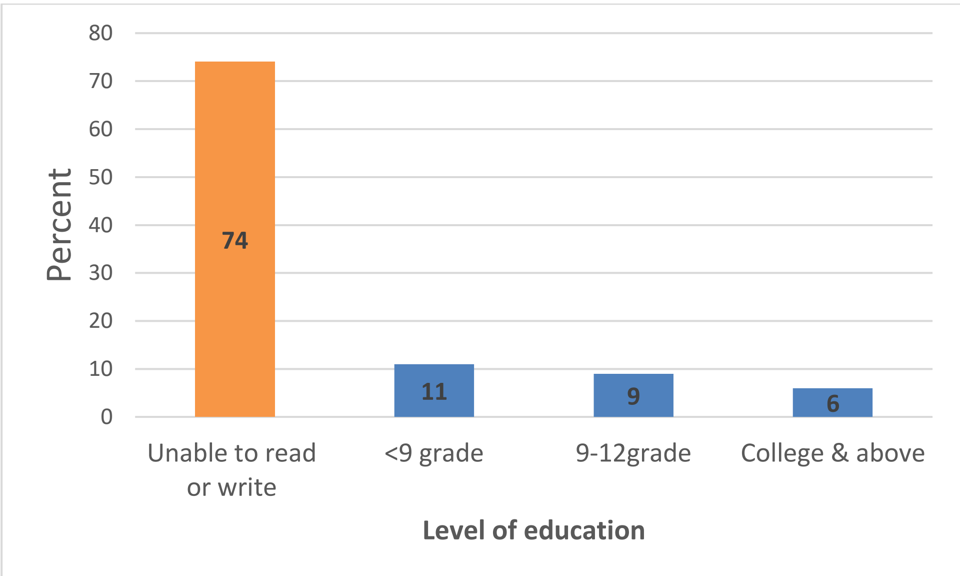

Figure 4. 2: Percent distribution of parents/caregivers of children aged 12 to 23 months by the highest level of schooling attended or completed (N=300).

4.3.1.4 Woreda (District)

Gode Woreda had the most study participants which were 70 (23.3%), Adadle had 69 (23.3%), Gode City 58 (19%), Denan 54 (18%) and Brano had 49 (16.3%) as shown in Figure 4.3.

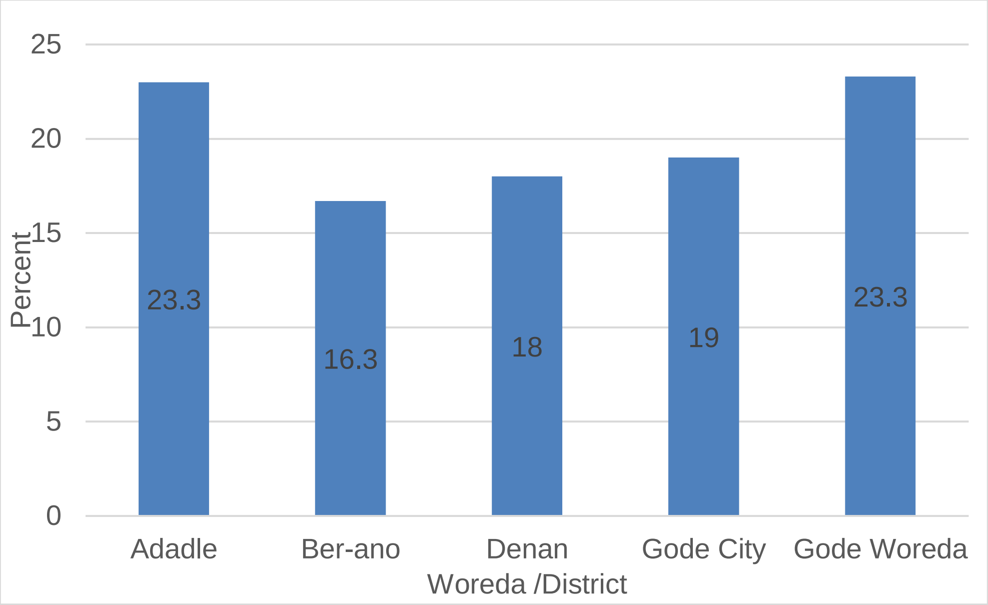

Figure 4. 3: Percentage distribution of the respondents by assignment district (N=300)

4.3.1.5 Place of residence

When compared to rural regions, metropolitan areas offer greater health infrastructure, better transportation, shorter distances, and better geography for accessing and using primary healthcare (Egbemudia & Andrew, 2018:11). The location of a person's domicile, whether rural or urban residence, determines access to services and information, regarding health and other elements of life. More than half of the respondents, 159 (53%) were from the rural area. From the total of rural or urban residence, almost all 295 (98.3%) of the respondents had mobile lifestyles in this study.

4.3.1.6 Distance to the immunisation site

Distance of the immunisation site was reflected in three categories: below 30 minutes, between 30 to 60 minutes, and above 60 minutes. The mean distance to the immunisation site was 19 minutes and SD: 19:36. The minimum and maximum distances to the immunisation site were 2 minutes and 2 hours, respectively. Based on the distance of the immunisation grouping, 262 (87.3%) of the respondents were categorized below 30 minutes walking distance to the immunisation site while 39 (12.7%) walked more than 30 minutes distance to the immunisation site.

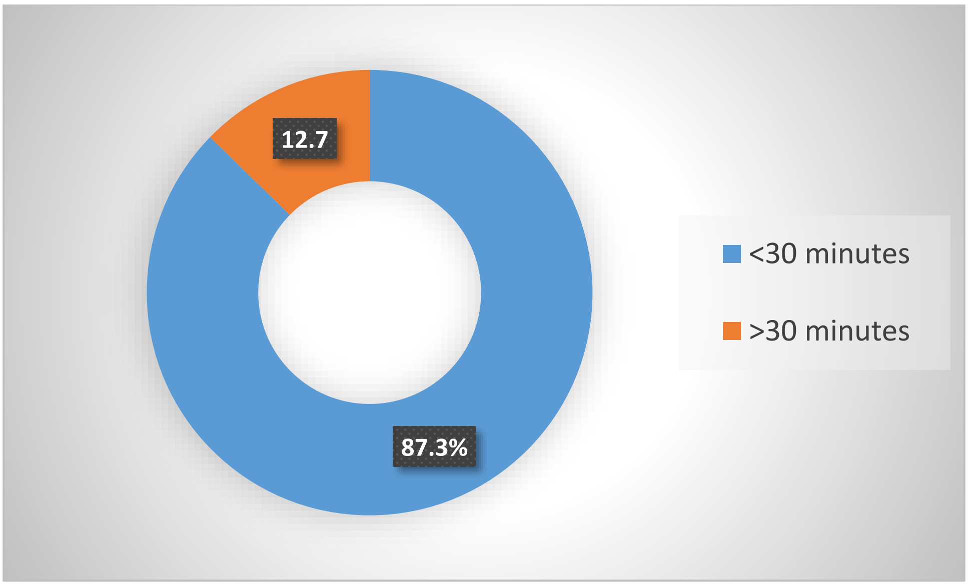

Figure 4. 4: Walking time distance to the immunisation site (N=300)

4.3.1.7 Religion and Marital Status,

Almost all 299 (99.7%) of the respondents in the study areas were of Muslim religion and only one respondent was of catholic religion. The majority 292 (97.3%) of parents/caregivers of the children were married and few 8 (2.7%) were divorced as shown in Table 4.1.

4.3.1.8 Number of older children and vaccination status

The number and immunisation status of immediate older children in each household had an important factor on the current childhood immunisation status of study age groups. Households with less than four immediate older children were 166 (55.3%) and greater than five immediate older children were 134 (44.7%). Among the households with less than four immediate older children, 124 (75%) were fully vaccinated and in households with greater than five, immediate older children 35 (26%) had fully been vaccinated. The variables' assumptions were that the higher proportion of vaccinated immediate older children in households, the higher chance of being vaccinated in the study age group. In another similar study in New Delhi, it was indicated that more number of children neglected led to partial or no immunisation (Rathi & Meena 2017:3).

4.3.1.9 Socio-economic Position of Parents/caregivers

When compared to neighbours, most parents/caregivers of children aged 12 to 23 months had a moderate 248 (83%) economic position, while fewer parents/caregivers had a low 43 (14%) and high 9 (3%) economic position. With higher proportions of fully immunised children, 64 (26%) were in a moderate economic position compared to neighbours, and a higher proportion of never immunised children 8 (18%) in lower economic position compared to neighbours.

Similar studies in India revealed a socio-economic gradient in immunisation coverage, with higher proportions of fully immunised children in higher wealth quintile households and a higher proportion of never immunised children in lower wealth quintile households (11.9%) (Srivastava, Fledderjohann & Upadhyay 2020:7). These findings were almost similar to the above current findings.

Table 4. 1: Socio-demographic distribution of parents/caregivers of children 12 to 23 months by background characteristics N=300).

Background Characteristics of the Respondents		n	%
Primary caregiver of the child	Parents	294	98
	Father	4	1.3
	Grand Parents	2	0.7
	Other	0	0
Residence	Rural	141	47
	Urban	159	53
Able to read or write	No	223	74
	Yes	77	26
Highest grade of the respondent completed (N=77)	<9 grade	32	10.7
	9-12grade	26	8.7
	College & above	19	6.3
Occupation	Business/shop/office	22	7.3
	Farming	7	2.3
	Housewife	221	73.7
	Pastoralist	41	13.7
	Other, Specify	9	3.0
Religion	Catholic	1	0.3
	Muslim	299	99.7
Marital status	Divorced	8	2.7
	Married	292	97.3
Walking time to the immunisation site	up to 30 min	262	87.3
	>30 min	38	12.7
Are you a mobile resident	No	2	1.7
	Yes	295	98.3
If yes, frequently moving areas	water point	295	98.3
Immediate older child fully vaccinated	No	38	12.7
	Yes	262	87.3
Economic position compared to neighbours	High	9	3.0
	Low	43	14.3

	Moderate	248	82.7

4.3.2 Parents/caregivers' Knowledge and Awareness of immunisation services

The knowledge and awareness of parents/caregivers on immunisation services were assessed by using 24 indicators. Almost all 300 (94.9%) of the total respondents had ever heard of immunisation. Of those who were aware of immunisation, 281 (94%) mentioned immunisation campaign, 259 (86%) the importance of immunisation, 234 (78%) where to get routine vaccination, 200 (67%) return to next dose of vaccination, and 213 (71%) mentioned age to get routine vaccination.

In addition, the majority, 286 (97%) of the respondents indicated that immunisation protects against childhood illnesses, and 220 (73%) of the parents or caregivers thought a child should start immunisation at the age of birth, while 29 (10%) thought immunisation should be administered after 45 days, 36 (12%) at the first two weeks and 4 (1.3%) after two weeks. Less than half of the respondents, 111 (37%) mentioned that vaccines are harmful. About 172 (57%) and 73 (24%) of the respondents responded that children with Fever and Diarrhoea had been vaccinated (Table 4.2).

Parents/caregivers who have participated in this study were also asked whether some children should be vaccinated; or might be hurt by vaccination and if they had any doubts or suspicions regarding getting their children vaccinated. Just above half, 152 (51%) of the respondents mentioned that they do not have a perception that some children should not be vaccinated or might be hurt by vaccination. Among those, they reported that, some children should not be vaccinated or might be hurt by vaccination, 35 (12%) and 118 (39%) reported that new-born and sick children should be among the groups that should not receive vaccination respectively (Table 4.2).
Research done in Northern Ethiopia on parents awareness of the ages at which their children should begin and end vaccination, revealed that 73.3% and 65.5% of them knew the ages at which their children should begin and finish immunisation, respectively (Tesfaye, 2018). More than one-third of the parents (37%) were concerned that immunisations might make their children unwell. Even if their children

were unwell, most of the parents, (85%) said they would take their children for immunisation. This study yielded the most comparable results. In contrast, a comparable research in Saudi Arabia found that Common Colds, Ear Infections, and diarrhoea were deemed contraindications to immunisation by 280 (38.3 %) of the parents (Alamri, Horaib & Alanazi 2020:252).

Table 4. 2 Variables on parents/caregivers knowledge and awareness of childhood immunisation services

Variables		**Frequency (N)**	**Percent (%)**
Ineformatioin about campaigns	No	19	6.3
	Yes	281	93.7
Importance of vaccination	No	41	13.7
	Yes	259	86.3
Where to get routine vaccination	No	66	22
	Yes	234	78
Return to next doses of the routine vaccination	No	100	33.3
	Yes	200	66.7
Age to get routine vaccination	No	87	29.0
	Yes	213	71.0
Do you think immunisation prevents against childhood illnesses?	No	13	4.3
	Yes	287	95.7
When do you think a child should start immunisation?	After 45 days	29	9.7
	After two weeks	4	1.3
	At Birth	220	73.3
	First two weeks	36	12
	Don’t Know	11	3.7
Do you think vaccines are harmful?	No	189	42.7
	Yes	111	37
Do you think child with fever be vaccinated	No	128	42.7
	Yes	172	57.3
Do you think child with diarrhoea be vaccinated?	No	227	75.7
	Yes	73	24.3
Do you believe some children not receive vaccination?	No	148	49.3
	Yes	152	50.7
Which children should not receive vaccination?	New-borns	35	11.7
	Sick children	118	39.3

4.3.3 Source of information about Immunisation

Based on the study results, health workers (including health extension workers) and community volunteers were reported by the respondents as the primary source of information about immunisation, 272 (91%) and 258 (86%), respectively (see Figure 4.5).

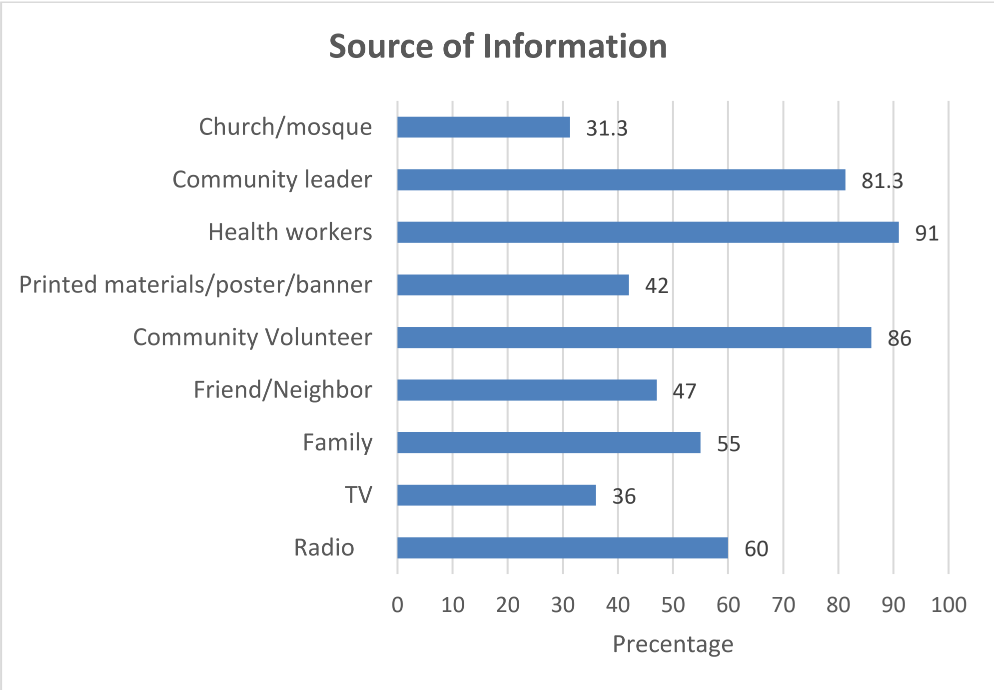

Figure 4. 5: Percent distribution of source of information on immunisation (N=300).

Another research done in the southern region of Ethiopia found that most of the women who knew about vaccines learned about them from health workers, while 128 (14.0%) learned about them through community volunteers. Only less than a quarter of women were aware that vaccinations begin at birth, while more than half were aware of the age at which a child should be vaccinated (Hailu, Astatkie, Johansson & Lindtjrn 2019). Health workers were the primary source of immunisation information. This is almost identical to the current study, with the highest awareness of the parents/caregivers on which a child should be vaccinated, whereas current study further reflected that the highest knowledge and attitude of the parents/caregivers of a child did not relate to children being vaccinated. This could be due to parents and caregivers' mobile lifestyles and lack of practice on childhood vaccination.

4.3.4 Parents/caregivers' Knowledge and Awareness of VPD

Concerning the knowledge of the respondents about childhood diseases that could be prevented by routine immunisation, an overwhelming proportion of the respondents, 276 (92%) mentioned Polio, and Measles, 267 (89%) was relatively higher than other Vaccine Preventable Diseases, while a substantial proportion of them, 217 (72.3%), reported Pneumonia and 202 (67.3%) reported Tetanus Homophiles influenza type B and Hepatitis B infection were the least reported diseases, 30 (10%) and 90 (30%) respectively (see Figure 4.6 and Table 4.3).

Two Indian studies indicated that the knowledge of parents or caregivers of children 12 to 23 months on vaccine prevention against Measles was relatively high at 71.9% than other Vaccine Preventable Diseases (Sankar 2018:3-6) and proportion of people knowing Polio, Measles, DPT and BCG were much lower at only 24.7%, 18.4%, 21.4% and 29.9% respectively (Akanksha & Meena 2017:2). This may be due to the frequent numbers of Measles and Polio outbreak cases, and the responses in our study areas may improve parents and caregivers' awareness and knowledge of Vaccine Preventable Diseases.

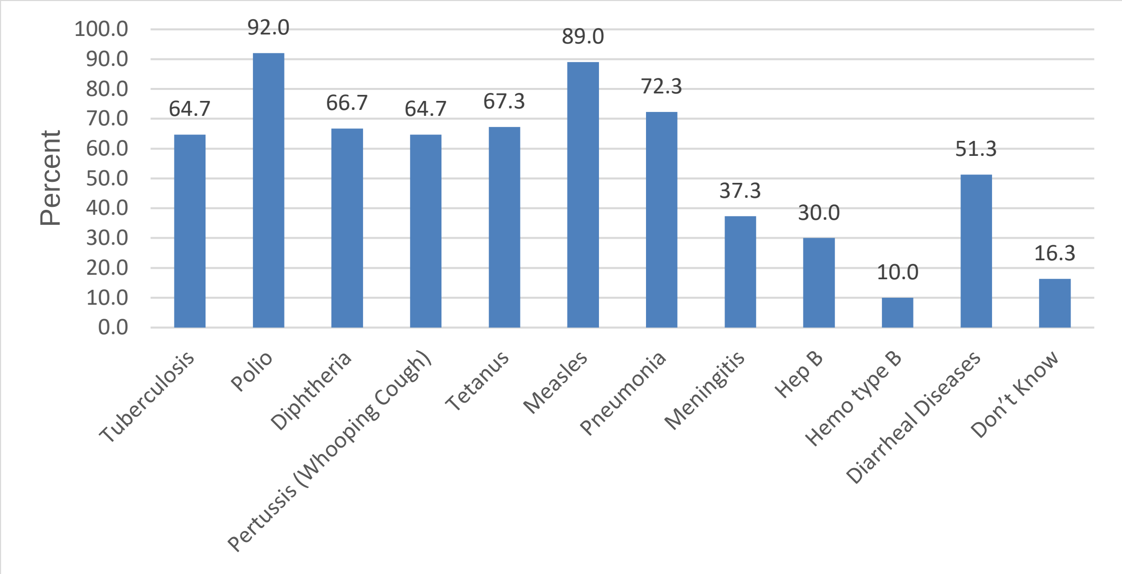

Figure 4. 6: Percent distribution of vaccine-preventable disease indicators (N=300).

4.3.5 Immunisation Coverage of Children Aged 12 - 23 months.

Immunisation coverage was defined as reported immunisation evidenced by card, history from parents/caregivers, or by EPI register from a nearby health facility (EPHI & MOH Ethiopia 2021:78). The proportion of children aged 12 to 23 months, who got particular vaccinated at any point before the data collection, was considered as fully vaccinated (according to a vaccination card, health facility visits, or history) (EPHI & MOH Ethiopia 2021:75). According to the WHO guidelines (WHO, 2018), a child is fully immunised with all basic vaccinations if they had received Bacillus Calmette Guerin (BCG) vaccine against Tuberculosis at birth; three doses each of Polio, Pentavalent (diphtheria-tetanus pertussis-hepatitis B (Hep), Haemophilus influenza type B (Hib) and Pneumococcal Conjugate Vaccines at 6, 10 and 14 weeks of age, two doses of Rota vaccine; and vaccination against Measles at 9 months of age (FMOH Ethiopia 2021:20).

Given the value of vaccination cards in ensuring that children have received all recommended vaccinations according to schedule, parents/caregivers were asked whether they ever had a vaccination card and showed the data collectors the vaccination card if they had any. If the card were available, the data collectors would have copied the dates of each vaccination received in the respective section of the data collection tool. If a vaccination card were not available, parents would have been asked to recall if the child had received the BCG, Polio, DPT, HepB-Hib, Measles, Pneumococcal, and Rotavirus Vaccines.

For those who indicated that the child had received the mentioned vaccines, the subsequent questions were asked about the number of doses that the child received. In addition, for any children that did not have the vaccination cards, the field data collection team visited the respective health facility to collect vaccination records to complement the immunisation information obtained based on parents' recall. Accordingly, Table 4.3 presented the information on whether children were ever vaccinated for routine immunisation, the presents of BCG Scar in the right upper arms of children as verified by the field level data collection teams, the availability of vaccination cards and the reason for not presenting the card at the time of data collection.

4.3.5.1 Vaccination Card Ownership and Availability

Among children who participated in this research study, 184 (61.3%) had ever been vaccinated for regular vaccination, 79% (95% CI: 73.0 - 85.0%) parents/caregivers reported that they had a child vaccination card. However; 41% (95% CI: 32.7- 48.7%) of parents reported that the cards could not be verified by data collectors. As a result, the overall immunisation card retention percentage in this study was 70 (38%). A similar age group study in Yemen observed an immunisation card retention rate of 84.9% (Al-Mendalawi, 2011) and 66.7% in Al-Mukalla, Yemen. Figure 4.7 shows that most of the reasons for card non-availability were missed, which was lower than other similar research because the bulk of the respondents in this study were pastoral and migratory communities. The higher card retention rate was highly contributing to full immunisations as compared with low card retention on immunisations.
Overall, 184 (61.3%; 95% CI: 55.8 - 66.8%) of parents/caregivers of the respondents said their children had been vaccinated for regular vaccination, and BCG scars were found in 151 (82%; 95% CI: 76.5 - 87.6%) of the vaccinated children who were verified by data collectors (See in Table 4.4).

Table 4. 3 Childhood vaccination status and availability of vaccination cards among the respondents

Variables		Frequency	Percent (%)
Ever vaccinated for routine immunisation (N=300)	Yes	184	61.3
	No	116	38.7
Child Vaccination card (N=184)	Yes	145	79
	No	39	21.1
Vaccination card seen (N=184)	Yes	86	59.3
	No	58	40.7
BCG Scar Observed (N=300)	Yes	130	43
	No	170	57

4.3.5.2 Reason for Non-availability of Vaccination Card

The main reason for non-availability of card was missed, 119 (64.3%), kept in the health facility 37 (20.3%), locked in other places 6 (3.4%) and not received 22 (12%) (See Figure 4.7).

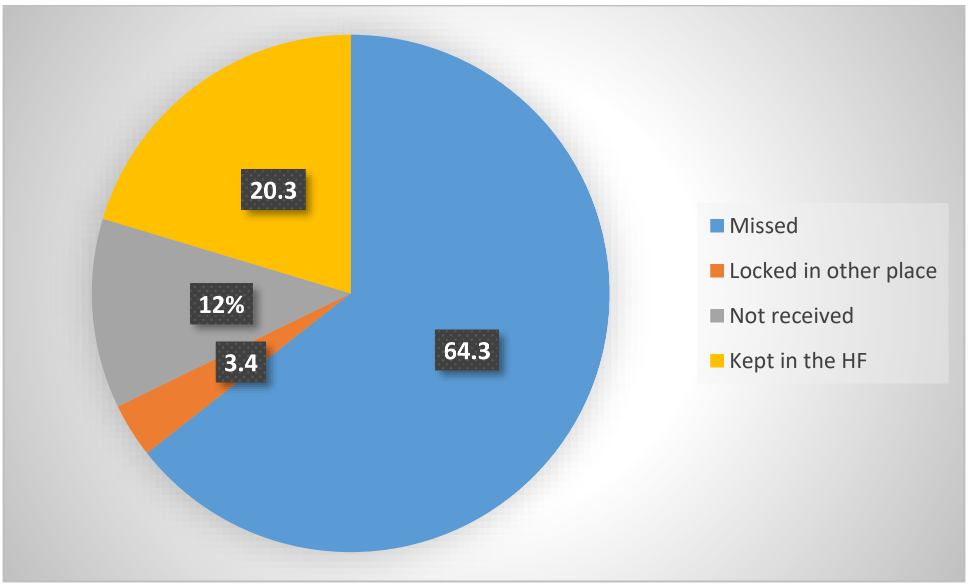

Figure 4. 7: Percentage distribution on the reasons for non-availability of vaccination card (N=184)

4.3.5.3 Crude Vaccination Coverage of Specific Antigen

Among ever vaccinated from the Routine Immunisations 46 (25.2%; 95% CI: 18.8-31.4) of the children in this study, information on childhood vaccination was obtained from vaccination cards, while information on vaccination history and facility records was obtained for 126 (68.4%; 95% CI: 61.5-75.0) and 12 (6.4%; 95% CI: 2.9-10.0) of the children, respectively. The term "crude coverage" was defined as vaccination provided, as proven by cards and records, or by history from parents (UNICEF & WHO 2017).

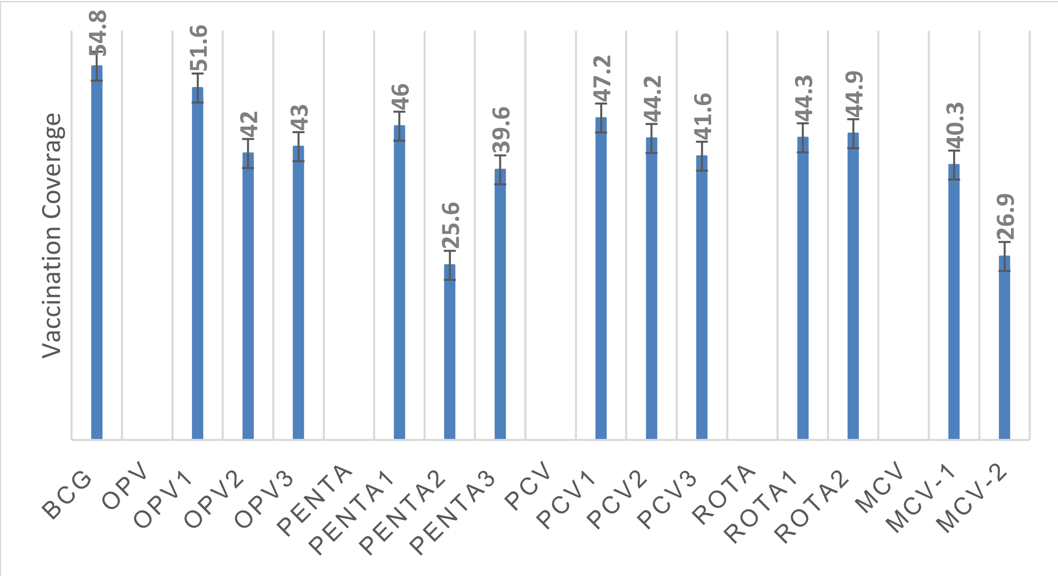

Figure 4. 8: Vaccination coverage of specific antigens (N=184)

More than half, 101 (55%; 95% CI: 47.6-61.9) of children aged 12 to 23 months received BCG vaccination and 74 (40.3%; 95% CI: 35.0-46.0) received Measles vaccination. The proportion of children who received, Polio 1, and Penta 1 were 96 (52%; 95% CI: 44.3-59.0) and 85 (46%; 95% CI: 40.3-52.0) respectively while 79 (43%; 95% CI: 37.3-49.0) and 74 (40%; 95% CI: 34.0-45.1) of children received Polio 3, and Penta 3 respectively (see Table 4.4).

Table 4. 4: Vaccination status children aged 12 to 23 months by background information (N=184)

Vaccine antigens	Vaccination by card		Vaccination by HF register		Vaccination by history		Total	
	%	CI	%	CI	%	CI	%	CI
BCG	26.7	[21.7-31.7]	8	[4.9-11.0]	20.1	[14.3-26.0]	54.8	[47.6-61.9]
OPV1	27.3	[22.3-32.4]	6.3	[3.5-9.0]	18	[12.3-23.4]	51.6	[44.3-58.8]
OPV2	26.7	[20.7-30.6]	5	[2.7.-7.8]	10.3	[7.0-14.0]	42	[36.4-47.5]
OPV3	26	[21.0-31.0]	6	[3.3-8.7]	11	[8.0-14.1]	43	[37.3-48.6]
PENTA1	27	[22.0-32.0]	7.7	[4.7-10.6]	11.3	[8.0-15.0]	46	[40.3-51.6]
PENTA2	8.6	[5.5-11.8]	7	[4.1-9.8]	10	[7.0-13.3]	25.6	[20.6-30.5]
PENTA3	26	[21.0-31.0]	6.3	[3.5-9.0]	7.3	[4.3-10.2]	39.6	[34.0-45.1]
PCV1	28.3	[23.2-33.4]	9.6	[6.3-13.0]	9.3	[6.0-13.0]	47.2	[41.5-53.0]
PCV2	27.3	[22.3-32.3]	9	[5.7-12.2]	7.3	[4.3-10.2]	44.2	[38.5-50.0]
PCV3	26	[21.0-31.0]	5.6	[3.0-8.2]	10	[7.0-13.3]	41.6	[36.0-47.1]
Rota1	26.7	[21.7-31.7]	5.3	[2.8-7.9]	12.3	[9.0-16.0]	44.3	[39.0-50.0]
Rota2	26.3	[21.3-31.3]	5.3	[2.8-7.9]	13.3	[9.4-17.1]	44.9	[39.2-50.5]
MCV-1	27.3	[22.3-32.4]	6	[3.3-8.7]	7	[4.0-9.4]	40.3	[35.0-46.0]
MCV-2	22.3	[17.6-27.0]	1.6	[0.2-3.]	3	[0.8-4.4]	26.9	[22.0-32.0]

On the specific antigen, children below half percent, 50 (27%), 15 (8%) and 37 (20%) received BCG vaccination by card, registration, and history respectively. The number of children who received, Penta 1 and Penta 3 were 52 (28%; 95% CI: 22.0-32.0) and 48 (26%; 95% CI: 21.0-31.0) respectively (see Figure 4.9).

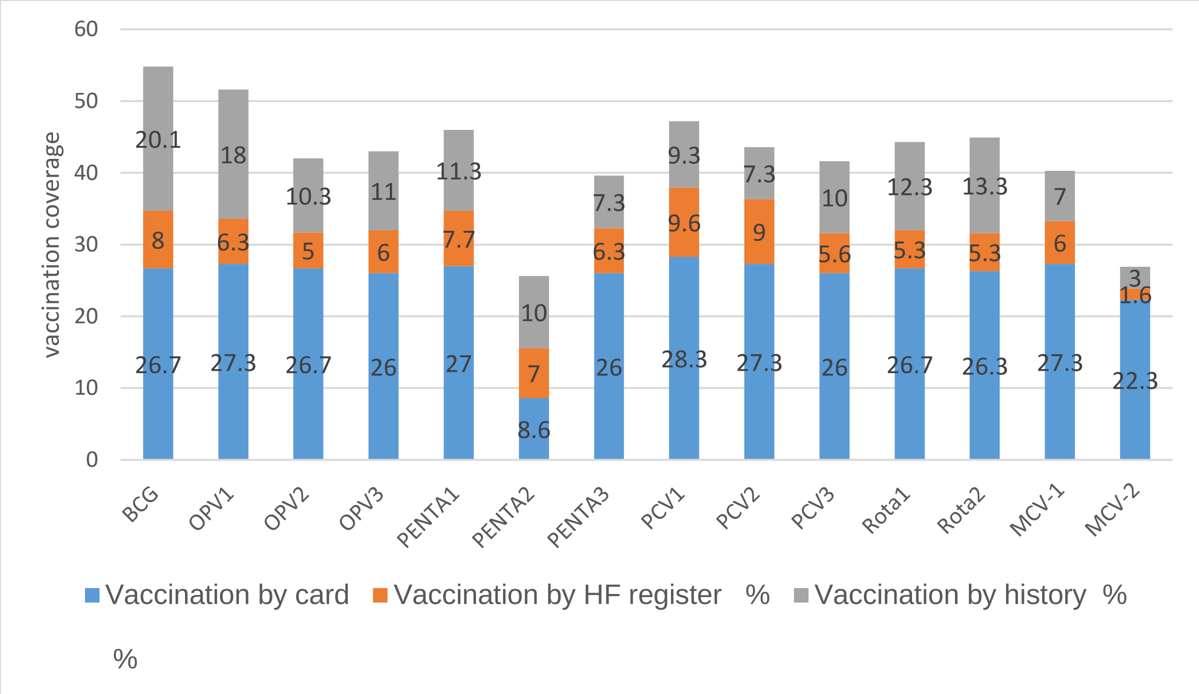

Figure 4. 9: Basic vaccination by source of information (N=184)

4.3.5.4 Valid Immunisation Coverage

Valid coverage was defined as vaccination documented by a card. The existence of a card or verification from a facility record with a date when the vaccination was provided determined validity. The overall valid vaccination coverage (card and record) was 81 (27%) in this study. Valid immunisation coverage by specific antigen was described in Figure 4.10.

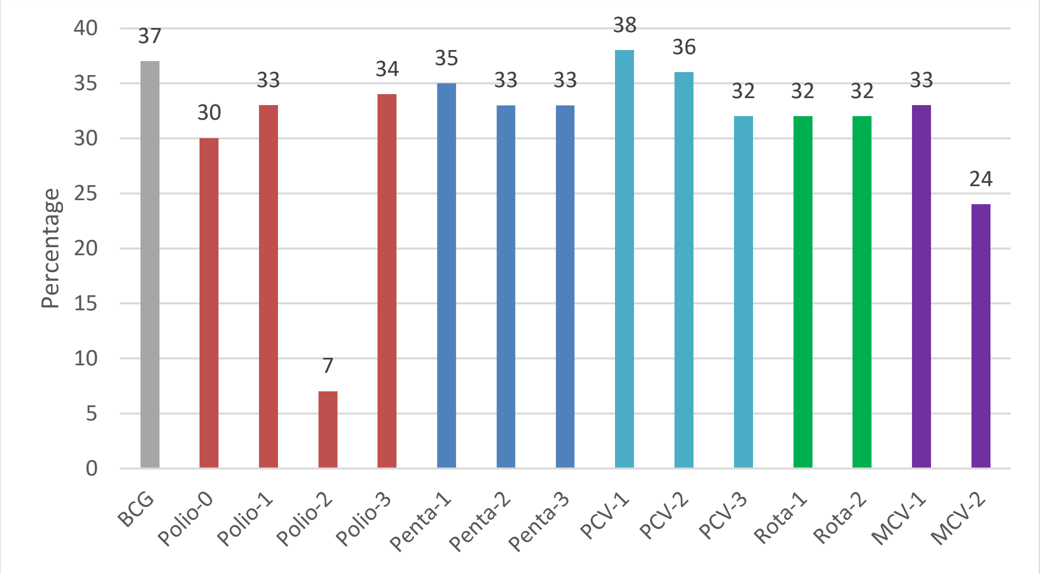

Figure 4. 10: Percentage distribution of valid immunisation coverage (N=300)

4.3.5.5 Valid Full Immunisation Coverage

The proportion of fully vaccinated children is defined as those who had all basic vaccinations, including BCG, Measles (MCV1), three doses of PENTA, OPV, and two doses of Rota vaccines, excluding Polio vaccine given at birth, as documented by card or records (WHO 2020:11). From a total of 300 children aged 12 to 23 months, the proportion of children receiving valid full vaccination were 81 (27%), partially vaccinated 39 (13%) and not vaccinated 180 (60%) (Figure 4. 11).

Another similar study in the Northwest part of Ethiopia found that 58.4%, 17% and 24.6% of children aged 12 to 23 months were fully vaccinated, partially vaccinated, or not vaccinated, respectively (Tesfaye 2018:2351). Other similar age group studies in non-pastoralist areas of Ethiopia revealed that 428 (75.6%) children aged 12 to 23 months were fully vaccinated, while 5.9% were not vaccinated at all. The remaining 18.5% were only partially vaccinated (Mekonnen, Bayleyegn & Ayele 2019:4) This finding was higher as compared to the current study, the possible reason for this discrepancy may be that children in high land and stabilised communities are more likely to be vaccinated than children in pastoralist and hard-to- reach communities.

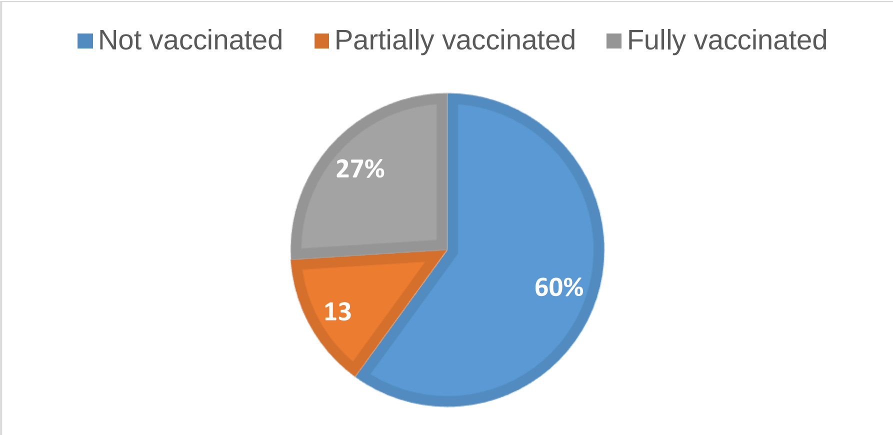

Figure 4. 11: Immunisation coverage of children aged 12 to 23 months (N=300).

In a similar study in Ethiopia, the coverage of full vaccination, partial vaccination, and non-vaccination was 71.77%, 16.67%, and 11.56%, respectively, out of a total of 372 study participants (Jimma *et al.*, 2021). This was rather high vaccination coverage when compared to the Pastoralist Community immunisation coverage in this research. This studies entire immunisation coverage was higher than the Mini 2019 EDHS Report in the Somali regional and at national level coverage, but lower than the past similar studies. The EDHS reported low proportion of completely immunised children compared to this district, which could be owing to the EDHS data being national level statistics, but it could also be due to a weak immunisation system and hence a large variability of immunisation services.

Another research done in Yemen found that 10.4% of children were partially immunised and 6.5% had never been immunised (Al-Mendalawi, 2011); which was lower than the percentage seen in this study. This gap might be attributed to improvements in vaccination programs and improved immunisation service preparedness in comparison to the studies of hard-to-reach Pastoralist Communities.

4.3.6 Factors on Valid Immunisation Coverage

The proportions of children receiving valid vaccination were classified into three portions with related to socio-demographic variables as shown in the Table. Observing the vaccination coverage, Denan Woreda had a comparatively high immunisation coverage as compared to other study areas. In comparison to rural residents, urban residents residing with parents/caregivers had better immunised children. If the child had gotten any of the antigens specified in the numbers above, there would be no record and no recall from any supplier. Sixty-four percent of non-educated respondents were not vaccinated as compared to the educated respondents. In addition, the total respondents of unvaccinated children had less than 30 minutes walking time to the immunisation site, 64% (95% CI: 58.0-69.5) as compared to unvaccinated children who had greater than 30 minutes walking time to the immunisation site.

Table 4. 5: Overall immunisation coverages among children aged 12 to 23 months with background characteristics.

Background characteristics	Vaccination Coverage						
	Not vaccinated		Partially vaccinated		Fully vaccinated		N
	%	CI	%	CI	%	CI	
Woreda Name							
Adadle	75	[65.1-85.5]	4	[6.0-26.1]	17	[11.0-30.0]	69
Berano	66	[83.0-79.1]	16	[20.8-43.8]	18	[7.3-28.6]	50
Denan	43	[29.4-56.0]	19	[46.8-80.4]	39	[26.0-52.0]	54
Gode City	35	[23.0-47.4]	33	[21.0-45.5]	32	[19.5-44.0]	57
Gode Woreda	77	[67.3-87.0]	2	[-1.3-4.2]	21	[12.0-31.0]	70
Residence							
Rural	76	[69.2-83.2]	2	[-0.2-4.4]	23	[16.1-30.0]	145
Urban	47	[39.2-55.0]	25	[18.0-31.2]	28	[21.2-35.4]	155
Education							
Educated	32	[22.0-43.0]	16	[7.5-23.7]	32	[22.0-43.0]	77
Non-educated	63.7	57.4-69.9	13	[8.6-17.4]	23	[17.7-28.9]	223
Walking time on the immunisation							
up to 30 min	64	[58.0-69.5]	12	[8.2-16.1]	24	[19.0-29.2]	262
>30 mint	39	[24.0-55.0]	24	[10.1-37.2]	37	[21.5-52.1]	38
Resident							
Mobile resident	60	[55.0-66.0]	14	[9.9-18.0]	26	[21.0-31.0]	295
Permeant resident	80	[45.0-115.0]	0	[0-0]	20	[-15.0-55.0]	5

4.3.7 Vaccination Dropouts

Dropouts between the first and last immunisations (for Penta1 and Penta3) may be an indication of the EPI's capacity to follow up with each birth cohort. Dropout rates are used to evaluate program efficacy and to determine follow-up (FMOH Ethiopia 2021:18). Because this immunisation is rarely given during campaigns, the dropout between the first and third PENTA doses is the strongest predictor (Chanie *et al.*, 2021). Dropout rates of more than 10% in typical EPI programs usually signal a quality issue with the program that must be addressed (Negussie, Kassahun, Assegid & Hagan 2016). This study discovered significant dropout rates in the vaccination program by using legitimate coverages of BCG as an entry vaccination and Measles as an exit vaccine. The overall dropout rate (card and records) of BCG and Measles was 13.5%.

The dropout rate for Penta (card and records) (PENTA 1-3) was 19.8%. The statistics might point to potential issues with the vaccination program. Infant mortality and migration, irregular vaccination sessions, a lack of information about future immunisation schedules, fever or abscess after vaccination, and other factors all impacted the vaccination dropout rate in this research. According to studies conducted in Southern Nigeria, the DPT/Penta dropout rate in rural communities was 77.3%, whereas in urban communities was 12.3%. In comparison to this study, which was lower in rural and higher in urban communities, this was over the WHO standards and requires attention to reach defoliated or unvaccinated children (Dienye, Itimi & Ordinioha 2012).

Lack of understanding, fear of side effects, and religious and cultural barriers were the top causes of vaccine dropout, according to research conducted on children aged 12 to 23 months in Assosa Town, western Ethiopia (Jimma, GebreEyesus, Chanie & Delelegn 2021:283). Unavailability of vaccines, inadequate immunisation, parents' ignorance of age-related immunisation, and the child being sick and being brought in without getting immunised were all key reasons for incomplete immunisation, according to a similar study in India (Mugada, Chandrabhotla, Kaja & Machara 2017:158).

4.3.8 Reasons for Not Vaccinating Children

The respondents mentioned bad rumours 89 (30%), long waiting time in a time of vaccination 53 (18.3%) and absence of vaccinators 53 (18%) as some of the major barriers to not vaccinating children. Similar research in Southern Ethiopia revealed that the primary causes of measles vaccination discontinuation were: lack of vaccinators, family disease (child/mother sickness), lack of vaccine, lack of knowledge on the vaccination schedule, and insufficient children to open vial (Tilahun, Haimanot & Tigabu Beyene Handiso, 2016:152). Other similar age group studies in non-pastoralist areas of Ethiopia revealed that the most common reasons cited by parents/caregivers for non/incomplete vaccination of their children were incorrect appointment dates (46.4%) and stock-out of vaccines (19.6%) (Mekonnen, Bayleyegn & Ayele 2019:5). Because of the lifestyle of the community and the study areas, this reason differs from the current study.

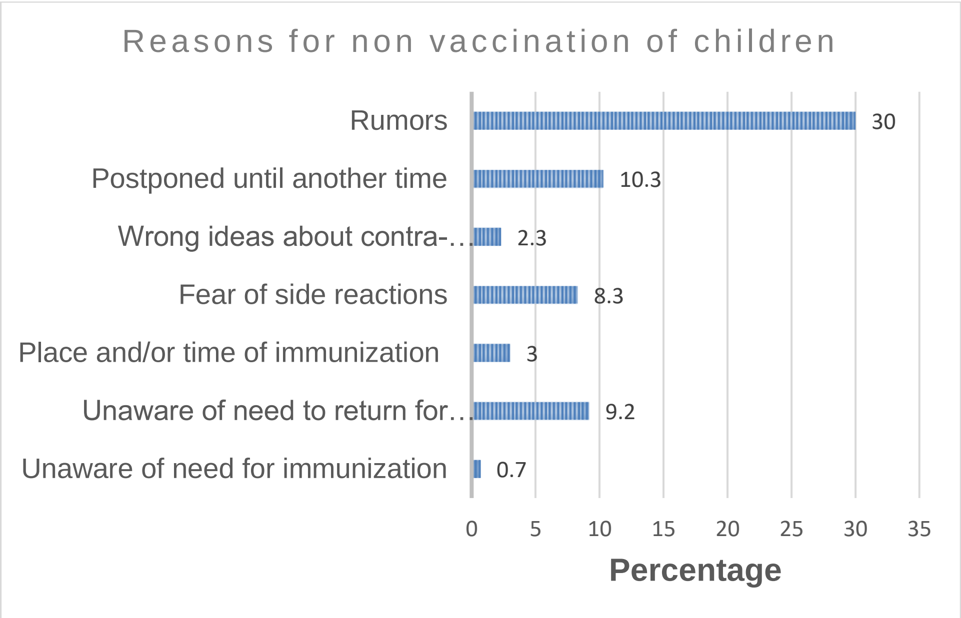

Figure 4. 12: The main reasons for parents/caregivers not ever vaccinating children (N=180).

4.3.9 Failure to Complete Childhood Vaccination

The respondents who did not complete their children's vaccinations were asked to provide their reasons. The majority, 56 (19%), of them responded that the place of immunisation was too far and the root cause for not completing immunisation. Again, 18% mentioned long waiting time and absence of the vaccinators as the main reason for vaccine dropout.

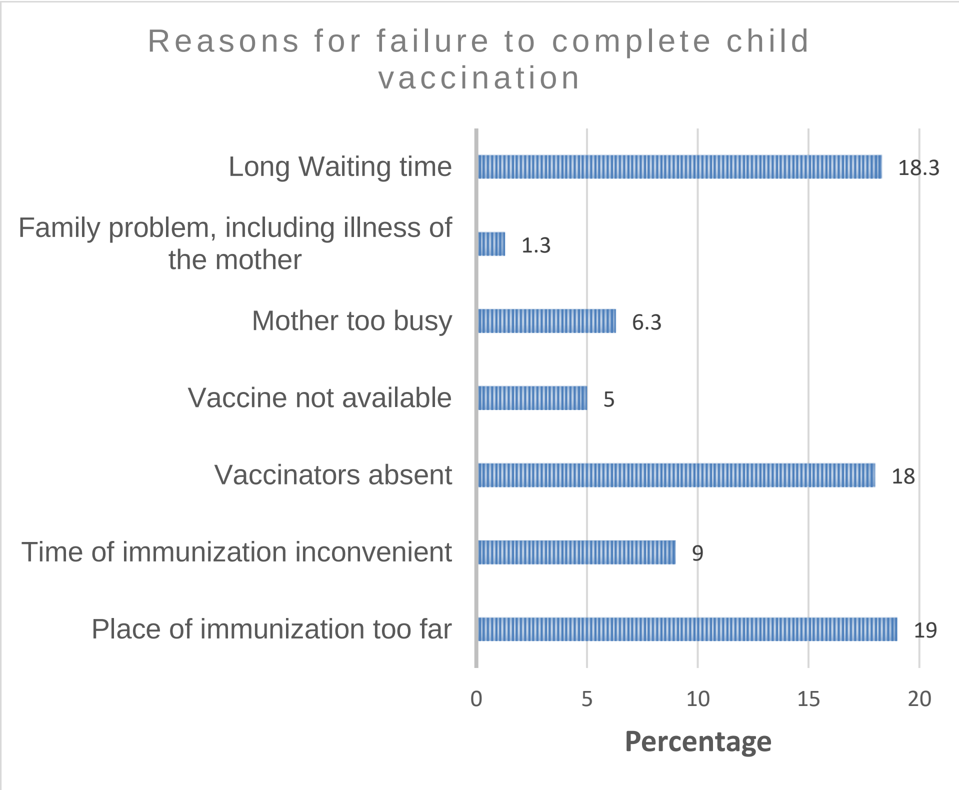

Figure 4. 13: The main reasons for failure to complete vaccination (N=180)

According to research conducted in the western area of Ethiopia, the major reasons for parents not vaccinating their children were fear of Covid-19, lack of information, and fear of vaccine adverse effects (Jimma *et al.*, 2021). The main factors were 37.2 %, 16 37.2 %, and 23.3% respectively (Jimma, GebreEyesus, Chanie & Delelegn 2021:283). According to research conducted in Nigeria, among the non-vaccinated or incomplete vaccination, 37% of them argued the location of immunization was too far and 25% had little trust that immunization will protect their children from vaccine-preventable illnesses. Due to a lack of vaccine availability, 4% of respondents did not finish their child's immunisation schedule (Lydia Taiwo *et al* 2015:3).

Table 4. 6: Reasons for parents/caregivers of the child not receiving and failure of vaccination (N=180).

Variables		Frequency	percentage
Unaware of need for immunisation	No	99	33
	Yes	2	0.7
Unaware of the necessity to return for a second dosage	No	66	22
	Yes	29	9.2
Place and/or time of immunisation	No	131	44
	Yes	1	3
Fear of side reactions	No	78	26
	Yes	25	8.3
Wrong ideas about contra-indications	No	154	51.3
	Yes	7	2.3
Postponed until another time	No	129	43
	Yes	31	10.3
Rumors	No	72	24
	Yes	89	30
Place of immunisation too far	No	104	35
	Yes	56	19
Time of immunisation inconvenient	No	108	36
	Yes	27	9
Vaccinators absent	No	66	22
	Yes	53	18
Vaccine not available	No	104	35
	Yes	14	5
Parents too busy	No	100	33.3
	Yes	19	6.3
Family problem, including illness of the parents	No	114	38
	Yes	4	1.3
Long Waiting time	No	64	21.3
	Yes	55	18.3

4.3.10 Vaccination Services

Immunisation service is delivered in various approaches including at static sites (at HFs and/or in the compound), outreach service (villages more than 5 kilometres away from HFs) and mobile approach is implemented in difficult topography or distant and scattered settlements in pastoralist communities. Several factors within and outside the health care systems have synergistically contributed to the EPI program achievements in pastoralist community. These factors include:

4.3.10.1 Place of vaccination services

Service-related concerns were evaluated, including where they frequently took their children for vaccinations, whether they had received information from service providers, and their degree of satisfaction with vaccination services. The majority, of the respondents, 144 (48%) frequently brought their children to health centers for vaccinations, while 83 (28%) of parents/caregivers vaccinated their children on the health post. These findings were similar to those of the other research study conducted in the northwest part of Ethiopia where the vast majority of children (41.9%) were immunised in health centres and vaccination sites at health institutions health center and health post, have more likely to be fully vaccinated when compared to hospital and outreach vaccination site (Tesfaye, 2018).

According to a systematic review conducted in Sub-Saharan Africa, the majority of the caregivers were aware of the benefits of routine immunisation but were unaware of the locations of the vaccination posts and the dates of the follow-up vaccination (UNICEF, 2019).

4.3.10.2 Parents/Caregivers' Satisfaction with Vaccination Cession

When asked about their satisfaction with the vaccination services delivered at local health institutions, more than three quarters, 168 (91%) of parents/caregivers were satisfied with vaccination services and the remaining 16 (9%) were not satisfied. Among the non-satisfaction 4 (25%) indicated that the vaccination site was closed.

A comparable research in Ethiopia's eastern central region indicated that two-thirds of patients (67.3%) and one-third of controls (39.5%) were dissatisfied with healthcare delivery (Yenit, Gelaw & Shiferaw 2018) and Other studies in Hawassa City and Dere Dawie found that carer satisfaction with immunisation services provided was 76.7% and 84.6%, respectively (Dana, Asefa, Tadewos & Yitbarek 2021; Debela, Negassa, Hareru, Sisay & Soboksa 2022). This disparity might be attributed to the respondents' subjective character, the sort of indicators employed, and the categorisation used to assess satisfaction level.

4.3.10.3 Suggestions for Measures to Improve the Vaccination Service Utilization

When asked to identify measures that may be taken to enhance their communities' vaccination service use, parents/caregivers were unable to do so. The 142 (47.3%) respondents suggested that friendly vaccinators be deployed, 8 (2.6%), that vaccination sites be available within a reasonable walking distance, 39 (13%) that the vaccination site be kept clean, 44 (15%) that the waiting time be reduced, and 61 (21.3%) that all antigens be available at the vaccination site as important measures that could be taken to improve their communities' vaccination service utilisation (Table 4.9).

In a similar systematic review study in Sub-Saharan Africa, parental/caregiver barriers such as long waiting times, provider hostility, keeping the vaccination site attractive, vaccine misconception, trust, home delivery, parent forgetfulness, convenient time, and language barrier were all modifiable and corrective measuring areas to improve immunisation upticks (Bangura *et al* 2020:4).

Table 4. 7: Vaccination service-related characteristics of the respondents in pastoralist community (N=184)

Place for vaccination		Frequency	Percentage
	Health Centres	144	48
	Health Post	83	28
	Outreach Activity	31	10.3
	Others (Hospitals, Private providers)	42	14
Parents/caregivers' satisfaction with vaccination session			
	No	16	9
	Yes	168	91
Reasons for not satisfied (N=16)			
	Vaccinator not friendly	1	6.2
	Adverse effects of vaccine	2	12.5
	Long waiting time	2	12.2
	Vaccination site closed	4	25
	Vaccinator absent	3	19
	Vaccination site is dirty/not clean	4	25
	Others		
Suggestions about Measures to Improve the Vaccination Service Utilization			
	Friendly vaccinator	142	47.3
	Availability of all antigens	61	20.3
	Shorter waiting time at the vaccination site	44	15
	Clean vaccination site	39	13
	Others (Vaccination site with reasonable walking distance, inexpensive services)	8	2.6

4.3.11 Immunisation Monitoring System for Service Readiness

According to the WHO immunisation service readiness, the dominating components of readiness score at PHCU include staff and training; equipment; vaccine; commodities and supplies. A readiness score of 50 indicated that, on average, half of the PHCUs that provided the vaccination service possessed all of the required inputs

(WHO 2015:46). The preparedness of the immunisation service was judged based on the PHCU's readiness to perform the service and the availability of tracer materials (Tadesse, Gelaw, Hail, Bisrat, Asress, Asegdew & Tessema 2019:4). The availability of the 18 tracer items found was used to assess preparedness to provide child immunisation services (Zemedu 2020:35). According to the WHO immunisation monitoring system, 18 tracer items and more for a given country setting were used (WHO 2015:46). A total of 34 tracers were included in this study under planning and coordination (6 tracers), cold-chain management (8 tracers) and vaccine supplies (6 tracers), services delivery (11 tracers) and community linking and involvement (3 tracers).

4.3.8.1 Planning and Coordination

Planning includes coordinating efforts with a variety of stakeholders, with an emphasis on gaining political and legal support for the EPI's ideals and goals, as well as technical and operational help (Pan African Health Organization & WHO 2020:13). The Leadership, Management, and Coordination (LMC) platforms guide and support EPI's work. The LMC's overarching goal is to improve EPI coverage, quality, and equity by strengthening leadership, management, and coordination of the immunisation program at the national and sub-national levels (EPSA 2020:20). At the federal, regional, zonal, Woreda (district), and PHCU levels, various coordinating mechanisms exist, with different powers and functions assigned to each level of the health system (EPHI 2015:8). Each level has its own administrative structure and decision-making power for the people who live in its catchment area. The National Institute of Health and Family Welfare (NIHW) 2018:11, recommends that bottom-up Micro-plans for the vaccination program be included in the planning of other health programs and services.

Micro-plan Developed and Displayed on the Wall

In this study, three out of five (67%) primary health facilities reached every district or community (RED/C) Micro-plan developed and displayed on the wall of the immunisation room and 56 (87.5%), most of the health facilities were catchment areas maps availability and were posted on the wall of the immunisation room. The Ethiopian

Public Health Association study in the six regions of Ethiopia showed that 34.5% had reached every community (REC) Micro-plan at zonal levels and out of that, 20% had posted the Micro-plan on the wall. Similarly, the existence of a Micro-plan at Woreda level to reach the community was less than 50%. It was nearly 28% at the health centre level, of which 23.3% was verified for being posted on the wall (Ethiopian Public Health Association, 2017:18).

Another qualitative research in Uganda found that most of the healthcare employees were aware of the availability and importance of the Micro-plans and the Micro-planning process in their workplaces but the planning process was hampered by a lack of understanding about communities and program catchment regions, which made it difficult to identify difficult-to-reach locations and prioritise them according to need (Mafigiri, Iradukunda, Atumanya, Odie & Mancuso 2021:4).

Availability of a Trained Health Practitioner in the Facility

Appropriately trained staff was available to manage and provide immunisation services. Seventy-seven percent of health facilities had at least one health practitioner who had received vaccination training for children. Similar Research in Service Availability and Readiness Assessment (SARA) in Ethiopia and pastoral and semi-pastoral CORE Group Ethiopia implementation found that 79% and 86% of health facilities had at least one health practitioner who had been trained on immunisation. The findings of this study were almost similar to the findings of the current study.

Availability of a Defaulter Tracking System

Every child should receive a series of vaccinations and have a minimum of five contacts with the health system between the ages of birth and nine months. It is critical that HF has a system in place to track children who do not return for follow-up antigens or boosters (JSI Research & Training Institute 2018:9). More than half of the health facility, 38 (59%), included in this study does not have a children vaccination defaulter tracking or monitoring system in place but other HFs 26 (41%) employ a defaulter tracking system known as tickler files.

The Ugandan Ministry of Health and the African Field Epidemiology Training Program have Defaulter tracking systems in place and work hard to identify, track, follow up on, and refer defaulters from communities back to health facilities for catch-up immunisation doses (Africa CDC 2022).

Availability of Previous Monthly Reports

In theory, data from health facility levels are sent regularly to the Woreda , District Health Office, or the next level for aggregation and submission to the next reporting system (Kazadi *et al* 2019:12). In this research study, less than half, 41 (36%), had never seen the previous years of monthly summary reports. Other similar studies on data quality in the southern part of Ethiopia found that the overall previous monthly report at the District/Woreda level was 62.5% (Argaw *et al* 2022:5). These findings were higher than the current research with the possible explanations that the responsibility and concentration of health workers in pastoralist areas were lower than in those in high land due to environmental influence.

Availability of Immunisation Implementation Guidelines

Guidelines are recommendations intended to assist health care providers and recipients, as well as other stakeholders, in making informed decisions. The WHO has immunisation guidelines on local situations and structures that are easily accessible (WHO, 2018d). The availability of the immunisation implementation guideline was assessed in this study.

Only one-sixth, 10 (16%) of the health facilities had immunisation implementation guidelines available, but the majority of 48 (75%) of the health facilities had not seen immunisation implementation guidelines. This meant that most health care providers worked without following the stipulated procedures and guidelines.

Table 4. 8: Health facility planning and coordination related variables (N=64)

Variable		Frequency (N)	Percentage (%)
RED/C Micro-plan developed and display on the wall	No	21	33
	Yes	43	67
Availability of catchment area map	No	8	12.5
	Yes	56	87.5
Availability of one (1) trained immunisation qualified HW	No	15	23.4
	Yes	49	76.6
Availability of a defaulter tracking system in place	No	38	59.4
	Yes	26	40.6
Availability of all monthly reports for the previous year	No	23	64
	Yes	41	36
Availability immunisation implementation guideline	No	48	75
	Yes	16	25

4.3.8.2 Vaccine Supply and Cold-Chain Management

Consistent vaccination supply is a critical component guaranteeing EPI availability program (Krishnaswamy, Lambach & Giles 2019:945). In 2010 WHO and UNICEF launched an Effective Vaccine Management (EVM), and all vaccines and diluents were kept and supplied in a cold-chain system at temperatures within the WHO-recommended limits (WHO 2014:2).

Availability of Vaccines in the Facility during the Study Period

In terms of 64 health facilities assessment on specific vaccine availability on the day of the study, 59.3% had BCG vaccine, 76.5% had OPV vaccine, 75% had pentavalent vaccines and 62.5% measles vaccine as shown in Figure 4.14. According to a South African study, vaccine shortages, particularly at the health facility level was a major concern in the immunisation supply chain systems. To meet the immunisation coverage targets and achieve universal health coverage, an uninterrupted supply of vaccines at various supply chain levels, particularly at the lowest level, was required (Iwu-jaja *et al.*, 2022).

Furthermore, another study in Nairobi found that the most affected and out-of-stock vaccines were Tetanus (88%), Measles (81%), and Oral Polio (79%) (Kanja *et al* 2021:4). Inadequate vaccination supply suggested a poor Micro-planning exercise, vaccine scarcity, transportation supply constraints, incorrect stock transactions and so on.

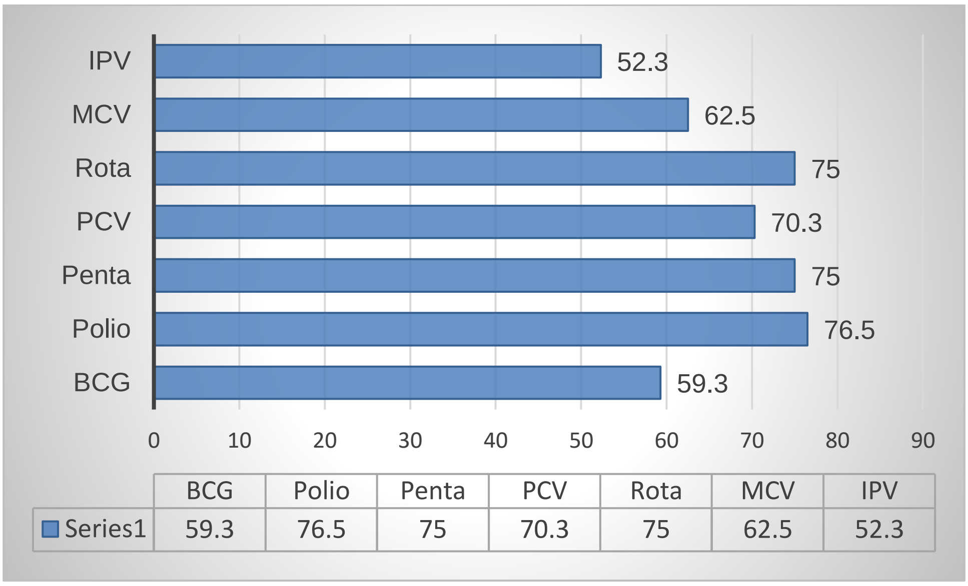

Figure 4. 14: Percentage distribution of vaccine availability at the time of study at health facility levels (64).

Recording of Vaccines Issued on the Ledger Book

Vaccine stock management is an important aspect of the supply chain because it keeps complete and accurate records of vaccine stock transactions, and vaccine conditions, and ensures continuous vaccine availability to the target population (Iwu-jaja *et al* 2022). Only 22 (34%) of the health facilities in this study had received vaccines and documented them in a vaccination ledger book.

Another South African studies found that there was inadequate stock documentation and tracking of vaccines and other logistics suppliers (Iwu-jaja *et al.*, 2022). This was attributed to poor stock forecasting, overstocking, and poor cold-chain maintenance.

Availability of Cold-Chain Temperature Monitoring Device

Vaccines are biological products that lose potency when exposed to high temperatures and/or freesing. It is critical to monitor the temperature of vaccines during storage and transportation (UNICEF 2016:1). Refrigerator temperatures were assessed on the day of data collection and compared to temperature records from the previous 30 days. A total of 46 (72%) health facilities had fridge tags available, with 51 (80%) of health facility refrigerator temperature monitoring sheets completed twice daily in the previous 30 days and 39 (61%) of the monitored refrigerators' temperature records falling within the permitted temperature range norm (2 to 8-degree centigrade).

According to an effective vaccine management study conducted in Ghana and West Shewa Ethiopia, 60% and 74% of health facilities, respectively, monitored the temperature twice daily, and 90% and 95% of temperature monitoring devices were available (Osei, Ibrahim & Amenuvegbe, 2019, Delelegn & Yilma 2018:11). Another similar study in Ethiopia found that 21 (51.2%) public health centres visited, had done twice daily temperature monitoring in logbooks, but only 8 (19.8%) had weekly temperature logbook monitoring by the officer in charge and only 32 (78.1%) had working thermometers or refrigerator tag available (Feyisa 2021:364). According to the WHO effective vaccine management indicator, greater than 80% was the minimum temperature monitoring benchmark. In this regard, both above study findings fell below the WHO-recommended minimum standard.

Cross-Checks of Available Vaccinations, Re-Constitution Syringes, Safety Boxes, Diluents, and Droppers

From the observed health facility, 30 (47%) have an equal number of AD and re-constitution syringes to match the vaccines available, and more than half, 44 (69%) of health facilities had enough safety boxes to correspond to the number of AD and re-constitution syringes. In addition, in three quarters, 52 (81%) of the total health facility were available for vaccine during the immunisation sessions for BCG, Polio, Penta, MCV, PCV, Rota and IPV (Table 4.11).

Another similar study in Ethiopia found that 34 (82.9%) public health centres checked and ensured the corresponding matching doses of diluents for BCG and Measles (Feyisa 2021:364). The mechanism for maintaining vaccination stockpiles, as well as the cold-chain transportation, and storage, were in place (Rogie & Berhane 2013). The supply chain from the district stores to the health facilities was known to the respondents. Stock outs of vaccinations, particularly BCG, IPV, Measles, and Oral Polio, hampered the delivery of immunisation services. Stock-outs were a common occurrence, according to the respondents from a variety of facilities (Malande *et al.*, 2019).

Table 4. 9: Percentage distribution of cold-chain and vaccine management

Variables		Frequency	Percentage
Are vaccines received and issued recorded in a vaccine ledger book?	No	42	66
	Yes	22	34
Availability of vaccine during the immunisation sessions (BCG, Polio, Penta, MCV, PCV, Rota and IPV)	No	13	20
	Yes	51	80
BCG		38	59.3
Polio		49	76.5
Penta		48	75
PCV		45	70.3
Rota		48	75
MCV		40	62.5
IPV		34	52.3
Availability of refrigerator Tag	No	18	28
	Yes	46	72
Refrigerator temperature monitoring sheets were completed two times per day.	No	13	20
	Yes	51	80
Cold-chain temperature b/n 2-8 0C.	No	25	39
	Yes	39	61
Cross-checks of available vaccinations and diluents and droppers.	No	25	39
	Yes	39	61
Is there an equal number of AD and re-constitution syringes available to match the vaccines?	No	34	53
	Yes	30	47
Enough safety boxes to correspond to the number of AD and re-constitution syringes (Y/N).	No	20	31
	Yes	44	69
The presence of a foam pad in the vaccination carrier	No	29	55
	Yes	35	45
Vaccines are legible and have not expired, and they have VVM stages 1 and 2.	No	12	19
	Yes	52	81

4.3.8.3 Service Delivery

Because the implementing bodies (Woredas) are becoming more capable, both administratively and economically of participating in resource mobilization and allocation for immunisation programs in their respective areas, the EPI program has benefited from the democratisation and decentralisation of the health service

(The Vaccine Alliance, 2020:20). The study findings showed that 61 (95.3%), 63 (98%) and 57 (89%) of the observed health facility had available correct diluents for reconstituting each vaccine, sterilized syringe/needle for reconstituting and benches for clients to sit comfortably in the vaccination room, respectively.

The auditing also discovered that 56 (87.5%), 62 (97%), 56 (87.5%) and 26 (41%) of the observed health facility were found to have immunisation registries (tally sheet, registration book), used safety box, explain to the caregiver about the immunisation card and next visit date, and availability of written feedback from the higher levels was identified and observed (Table 4.10).

Table 4. 10: percentage distributions of tracer items on service delivery (N=64).

Variables		Frequency	Percentage
Availability of all vaccines during the immunisation sessions	No	6	9.4
	Yes	58	90.6
Availability of correct diluents for reconstituting each vaccine?	No	3	4.7
	Yes	61	95.3
Is a sterile syringe/needle available to reconstitute each vial of Measles, BCG?	No	4	2
	Yes	60	98
Availability of adequate benches for clients to seat comfortably.	No	7	11
	Yes	57	89
In the immunisation room, there is a water bowel and a stand for washing hands.	No	53	83
	Yes	11	17
Administration of vaccines in the correct site, route, and dose.	No	4	94
	Yes	60	6.3
For each dosage of antigen, just one syringe/needle should be used.	No	2	3
	Yes	62	97
Availability of immunisation card and next visit date, and explain to the caregiver	No	8	12.5
	Yes	56	87.5
A safety box is used to dispose of spent syringes and needles.	No	2	3
	Yes	62	97
The usage of an immunisation registry (tally sheet, registration book) with proper entries	No	8	12.5
	Yes	56	87.5
Receiving higher-level support supervision (National, State, LGA)	No	21	33
	Yes	43	67
Written feedback from the higher levels	No	38	59
	Yes	26	41

4.3.8.4 Community Involvement in the Immunisation Activity

Involving local government officials, community leaders, and religious leaders in the immunisation system can lead to increased advocacy and ownership of immunisation services. This begins with educating community leaders about vaccination services and inviting them to important decision-making (JSI Research & Training Institute 2015:10). Partnering with communities for vaccination refers to supportive, coordinated action that health workers and community members may take to achieve their common objective of delivering accessible, dependable, and friendly services that are utilised correctly by all (WHO 2018a:3).

Out of the 64 health facilities, only 28 (43%) of the health facility were community linking plans, among the majority of the communities actively engaged/involved in community mobilisation activities in the outreach, or supplementary immunisation activities (SIAs) (Figure 4.15).

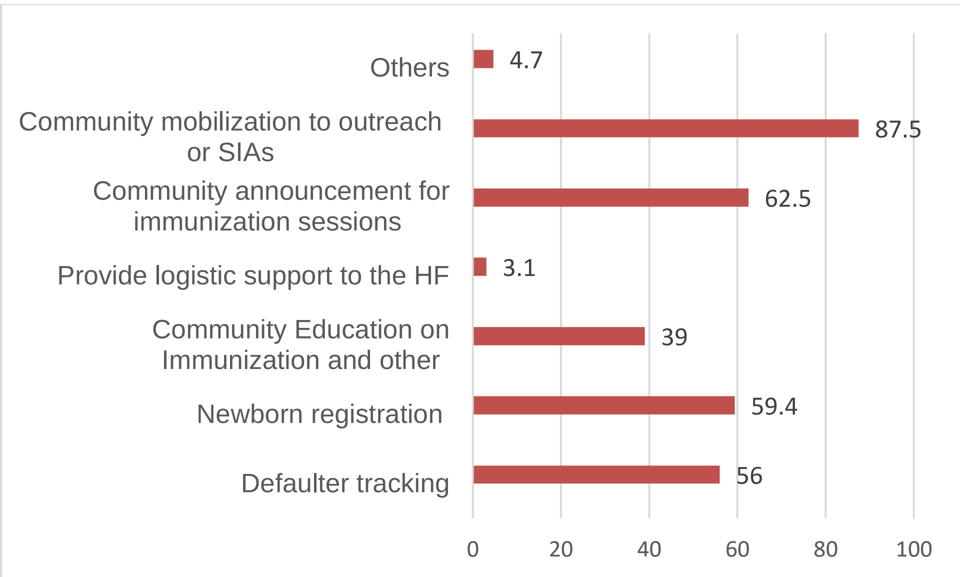

Figure 4. 15: Percentage distribution of community participation activities in the vaccination program

Summary of Immunisation Monitoring System for Service Readiness

Based on the WHO immunisation monitoring system for service readiness (WHO/PAHO 2016), there should be 18 and more tracers for specific contexts of the country (WHO 2015:46). As shown in Figure 4.16, all the observed health facilities (64) were rated on their preparedness to offer the service based on the availability of the 22 tracer items under personnel and guidelines, vaccination and commodity, and service delivery equipment. From the observed health facility, 30 (46%) of them had availability of at least one trained staffing and guideline, 43 (67.2%) had availability of vaccine and other related commodities and nearly three quarter (67.6%) had equipment availability for service delivery.

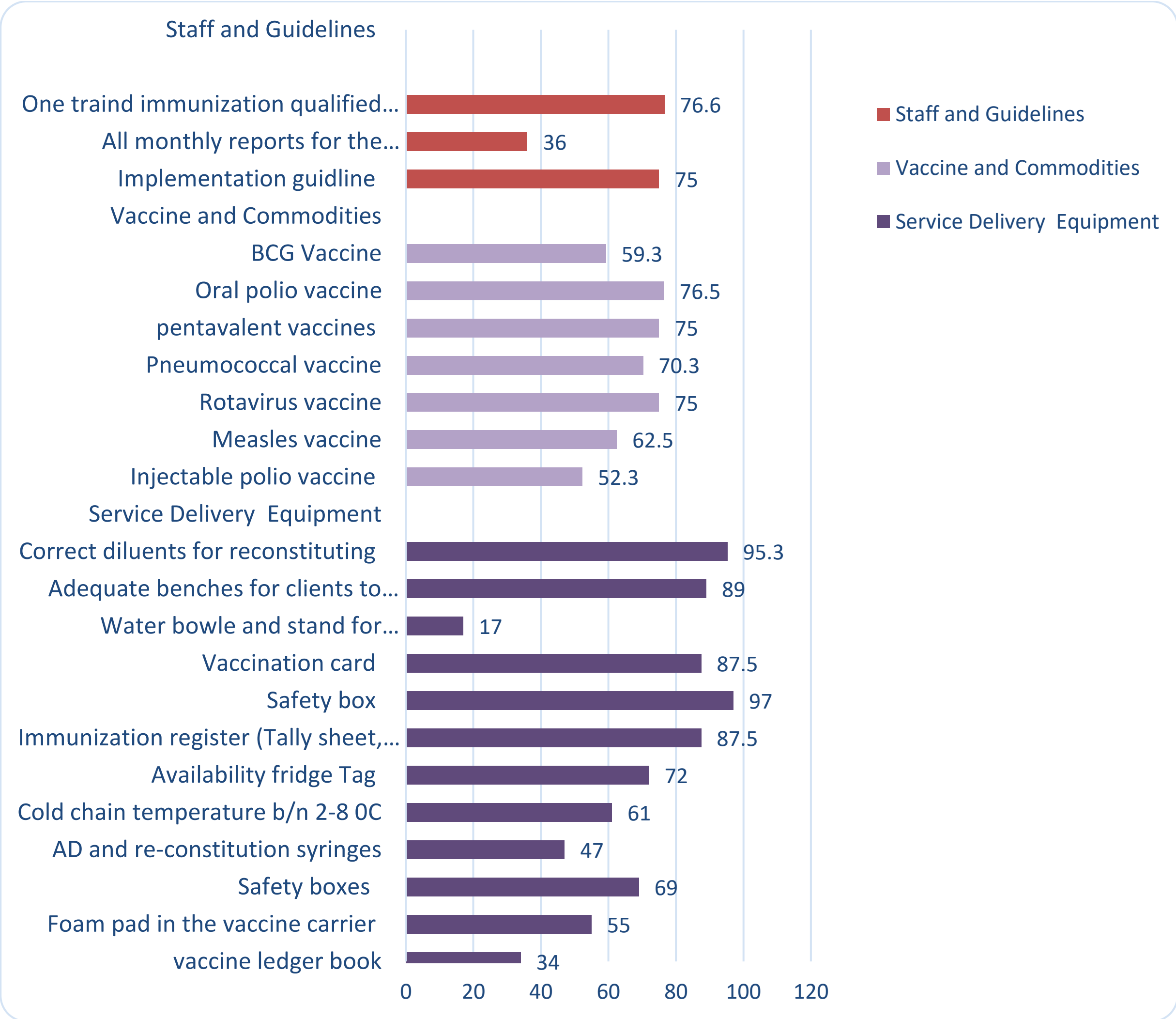

Figure 4. 16: Percentage of facilities that serve as tracer items for childhood immunisation services (N=64).

4.4 FACTORS ASSOCIATED WITH IMMUNISATION STATUS AND REDUCTION

For bivariate analysis, the dependent variable was utilised to evaluate all the explanatory variables. The study of two factors to understand the empirical link between explanatory and dependent variables is known as bivariate analysis (Bivariate Analysis 2019). To study the link between the result and the explanatory factors, the Chi-square method is applied. The computed show may be a standard measurable display for a parallel variable. It is used to determine the likelihood of a parallel result based on one or more relevant factors (Bivariate Analysis 2019). The dependent variable in the research was a dichotomous variable with a Yes or No response. Binary logistic regression was employed in this study to explore the relationship and significance between the dichotomous dependent variable and the independent components. Bivariate binary logistic regression was used to cross-check components that had an excellent fit (Chi-square) with the dependent variables. The logistic regression incorporated all factors that indicated a correlation during the bivariate analysis.

4.4.1 Chi-square Test for Socio-demographic Variables

The Chi-square test was used in a bivariate study to discover correlations between socio-demographic and outcome variables. Among the socio-demographic variables are the following: walking distance up to 30 minutes (x^2:1.8, p: 0.03), moderate economic position (x^2:0.17, p: 0.02) and ANC follow up during pregnancy (x^2:0.08, p: 0.00). Table 4.11 shows a substantial association with the outcome variable.

4.4.1.1 Educational Levels

In this study, education levels had no significant relationship with immunisation status (x^2: 2.5, p: 0.11). Illiterate parents/caregivers had 0.63 lower odds of practising childhood vaccination than any grade level of educated parents/caregivers (OR: 0.63, 95% CI: 0.35-1.11). Parents/caregivers who attained secondary or more groups of education were 1.5 times more likely to have fully immunised children than illiterate parents. Parents and caregivers in cities were more educated than those in rural areas. More than half (57%) of rural parents/caregivers had never attended school, compared to 84.4 % of metropolitan women.

The relationship between the parents education and vaccination status was found to be statistically insignificant in a comparable study conducted in India (Mugada, Chandrabhotla, Kaja & Machara 2017). The reason may be due to high movement of pastoralist community; the immunisation information was easily captured and vaccinated as soon as possible rather than formal education. Maternal/caregiver educational level was significantly increasing the immunisation status of children in different studies. It seemed that literate parents were more likely to get their children vaccinated than illiterate ones (Lamiya, Mundodan & Haveri 2019:19).

A comparable research in Ethiopia's Amhara Region found that parents with a secondary or higher level of education were 2.39 times more likely to have fully vaccinated children than uneducated parents (Girmay & Dadi 2019:4). Furthermore, research in Ghana found that the probabilities of receiving complete vaccination increased dramatically with the parents educational level, for example immunisation of children in the maternal secondary education had 3.7 times, and tertiary education had eight times vaccinated children than that of those without education (Dadzie 2019:66). In another research in Nigeria, DPT3 coverage was 49% for children born to unschooled parents but 85% for children born to parents with a high school diploma or above (Ghosh & Laxminarayan 2017:1089).

4.4.1.2 Resident

In this study, the urban, rural, mobile, and permanent residents had no significant relationship with fully immunisation status (AOR: 0.74, 95% CI: 0.33, 0.65) and (AOR: 0.72, 95% CI: 0.07, 6.54) respectively, but 44 (28%) urban children had been fully vaccinated as compared to 112 (77%) of those who were not fully vaccinated in rural areas for mobile residents in this study, the majority of 295 (89.3%) of the respondents had mobile resident, and three quarter (75%) of the children in the mobile resident were not fully vaccinated (AOR: 0.72 95% CI: 0.07-6.54), as shown on Figure 4.17.

The proportion of totally unvaccinated children increased from 4 to 10% in urban areas and from 17 to 23 % in rural areas between 2016 and 2019, according to the Ethiopian Demographics Health Survey (DHS) report. While the place of residence remained an influential determinant of equity in vaccination in Ethiopia, the gap was reducing (Ethiopian Central Statistical Agency, 2016; EPHI & MOH 2019:17). In contrast, aresearch in Bangladesh found that urban children were 1.35 times more likely to be completely immunised than rural ones (Sarker 2019:6).

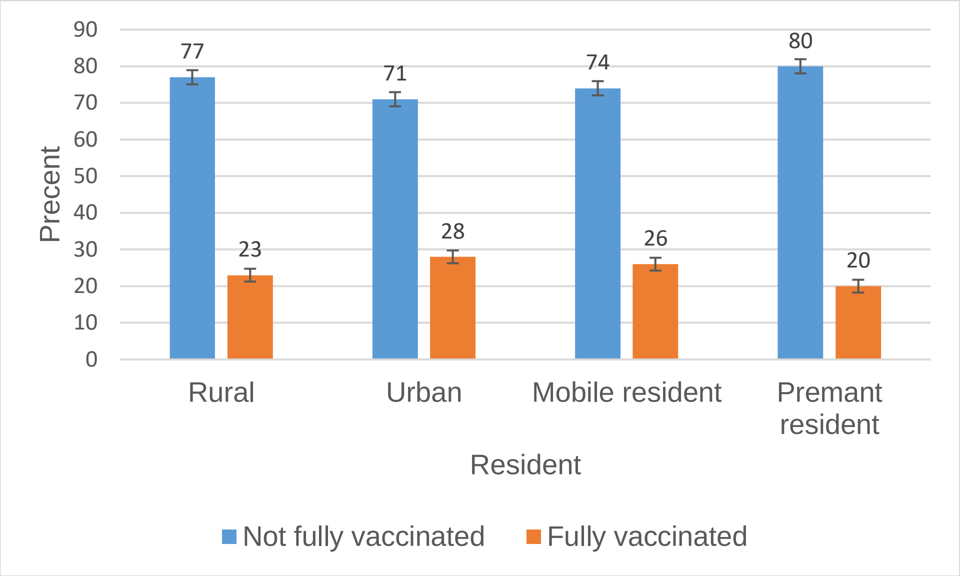

Figure 4. 17: Percent distribution of parents/caregivers aged 12 to 23 of residents by immunisation status (N=300)

4.4.1.3 Distance to the immunisation site

In this study, walking distance to the immunisation site and childhood vaccination coverage had a significant association (x^2:1.8, p: 0.03). Figure 4.18 shows that parents/caregivers of children who lived more than 30 minutes from the vaccination site were considerably less likely to obtain complete immunisation than those who lived less than 30 minutes from the vaccination location (AOR: 0.51, 95% CI: 0.25, 1.02). Researchers discovered that distances from houses, transportation expenses, and an insufficient transportation infrastructure, influenced the use of healthcare services in several studies (Anyabolu 2016:43).

Comparable research in Ethiopia on the relationship between travel time to health facilities and childhood vaccine coverage found that the journey time to vaccination sites had a significant link with Penta3 vaccine coverage. Another qualitative study in Nigeria found that distance to health facility from the living areas were major factor in the vaccination of children as parents/caregivers indicated that the vaccination centre was far and took a long time and became a big burden (Anyabolu 2016:71). The issues of distance, transportation costs, and supplementary have been recognised as important barriers to women receiving vaccination services (Egharevba, Pharr & Wyk 2017:88).

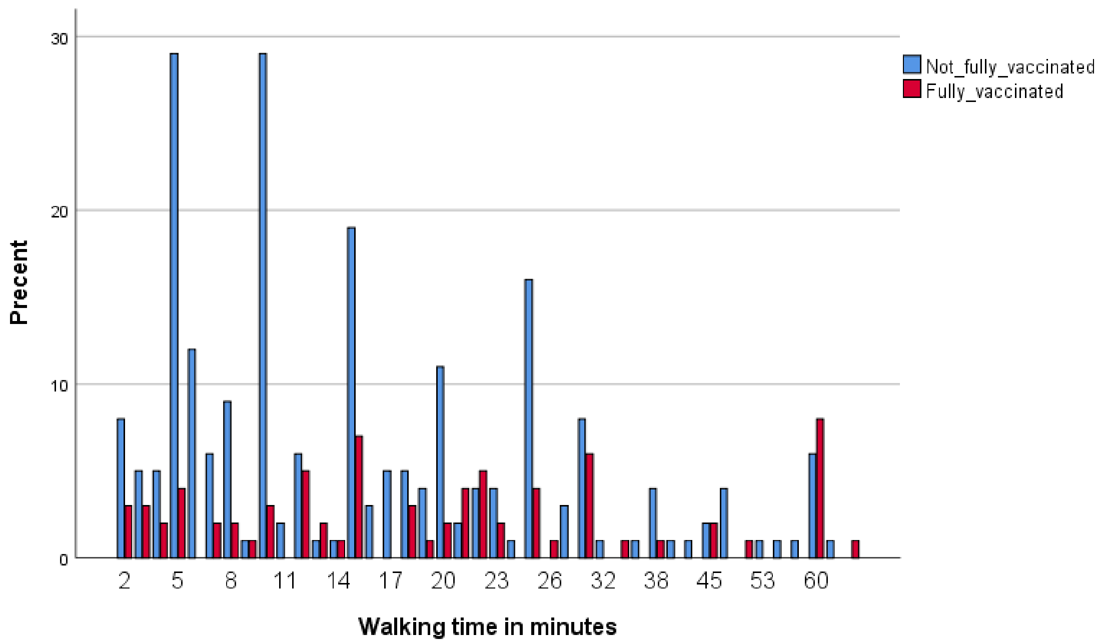

Figure 4. 18: Waking time distribution to the immunisation site (N=300)

Geographical accessibility affects the completeness of childhood vaccinations. According to Ethiopian research on the relationship between travel time to health facilities and child vaccine coverage, journey time to vaccination site has a strong link with Penta3 vaccine coverage, for example, children living 60 minutes away from a health post were considerably less likely to obtain the Penta3 immunisation than those living 30 minutes away (Okwaraji et al 2012:6).

4.4.1.4 Religion and Marital Status

In this research study, married respondents 76 (26%) had relatively fully vaccinated children than the divorced ones. Most of the study participants were of Muslim religion and had no significant association with child vaccination. Some religions had either resistance to vaccination or there was no prohibition against vaccines. However, some countries have broad immunisation limitations, and Muslim religion believes in political objections and vaccines in different countries like Pakistan, Afghanistan, and Nigeria (USAID, 2018).

A study in15 Sub-Saharan Africa 15 countries on religious affiliation and immunisation coverage, found that there were significant differences according to religion. Children from Muslim parents had not gotten immunisations compared to those from Christian parents in six countries, with the ratio of unvaccinated children ranging from 1.87 in Ethiopia to 9.78 in Guinea-Bissau (Calu et al 2020:1163). Another study in Nigeria on the optimisation of childhood immunisation found that Islamic religion had been identified as a barrier to being fully immunized, but in urban Muslims, the barriers were much more reduced because childhood immunisation strategies were implemented (Obanewa, 2019). In this study, Muslim religion had no effect on vaccine resistance; rather, other factors contribute to vaccination.

Table 4. 11: Chi-square analysis of sociodemographic variables (N=300)

Background characteristics	Not fully vaccinated #	%	Fully vaccinated #	%	P-value	Crude AOR (95% CI)
Residence						
Rural	112	72.3	33	[21]		1
Urban	111	71.6	44	[28.3]	0.26	0.743 (0.44-1.25)
Walking time on the immunisation						
up to 30 mint	119	64	77	[41]		1.8 (1.2-3.77)
>30 mint	90	86.5	14	[13.5]	**0.03**	1
Resident						
Mobile resident	218	74	76	[26]		0.72(0.07-6.54)
Permanent resident	4	66.7	2	[33.3]	0.77	1
ANC follow up						
Yes	118	59%	81	41%		0.085(0.03- 0.22)
No	96	95%	5	5%	**0.00**	1
Economic position compared to neighbours						
Low	37	82%	8	18%	0.07	1
Moderate	182	74	64	26%	**0.02**	0.17(0.03-0.79)
High	4	44	5	56	0.06	0.28(0.07-1.08)
Number of other children						
<4	124	75	42	25		1
>5	99	74	35	26	0.87	1.0(0.62-1.75)
Educational level						
Non-educated	171	77	52	23		1
Educated	52	67	25	32	0.11	0.63(0.35-1.11)
Immediate older child fully vaccinated						
Yes	194	75	64	25		1
No	29	69	13	31	0.39	1.35(0.66-2.77)
Economic position compared to neighbours						
Low	37	82.2	8	17.8	0.07	1
Modern	182	74	64	26	0.02	0.17(0.04-0.8)
High	4	44.5	5	55.5	0.06	0.28(0.07-1.08)
Religion						
Muslim	222	74.3	77	25.8		1.35(1.26-1.44)
Catholic	1	100	0	0	**0.00**	1
Marital status						
Married	216	74.0	76	26		0.74(0.69-.79)
Divorced	8	100	0	0	**0.03**	1

4.4.2 Chi-square test for knowledge on immunisation correlated to parents/caregivers.

Regarding knowledge and awareness of parents or caregivers of children 12 to 23 months, there were 26 multiple choice and multiple response question options on the knowledge and awareness of immunisation. Each item had been categorized into two options, among the two, one was the correct answer, and the remaining was the wrong option. Each right answer received a '1' score, and the wrong answer was given a 'zero'. The maximum expected score was 26 for both knowledge and awareness of immunisation service activity and the minimum score '0'. Using the two variables included in the data collection tool (Knowledge and awareness), a composite variable was constructed to assess the overall knowledge and awareness level of the respondents who participated in this study. In line with the procedure used in similar studies, the knowledge and awareness of immunisation services score were arbitrarily interpreted for the mean value of all knowledge and awareness indicators of the respondents who scored mean and above the mean level for one of the questions (El Shazly *et al.*, 2016), were considered to have vaccination-relevant knowledge (good knowledge and awareness), while those who scored below the mean level were considered to have no vaccination-relevant knowledge and awareness (poor knowledge and awareness) (El Shazly *et al* 2016; Gentle 2019). Accordingly, almost half, 53.7% (95% CI: 48.02-59.30) of the respondents had good knowledge as per the finding of the present study (Figure 1).

As a result, less than half, 46.3% (95% CI: 40.6-51.9) of the respondents had below the average value of vaccine preventable diseases called poor knowledge, and 53.7%: (95%: CI: 48.02-59.30) had more than mean value of knowledge and awareness indicators called good knowledge, while nearly three fourth, 73.3% (95% CI: 68.3-78.3) was knowledgeable about the time of vaccination. This infers that most parents were not completely aware of the importance of specific vaccines but had the chance to know the time of immunisation (see Figure 4.19).

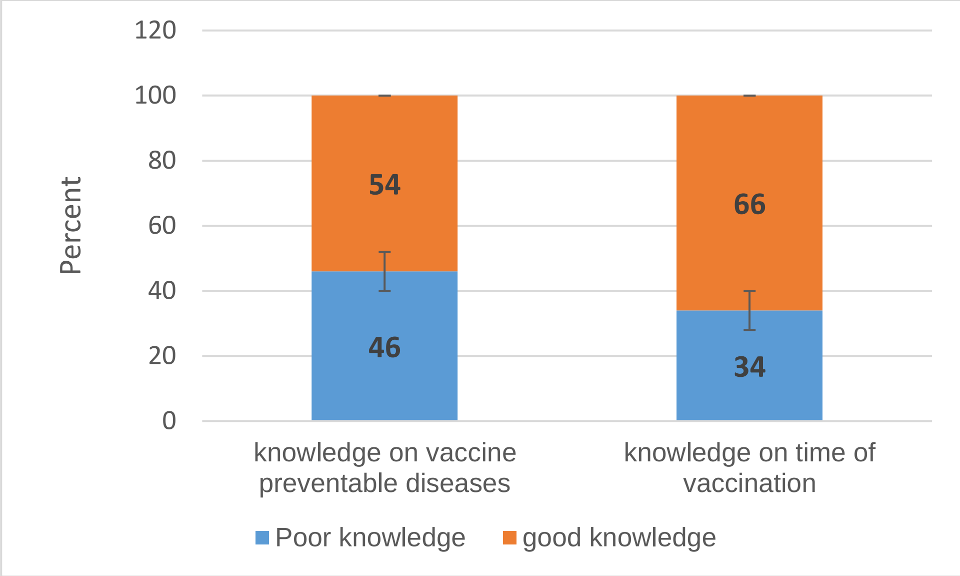

Figure 4. 19: Overall knowledge of respondents on vaccine preventable diseases and time of vaccination.

In several studies, most parents had a good or satisfactory understanding of immunisations. In India 75% of the parents had satisfactory knowledge, attitude and practice on vaccine preventable diseases (Sankar 2018:6) and the majority of Ghanaian parents or caregivers of children aged 12 to 23 months recognized the significance of vaccination activities (Dadzie 2019). In a similar study in Saudi Arabia on knowledge and attitudes of parents on childhood immunisation, 91.9% parents had good knowledge on vaccine preventable diseases (Alamri, Horaib & Alanazi 2020:7) and 73% of the parents in Chesnais parents had good knowledge about immunisations and associated facts (Kumar & Kavinprasad 2018:4847). Because most women had little or no understanding of the benefits of immunising their children, most of them did not complete the process. Studies also supported the theory that inadequate immunisation was due to a lack of information (Gentle 2019:48). There was a need to enhance parents' and parents' awareness of the need for immunisation, particularly considering the numerous health benefits.

The Chi-square test was used in a bivariate study to discover connections between sociodemographic and outcome variables (knowledge of vaccine-preventable illnesses). Vaccination refusal for the child showed a substantial correlation with awareness of vaccine-preventable illnesses among sociodemographic factors and others: parents or caregivers of immediate older children (x2:5; 2, p: 0.00), parents or caregivers who had resided in Denan Woreda s/district and were able to read or write (x2:0.6, p: 0.1) had an association with immunisation knowledge of vaccine-preventable diseases. However, parents or caregivers of residence, walking time on immunisation site, ANC follow up economic position compared to neighbours and several children were not the significantly associated factors with immunisation knowledge in bi-variant analysis (Table 4.13).

There was a relationship between postnatal parents’ demographic features and their awareness about childhood immunisation. The importance of the Malaysian study on postnatal parents' knowledge and attitudes about child immunisation disclosed the sociodemographic characteristics that impacted postnatal parents' comprehension of childhood immunisation (Balbir Singh, Badgujar, Yahaya, Abd Rahman, Sami, Badgujar, Govindan & Ansari 2019:2547). Age, education, and occupation (P 0.05) were shown to be significant determinants of postnatal parents' awareness about childhood vaccination (Debela *et al* 2022:100455). However, when it came to postpartum parents' vaccination knowledge, ethnicity and occupation had little bearing (Balbir Singh *et al* 2019:2546).

Table 4. 12: Knowledge of immunisation correlated to parents/caregivers’ demographic characteristics on Chi-square test (N=300).

Background characteristics	**poor knowledge**		**good knowledge**			**Chi-square**	
	#	**%**	**#**	**%**	**n**	**Value**	**P-value**
Woreda /District							
Adadle	26	38	43	62.3	69		
Beercano	38	76	12	24	50	1.3	0.4
Denan*	28	52	26	48	54	0.2	**0.001**
Gode City	16	28	41	72	57	0.7	0.4
Gode Woreda	31	44.3	39	56	70	2	0.06
Residence							
Rural	72	50	73	50	145	0.7	0.2
Urban	67	43	88	57	155		
Walking time on the immunisation							
up to 30 minutes	125	48	137	52	262	1.56	0.2
>30 mint	14	37	24	63	38		
Resident							
Mobile resident	136	46	159	54	295	0.08	0.2
Permanent resident	3	60	2	40	5		

ANC follow up							
Yes	81	43	108	57	189	0.13	1.4
No	58	52	53	48	111		
Economic position compared to neighbours							
Low	23	51	22	49	45		0.3
Moderate	113	46	133	54	246	0.5	0.3
High	3	33	6	66	9	0.6	0.4
Number of other children							
<4	74	45	92	55	166	1.1	0.4
>5	65	49	69	51	134		
Able to read or write							
Yes	109	49	114	51	223	0.6	0.1
No	30	39	47	61	77		
Immediate older child fully vaccinated *							
Yes	106	41	152	59	258	5.2	**0.00**
No	33	78	9	21	42		
Refused vaccination for this child *							
Yes	56	63.6	33	36.4	89	0.36	**0.00**
No	82	38.9	129	61.1	211		
Satisfaction with vaccination services							
Yes	102	52.6	92	47.4	194	0.7	0.5
No	57	54	49	46	106		

*Variables with a substantial correlation to the outcome variable

4.4.3 Chi-square test for parents/caregivers' barriers and enabling factors on Immunisation

Among variables under this category, antenatal care attendance for the last pregnancy (x2:12, p: 0.00) and modern economic position, compared to neighbours (x2:7.4, p: 0.02), had a significant association on the immunisation uptake (Table 4.14). The level of satisfaction with vaccination service among partners/caregivers was not shown to be substantially linked with valid immunisation coverage, walking distance to the vaccination site, shorter waiting time at the vaccination site, availability of all antigens, clean vaccination site and immediate older child fully vaccinated.

4.4.3.1 Antenatal care attendance

More than half, 189 (63%) of parents of children aged 12 to 23 months had attended more than one antenatal care visit during pregnancy, while 111 (37%) of parents/caregivers of children aged 12 to 23 months had not attended antenatal care visit during pregnancy. In this study, among 189 (63%) parents of children aged 12 to 23 months had visited more than one antenatal care service during pregnancy, where 71 (68%) parents had fully vaccinated children than 111 (37%) parents never had ANC visits during pregnancy as shown in the Figure 4.20.

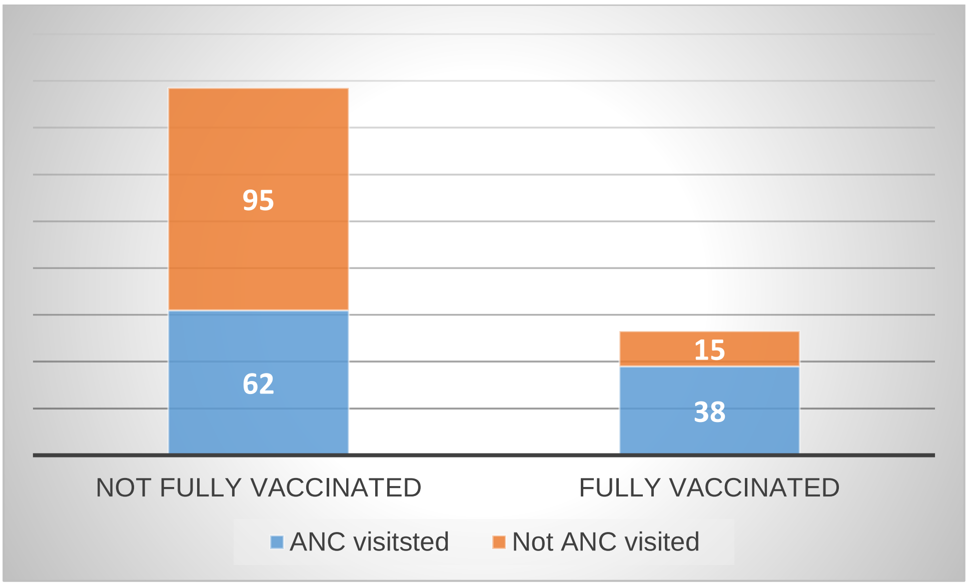

Figure 4. 20: Percentage distribution of ANC attendance with fully immunized children (N=300).

In Assosa Town, Western Ethiopia, 78% parents attended their ANC visit during their pregnancy (Jimma *et al.*, 2021). According to a UNICEF research, ANC attendants can assist women prepare for birth and spot risk indicators during pregnancy and labour (UNNICEF, 2016). Micronutrient supplements, hypertension medication to prevent eclampsia, and tetanus vaccine were also available to women. Women who appeared late in pregnancy missed out on the opportunity to get vaccinated in time, providing the best protection for themselves and their new-borns (Krishnaswamy, Lambach & Giles 2019: 946). In this study, parents who received prenatal care (ANC) were six times more likely to have completely immunized children than those who did not receive ANC (x^2:0.08, p: 0.00) (Girmay & Dadi 2019:5).

According to research conducted in Wag-Himra Zone, Amhara Regional State, and Northern Ethiopia, parents who had three or more ANC visits were 2.75 times more likely to have totally immunised infants than those who had never had ANC visits (Girmay & Dadi 2019:5). In Afghanistan, similar studies found that those who attended ANC at least four times had a 3.2 times higher relative risk of being fully vaccinated and 2 times higher relative risk of being partially vaccinated than those who did not (Aalemi, Shahpar & Mubarak 2020:6). In a research conducted in Nigeria, it was discovered that maternal attendance at prenatal care (ANC) conferred a considerably higher likelihood of the child being vaccinated than infants whose parents did not attend ANC (Obanewa 2019:127). Children whose parents went to a prenatal clinic and gave birth in a health institution had a lower likelihood of not being properly vaccinated (Adedokun et al 2017:5). Women who had three or more ANC visits were 2.75 times more likely to have completely vaccinated infants than parents who had never had ANC visits, according to a study done in Wag-Himra Zone, Amhara Regional State, and Northern Ethiopia (Girmay & Dadi 2019).

4.4.3.2 Economic position

Parents/caregivers' economic position was one of the factors on childhood immunisation status. In this study, from the majority of the fully and not fully vaccinated children, 64 (26%) were in a moderate economic position compared to neighbours. Modern economic position compared to neighbours, had a significant association on the immunisation uptake compared to neighbours (x^2:7.4, p: 0.02). The poor home economic position was shown to account for around 38% of total socio-economic disparities in child vaccination. Parents' illiteracy was a crucial factor, accounting for about 34% of the difference in vaccination rates (Lauridsen and Pradhan, 2017). Studies conducted on socio-economic inequality in India showed that poor household economic position was found to account for around 38% of total discrepancies in child immunisation, due to socio-economic factors. These were the higher economic inequalities effects on immunisation coverage.

4.4.3.3 Immediate older child and vaccination statues

The number of immediate older children in each of the selected households' fully vaccination status had no significant associations in the study of children aged 12 to 23 months (AOR: 0.9, 95 CI: 0.46-1.76). In other similar studies in Bangladesh, a large number of children had a significant factor for full immunisation, as a small or medium number of children were often fully immunized more than their counterparts (AOR=1.56; 95% CI 1.32 to 1.86, p<0.001) (Sarker, 2019). The firstborn child was somewhat more likely than the others to get vaccinated 87.7% for the child's second birth order and 81.6% for the child's third or higher birth order (Sarker, 2019). According to a study conducted in India, the first child had a lower likelihood of receiving complete immunisation than the second and third. A better understanding of the benefits of immunisation and the availability of polyvalent vaccinations, which treat two or more illnesses, were to blame (Mugada *et al* 2017:160).

4.4.3.4 Parents/caregivers' satisfaction level with vaccination service

The parents'/caregivers' satisfaction level with vaccination service had no significant associations with children aged 12 to 23 months being fully or not fully vaccinated. This finding was consistent with one of Nigeria research on parents' satisfaction with childhood immunisation services (Uwaibi & Omozuwa 2021:89).

Table 4. 13: Parents/caregivers' responses on barriers and enabling factors on childhood immunisation uptake (N=300).

Variables	Not fully vaccinated		Fully vaccinated.			
	#	%	#	%	Value	**Sig (2-sided)**
ANC follow up						
Yes	118	59	81	41		
No	96	95	5	5	11.7	0.00
Partners/ caregivers satisfaction level on vaccination service						
Yes	122	63.2	71	37		
No	107	100	0	0	94	0.9
Refusal of vaccination for this child						
Yes	72	81	17	19		
No	151	72	60	28.4	0.6	0.1
Any suggestions more likely to get immunisation						
Friendly vaccinator	107	75.4	35	25	1	
Vaccination site with reasonable walking distance	7	100	0	00	32	
Shorter waiting time at the vaccination site	30	68.2	14	32	67	0.9
Clean vaccination site	36	80	9	20	48	
Free or inexpensive services	1	100	0	00	1	
Availability of all antigens	43	70.5	18	29.5	52	
Immediate older child fully vaccinated						
Yes	194	75	64	25		
No	29	69	13	31		0.39
Economic position compared to neighbours						
Low	37	8.2	8	17.8	1	0.07
Moderate *	182	70	64	26	0.2	0.02
High	4	44.4	5	55.6	0.3	0.06

4.4.4 Chi-square test for the reasons for not receiving and defaulting vaccination

The reasons of parents/caregivers of respondents for defaulting from the vaccination service or not fully immunising children in the pastoralist areas categories which showed a relationship were fear of side reactions/effect on vaccination (x2:1.5, p: 0.04) and oblivious to the need to return for a second vaccine dosage (x2:1.3, p: 0.03). These reasons had a higher level of association compared to other reasons for not receiving vaccination given by parents/caregivers (Table 4.14). In addition, factor analysis was conducted on these indicators.

Table 4. 14: Reasons given by parents/caregivers for not receiving and defaulting vaccination Chi-square test (N=219)

Reasons for not receiving any vaccine	Not vaccinated		Partially Vaccinated			
	#	%	#	%	Value	Sig (2-sided)
The need to return for a second vaccine dosage*						
Yes	72	[97]	2	3	1.3	**0.03**
No	97	[98]	2	2		
Unaware of the need for immunisation						
Yes	66	[97]	2	3	0.9	0.9
No	64	[97]	2	3		
Unaware of place and/or time of immunisation						
Yes	29	97	1	7	1.4	0.7
No	128	98	3	2		
Fear of side reactions/effects *						
Yes	61	[100]	0	0	**1.5**	**0.04**
No	74	[95]	4	5	32	
Wrong ideas about contra-indications						
Yes	7	100	9	23	0.9	0.6
No	`159	[97]	4	3		
Postponed until another time						
Yes	31	100	0	0	0.9	0.3
No	126	98	3	2		
Wrong rumours						
Yes	87	99	2	2	1.3	0.7
No	70	97	2	3		
Place of immunisation too far						
Yes	56	100	0	0	0.9	0.1
No	101	96	4	4		
Inconvenient time for immunisation						
Yes	27	100	0	0	1.3	0.8
No	105	97	3	3		
Absent of vaccinators						
Yes	53	100	0	0	0.9	0.1
No	63	95.5	3	4.5		
Parents too busy						
Yes	18	100	0	0	2.7	0.4
No	98	98	2	2		
Family problems, including illness of the parents						
Yes	4	100	0	0	0.9	0.7
No	111	97.4	3	3		
Long Waiting time during vaccination						
Yes	95	100	0	0	0.5	0.6
No	62	97	2	3		

*****Variables, which showed a significant relationship with the outcome variable

4.4.5 Bivariate and multivariate binary logistic regression analysis

The factors that had a quantitatively important connection in bivariate calculated relapse were shown in multivariate double calculated relapse. From the data collected in this study, 10 variables were considered as potential predictors of the dependent variable: receiving all basic vaccinations. Nevertheless, two variables (religion and mobile residence) were excluded from the inferential analysis, given the fact that almost all (99.7%) and (98.3%) of the respondents had reported Muslim religion and mobile resident respectively. As a result, the remaining 8 variables were used in a basic binary logistic regression to select candidate variables for the multiple binary logistic regressions. Eight (8) variables, namely age, residence, read and write, walking time to immunisation location, socioeconomic status, ANC follow-up, satisfaction with vaccination service, and some children should not be vaccinated/may be harmed by the vaccine, were found as potential options for multiple binary logistic regression with a p-value ≤ 0.2. Explanatory variables with a p-value < 0.2 during the crude analysis were included in the multivariable model. In the multivariable analysis, adjusted odds ratios (AORs) and 95% CI were estimated, and a p-value < 0.05 was used to declare the level of statistical significance.

The results in the multiple binary logistic regression model revealed that four variables (parents/ caregivers with age 25-29, parents, able to read and write, walking time to immunisation site and caregivers who have ANC follow up for the last pregnancy) were found to be statistically significantly associated with receiving all basic childhood vaccinations (p-value < 0.05). Hence, those respondents with age 25-29 were 2.67 times more likely to have a fully vaccinated child as compared with parents/caregivers with ages more than 35 years (AOR: 2.67 95% CI: 1.21 - 5.89).

Parents or caregivers who were able to read and write were 2.5 times more likely to have a fully vaccinated child as compared with parents/caregivers who were unable to read and write (AOR: 4.32, 95% CI: 3.66-9.63). Parents/caregivers who lived closer to the immunisation site and had a walking time less than 30 minutes to reach the nearby vaccination site had 2.5 times more vaccinated children than their counterparts, who took more than 30 minutes walking time to reach the nearby vaccination site AOR = 2.55 with 95% CI (2.23, 5.32). Based on the finding of this study, parents/ caregivers who had ANC follow up for the last pregnancy were 5.94 times more likely to have a fully vaccinated child as compared with parents/ caregivers who did not have ANC follow up (AOR: 5.94 95% CI:2.77-12.74).

Table 4. 15: The Multi-variable logistic regression; determinants of vaccination utilization

Variables	**Categories**	**P-Value**	**COR**	**95% CI for EXP(B)**		**P-Value**	**AOR**	**95% CI for EXP(B)**	
				Lower	Above			Lower	Above
Age*	15-24	.87	1.065	.497	2.281	0.259	1.71	0.67	4.36
	25-29	0.02	2.125	1.114	4.054	0.015*	2.67	1.21	5.88
	30-34	0.92	1.035	.521	2.057	0.666	1.20	0.52	2.78
	>=35	1	1			1	1		
Residence	Rural	0.13	.697	.433	1.121	0.159	1.57	0.83	2.96
	Urban	1	1			1	1		
Able to read and write**	Yes	0.001	5.592	3.938	9.703	0.01	4.32	3.66	9.63
	No		1				1		
Walking time to immunisation site*	< 30 mints	0.01	3.514	3.759	8.021	0.021	2.55	2.23	5.32
	>=30 mints	1	1			1	1		
Socio economic status	Low	0.05	.229	.051	1.01	0.471	0.51	0.08	3.10
	Moderate	0.292	.486	.127	1.85	0.86	0.87	0.18	4.17
	High	1	1						
ANC**	Yes	0.00	6.085	3.234	11.448	0.00**	5.941	2.77	12.743
	No	1	1						
Satisfaction with Vaccination Service	Yes	0.00	7.527	1.666	34.013	0.39	2.08	0.38	11.238
	No	1	1			1	1		
Some children should not be vaccinated/ might be hurt by vaccine	Yes	.014	.527	.317	.877	.242	.677	.352	1.301
	No	1	1			1	1		

****p-value ≤ 0.01   *p-value < 0.05**

4.4.6 Factor and Principal Component Analysis

Principal Component Analysis (PCA) is a measurement tool that may be used to reduce several different factors to a limited handful that still includes the majority of the contained in the original large set. PCA is a mathematical process that turns a collection of (possibly) linked items into a collection of (smaller) uncorrelated elements known as principal components (Factor analysis 2014; Jolliffe & Cadima 2016:1-12).

4.4.6.1 Factor Analysis of Parents/Caregivers' Reasons for Not Receiving any Vaccine Indicators

Correlation matrix and first solution descriptive statistics include the KMO and the Bartlett's Test of Sphericity. Method of Extraction Analyse the principal components to show the un-rotated factor solution (Alemu 2021).

4.4.6.1.1 Kaiser-Meyer-Olkin (KMO) test

Kaiser-Meyer-Olkin (KMO) is a measure of sample adequacy in the Confirmatory Factor Analysis (CFA) correlation matrix that examines how strongly one item is related to other items. KMO is advised when the cases-to-variable ratio is less than 1:5. A KMO correlation of 0.60 - 0.70, on the other hand, is considered adequate for understanding the EFA output, and it varies from zero to 1 (Taherdoost, Sahibuddin & Jalaliyoon 2014:379). The KMO test-sampling adequacy is 0.43, which is greater than the permitted range of 0.5 and allows the PCA and factor analysis for the perception indicators to be performed.

4.4.6.1.2 Total variance explained

The Eigenvalues measure how much each element contributes to the overall sample difference. The eigenvalue ratio is the proportion of the factors' explanatory power with respect to the variables (Taherdoost, Sahibuddin & Jalaliyoon 2014:379). If a component had a low eigenvalue, it would not contribute much to the explanation of variations in the variables and may be overlooked in favour of more relevant factors. Factors with Eigenvalues larger than one would be identified for future auditing (Ledesma, Valero-Mora & Macbeth, 2015:4; Principal Components Analysis 2014).

In both Extractions, five components were derived from 14 parents/caregivers' reasons for not receiving any vaccine indicators, as shown in Table 4.16. Among all the remaining components, the five with an eigenvalue larger than one provided the most variability. These variables' introductory Eigenvalues were more than 1, which was the least cut-off point. Also, the extricated component clarified 61% of the variety. In Social Science, the information ought to be able to extricate at slightest 60% of the variety, even though, it might go up to 55% in certain cases, and less than 50% would be less pertinent information (Taherdoost, Sahibuddin & Jalaliyoon 2014:381) (Table 4.16).

Table 4. 16: Total variances explained for parents/caregivers' reasons for not receiving and failure vaccination indicators

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.476	24.828	24.828	3.476	24.828	24.828	2.701	19.296	19.296
2	2.842	20.296	45.124	2.842	20.296	45.124	2.637	18.837	38.134
3	2.085	14.892	60.016	2.085	14.892	60.016	2.429	17.349	55.482
4	1.749	12.494	72.510	1.749	12.494	72.510	2.144	15.317	70.799
5	1.581	11.294	83.803	1.581	11.294	83.803	1.821	13.004	83.803
6	.829	5.918	89.721	-	-	-	-	-	-
7	.433	3.095	92.816	-	-	-	-	-	-
8	.363	2.595	95.411	-	-	-	-	-	-
9	.301	2.147	97.558	-	-	-	-	-	-
10	.167	1.194	98.751	-	-	-	-	-	-
11	.092	.659	99.411	-	-	-	-	-	-
12	.051	.363	99.773	-	-	-	-	-	-
13	.023	.164	99.937	-	-	-	-	-	-
14	.009	.063	100.000	-	-	-	-	-	-
Extraction Method: Principal Component Analysis.									

4.4.6.1.3 Scree plot

A Scree plot is the number of criteria to keep, and the outcomes might vary. Although when the sample size is big, the N: P ratios are (>3:1), and the commonalities values are high, this disagreement and subjectivity were decreased. Even though the Eigenvalue identified five components, the Scree plot identified just four. It is a different way of explaining total variation (Figure 4.21).

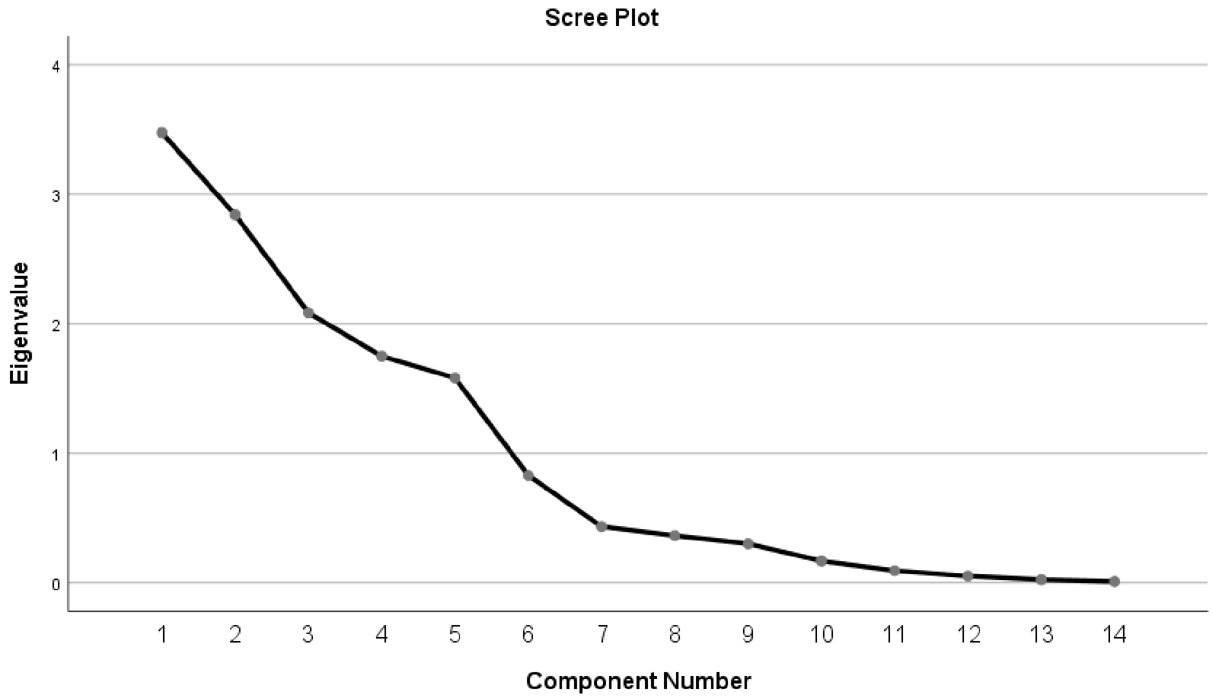

Figure 4. 21: Scree plot representation for parents/caregivers' reasons for not receiving and failure vaccination indicators.

Three components were stacked as component one, and the combination of these three factors created a compute or build known as requirement of data for unawares of the necessity for vaccination, the requirement to return for a repeat dosage, and the location and/or time of immunisation.

Five variables were loaded as part of component two, lack of motivation and unknown, as there was a factor of parents/caregivers' reasons for not receiving any vaccine. Fear of side effects, incorrect assumptions about contraindications, postponement till another time, lack of confidence in vaccination, and misinformation are all components.

Seven variables were loaded as component three and termed a construct means of obstacles of parents/caregivers' reasons for not receiving any vaccine. The location of immunisation was too far away, the time of immunisation was inconvenient, the vaccinators were missing, the vaccine was not available, the parents were too busy, there was a family problem, including the parents' illness, and there was a long waiting period for immunisation. Generally, from these parents/caregivers, the reasons for not receiving any vaccine were identified (Table 4.17).

Table 4. 17: Varimax rotation of a rotational component matrix for parents/caregivers not receiving and failing immunisation indicators

Rotated Component Matrix[a]					
	Component				
Variables	1	2	3	4	5
Unaware of the need for immunisation	.941	.050	.170	.042	.075
Unaware of need to return for subsequent dose	.080	.679	-.075	.650	.018
Place and/or time of immunisation	.067	-.003	.786	-.135	-.173
Fear of side reactions	.423	-.406	.549	-.177	.281
Wrong ideas about contra-indications	.066	.225	.835	.167	.098
Postponed until another time	.562	-.334	-.042	.557	.383
Rumours	.803	.138	.150	.285	-.051
Place of immunisation too far	-.129	-.069	.203	.023	.914
Time of immunisation inconvenient	-.270	.895	.170	.130	.146
Vaccinators absent	.168	-.009	.083	.956	-.164
Vaccine not available	-.577	.348	.318	.491	.289
Parents too busy	.320	.844	.183	-.171	-.019
Family problems, including illness of the parents	.044	.099	.722	.123	.174
Long Waiting time	.327	.423	-.141	-.186	.741
Principal Component Analysis is the extraction method.					
Varimax rotation with Kaiser normalization.					

4.4.5 Conclusion

The quantitative data from this study were analysed by using univariate, cross-tabulation, bivariate, and multivariate parallel computed relapse, and calculated auditing and the findings were given and discussed in depth considering the relevant literature. According to the null hypotheses indicated in Chapter 1 of this study, parents'/caregivers' knowledge and awareness of immunisation had no link with the uptake of all basic vaccinations. Parents'/caregivers' knowledge and awareness of immunisation hypotheses were rejected, and immunisation improvement guidelines were developed/updated in the specific local context. The hypothesis was accepted.

4.5 QUALITATIVE FINDINGS AND DISCUSSIONS

The objective of the qualitative research paradigm was to explore the health professionals' perceptions of vaccination programs in Pastoralist Communities, as well as the problems they faced during the implementation of the immunisation program. A total of twelve (12) participants were interviewed for their perceptions of the performance of the vaccination programs in their area and to identify some of the challenges the health system had been facing in the delivery of the vaccination programs, which were used for the generation of programmatic recommendation to enhance children vaccination uptake in the area. A semi-structured interview guide prepared in Amharic language (local language) was used to facilitate the data collection from each of the selected respondents. Each participant's interview lasted/took an estimated 40-50 minutes. After obtaining the consent of each of the participants, each interview was recorded using a digital audio recorder and field notes were carefully taken during the process. The audio files were transcribed verbatim and translated from the local language into English. Following the transcription and translation of the recorded data, the transcripts were uploaded into ATLAS ti 8 software for the final coding and analysis. Finally, the data from the transcripts were coded, recoded, grouped, and regrouped (Megerso *et al.*, 2021). Following that, thematic analysis was utilised to guide the analysis process, and the study's findings were based on the final themes established during the process.

4.5.1 Demographic Characteristics of Participants

The researcher collected and evaluated in-depth interviews with 12 health workers from eight different health institutions with one zone, one hospital and two district health offices immunisation experts participated. One immunisation focal person was taken in each study area Woreda or District, Hospitals, and Health Centre. The two Districts were chosen based on their proximity to the Shebele Zone town. Shebele Town is the closest District, and Beercano District is the furthest. Following the quantitative results, a semi-structured interview guide was created. The experts in all disciplines were permanent government employees, and most of the vaccination focal individuals in the health facility were nurses, while in the District Health Offices and Zonal level, were health officers and public health specialists, respectively as indicated in Table 4:20.

Table 4. 18: Socio-demographic variables for the qualitative participants

Participant code	Socio-demographic characteristics					
	Gender	Age	Education	Profession	Current position	Experience in years
P1	M	28	BSc Degree	Nurse	Health facility Head	4
P2	M	24	Diploma	Nurse	Immunisation focal person	3
P3	M	27	Diploma	Nurse	Immunisation focal person	4
P4	M	30	Master of Public Health	Public Health Expert	Immunisation focal person	11
P5	M	31	Master of Public Health	Public Health Expert	MNCH focal	8
P6	M	28	BSc Degree	HO	Health facility Head	3.6
P7	M	27	BSc Degree	HO	Immunisation focal person	4
P8	M	26	BSc Degree	HO	Health facility Head	5
P9	F	27	Diploma	Nurse	Immunisation focal person	5
P10	M	28	BSc Degree	Nurse	Immunisation focal person	7
P11	M	30	BSc Degree	Nurse	Immunisation focal person	4
P12	F	24	BSc Degree	HO	Immunisation focal person	5

4.5.2 Organization of the Themes and Sub-themes

The data analysis revealed four primary themes with associated sub-themes. Each primary theme and its associated sub-themes were reinforced by appropriate verbatim statements from the participants. To disguise their identities, the participants were represented by codes. Table 4.19 depicts the themes and their corresponding categories.

Table 4. 19: Themes and Categories

Theme	Categories

1 Immunisation System Monitoring Condition	• Awareness and challenges with the immunisation system
	  o Shortage of Staff
	  o Lack of proper documentation on multiple antigens
	• Availability and quality of RED/C Micro-plan
	  o Monitoring the RED Micro-plan
	• Possible suggestions of health providers for improving quality Micro-planning
	• Vaccine monitoring supply and management

2 Low immunisation coverage	• Barriers and Challenge related to childhood immunisation
	  o Demand side challenges:
	  o Supply side challenges
	  o Distance from the vaccination site
	  o Cultural barriers
	  o *Shortage of logistic services*
	  o Other Demand side barriers
	• Suggestions of health providers to improve immunisation uptake
	• Possible reasons and health provider suggestions to reduce high dropout rate.

3 Low knowledge of parents/caregivers on VPDs except for polio and Measles	• Possible reason for low knowledge of other VPD • Possible suggestions for improving the knowledge of other VPD
4 Low community involvement in vaccination service	• Challenges to community engagement • Heath providers' suggestions on community engagement • Contribution of community involvement in the EPI Program

4.5.3 Theme 1: The condition of the immunisation system

- **Awareness of HCPs on immunisation system**

Immunisation focals who were health workers were interviewed on how immunisation system works and its challenges. With regards to the immunisation system, many of the respondents who managed the vaccines expressed that there was not much burden following the immunisation that came with the job. The immunisation system was a daily service from Monday through Friday, but when it came to Measles and Polio vaccinations, it was only by appointment and sometimes on special days.

''Health workers plan their schedules to ensure that vaccination services were provided at all levels of the health system.'' (P3)

According to qualitative research done in Ethiopia's Benishangul-Gumuz area, immunisations were delivered twice weekly at health facilities and once weekly at health posts, with BCG and Measles vaccinations administered once a month (Teshome, Kidane, Asress, Alemu, Bethlehem & Bisrat 2020:3). A research study conducted in India found that parents could get their children vaccinated on Sundays or even on holidays, however, vaccination days were typically Mondays through Fridays. Polio was an exception since most campaigns were held on Sundays or holidays (Singh *et al* 2019). These study findings represented a high chance for parents or caregivers to get vaccinated for their children, however, current study findings limited the time of vaccination and influenced the probability of unvaccinated children.

- **Challenges with the immunisation system**

Shortage of Staff

Despite the rapid expansion of immunisation program in its scope and type of antigens, the current human resources for health structure and staffing in the zone is grossly inadequate and not uniform among Woreda s. One of the numerous issues in the EPI program was the high attrition rate and personnel turnover in the immunisation system. HCPs mention that whether there was a burden with other jobs or a shortage of staff, they would consider it an urgent activity and pay careful attention to it. If they are burdened with the work there have been committees organized to solve the problem, similarly, to reduce the workload and additional health workers were requested to assist them from Monday to Friday. One of the 27-year health officer professional narrated:

> *“Mondays are more stressful for them since they are so busy, so more personnel are needed to address stressful work.”* (P7)

According to Ugandan research, several community leaders and village health team members saw insufficient health worker staffing and vaccine stockouts as key challenges to vaccination program delivery (Malande *et al.*, 2019).

Lack of proper documentation on multiple antigens

Immunisation data is recorded using standardised formats both at the health facility and health post level. The immunisation register is used as a parent document at health centres and hospitals to record child immunisation data. The monthly reporting format is used to report vaccination data along with other health services at the end of each month. A 27-year-old nurse professional said:

> *‘’…when different children may have multiple vaccine antigens and it required registering them multiple times, which can lead to improper registration of documents since they are stressful…’’ (P3).*

The finding of this current study is in line with other similar studies that were conducted in the Eastern part of Oromia Region of Ethiopia. Workload, not registering and/or tallying, illegible data, no or poor supportive supervision and feedback, lack of commitment, lack of tools (e.g. tally sheet, registration book and reporting format), and missing reports (losing reports) were the main challenges and barriers identified for poor levels of immunisation data quality (Kebede, Adeba and Chego 2020:8).

- **Availability and quality of immunisation RED/C Micro-plan**

Every district, health centre, and health post within the PHCU should have an up-to-date catchment area map that reflects the current location and relative size of the population groups in its catchment areas on display. Specific facilities are in charge of specific catchment areas and the people that live there (WHO, 2016a). Most of the respondents reflected on the availability and concept of reaching every direct/community Micro-plan, though it may not be consistent and not achieve the goal it needs. The reasons could come from misunderstanding the reaching every district Micro-plan at a community level in the immunisation program or the lack of knowledge.

Monitoring with RED Micro-plan

RED Micro-plan implementation has contributed to improving planning, access, utilisation, and coverage of RI. However, during the implementation, it was realised that the practical application of all the RED components was sub-optimal to achieve the intended results. An integrated planning process aids in the coordination of techniques to maximise resources and identifies potential issues that may come from integrated service delivery (WHO UNICEF & JSI CDC, 2017:25).

"One of the interviewed participants said checking registration tools, EPI cards, and EPI charts were regarded as good methods of monitoring the quality of RED Micro-plans and identifying whether there was a problem between accessibility and utilisation of service was critical." (P3)

Possible suggestions of healthcare providers for improving quality Micro-planning

- **Involving stakeholders in the revision process**

Healthcare providers were asked about stakeholders in their context involved in the development of the Micro-planning process. To maximise the effect of reaching every district Micro-plan at the pastoralist community, MoH with partners support the adapted simplified version of the RED guide for application at the PHCU level in the local context. Some of the responses include making accurate registration and the time of RED Micro-plans by the end of the year or starting the New Year. A 26-year-old health officer professional said:

> *‘’The Micro-plan is revised, and staff members can revise desk review through the invitation of all primary healthcare units. Going inside of the community and knowing whether their children are vaccinated or not, posting Micro-plans on the wall of health facilities, and evaluating the health workers' activity on EPI.’’ (P8).*

A 31-year-old public health care expert professional said:

> *‘’Micro-plan has been revised because it can be a change of target population as in some parts of a community in and out of population will go on other places for additional population and they will come locally, so calling or inviting members like health workers, partner and community were a part of Micro-planning development process.” (P5)*

The participation of community and village chiefs, community health volunteers, teachers, and religious instructors in the development of Micro-planning helps to foster a sense of shared responsibility for immunising children, know the number of village children, and enable open communication between health workers and community members (Clarimundo 2013:3).

- ***Training for the Healthcare Workers on How to Develop High-Quality Micro-plan***

District and health facility staff need to continuously generate and collect liable information that describes the quality and effectiveness of their health services Micro-planning to make informed decisions on the direction of routine immunisation programs. In responding to a question on how the quality of Macro-planning at the health facility level can be improved, a 30-year-old nurse professional said:

“Quality of the posted Micro-plan in various health facilities is poor… therefore, training on how to develop high-quality Micro-plans is required, particularly in the pastoralist communities in the local context’’ (P11).

Discussions for the method of preparing and evaluating bottom-up Micro-planning improvement are held two times a year to help with the identification of bottleneck problems in the planning and implementation of EPI programs in pastoralist communities. Another 31-year-old public health expert professional said:

“At the hospital, the level does not have any information regarding RED/C Micro-plan because they were not invited to participate in any training or meeting regarding yearly Micro-plan, but the plan was discussed at the hospital level only.’’ P5.

The finding of this current study is in line with other similar studies that were conducted in Uganda on which macro-mapping is the district's first engagement in RI planning. It is a constant process of locating and allocating communities to HFs to provide high-quality health care. For REC Micro-planning, a thorough understanding of HF catchment regions and populations is required (Winchester 2016:3).

- **Vaccine Monitoring Supply and Management**

The quantitative portion of this study's findings demonstrated that most of the health facility document review vaccinations were not received and issued and were not recorded in a vaccine ledger book. Follow-up questions were asked to clarify the aspect. According to the study, the majority of HWs usually forget to record because of an excessive amount of work. If what had been done is not recorded in the record book, then many errors would occur. If health workers fail to peruse the record/ledger books, there is a likelihood that they could forget to register, leading them not to follow up on vaccines received and to issue based on the ledger book. A 24-year-old public health officer professional said:

> *“Whine you see in most of the pastoralist health facility high vaccine wastage rate was observed this is due to lack of supply on vaccine ledger book and health workers recording problems.’’ (P12)*

Most of the respondents said that health workers’ negligence and lack of supportive supervision from the government office were contributory to this factor. A 27-year-old nurse professional said:

> *‘’Knowledge gap of how to use vaccine ledger books recording and implementing vaccine forecasts at a lower level of HF’s beneficial on these facilities.’’ (P9)*

In addition, a 30-year-old nurse professional said the following statement related to record keeping:

> *‘’The issues with the ledger books are the fact that it is too large and difficult to keep records also the knowledge behind the record-keeping is not provided to the workers' satisfaction and motivation regarding their immunisation responsibilities.’’ (P11).*

According to research done in Ethiopia's Oromia region, most of the public health facilities (85.4%) visited throughout the survey had documented all immunisation, logistical, and diluent information. Even though 37 out of 41 (90.2 %) public health institutions had a stock registry in place, only 19 (46.3%) had current vaccination data (Feyisa 2021:364). This finding was higher in vaccine supply and management documentation than in our current study. The possible reason for this discrepancy could be that the present study emphasised the use of vaccines rather than the appropriate documentation of vaccine supply. The other reason could be the high temperatures in pastoralist areas and that some health workers have a low/short concentration span to work on each of the activities.

4.5.4 Theme 2: Low Immunisation Coverage

In the quantitative part of this study, most of the community respondents mentioned that they heard of immunisation. However, there was low routine immunisation coverage, with implications of myriads of challenges.

Barriers and Challenges Related to Childhood Immunisation

Based on the context of the country, various issues had been identified as barriers to access and utilize immunisation services in the pastoralist community. In this study, the barriers related to low immunisation, are presented as follows:

Demand Side Challenges

Vaccines and general immunisation services were misunderstood by communities' and sometimes the community disregarded the effectiveness of all childhood vaccines. In this relation, a 28 year old nurse professional stated:

> "S*ome families fear that vaccines can cause fever and diarrhoea, and because of that they would not want their child to have any form of vaccinations.'' P10*

Some of the participants agreed that the pastoralist communities also thought that since the child was healthy, he or she would not need any vaccination. A study done in India's slum communities found that participants were concerned about the fever and discomfort which extended for one week and lack of support, which led to a refusal to vaccinate the child again (Singh *et al* 2019:5). This indicated that health care workers or vaccinators needed to be informed about the vaccine's side effects before vaccinating children.

Most of the respondents in this research study stated that the movement of pastoralist communities from place to place could cause low coverage of immunisations and a high dropout rate. For example, a child could take PENTA 1 and be required to take PENTA 2&3 for the fully vaccination but they are not able to take the second dose. Participants mentioned several reasons for low immunisation coverage. A 28 year old health officer professional said:

“The parents were responsible for the majority of household activities, including childhood vaccinations, but 'this imbalanced gender role can affect childhood vaccination uptake.’’P4

In addition, a 24-year-old health officer professional said:

“Some vaccinators vaccinated children but did not record them, which is one of the reasons for low immunisation coverage.’’ P12

Lack of information, knowledge, motivation, limited male partners' support, low perception about the importance of vaccines, lack of trust in vaccines and forgetfulness are some of the motioned barriers to childhood immunisation in the pastoralist community. Besides language and ethnic related barriers, being a single parents, feeling ashamed of poverty-associated reasons, fear of mistreatment from service provider, fear of side effect, computing priorities and inadequate interpersonal communication and counselling of parents and caregivers were also documented as barriers (Bangura et al 2020:12).

Supply Side Challenges

Most of the participants agreed that lack of health facilities low community awareness, low health education, low partner support, low government budget, and low technical capacity of health workers were the major causes for low immunisation coverage. In this relation, a 28 year old nurse professional stated:

‘’…low immunisation coverage could be attributed to issues with electricity and solar refrigerator installation, as well as the infrequent operation of cold-chain systems are common supply challenges in the pastoralist areas”.P10

Similar qualitative research in Nigeria discovered that factors such as information and awareness of the importance of immunisation, convictions, and states of mind toward immunisation, past experiences with immunisation, and well-being administrations variables influenced caregivers' and family decision-makers beliefs and individual encounters (Akwataghibe *et al* 2019:8).

Another qualitative study in Ethiopia found that the most universally shared variables among participants were unreachable healthcare facilities, a lack of immunisation service, poor motivation, an unfavorable attitude and incompetence, terrible treatment of health workers (HWs), a lack of resources/logistics, insufficient information on vaccination day, and a long wait time (Tadesse, Getachew, Assefa, Ababu, Simireta, Birhanu & Hailemichael 2017:3).

Distance from the vaccination site

On the quantitative part of this study, parents/caregivers of children who lived more than 30 minutes walking distance from the vaccination site were less likely to obtain complete immunisation than those who lived less than 30 minutes from the vaccination location. Most of the participants indicated that distance and difficult topography to vaccination service delivery points, as well as a lack of transportation, were key barriers on low vaccination coverage. A 27-year-old nurse professional said:

> *"Immunisation related barriers are caused by the distance from vaccination sites and the fact that pastoralist sites are usually in remote areas with no access to vaccines services." (P3)*

Another qualitative study in Ethiopia found that long distance was a particular problem for discontinuity and refusal among rural women and those who live far from healthcare facilities (Tadesse *et al* 2017:4). A comparable study in Somalia found that the parent's level of education, the location of the babies' birth, and the participants' distance from the health facility, were some of the linked obstacles to poor vaccine coverage (Jama 2020:4).

Cultural Barriers

In diverse vaccination perspectives, people have divergent cultural viewpoints and value systems. Individual rights and public health views toward vaccination, varied religious viewpoints and vaccine concerns, fear and mistrust of vaccines among many cultural perspectives are some of the issues (Territory 2022:7). A 31-year-old Public Health Expert professional said:

> *‘’Some of the barriers for childhood vaccination were cultural beliefs of parents or caregivers of childhood those believe that the vaccine itself will bring the disease, or that the immunisation program itself is a family planning program that wants to reduce childbirth in women.’’(P5)*

Another 31-year-old public health expert professional from the hospital stated the following statement:

> *“Muslim parents or caregivers are unwilling to participate in immunisation activities, particularly for parents…” (P5)*

A comparable study conducted in another section of Ethiopia discovered that social norms around vaccination were strong, with 94% of parents of children under the age of five, believing that most of the parents know and ensure that their children are vaccinated. This aspect is relatively higher in urban, rural, and nomadic contexts (Alemayehu et al 2022).

Shortage of logistic services

One of the biggest logistical issues is cold-chain infrastructure and transportation capacity from last-mile vaccine delivery to hospitals and HCs. A 27-year-old public health officer professional said:

> *“Transporting vaccine distribution via to the health facility on time and cold-chain infrastructure such as refrigerator spare part and temperature monitoring devices is one of major logistics problems at Woreda levels”. (P7)*

A 30-year-old nurse professional said the following statement related to poor road infrastructure:

“Poor road infrastructure is a major issue in pastoralist community for both vaccination distribution and bringing parents or caregivers to the health centre”. (P11)

Other Demands as Side Barriers

Participants regard staff turnover and low accountability as other side barriers. A 28 year old nurse professional said:

“Staff turnover and low accountability of vaccinators and vaccine suppliers to vaccination site are also other barriers for low immunisation coverage.” (P10)

Staff absenteeism was also cited as a challenge to be addressed. A 30-year-old public health expert professional said:

‘’Staff absenteeism is well-known in the pastoralist community, but respondents believe that by working as intended and assuring people that any faults in staff absences have been remedied, they may lessen this concern.” (P4)

Constraints, provision of services, transportation, distance or location to HF, lack of vaccine availability and fragmented care, quality of health care provider communication/interaction, impermanent residence, social/health system exclusion, or poverty are frequently mentioned in a systematic global overview of vaccination barriers (Kaufman, Tuckerman, Bonner, Durrheim, Costa, Trevena, Thomas & Danchin 2019:9). Another study indicated that vaccine side effects, complex vaccine schedules, the hassle of the vaccination procedure, having a child who is regularly too unwell to vaccinate, and religious concerns were all statistically connected to under immunisation (Anderson 2014:5).

- **Suggestions of Health Providers to Improve Immunisation Uptake**

Different public health specialists endorsed various recommendations to improve immunisation coverage, and the study participants recommend the improvement of childhood immunisation. A 31-year-old public health expert professional said:

> *"If the community is concerned that there were not enough staff members present, far-flung mobile teams will be dispatched, as well as increased health education and the necessity of childhood immunisations." (P5)*

Participants suggested improvement of health facility infrastructure and registration of children to be given vaccination as important in addressing low immunisation uptake. A 27-year-old public health officer professional said:

> *"Increasing health facilities infrastructure with more health posts in rural areas will improve the accessibility of vaccination services as well as reduce unvaccinated and refusals of parents/caregivers." (P7)*

> *"What can also help was doing registration of under 1 child in order to be given vaccination and those not given, to explain to parents that they have a responsibility to protect the health of their children. It is also helpful to explain the fever reaction that children develop after being vaccinated to the parents, so they are not worried…(P7).*

Improving the delivery of vaccines to the pastoralist community and to all vaccine sites as well as educating and bringing more awareness to the public will benefit the children. One 27-year-old nurse professional said the following statement:

> *"…. comparing the vaccinated and unvaccinated children was a convening method to communities that vaccinated children are healthier than those that are not vaccinated." (P3)*

Mobile teams were also recommended as a link between the community and health facilities. A 30-year-old nurse professional said:

> *"With the lack of health facilities in the rural areas having mobile health teams raised the level of immunisation uptake and improved the linkage of community and health facilities." (P7)*

Some of the participants agreed that by increasing community awareness and using different means like media (FM Radio), holding public conferences to explain the importance of immunisation could increase awareness in Pastoral Communities. A study conducted in Indian slums suggested that immunisation drives be announced from immunisation workshop locations, and public notice boards to inform about immunisation, involve teachers and quacks, send a reminder message via WhatsApp or mobile text message, and recognize or reward villages or communities with active participation and high immunisation coverage (Singh *et al* 2019:4).

Most of the respondents said increasing transportation access to the immunisation activities like outreach and mobile vaccination cessations and incentivising the health care professionals to immunise childhood vaccination in hard-to-reach/remote kebeles. In addition to more supportive supervision at both regional and district levels, strengthening proper documentation at lower-level health facilities was viewed as greatly increasing childhood immunisation uptakes. A 28 year old nurse professional verbalised the following statement:

> *"Keeping records, providing service every day and contacting the people that have missed doses will create a more cohesive way of monitoring the vaccinations." (P1)*

The participants recommended ministerial support on conducting training for health workers about EPI, as well as providing paper books, cars and the district help with the card when the vaccination is available. District health offices carry out supportive supervision and the distribution of vaccine supplies. The Ministry of Health helps to refrigerate the vaccines and monitors the health facilities. Changes to healthcare offices, responsibility for healthcare administrations, community inclusion amid vaccination administrations, progressing mindfulness among guardians and caregivers, content message or review for upcoming/pending measurements, motivating forces for giving and receiving inoculation administrations, and community criticism on inoculation administrations are some of the proposals made by research participants in a study conducted in India (Singh *et al* 2019:6).

- **Possible reasons and health provider suggestions to reduce high dropout rate**

The rate difference between the first and final dosage, or the rate difference between the first and last immunisation, is known as the dropout rate. It is a measure of how well a vaccination program is working. A dropout rate of more than 10% generally indicates a fault with the program's quality (Handiso 2016:146). So, the participants were asked a question about the causes of the high dropout rate and what could be done to reduce it. The study participants stated several reasons for the high dropout rate. A 28 year old nurse professional verbalised the following statement:

> *"Pastoralists were prone to travelling around a lot, so they take 1 or 2 doses and move to other areas where there were no facilities to store the leftover doses, and they also don't have their vaccination records." (P10)*

A 30-year-old public health expert professional said the following statement regarding financial factors:

> "*The high dropout rate might be attributed to the high costs associated with it, as well as a lack of funding support from the government to track down defaulting children." (P4).*

A 28 year old public health officer professional said:

> *"Some parents or caregivers of children refuse a vaccination due to dissatisfaction with the vaccination services" (P6)*

In addition, a 24-year-old public health officer professional said:

"*Turnover of experienced staff may increase the dropout rate of a child because experienced staff can readily record and provide choices to attain interrupted childhood vaccination." (P12)*

Knowing specifically what causes the dissatisfaction and trying to come up with different strategies to satisfy the parents should be the action taken immediately. The immediate action that needs to be taken is knowing specifically what the causes of dissatisfaction are and different strategies to satisfy parents/ caregivers should be applied. Explaining the importance of the vaccine and its benefits could be a critical component to increase and reduce childhood vaccination. The participants proposed several suggestions to reduce high dropout rate. A 30-year-old nurse professional said the following statement regarding creating a network using religious leaders:

"Pastoralist health systems were creating a network of one to five neighbourhood platforms each 1-to-5 platform linked with religious leaders to vaccinate and educate the importance of childhood vaccination as a shared interest." *(P11).*

A 27-year-old public health officer professional suggested allocating funds to reduce defaulting and never immunised children in the following statement:

"*Allocating sufficient funds to the vaccination program, the number of vaccine doses administered on catch-up and outreach vaccinations strategies to reduced defaulted or never immunised children in pastoralist communities." (P7)*

In addition, A 28 year old public health officer professional suggested the following:

"*If it is feasible to convert injectable vaccine antigens to orally administered antigens, it will minimise parents or caregivers' dissatisfaction and improve child dropout rates, as well as provide a vital EPI message to parents or caregivers to complete immunisation* schedules*." (P6)*

A 24-year-old public health officer professional said the following statement regarding reducing staff turnover of experienced staff:

> "…. *reducing turnover of experienced staff may minimise the dropout rate of a child because experienced staff can readily record and provide choices to attain interrupted childhood vaccination." (P12)*

Comparing vaccinated and not vaccinated children to persuade parents was also suggested by a 30 year old nurse professional who said:

> *"Comparing the children who have been vaccinated to the ones that have not been vaccinated can persuade parents to give their children a chance at a better healthier life*." (R11)

Good customer service can motivate parents to bring children for immunisation. A 28 year old public health officer professional said:

> *"Being welcoming and having good customer service you can bring parents to keep on bringing their child for more doses and…" (R6).*

The availability of health workers at the facility was also suggested. A 24-year-old public health officer professional said:

> *"Health workers also being available and working at all times would be more convenient for parents to continue coming to the facility." (P12).*

A defaulter tracking system and reminding parents/caregivers to bring children for immunisation was also recommended. A 30-year-old public health expert professional said:

> *"Developing defaulter tracking systems or reminders of the parents or caregivers to vaccinate the defaulted and under immunised children. (P4)*

In the northern part of Ethiopia, a case-control study was done and the reasons for vaccine dropout found were child related factors (child sickness, missed appointments, and parents/caregivers' lack of knowledge of immunisation continuing phases) and institutional related ones (parents/caregivers' transportation to health facilities, quality of vaccination services and data quality issues) (Galadima, Zulkefli, Said & Ahmad 2021:5). Mobile health strategy and outreach vaccination services can minimise community vaccination dropout by making home visits to catchment households to check vaccination dropout and deliver health education about the need of completing child vaccines (Chanie, Ewunetie, Molla & Muche 2021:8). Also another similar study in Ethiopia recommended that the community engagement and catch-up vaccinations services should reach defaulted children or never immunised children (Demissie *et al* 2020). Other studies in Kenya recommended that applying SMS reminders in routine vaccination services reduces vaccination dropout (Haji, Lowther, Ngan'ga, Gura, Tabu, Sandhu & Arvelo 2016:4).

4.5.5 Theme 3: Low knowledge of Parents/caregivers on VPDs except for Polio and Measles

On the quantitative part of this study, the result showed that most of the community participants have relatively high knowledge and awareness of Polio (92%) and Measles (89%) vaccines, as compared to other vaccines for preventing other diseases. The researcher was interested to know the reasons for the participants' high knowledge and awareness of Measles and Polio vaccines than of other vaccines.
Most of the participants indicated that parents/caregivers do not fully understand the benefits of other vaccines, though education to raise awareness was given after a long period of time. However, most of the respondents mentioned that parents/caregivers fully understand the benefits of both Polio and Measles against diseases.

- **Possible reason for low knowledge of other VPD**

Participants indicated that many parents/caregivers are not given an explanation of the purpose of each vaccine and antigen, and so left ignorant about what next is needed, especially since as individuals and households, they are the first and important allies for improving immunisation services. Most of the parents/caregivers know the benefits of Polio and Measles vaccination but there is limited awareness of other antigens in the above quantitative findings. Participants verbalised several statements related to knowledge and awareness of the vaccines and their benefits. A 30-year-old nurse professional said:

> *"The fact that Polio and Measles are the most common in the community puts the people at a disadvantage in helping the people understand the other vaccines and their effectiveness." (P11)*

Campaigns for Polio and Measles vaccination were reportedly conducted more frequently in the communities than for other vaccinations. A 30-year-old public health expert professional said:

> "*Also, the campaign on Polio and Measles is more exposed to these communities instead of other vaccine antigens." (P4)*

More budget for Polio and Measles was reportedly allocated than for other immunisation programs. A 27-year-old nurse professional said:

> *"Polio was an opportunity for other immunisation program activities, allowing more budget for Polio irradiation activities such as Polio and Measles campaign." (P3)*

Parents were reportedly complaining that they were not informed about the purpose of each vaccine and antigen and hence lack knowledge. A 26-year-old public health officer professional said:

> *A common complaint among parents or caregivers was that they are not informed about the purpose of each vaccine and antigen, leaving them unsure of what else they required (P8).*

Studies conducted in south India showed that the majority of parents or caregivers had better knowledge and awareness of Polio vaccine than other Pentavalent Vaccines (Sankar 2018:4), which was similar to the findings of this research study.

- **Possible Suggestions for Improving the Knowledge of Other VPD**

Some participants proposed several solutions for improving parents'/caregivers' knowledge and awareness of other antigens of VPD. Different awareness creation activities during campaigns were suggested by a 27 year old public health officer professional who said the following statement:

> *"Different awareness creation activities on the campaign may create more knowledge and awareness to the community, and the Polio budget supported other immunisation activities specially Measles campaign." (P7)*

A 28 year old nurse professional suggested that health education in the pastoral communities be increased as follows:

> *"Increasing health education in these pastoralist communities can help bring more awareness to the other kinds of vaccines that are out there." (P9)*

Role play and group discussions were suggested as a way of giving people knowledge and practical lessons. A 26-year-old public health officer professional said:

> *"Staff personnel from the health department can go into the communities and lead group discussions and role-plays to teach parents or caregivers practical lessons about other vaccine-preventable diseases were a method of increasing knowledge and awareness of the community." (P8)*

The research study conducted in northern Ethiopia found that parents' lack of understanding of vaccination schedules and benefits had been linked to missed scheduled vaccines which are in line with this research study findings (Demissie *et al* 2020:7). Parents were reportedly having inadequate awareness of VPDs and how to avoid them through immunisation, and they were terrified of the negative consequences of not vaccinating children in India (Singh *et al* 2019:5).

4.5.6 Theme 4: Community Involvement in Vaccination Service

Community involvement is defined as a process in which communities are involved in the planning, decision-making, and execution of factors that directly affect them to various degrees (Jain et al 2020:5). Participation and membership of community mobilisers have a positive effect on minimising maternal death and improving the use of child immunisation service. The results of the quantitative part of this research study showed low community linking plans at health facility levels. This was a matter of what the challenges and possible suggestions to engage communities in the EPI program were.

- **Challenges to Community Engagement**

Women Development Army (WDA) and other community platforms are available and functional in agrarian settings, but in pastoralist setting the above platform is not functional and has poor community linkage and engagement in the immunisation program. Some of the immunisation partners working in these areas were selecting community mobilisers to engage community mobilisation during campaign and outreach vaccination campaigns but they had weak monitoring systems for community mobilisers' activity. Most of the respondents said that community leaders and some religious leaders in the Pastoralist Community were involved in raising public awareness about the benefits of immunisations, community mobilisation during campaigns and outreach vaccination campaigns but this community platform in the pastoralist settings had not been strong. A 27-year-old nurse professional said:

> *"There is no linking platform to the mobile communities to engage and participate in the immunisation programs in the pastoralist community." P9*

Heath Providers' Suggestions on Community Engagement

The research participants proposed some community engagement activities in the immunisation program. A 30-year-old public health expert professional said:

> *"Committee involvement requires networking with the community, health centres and facility referral processes." (P4).*

Involvement of religious and community leaders was mentioned by a 30-year-old nurse professional who said the following statements:

> *"Most religious and community leaders in the pastoralist society were powerful figures in the community. Similarly, community leaders and health extension workers form a committee to meet monthly to discuss whether immunisation sessions went as planned, registration of pregnant parents and reaching out to defaulters for mobile or outreach vaccination programs" (P11).*

The importance of community committees was also indicated by a 26 year old public health officer professional who said:

> "*Community committees are vital since it is difficult to administer immunisation because they register under one children and pregnant women, which leads to them connecting with the health centre for EPI services''(P8).*

In addition, a 27-year-old public health officer professional said:

> *"EPI's performance is evaluated through performance monitoring, and a quality improvement team at health facility levels together with community committees" (P7)*

Establishing EPI focus groups was indicated by a 24-year-old nurse professional as beneficial to promote community engagement as follows:

"Establishing EPI focus groups might also be beneficial to promote community engagement on immunisation programs during planning, training and implementation of different parts of the immunisation activity." (P2)

Collaboration of community leaders and health facility EPI committees to follow defaulters was indicated by a 27-year-old public health officer professional who said the following statements:

"Community leaders and health facility EPI committees should collaborate to follow defaulters and bring unvaccinated people to the health facility." (P7)

- **Contribution of Community Involvement in the EPI Program**

Some participants said that the community was involved in strengthening immunisation and committed to working together on immunisation services and other health services. They participated well in the immunisation and made inputs in immunisation activities. A 28 year old nurse professional said:

"Political involvement and accountability on the ground were attempting to involve influential people in the community, such as a religious leader, who could lead some part of community mobilization activity to influence other parts of the community rather than other educate people." P10

Mixing male and female participants during role plays was regarded as important in the decision on children's vaccination. A 24-year-old nurse professional said:

"Mixing male and female participants using posters and role-play is identified that males have a higher ground when it comes to deciding whether or not their children get vaccinated." (P2).

Most of the respondents said that frequent discussions with the community on immunisation and vaccination service could improve community responsibility and ownership of immunisation activities. A study conducted in the northwest Ethiopia (Feyisa, 2021:362), on community engagement, explored that the Ethiopian health systems encourage community volunteers to participate in health systems, particularly in the immunisation program. These volunteers were known as Health Development Army Leaders (HDAL), who worked closely in the lower health systems. The Health Development Army played an important role in the registration of pregnant women, as well as following family visits to provide health education, appointment reminders, defaulter tracing, and household mobilisation for health promotion activities (Demissie et al 2020:11). The results of this research study is similar to the current study findings in the community involvements on the immunisation program.

Another study in Ethiopia found that community engagement was often low, despite that immunisation service uptake was influenced by several important factors, including caregiver behaviour, family characteristics, and communication (Demissie et al., 2020). Other comprehensive analyses of community involvement in poor and middle-income countries revealed no clear link between the levels or types of participation and specific intervention activities (Jain, Engelbert, Gaarder, Bagai & Eyers 2020), but that providing immunisation reminders to caregivers, engaging the hardest to reach households, mobilising the community at large (Jain *et al* 2020:5).

4.5 SUMMARY

This chapter provided the discussion of the study results on perceptions of the Immunisation Program, reasons and factors of low immunisation coverage and refusal of vaccination, recommendations of how to improve immunisation coverage and reduction of vaccine drop-out, reasons for low knowledge of VPD in the study area of a pastoralist community. When quantitative and qualitative methodologies were combined, the researcher had a better knowledge of the study topic than if they were used separately. The development of immunisation improvement Guidelines should be based on the assessed and identified needs.

The qualitative findings on the attitudes and problems of the vaccination campaign in the pastoralist community were backed by the quantitative findings. When contrasting the findings of the earlier studies to those of the current research study, it emerged and was concluded that unvaccinated children and refusal of children vaccination services in the pastoralist community needed urgent attention and gave direction to healthcare providers' recommendations on which activities were more effective to improve low parents/caregivers' knowledge, unimmunised children and refusal, and challenges to the EPI programs were clearly shown. In addition, an immunisation improving Guideline could assist HCPs and immunisation implementing partners to guide on which activities are most helpful in improving immunisation coverage and reducing unimmunised children and refusals of vaccination services in the pastoralist community.

CHAPTER 5

INTEGRATION AND TRIANGULATION OF QUANTITATIVE AND QUALITATIVE FINDINGS OF THE STUDY

5.1 INTRODUCTION

In the preceding chapter, the quantitative and qualitative findings of this study were separately provided. In this chapter, the findings from the two study approaches were combined and triangulated to show how they differ or complement each other. Triangulation is defined by Cathian, Murphy, and Nicholl (2010:4587) as the utilization of many data sources in qualitative research to generate a thorough picture of the event. The word "integration" has been used to describe the interaction and conversation between data from quantitative and qualitative components of a research program, which are frequently carried out to achieve the fabled "whole greater than the sum of its parts."

This study was an Explanatory Sequential Mixed Method design in which the quantitative research design was applied sequentially with the quantitative tools to the detailed understanding of immunisation problems on parents/caregivers' knowledge and awareness of Vaccine-Preventable Diseases, Current Immunisation Status and Dropout rate, and Monitoring Systems of Immunisation Service Deliveries. Then after conducting and analysing the quantitative data, qualitative data collection and analyses were conducted to explain the initial quantitative data results (Creswell 2018:287).

The quantitative and qualitative data were integrated to enhance the Mixed Methods approach's efficacy in supporting the rise of new ideas. The qualitative and quantitative data were evaluated during the integration. Furthermore, integration was projected to increase the mixed methodology research benefits (Smith *et al* 2020, Creswell 2018:23).

5.2 DISCUSSION OF THE MERGED FINDINGS

5.2.1 Demographic characteristics

The results from the quantitative data indicated that parents/caregivers with age 25-29 were 2.67 times more likely to have a fully vaccinated child as compared with parents/caregivers with age more than 35 years (AOR: 2.67 95% CI: 1.21 - 5.89). This might be due to prolonged exposure to the immunisation information and more acceptance of health workers' advice in the living environment. In addition, among variables under this category: antenatal care attendance for the last pregnancy (x2:12, p: 0.00) and parents/caregivers had moderate economic position compared to neighbours (x^2:7.4, p: 0.02), had a significant association on all basic vaccination as compared to low household economic status.

When compared to 23% of children living in rural areas, 28% of children who live in urban areas were more likely to finish vaccination. This is due to more information and access to immunisation services. A similar study in northern Ethiopia found that children whose parents live in cities were 2.04 times more likely to finish vaccinations (Tesfaye 2018:2352). Walking time and distance up to 30 minutes were 1.8 times more likely to have a fully vaccinated child as compared with above 30 minutes distance from the vaccination site. Long distances were a deterrent to parents/caregivers of immunised children. Another auditing in Japan, (Baudouin, Nadia, Olivier, Oleksandr & Yoriko 2017:1308), in Nigeria (Shazly, Khalil, Ibrahem & Wahed 2016), and Hard to reach Eastern Ethiopia (Girmay & Dadi 2019:5) supported this conclusion. However, in the qualitative design, there were more males (10) than females (2). In terms of educational attainment, 223 (74%) quantitative design respondents), were unable to read or write for formal schooling, but most qualitative design participants, (7), had degrees, with three and two having Diploma and Master's degrees, respectively. The qualitative participants' greater levels of education corresponded to their job titles and responsibilities.

Different factors had been demonstrated to contribute to an individual's advancement in health practices, according to Conner (2002:4). Mosadeghrad (2014:81) asserts that the traits and personalities of HCPs influence the quality of healthcare services delivered. Becker and Newsom (2003:742) emphasize that demographic characteristics exhibit consistent relationships with developments in the healthcare system.

5.2.2 Awareness of immunisation

The quantitative strategy of this study discovered that 94.9% had ever heard about vaccination. Of those aware of immunisation, 281 (94%) mentioned about immunisation campaign, 259 (86%) the importance of immunisation, 234 (78%) where to get routine vaccination. Based on the study results, health workers (including health extension workers) and community volunteers were the primary source of information about immunisation, 91% and 86%, respectively. Similarly, all participants interviewed in the qualitative part, verbalised ed that they had awareness of the immunisation system which was a day-to-day activity to serve the community.

A study conducted on the parents' views about immunisation found that parents took their children for immunisation to safeguard them against 16 potentially fatal diseases as parents. As members of the community, they pushed for all children to be immunised so that they were protected from vaccine-preventable diseases that could be very serious, necessitate hospitalization, or be fatal (Baudouin, Nadia, Olivier, Oleksandr, & Yoriko 2017:1309).

5.2.3 Reasons for low Immunisation Coverage

The results from the quantitative design of this study revealed that the proportion of children receiving valid full vaccination was 27% (95% CI: 21.0-31.0), partially vaccinated 7% (95% CI: 4.1-9.1) and not vaccinated 60% (95% CI: 55.1-66.1) respectively, which is below the WHO Global Vaccine Action Plan 2011–2020 (WHO 2013c) calls on all countries to reach ≥90% national coverage and ≥80% coverage in every district or equivalent. Both the quantitative and qualitative findings showed a different reason for not vaccinating and defaulting/failure of completing vaccination.

Quantitatively, unfavourable rumours (30%), long waiting time at the time of vaccination (18.3%) and absence of vaccinators (18%) were some of the major barriers for not vaccinating children and place of immunisation too far (19%) were the root causes for children not vaccinated or completed immunisation. In addition, the misunderstanding of the effectiveness of vaccination, fear of vaccination side effects, lack of health facility, low community awareness, movement of pastoralist community, gender roles, no access to vaccination, lack of knowledge regarding the importance of the vaccine, lack of partner support, cultural barriers were factors in low immunisation coverage, according to the qualitative study findings.

II with HWs working EPI focal

Community survey

- Bad rumors 89 (30%)
- Long waiting time in time of vaccination 53 (18.3%)
- Absence of vaccinators 53 (18%) are one of the major barriers of not vaccinating children
- place of immunisation too far 19%
- long waiting time and absence of the vaccinators 18%

Some of the pastoralist communities thought that the child is healthy and will not need any immunisation (P4,P6,P7)

some believe that the vaccine itself will bring the disease, or that the immunisation program itself is a family planning program

'Staff absenteeism is well-known in the pastoralist community, (P4)

Most of the participants agreed that: *"Pastoralists were prone to traveling around a lot, so they take 1 or 2 doses and move to other areas where there were no*

Health Facility level Observations

- Reaching every district or community (RED/C) Micro-plan developed and displayed 67%
- Community linking to the HFs 43%
- Defaulter tracking system 59%
- Immunisation trained qualified HW 76%
- Vaccine received and issued in a vaccine ledger book 34%
- Availability of essential vaccines 67%
- Equal number of AD and re-

Most of the respondents indicated that the quality of the posted Micro-plan in various health facilities is poor.

Committee involvement requires networking with the community, health centers and facility referral processes." (P4).

Doing registration of under 1 child to be given vaccination and those not …P5,

Keeping records, providing service every day and contacting the people that have missed doses will create a more cohesive way of monitoring the vaccinations." (P10).

P=participant

Figure 5. 1: Community Survey, Health facility and in-depth interviews' (II) data joint display on the reason of low immunisation coverage.

According to the different African countries' study on Childhood Immunisation Coverage showed that below the WHO global vaccination plan, for example: all the required vaccines were 66%, while 34% were found to be incompletely vaccinated in Gambia (Touray, Barrow, Kinteh, Badjie, Nget, Touray, Tatta & Ceesay 2021:6), 20% of fully immunized in Somalia (Jama 2020:4), 4.5% of the children had never been immunised, while 65.2% were fully immunised on children of 12 to 23 months of age in Nigeria (Obanewa 2019;23) and Ethiopian Mini-EDHS 2019 reported that, 44.1% of children aged 12 to 23 months in Ethiopia received all basic vaccinations. The percentage of children aged12 to 23 months who received all basic vaccinations were18.5% in Somali Regional States.

In a similar study, different factors on low immunisation coverage had been studied in different study areas. Fear of vaccine side effects, location of the office, parents who is also active, vaccinator refusing to immunize due to ill child's well-being, and family concerns, were the top reasons for failing to immunize or finish immunisation (Obanewa 2019:23). A similar study in Somalia, the place of delivery of the baby (p = 0*:*0001), and the distance of the participants to the health facility (p = 0*:*026533) were statistically significant association of fully vaccination (Jama 2020:4).

Children in Nigeria were not inoculated for a variety of reasons, including a lack of commitment to vaccine administrations, lack of information about immunisation, and failure to communicate effectively with parentss about immunisation (Anyabolu, 2016; Victoria et al 2017:2). Extreme geographic separations or extended journey durations to an HC, joined with a deficient transportation foundation and a lack of open transportation offices, might have a negative effect on the utilization of wellbeing administrations and well-being outcomes (Delamater, 2012:1)

5.2.4 Knowledge and awareness regarding Vaccine-preventable disease

According to the quantitative results, less than half, 46.3% [95% CI: 40.6-51.9] of the respondents had below the average or mean value of the knowledge and awareness indicators and 53.7%: 95%: CI [48.02-59.30] had more than the mean value of knowledge and awareness indicators called good knowledge. In a different study, most of the parents had adequate or satisfactory immunisation knowledge. In India, 75% of the parents had satisfactory knowledge (Sankar 2018:6) and the majority of the Ghanaian parents or caregivers of children who were aged 12 to 23 months respondents understood the importance of immunisation exercises (Dadzie 2019:66). In a similar study in Saudi Arabia on knowledge and attitudes of parents on Childhood Immunisation, 672(91.9%) parents had good knowledge on vaccine-preventable diseases (Alamri, Horaib & Alanazi 2020:7) and 73% of the parents on Chesnais parents had good knowledge about immunisations and associated facts (Kumar & Kavinprasad 2018:4847).

Community survey data

- 53.7% had more than mean value of knowledge and awareness of VPDs
- 73.3% were knowledgeable about the time of vaccination
- polio (92%) and measles (89%) is relatively higher than other VPDs

II with HWs working EPI focal

Most of the respondents reflected that parentss or caregiver do not fully understand the benefits VPDs other than polio and measles.

Polio and measles are more exposed to the communities on frequent polio and measles campaign instead of other VPD antigens.

Parentss or caregivers were that they are not informed about the purpose of each vaccine and antigen, leaving them unsure of what else they require.

Figure 5. 2: Community Survey and II data joint display on the knowledge and awareness of VPDSs

In addition, parents/caregivers of immediate older children were fully vaccinated (x2:5.2 p: 0.00) and were five times more aware and knowledgeable about VPD than those who were not fully vaccinated in this study. This might be because fully-vaccinated- immediate- older- children had a greater chance of knowing more about vaccine-preventable diseases and the importance of immunisation than non-immediate non-vaccinated- immediate- children. Furthermore, previous refusals of vaccination cessation for children had parents/caregivers with a better understanding of VPD than unvaccinated children. This indicated that some parents' or caregivers' refusals to vaccinate their children may occur due to other problems than the low knowledge of vaccine-preventable diseases.

Reading and writing parents/caregivers (x2:0.6, p: 0.1) understood vaccine-preventable diseases better than those that are not able to read or write. The level of parental education was the most important factor related to immunisation knowledge and the most easily understandable of vaccine-preventable diseases. Concerning the knowledge of the respondents about childhood diseases that could be prevented by routine immunisation, an overwhelming proportion of the respondents mentioned polio 92%, and measles 89%, which was relatively higher than other vaccine-preventable diseases in the quantitative findings. Similarly, other two Indian studies indicated that the knowledge of parents/caregivers of children 12 to 23 months on vaccine prevention against measles was relatively high 71.9% than other vaccine-preventable diseases (Sankar 2018:3-6) and the proportion of people knowing Polio, Measles, DPT and BCG were much lower as 24.7%, 18.4%, 21.4% and 29.9% respectively (Tech, Adv, Med, Biol, Akanksha & Meena 2017:2).

In the qualitative section of this research study, the researcher explored how the knowledge of vaccine-preventable diseases in the pastoralist community can be improved. Due to frequent social mobilization and advocacy in the campaigns, the knowledge and awareness of patients and caregivers were relatively higher. This indicated that increasing health education, social mobilisation, and advocacy in Pastoralist Communities could help bring more awareness and knowledge of the other kinds of vaccine-preventable diseases and improve the knowledge of parents/caregivers. The educational level of parents or caregivers was one of the factors that influenced the ease of understanding other Vaccine-Preventable Diseases. Because most Pastoralist Communities lack formal education, this type of informational education about VPD took time to understand the community, even in educated people.

The amount of parental training was the most important factor when it came to vaccination knowledge and guardians' skills. The amount of education was independently connected to the knowledge of childhood immunisation, and 47% of college graduates had more notable knowledge of discretionary childhood antibodies than dads who had graduated from elementary school (Kara, Polat, Yayla, Demirdag, Tapisiz, Tezer & Camurdan 2018:453). Other studies in Malaysia on instructive mediation on progressing parents' knowledge of child vaccination, revealed that guardians had a beneficial influence on their knowledge of immunisation when there was any linked immunisation (Awadh et al 2014:7).

5.2.5 Community Involvement in vaccination service

Qualitatively, committee involvement requires networking with the community and health centres and raising awareness in the community. The committee meets monthly and discusses gaps and solutions for these gaps. Community and some of the religious leaders in the community are involved in raising public awareness about the benefits of immunisations, vaccinations, and regular healthcare and linkages with the vaccinators and their community registering under one child and pregnant women, which leads to connecting the health centre to get EPI service. The findings in the quantitative approach revealed that 43% of the health facility was the community linking plan. Among this, most of the community members were actively engaged/involved as community mobilizers in the time of outreach or supplementary immunisation activities. In addition, 59% of the community members like religious leaders and community volunteers were involved in new-born registration and 56% in defaulter tracking.

5.2.6 Planning and management of immunisation program

Most of the respondents in the qualitative study reflected on the availability and concept of reaching every district/community Micro-plan but the Micro-plan may not be consistent and achieve the goal it needs. Registration and careful monitoring of the community may be corrected through regular follow-up visits. Checking registration tools, EPI cards, and EPI charts are good methods to monitor the quality of RED Micro-plans. In quantitative study, 67% of the primary health facility reached every district or community (RED/C) Micro-plan developed and displayed on the wall of the immunisation room and the majority 87.5 of the health facility were catchment area map availability and posted on the wall of the immunisation room. The quality of Micro-planning from the community to regional level planning was needed.

To develop the quality Micro-plan, some of the health workers needed additional training on how to develop quality microplanning at a lower level to improve the immunisation coverage in each district. The Immunisation Program needs to be well–planned to reach every child individually (Pan African Health Organization & WHO 2020:13). Bottom-up Micro-plans for the Immunisation Program should ideally be a part of the planning involving other health programs and services (National Institute of Health and Family Welfare (NIHW) 2018:11).

5.2.7 Vaccine supply and management

Quantitatively, only 34% of the health facilities in this study had vaccine received and issued documented in a vaccine ledger book, and refrigerator temperatures were measured on the day of data collection and compared to the previous 30 days' temperature records. Also, triangulated with the qualitative interview participants showed that some of the HCPs utilised vaccine ledger book but the majority did not use it even though it was available in the health facility. The majority of the HWs forget the record because of an excessive amount of work. If what has been done were not recorded there could be a likelihood of forgetting to register, and health workers not being able to follow up on vaccines received and issued based on the ledger book.

Vaccine ledger books are an important component for tracking whether a vaccine has been received and distributed. As a result of the improper utilisation and unutilised ledger books, most of the health facility's vaccine wastage is not determined. In addition, HCPs' capacity for the use of ledger books is one of the major problems in many health facilities. Most respondents reported a lack of understanding about how to utilise vaccine ledger books for usage and vaccination forecasting based on targeted beneficiaries. Some responders on the problem of inappropriate vaccination ledger books stated that the ledger books are excessively big, making it difficult to keep records and manage the record-keeping.

In the 2019 Ethiopian Effective Vaccine Management (EVM) assessment, the results showed that there had been an improvement at the primary score (National), sub national level, whereas the Woreda and health facility level had shown a decline in the score. However, a lack of proper documentation of temperature review activities and actions taken, lack of up-to-date temperature monitoring studies and mapping data, timely updating of transactions and archiving vaccines and supplies ledgers and lack of regular wastage monitoring were some of the gaps identified (MOH Ethiopia 2019b:15:15).

5.2.8 Integration of theoretical framework to the research results

In this study, employed the Explanatory Sequential Mixed Method and the Change Theory which described the reasons why a problem existed and guided the development of health interventions. The Explanatory Sequential Mixed Method and Change Theory was also used to explore factors that negatively contributed to immunisation coverage such as gaps in parents/caregivers' knowledge, perceptions, immunisation monitoring system, and specific challenges of immunisation focal persons on childhood immunisation. Partner engagement, providing vaccines and supplies, developing immunisation planning and management, increasing community demand generation, improving cold-chain systems and management, strengthening community engagement, knowledge, and behavioural change, improving immunisation service delivery, and increasing access were used as predictors of optimise Childhood Immunisation coverage.

The findings were reported by using the theoretical framework to discuss the results. The quantitative and qualitative findings were that unfavourable rumours, long waiting time at the time of vaccination, absence of vaccinators, misunderstanding of the effectiveness of vaccination, fear of vaccination side effects, and lack of health facility, low community awareness, movement of Pastoralist Community, gender roles, no access to vaccination, lack of knowledge regarding the importance of the vaccine, lack of partner support and cultural barriers were predictors in low immunisation coverage. The findings from the study contributed to the existing body of literature related to low immunisation coverage and the research findings strengthened the theoretical framework predictors on low immunisation coverage. Implementing the recommended immunisation activities on the guideline in Chapter 6 will optimize childhood immunisation coverage in pastoralist community.

The researcher evaluated the overall vaccine supply availability, EPI program planning and management, community involvement in immunisation programs, cold-chain systems and management, service delivery, knowledge, and awareness of VPD improvement and concluded that the childhood immunisation uptake, and the majority of the assessed framework indicators require corrective actions in a pastoralist context.

5.3 SUMMARY

In this chapter, the results from the quantitative and qualitative methodologies were triangulated and integrated. The researcher discussed various aspects where the respondents and participants had similar opinions, some additional information in the qualitative aspect, as well as aspects where specific conclusions differed.

CHAPTER 6

GUIDELINES FOR IMPROVEMENT OF CHILDHOOD IMMUNISATION PROGRAMS IN PASTORALIST COMMUNITIES

6.1 INTRODUCTION

The main purpose of developing the guidelines was to improve the childhood immunisation in the Pastoralist Community of Ethiopia. In this chapter, the rationale for developing the guidelines, guiding principles, objectives, scope, methodology, strategic objectives, development process, proposed activities, was included in the content of the guidelines. It was drafted by the researcher and reviewed by the invited expert panels involved in the Delphi study. Finally, the guidelines were finalised by incorporating the comments provided by the expert panel.The primary target for these guidelines were the hospitals, health centres, health posts and EPI implementing partners in the primary healthcare systems of Ethiopia.

6.2 RESEARCH METHOD

This study used an Explanatory Sequential Mixed Method design that involved a two phase in which the researcher collected quantitative data in the first phase, and qualitative data in the second phase (Creswell 2014:274) to determine variables that impact immunisation scope, benefit availability on immunisation, observing framework within health facility and challenges and suggested solution to improve childhood immunisation in the Pastoralist Community. The key findings of the research were discussed in the previous Chapters (4 and5) and the guidelines were developed based on the key findings of this study and the reviewed literature

6.3 RATIONALE FOR THE GUIDELINE IMPROVEMENT OF CHILDHOOD IMMUNISATION

- In this study and other similar studies, the findings showed that pastoralist immunisation performance immunisation coverage, and awareness and knowledge of the parents/caregivers were very low. There was also a high number of unvaccinated children and a drop-out rate.

- The Pastoralist Community wandered from place to place to locate water sources for the animals, resulting in a high percentage of missed and zero-dose children. To overcome this issue, several vaccination improvement techniques were required.
- The Guideline Document will provide direction and guidance to healthcare professionals and immunisation implementing partners and decision-makers to ensure that all eligible individuals who miss routine vaccine doses (defaulters, zero doses) should be identified and vaccinated in the pastoralist region.
- Furthermore, the Guideline Document will guide and support the improvements of vaccination services in the Pastoralist Community.

6.4 GUIDING PRINCIPLES

During the writing stage by the researcher and auditing by the welcome expert, the following directing standards were examined throughout the development process, for example; evidence based, availability of vaccine and routine immunisation status, and proposed implementation strategies to improve vaccination coverage, involvement and health system strengthening, feasible, cost effective, culturally acceptable, alignment with the global 2030 immunisation agendas and Ethiopian priorities, to reach unimmunized and missed children in place all over the regions.

6.5 OBJECTIVES

a) General objective

The overarching objective was to create a standards for optimising Childhood Vaccination Programs in Ethiopia's Pastoralist Community in the Somali Region of Ethiopia.

b) Specific objectives

- To create draft of a Guideline Document based on the study findings and the literature reviewed.
- To consider the expert inputs to be included in the Guideline Handbook
- To provide the end-user with the final approved Guideline Handbook.

6.6 DEVELOPMENT PROCESS

This section presents the steps that were followed in the development of the guidelines for the improvement of the Childhood Immunisation Program in Pastoralist Communities for the healthcare providers and immunisation implementing partners. The update of this recommendation was guided by the established operational procedures for guideline development specified in the WHO Handbook for Guideline Development (WHO, 2014c). The researcher obtained evidence for the construction of the immunisation improvement guideline in Step 1, from the summary and conclusions of the triangulated and integrated findings of this study. Step 2 included meetings, emails, and phone calls with key stakeholders and experts in the immunisation improvement guideline development process, during which the findings from the literature review were shared. The process was also influenced by WHO Handbook for Guidelines Development. This process is outlined as follows:

6.6.1 Selecting the topic and the purpose of the immunisation guideline

The title for this guideline was titled" Guidelines for Improvement of Childhood Immunisation Programs in Pastoralist Communities. The Guideline Handbook was developed as an intervention. The study had its own concrete Research Questions and Problems with an aim to provide healthcare practitioners with an easily available and accessible Guideline Handbook that they could use as a reference when presented with difficult circumstances in administering the Vaccination Programs.

6.6.2 Forming guideline development group

The Guideline Handbook was drafted by the principal researcher and shared with the selected Guideline Reviewing Expert Groups (G/Meskel MT, 2020:8). This was because the guidelines were developed in response to the scientific research findings. Sex Immunization Program experts were selected from the FMOH, RHBs, Immunisation Implementing Partners operating in Pastoralist Communities and Professional Association who were the key experts on Immunisation Program and the member of National Immunization Technical Advisory Group (E-NITAG). These colleagues supported and consulted the FMOH and RHBs in the development of different guidelines, solicited advocacy for policy change, led the implementation, disseminated technical & managerial guidelines, and monitored and evaluated Immunization Programs at national and regional levels. Following the experts' selection, the researcher contacted them either telephonically or in person and briefly shared the study's aims and its significant results.

After verifying their commitment to the involvement, each expert's verbal assent was requested before moving to the next stages. The researcher delivered the Draught Guideline for enhancing the Childhood Immunisation Programs in Pastoralist Communities through e-mails, followed by text messages reminding them to check their email inboxes on a regular basis and waited for their verification responses. A brief assessment checklist was included to assess the overall structure of the Guideline Handbook.

Table 6. 1: Expert checklist for comments and inputs for the developed guidelines on childhood immunisation programs in pastoralist communities

Expert focus area	**Comment**	**Area of improvement**	**Additional Input**
Relevance			
Applicability			
Exhaustiveness/content			
Target			
Exhaustiveness/content			

6.6.3 Scoping of the guidelines

To establish the breadth of the Vaccination Improvement Guideline, the study's objectives were clearly specified, and the members in the development group were specialists in the extended programs on immunisation and familiar with Pastoralist Community Immunisation Practice. The procedure took five months to be completed. The Vaccination Improvement Guideline Formulation Committee received the study's data and conclusions after they had been examined. The group interacted often, and a meeting was organised to summarise the process and conclusions. Meetings, phones, and emails were the primary modes of communication. The members of the group claimed that participation in the research posed no conflict of interest. Ideas, procedures, and strategies that were important in improving immunisation in Pastoralist Communities and removing barriers for healthcare providers and other Immunisation Implementing Partners in relation to appropriate selection and application of strategies to Pastoralist Communities to improve knowledge, awareness, and practice were discussed.

6.6.4 Identification, evaluation, and formulation of the evidence

To support and identify the key issues of poor vaccination coverage in the Pastoralist Community, a systematic extensive literature search was conducted prior to the study. The researcher developed evidence-based recommendations based on a writing audit and information from the respondents and members. Empirical data from participants as well as expert group feedback were incorporated into the development, and the full study findings served as the foundation for producing suggestions for enhancing Children Immunisation Programs in Pastoralist Communities.

6.6.5 Writing the guideline

The initial draught of the rules for improving Childhood Vaccination Programs in Pastoralist Communities was produced and submitted for feedback with the advancement gathering. The group offered valuable contributions that were incorporated into the final text. The researcher invited the experts to provide r important feedback on the proposed recommendations by sending text messages or calling them. In the first round, 83.3% of the experts (n=6) responded with their thoughts and opinions. The researcher summarised the supplied remarks and included them into the 2nd edition of the guideline, once the agreed-upon time for answers had passed. The experts were sent the revised draft, which included a summary of the first-round answer, and the procedure was repeated until the experts failed to share their responses and confirmed their agreement.

6.6.6 Consulting and peer-reviewing

The researcher used a Wide Writing View to examine and integrate the evidence. The members' experimental data and the master group's inputs were also used in the development of the guideline. To get as much essential information as feasible, data were collected using a Convergent Mixed Technique. The study's credibility, validity, and reliability were all maintained throughout.

6.6.7 Updating and reviewing

All the comments forwarded from the reviewers were collected. The collected experts' comments were reviewed and updated by the principal researcher to the parents' Guideline Handbooks .Above all, the final Guideline Handbook was prepared and shared with study area Healthcare Professionals and Vaccination Implementation Partners.

6.7 Guidelines for improvement of childhood immunisation programs in pastoralist communities for health care professionals and project implementing partners

6.7.1 About the Guideline

This Implementation Guideline Handbook was designed to be used by Healthcare Professionals and Woreda -Level Immunisation Program Managers, as well as Immunisation Implementing Partners that implemented immunisation activities in the

Pastoralist Community through the Expanded Program for Immunisation (EPI). It assisted Healthcare Professionals in selective Immunisation Implementation Activity in the Pastoralist Community to reach unimmunised and under immunised children. This process included research-based recommended activities in immunisation service delivery through applying the different recommended approaches to improve immunisation coverage. In addition to the change of knowledge on parents/caregivers, recommended approaches improved the knowledge of vaccine-preventable diseases and other immunisation factors.

The purpose of this guide was to indicate clear direction on the immunisation implementation approach to improve immunisation performance in the Pastoralist Community through the implementation of the listed recommended approaches. The implementation guide contained two main components; recommended strategies to improve vaccination coverage in the Pastoralist Community and introduction, consensus building, identifying religious institutions and building parents/caregivers' knowledge and practice, each implementing approach had detailed explanations.

6.7.2 Overview

Vaccination is a life-course approach to immunisation that has been widely utilised by vaccination beyond childhood to adolescence and adulthood for combating Vaccine-Preventable Diseases (VPD). Hence, the Expanded Program on Immunisation (EPI) is one of the best and most cost-effective preventive public health interventions (Ministry of Health, Ethiopia 2021:4). The EPI program was built on the direction and planning of the research findings in the Pastoralist Community and global technical immunisation guidelines. This Implementation Guideline emanated from the need to optimise childhood immunisation in the Pastoralist Community based on the current situation of the Immunisation Program in the Pastoralist Community. This Guideline mainly focused on current problems of the immunisation Program in the Pastoralist Community and possible directions of how to improve its immunisation performance.
Immunisation rates remained suboptimal in many Pastoralist Communities in Ethiopia, resulting in poor knowledge and awareness of many Vaccine-Preventable Diseases. Despite the media's significant influence and relevance, Healthcare Professionals and

Community Volunteers were identified as the most essential advocates for vaccination and sources of vaccine information for the public in the Pastoristl Community. Healthcare professionals and Community Volunteers should be given additional assistance for their immunisation training, have quick access to up-to-date vaccine information, and have simple access to expert consultation on vaccination-related issues. Vaccine Information Systems should be established to aid vaccination promotion in local contexts.

As per the key findings stipulated in this research, it is worth developing Guidelines to improve Childhood Immunisation Services in the Pastoralist Community in Ethiopia. As per the World Health Organization (WHO) guidance, the 272 Developed Guideline need to have a well-known end-user; and the recommendations included in the Guideline need to be tailored to the audience identified as the end-user (WHO, 2014c:18) In the context of these guidelines, it is prepared primarily to the Healthcare Providers and Immunization Implementing Partners in the Pastoralist Community; however, some of the strategic recommendations are also addressed to the higher-level health system; the Woreda /District Health Offices, Zonal Health Department (ZHD), Regional Health Bureau (RHB) and Federal. In a nutshell, these guidelines are one of the key contributions of this study; and would be delivered primarily to the study areas that support the Immunisation Program in the Pastoralist Community in Ethiopia.

6.7.3 Who is this guide designed for?

This Guide Handbook was designed for Healthcare Providers and Woreda -Level Immunisation Program Managers, as well as HC staff (supervisors, EPI focal people, vaccinators, and PHCU supervisors). The Guide Handbook may also be beneficial for National, RHB, and Zonal Level EPI staff and Vaccination Implementing Partners who may be involved in overseeing or implementing this guidance for informative reasons.

6.7.4 Principles of improving vaccination in a pastoralist community

All Immunisation Programs should have a strategy to reach unimmunised and missed immunisation children in place. Before implementing the different approaches to the immunisation program, the following standards categorisations would l be considered and selected (Centers for Disease Control and Prevention 2015:3).

- A catch-up vaccination plan should be in place for all immunisations so that people can get immunised even if they missed one or more doses.
- All children should be immunised as soon as they are eligible, and those who arrive "late" should not be denied vaccination.
- A well-functioning regular immunisation program should include a catch-up vaccination and community-demanded activity, and it should be done on a continual basis to ensure an individual's right to get the benefit of vaccination, even if it were late.
- Providing catch-up immunisation for pastoralists who have missed measurements could have a significant impact on narrowing immunisation gaps.
- Most vaccines are safe and effective to administer with no maximum age limit, and while convenient immunisation should always be the goal, it is virtually always better to inoculate late than never. There are a few antibodies for which there are upper age limitations for administration, but for the vast majority of Vaccine-Preventable Diseases (VPDs), providing antibodies late is detrimental.
- Informing caregivers and individuals about the need of protecting the home-keeping a vaccine-based record and bringing it to every health contact might help to highlight the importance of vaccination and the idea that it is never too late to be inoculated.

The following strategic objectives and actions would be incorporated and integrated based on the above quantitative and qualitative study findings and proposed healthcare provider suggestions:

6.7.5 Strategic Objectives and Activities to improve vaccination coverage in a pastoralist community

Routine immunisation services should be delivered to the eligible child throughout the year, despite unexpected interruptions due to emergencies, population movement and other factors. However, services should be continued by designing different effective approaches in the context of the Pastoralist Community to reach the unimmunized and missed doses of children. The following approach was included as per the findings of the study and the literature review.

In at least two rounds of input, the chosen experts in the field of infant and child health provided their important thoughts and opinions to complement the draft recommendations. To improve the vaccination coverage in Pastoralist Communities, the following consolidated strategic objectives and list of activities were developed into two broad categories on the health facility strategic objectives and community demand strategic objectives.

6.7.5.1 Healthcare facilities' strategic objectives and activities

The following unified strategic objectives and list of initiatives were developed to increase children immunisation rates in the Pastoralist Community of Ethiopia.

Table 6. 2: Summary of health facility strategic objectives and activities

Strategies objectives	**Specific activities**
Strengthen routine immunisation services throughout the year	• Continually integrating mobile health teams and catch-up vaccination into routine immunisation program delivery
Strengthen periodic intensification of routine immunisation (PIRI)	• Providing immunisation register and home-based record. • Organized mobile and outreach vaccination cessations
Improve Integrated periodic outreach strategy (IPOS)	• Organised outreach vaccination • Improve vaccination timing hours. • Assigning certain times to different groups of people • Preparing for the immunisation providers to reach childhood vaccination for longer distance to the health facility.
Developing quality of Micro-planning for the immunisation service delivery	Providing the following activities for quality of Micro-planning process: • Vaccine, logistics and human resource requirement • Vaccine and logistic distribution plan • Cold-chain status and vaccine storage plan • List of all towns, villages and settlements including target population

	• Individual team Micro-plans (with a clear description of the day-wise area to be covered and map) • List of high-risk areas and plan of coverage • List of special sites and plan of coverage • Transit team plan • Social Mobilization and communication plan • Border area plan • Supervision plan • Reporting plan
Ensuring availability of vaccines supplies and management.	• Develop and execute protocols for protecting and maximising in-country vaccine stockpiles. • Providing strict maintenance of temperature records, VVM indicators, and expiration date verification. • Allow for any expired or damaged vaccines, delayed delivery, and so on. • Implement a multi-dose vial policy. • Prioritizing the use of these vaccinations in accordance with the "first-in, first-out" (FEFO) approach. • Change distribution schedules to minimise burden on the cold chain.

6.7.5.1.1 Strategic Objective 1: Strengthen Routine immunisation services throughout the year.

According to the findings of the qualitative study, the immunisation system is a daily service from Monday to Friday, although Measles and Polio Immunisations are only available by appointment and sometimes on special days. Majority of the respondents stated that the movement of Pastoralist Communities from place to place can cause the low coverage of immunisations. In addition to administer RI throughout the year, the following extra immunisation measures were advised to the HCPs on the immunisation focus of the Pastoralist Community:

One participant said, *"With the lack of health facilities in the rural areas having mobile health teams were raised the level of immunisation uptake and improved the linkage of community and health facilities." (P11)*

Proposed Activities

The practice of mobile health teams and catch-up vaccination should be integrated into Routine Immunisation Service Delivery continuously. Every immunisation contact, whether fixed or outreach (including school-based), should be used as an opportunity to review an individual's vaccination status and catch up on any antigens that have been missed before that visit. For Pastoralist Communities, offering Catch-up and Mobile Health Team Vaccination is critical to ensure they can be caught up to date, according to the Immunisation Schedule where infrastructure and access to basic services are scarce. The following boxes indicate the concept of the Mobile Health Team and Catch-up Vaccination.

Catch-up Vaccination - references to the activity of immunising a person who is missing/has not received measures of vaccinations for which they are eligible due to any reason (e.g. delays, stock outs, getting to, aversion, benefit interferences, etc.) (WHO 2021a:4).
This was accomplished through conventional schedule immunisation benefit conveyance (settled, outreach, versatile, and school-based), intermittent escalated schedule immunisation (PIRI) exercises procedure that ensure people have the opportunity to get schedule immunisations (WHO 2021a:4). Catch-up vaccination as an on-going or continuous component of routine immunisation delivery.

Mobile Health Teams -are part of a strategy for the provision of occasional ambulatory immunisation health services. The selection of administrations advertising in disadvantaged populations living far from established health offices and sensitise communities to health and vaccination administrations (UNICEF 2020:61).

6.7.5.1.2 Strategic Objective 2: Strengthen Periodic Intensification of Routine Immunisation (PIRI)

In the qualitative aspect of this research study, it was found that providing EPI service for outreach and mobile services would bring people want to participate more in immunisation in pastoralist areas. In this regard, unvaccinated children were addressed by a periodic escalation of Routine Immunisation, such as Outreach and Mobile Vaccination Services.

Occasional implementation of scheduled immunisation?/// Periodic Intensification of Routine (PIRI) is a catch-all word for a variety of time-limited, irregular exercises used to offer scheduled inoculations in under-vaccinated populations and increase awareness of the advantages of vaccination. PIRI is used in either concentrated areas with limited access to vaccination administrations or more scope, or to target specific population groups (e.g., versatile and pastoralist communities).

Proposed Activities

- The doses in a PIRI movement should be administered after determining an individual's vaccination status and are considered scheduled immunisations and noted as such in the immunisation register and on the home-based record.
- PIRIs will often target a certain age group, such as children under the age of two or under the age of five. It provides a catch-up opportunity for anyone in that age cohort that has been missed or not reached during the year.
- PIRI activities will be repeated every four weeks (e.g. once a month for three months) to guarantee that the whole vaccination series are available (e.g, Penta1, 2, and 3).
- Other parents and child health treatments, such as Vitamin A Supplementation, De-worming, Nutrition Counselling, and IFA Supplementation for pregnant women, may be included in PIRIs.
- In addition to integrated services, Community-wide Social Mobilisation Actions regarding the advantages of Routine Vaccination and other General Health

Messaging, as well as boosting knowledge of the availability of immunisation services and VPD, should be prioritised.

6.7.5.1.3 Strategic Objective 3: Improve Integrated periodic outreach strategy (IPOS)

Distance from vaccination locations and lack of access to vaccine services were strongly associated with poor immunisation rates in pastoralist settings in both quantitative and qualitative studies. As a result, strengthening the integrated periodic outreach vaccination approach will boost immunisation uptake and access using a range of methods to reach those who are not reached by planned vaccination programs," promotes the modified use of both scheduled and campaign-style techniques to increase for the unreached children (USAID & WHO 2009). These exercises are distinguished by their intermittent or discontinuous heightens nature like campaigns, as well as their goal of hastening advancements to the timetable benefit scope. Key principles for objective 3 are the following:

- Use a variety of techniques to reach everyone who is interested
- Increase community demand for health services
- Ensure that unreachable people are contacted at least three times a year in each location.
- Improve the quality of maternal and child health services
- Evaluate and strengthen national health programs

According to the qualitative study findings, Mondays are more stressful for them, since they are busy, so more personnel is needed to address the stressful work. Therefore, possible solutions are as follows:

- Benefit hours may need to be extended or changed to accommodate anticipated increases in the number of persons once administrations commence.
- Preparing for the immunisation providers to reach childhood vaccination for longer distances to the health facility.

- Assigning certain times to different groups of people (e.g., more seasoned people, individuals with basic well-being conditions, youths, etc).

Proposed Activities

Outreach vaccination exercises should be expanded to include a broader age range to reach those who may not fall into the typical target groups for outreach activities. If possible, outreach exercises should be planned in concert with other well-being programs to catch persons with a bundle of needs -well-being mediations all at once.

6.7.5.1.4 Strategic Objective 4: Developing quality Micro-planning for the immunisation service delivery

The health policy of Ethiopia is structured and functioning with decentralized and democratization principles. The health sector strategic planning is guided by the principles of “one plan”, “one budget” and “one report”(Ali *et al.*, 2020). Every year Woreda -based immunization planning is prepared through a top-down and bottom-up approach for the EPI programs.
Most of the respondents in qualitative study found that reflecting the availability and concept of reaching every direct/community Micro-plan were available at PHCU level but the Micro-plan may not be consistent and may not achieve the goal it needs. Reasons were misunderstanding the reaching every district Micro-plan at a community level in the immunisation program or the lack of knowledge. Therefore, a good bottom-up Micro-plan is required. Bottom-up and doable Micro-planning in hard- to- reach and pastoralist health facility is essential in the involvement of HEWs, Kebele administration and community representatives bi-annually. According to the relocation of the pastoralist community, an updated and revised Micro-plan is needed.

The following components should be included in the Micro-plan, which should be created at the initial implementation level (health post levels). The planning will identify hard-to-reach communities and design local sound strategies to reach these communities and zero-dose children. In addition to this denominator and numerator, a related problem is the existing problems on the performance of the immunisation coverage. To comprehend this issue, each health office should have a handle in place for new-born and default following, as well as for recognizing and coming to zero-dose children in their catchment zone, as stated on the box- under should- be suggested within the pastoralist community. The following boxes indicate the concept of the denominator:

Notes about Denominator

Reliable estimates of the target population are essential for properly tracking and following up with defaulters as well as those in the catchment area who are difficult to reach or have trouble obtaining services. Estimates of target populations can be acquired from a variety of sources, including census data, local enumerators and head counts, and service statistics from vaccination and other programs.

Activities for developing Micro-plan

The following components should be included in the Micro-plan development activity, which should be created at the initial implementation level (health post levels):

- Vaccine, logistics and human resource requirement
- Vaccine and logistic distribution plan
- Cold-chain status and vaccine storage plan
- List of all towns, villages and settlements including target population
- Individual team Micro-plans (with a clear description of the day-wise area to be covered and map)
- List of high-risk areas and plan of coverage
- List of special sites and plan of coverage
- Transit team plan
- Social Mobilization and communication plan
- Border area plan
- Supervision plan
- Reporting plan (Global Polio Eradication Initiative, 2014).

Micro-planning by nature needs skill and commitment for achievement due to care plan for the cover of all children in target age. So, the trainer presents the use, plan and provides the basic logistic.

During these Micro-planning detail kebeles, Woreda s and regional levels will be covered. However, on the planning process in depth, the presentation, operations system, monitoring and evaluation, social mobilization, waste management, transportation and others will be planned.

6.7.5.1.5 Strategic Objective 5: Ensuring availability of vaccines supplies and management.

On the day of the study, 59.3% of health facilities had BCG vaccinations, 76.5% had OPV vaccinations, 75% had pentavalent vaccines, and 62.5% had Measles vaccinations, and most Health Facility Document Review Vaccinations were not received, issued, or recorded in a vaccine ledger book. As a result, vaccine supervisors at all levels of the supply chain should closely monitor their actual vaccine stock, vaccine consumption, wastage, and target population in their corresponding catchments, and adjust vaccine projections and allocation correspondingly, ensuring a buffer stock is kept on top of any revised consumption. Stock-outs of critical supplies may provide a difficulty, necessitating inventory rebinding at all levels and coordinated distribution of supplies once delivery channels are restored. The following aspects should be considered:

- Any vaccination plan must be preceded by an evaluation of vaccine stock management and operational Immunisation Supply Chain (ISC) system performance to identify and correct any deficiencies.
- Catch-up Vaccination, Mobile Health Team Vaccination, SIAs, and other types of Vaccination Techniques must become regular practice, and forecasts should be amended based on current demand, vaccine, and supply demands, depending on the relevant principles: The dose given to people should have been included in the prediction of immunisation s required to protect that age group.

- Delays in a vaccination series (e.g., Penta1, 2, 3) do not necessitate redoing the complete series, regardless of the amount of time after the previous dose was administered.
- As a result, Catch-up Immunisation needs the ingestion of any more vaccine per person (except in some cases where vaccination history cannot be ascertained and re-vaccination with some vaccines may be needed).

Activities on vaccine supplies and management

It is crucial to conduct regular monitoring of the availability of vaccines at service delivery points to decide the need for additional requests or reallocation. Further, reflected on the annual vaccine renewal every year to anticipate the need for a catch-up and integrate with emergency vaccine stocks. Vaccine supplies mitigation activities include:

- Develop and execute protocols for protecting and maximising in-country vaccine stockpiles, including strict maintenance of temperature records, VVM indicators, and expiration dates. Allow for any expired or damaged vaccines, delayed delivery, and so on.
- If one does not already exist, implement a multi-dose vial policy. Forecast and purchase vaccines and supplies, including any projected surge stock needed for catch-up immunisation of missed cohorts.
- Change distribution schedules to minimise putting burden on the cold chain.
- Prioritizing the use of these vaccinations in accordance with the "first-in, first-out" (FEFO) approach (WHO, 2014d).

6.7.5.2 Community Demand Strategic Objectives and Activities

In at least two rounds of input, the researchers and chosen immunisation experts developed strategic objectives and activities in parents or caregivers' demand generation and provided key thoughts and ideas to enhance the final recommendations. To increase children immunisation rates among Ethiopia's pastoralists, the following community demand consolidated strategic objectives and list of measures were prepared.

Table 6. 3: Summary table for community demand strategies objectives and activities

Strategies Objectives	Specific activities
Building parents or caregivers knowledge and practice	• Community conversation on immunisation • Involvements of religious leaders in immunisation
Communication and community engagement	Communication • Immunisation Advocacy • Social Mobilization • Program Communication Community engagement • Private sector involvement • Involvement in local community • Involvement in day-care centers and schools

6.7.5.2.1 Strategic Objective 1: Building parents or caregivers knowledge and practice.

During the study, poor integration and linkage between the HCPs and community volunteers on the EPI programs at regional, zonal and Woreda levels were observed, impacting the demand generation and other immunisation activities. Also, poor IPC skills from HCPs remain to be observed. One of the reasons for low immunisation coverage is the limited knowledge of caregivers on the Vaccine-Preventable Diseases, schedule of vaccination, right age of vaccination, need to return for a subsequent dose of vaccination, wrong ideas about contra-indications or wrong rumours, distance to the immunisation site, completing day to day priorities also pose challenges to family uptake and demand for immunisation to be observed. Ideally, different demand generation activities on immunisation contributed to knowledge, awareness, and practice of childhood vaccination.

According to the quantitative results, less than half, 46.3% [95% CI: 40.6-51.9] of the respondents had below the average or mean value the knowledge and awareness indicators and 53.7%: 95%: CI [48.02-59.30] had more than the mean value of knowledge and awareness indicators called good knowledge. To improve parents/caregivers' knowledge and awareness of immunisation, HCPs recommended the following community demand generation activities. The Guideline indicates the following strategies to improve pastoralist community demand for immunisation activities.

Activities on building parents or caregivers’ knowledge and practice

A. Community conversation on immunisation

The Community Conversation on Routine Immunisation (RI) is a participative approach that may be utilised with community groups. It is a transformational approach in the sense that it tries to effect fundamental changes in people's knowledge, attitudes, and behaviour (Catholic Relief Services 2007:21).
Community discussion is a method of engaging and strengthening the community for social change. This strategy was used in the 1970s in both Latin American and African countries, with positive results (CORE Group Polio Project Ethiopia 2016).

Community Conversation about regular vaccination is intended for use by community groups of up to 25 individuals during a series of two-hour meetings held twice a month for six months. It is beneficial to engage community leaders, Health Development Armies (HDAs), and Community Volunteers (CVs) since they are the most likely candidates to carry on any community strategy for improving Routine Immunisation that emerges from the group talks. It is essential to include other community members, ordinary men, and women of childbearing age because they may know less about the importance of RI and therefore will raise questions and misconceptions that are valuable to discuss. It is the responsibility of Health Extension workers to assist the CC in their Kebeles. The facilitators' abilities determine the quality of CC on RI. Facilitators must be trained and understand how to facilitate talks to fulfil learning objectives.

The method to meet the needs of people conversations offers a positive learning environment in which participants' freedom and equality are maintained, without being told "right or wrong" about the ideas they propose. Facilitators must also be familiar with community customs and culture.

Basic Skills of Community Trainers and Facilitators

- ***Brainstorming***: It is a process in which participants seek for an idea within them and have more time to critically analyse and listen to replies on a specific issue.
- ***Facilitation Process:*** provides space for communities to contemplate, visualise, and plan their answers, making the reaction faster, easier, and more proactive.
- ***Active Listening:*** is the ability of a discussion member to carefully follow what is being said. To obtain good outcomes, facilitators are encouraged to acquire this talent and actively listen to participants.
- ***Communication skill*** – It is the process of two people exchanging ideas, feelings, or attitudes to reach a shared understanding. The process of communicating ideas between two or more persons interacting for mutual action is known as understanding. There are five primary comprehension processes.

Participants will learn the six phases of community conversation methodology and the necessary skills and tools that facilitate the implementation of each step. To facilitate the acquisition of necessary skills, participants will engage in several role-plays and simulation games.

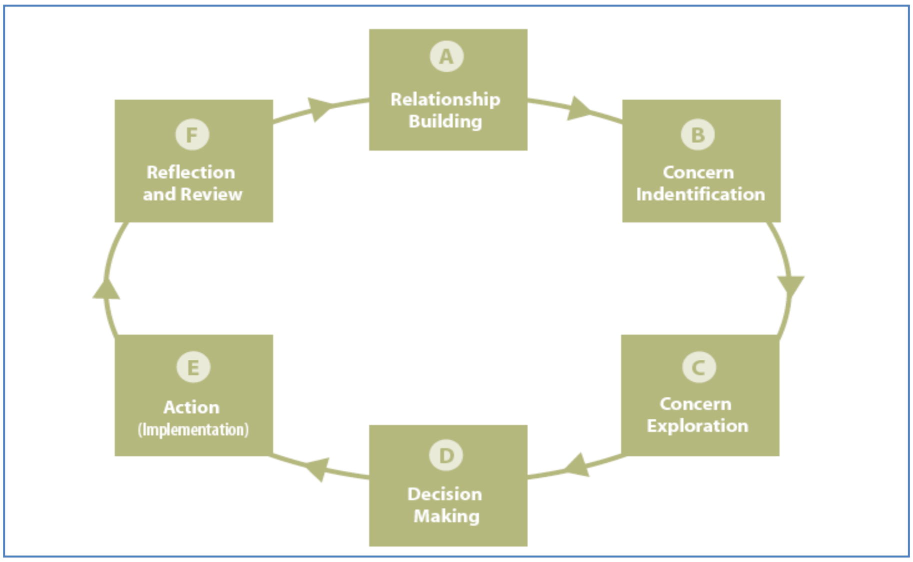

Figure 6. 1: Six Steps of community conversation facilitation

1. Relationship Building: This is typically the initial step in entering the community and involving the public in the process of transformation.
2. Concern Identification: Community problems are broad topics that trouble or worry the community. After concern assessment, the following concerns were raised: fundamental understanding of vaccine-preventable disease (VPD), kind of vaccines and vaccination schedule, rumour and misunderstandings, access to and use of immunisation services, community mapping, and so on.
3. Concern Exploration and Analysis: The trainer assists the community in exploring their problems. Other expressions for exploration include "to scrutinise bit by bit," "dig deeper," and "moving into uncharted terrain." Through auditing. To make meaningful and acceptable judgments, the community needs to have a thorough understanding of the recognised community problems and their causes. As a result, the analyses of the four windows allow one to observe objects from various angles. That is, one may examine individual and community levels considering internal and external elements to get a full picture.
4. Decision Making and Action Planning: Communities can take their individual decisions on the basis on the highlighted problems and results of their auditing. They envision the future and make judgments and commitments on potential activities for change and transformation required to confront RI concerns in their community.
5. Implementation Strategy: at this stage, community conversation participants, community leaders and other community members implement jointly those interventions stated in the action plan form, in accordance with the time frame. Involving all community members in the implementation process develops a sense of concern and ensures success and sustainability.
6. Reflection and Review: this is a process in which the community evaluates the community's successes in behavioural and social changes, and difficulties encountered during implementation, learns from the experiences; takes corrective measures, and guarantees durability.

B. Involvements of religious leaders in immunisation activities

The process of immunisation mainstreaming contains five components (CORE Group Polio Project Ethiopia 2021): (1) consensus-building, (2) identification of religious institutions and leaders, (3) training on immunisation mainstreaming, (4) implementation approach, and (5) monitoring and evaluation. each component has seven sub-components, such as description, purpose, participants, methods, owners of the process, process, and tasks, and expected outcomes/outputs.

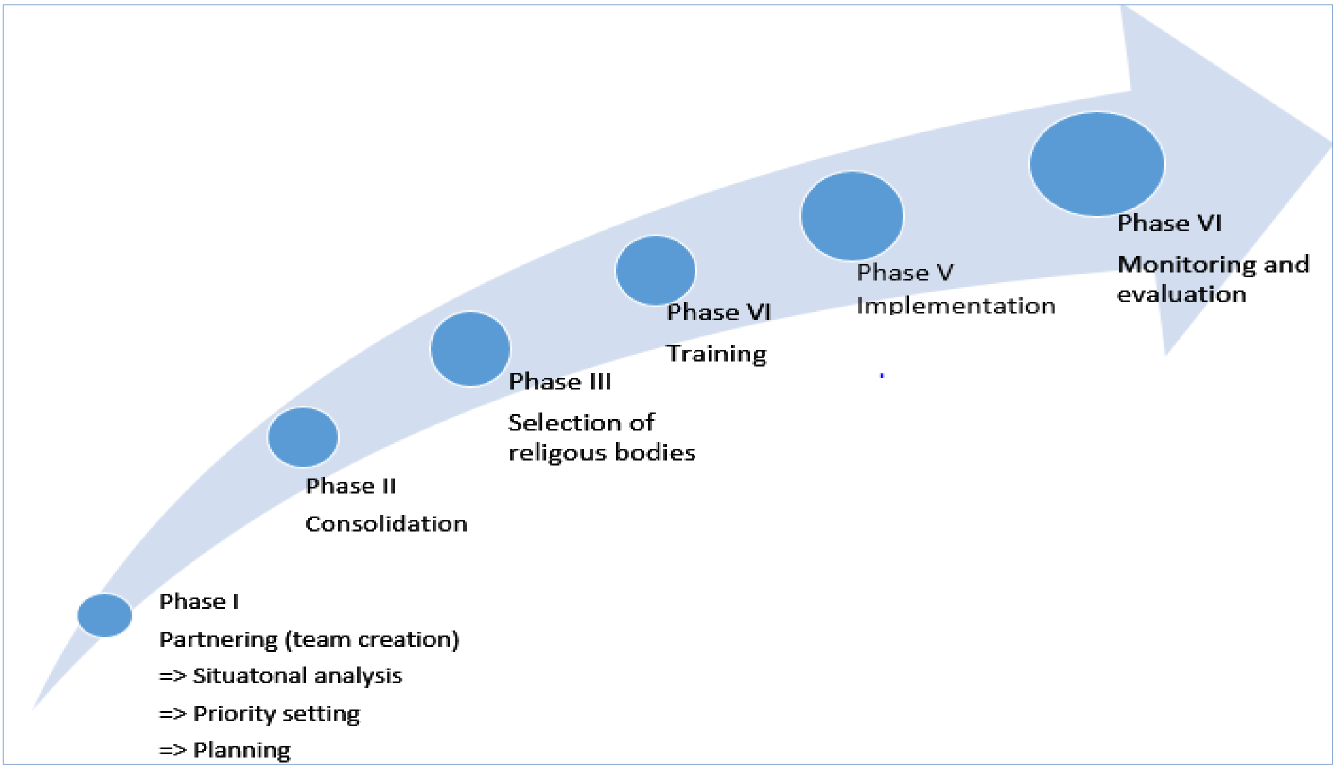

Figure 6. 2: Process of Immunisation Mainstreaming

Activity conducted on immunisation mainstreaming.

The following activities should be conducted :

- Identify topics to be addressed.
- Make sure that relevant key messages are available.
- Identify the place and allocate time to deliver the messages.

- Invite relevant professionals to support the message delivery (if necessary).
- Deliver the message to the target audience.
- Encourage audiences to share the messages with others.
- Document the activity (topics covered, date, place /name of religious institution/, time, number of audience /male & female/, name/s of educator/s, type of /key messages used).
- Report the activity to the HEWs.

Expected output on religious masterminding.

- Formal and informal sessions and gatherings utilised religious institutions involved in the facilitation of the sessions.
- People reached with immunisation key messages.
- Several sessions were conducted in informal gatherings and opportunities.

6.7.5.2.1 Strategic Objective 2: Communication and community engagement

Communication is one of several interconnected aspects that impact parents' and other caregivers' decisions to get their children vaccinated (Bisrat, Tadesse, Tsehay & Teshome, 2020:82). Communication interventions, on the other hand, are a crucial component of vaccination, and poor communication can harm vaccination uptake, vaccine completion, and parental faith in a vaccination program. The EPI program has three pillars of communication and community involvement activities: advocacy, social mobilization, and program communication. Individuals, caregivers, and communities should be informed about the value of vaccination and the significance of getting vaccinated on time through targeted messaging. This Guideline will focus on effective and recommended communication and community engagement in pastoralist communities.

Activities in immunisation communication

Immunisation Advocacy

Advocacy for immunisation can be used as a tool to ensure political commitment and bring all partners together to speak and act about immunisation. The potential targets of advocacy are members of parliament, ministries, regional president offices, members of regional parliaments, regional health bureaus, multi and bilateral donors, international and local NGOs, faith-based organizations/religious leaders, community leaders, women and professional associations, and media. Immunisation advocacy aims to gain government and other stakeholders' commitment towards immunisation and reaching those unvaccinated children, and defaulters so that increase/improve immunisation coverage and strengthen surveillance activities in those pastoralist communities.

Social Mobilization Activities

Social mobilisation was one of the major parts of communication, which aimed at sensitizing the community on the importance of immunisation and immunising children at large. As part of social mobilisation activities, transferring important messages to the community at large in the form of banners, brochures, and other social media in the local citation.

Program Communication

The goal of program communication is to get the program message to the end users. The overall program communication plan includes communication relays at each step. The Women Development Army (WDA), mainstream media, specialist conferences, and, to a smaller extent, media and public relations meetings are all employed as tools. In 2011, the GOE launched the Women Development Army (WDA), in which women are organised and mobilized in groups to convey practical ideas and encourage one another to enhance contraceptive, maternity, neonatal, and child health (RMNCH) services and hygiene habits with the assistance of HEWs.

Activities in community engagement

Community participation has been a fundamental concept and method for accomplishing the strategic goals of Ethiopia's health sector strategic plans. HEWs conduct home visits and outreach services to promote preventive health actions supported by the community engagement platform and have resulted in commendable improvements in parents and children morbidity and mortality, morbidity and mortality associated with major infectious diseases, and environmental hygiene improvements.

The Women Development Army (WDA) is a main grassroots community engagement tool. WDA has been expanded to virtually universal care in rural areas and partial coverage in urban areas (Assefa, Gelaw, Hill, Taye & Van Damme 2019:6). Social mobilization committees act as community participation platforms in pastoral nomads contexts. There have been interventions to strengthen WDA capability through competence-based training, with almost 500,000 WDA leaders taught (MOH Ethiopia 2019:21).

The WDG strategy's flaws can have a substantial detrimental impact on progress toward Universal Health Coverage (UHC) and achieving Sustainable Development Goals (SDGs). For example, despite the existence of numerous community participation platforms at the kebele level, their contributions to enhanced usage for health-related activities have been either mediocre or low (Assefa *et al.*, 2019). A new community involvement approach is now being designed and trailed for further widespread deployment to overcome the stated obstacles and limits. Women Development Groups (WDGs), Men Development Groups (MDGs), Village Health Leaders (VHLs), Positive Youth Development Groups (PYDGs), school clubs, and social institutions such as religious groups and other structures such as "Iddirs" are identified as major participants in the plan.

Private sector involvement

Communication between healthcare workers and caregivers during vaccination sessions, together with health professionals' knowledge, attitude, and practice, are some of the most important elements in determining optimal immunisation service uptake (Bisrat, Tadesse, Tsehay & Teshome 2020:82). Phone calls, content informing from caregivers, and more extensive informing through television, radio, social media, blurbs, and so on should point to raise open awareness that missing a planned immunisation does not fundamentally cruel that people are no longer qualified: antibodies given late are still secure and compelling at giving infection security, and caregivers and people should feel empowered to look for immunisation, even if it were postponed.

Involvement *of local community*

Civil society organisations, non-governmental organisations, religious institutions, and clan systems are all examples of civil society organisations. They can also assist in engaging vulnerable population groups, combating disinformation and rumours, and contributing to the generation and use of behavioural and sociological data to build effective tactics.

Involvement *of day-care centres and schools*

Day-care centres and schools could also be utilised as efficient channels of communication regarding immunisation, by informing learners and parents about the need of vaccination and reminding them to complete all immunisations.

6.7.6 Monitoring and Evaluation

EPI Program Managers and Supervisors at the National, Regional, zonal, and Woreda Levels, as well as Immunisation Partners, must prioritise monitoring and tracking vaccination performance. During supervisory visits, process indicators such as sessions scheduled and executed (especially for outreach) should be examined and addressed. Based on the oversight checklist, performance should be evaluated on a regular basis to offer feedback to health institutions and Woreda to avoid errors. Zero-dose and under-vaccinated children in Pastoralist Communities are difficult to reach. Furthermore, assessment surveys and operational research are advised to examine vaccination timeliness. Vaccine coverage for specific antigens should be used to monitor all doses provided. Monitoring and evaluation are included in the proposed

Guideline for increasing Child Immunisation in the Pastoralist Community of Somalia, Ethiopia. The guideline offers proposed indicators related to the aim and activities that should be collected on a regular basis to track implementation success.
Guidelines' impact would need to assess the locations where they are applied. EPI Operational Immunisation Partners should collaborate with Zonal and Woreda EPI departments to assess the impact of the recommendations by coordinating efforts and giving advice and practical assistance.

6.7.7 Summary

This study developed a Guideline for Immunisation Improvement Programs in the Pastoralist Community of Somali Region of Ethiopia. This Guideline reflects important approaches or strategies to reach unimmunized and missed immunisation children in low performing and hard to reach areas. The researcher is optimistic that the Guideline would help to improve children vaccination in Ethiopia's Pastoralist Community. Furthermore, this Guideline supports both the Healthcare Providers and Immunisation Implementing Partners. Any responsible body can use it following their needs analysis and assessment.

CHAPTER 7

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

7.1 INTRODUCTION

The overview, significant results, and limitations are presented in this chapter, along with suggestions for policymakers, vaccine implementers, nursing practice, and future research. The summaries and findings are in line with the study's goal, which was to provide recommendations and suggestions for improving children vaccination programs in a Pastoralist Community in Ethiopia's Somali Region.

7.2 RESEARCH DESIGN AND METHODS

This study used an Explanatory sequential Mixed Method of quantitative and qualitative research designs for analysing immunisation problems on parents/caregivers' knowledge and awareness of vaccine-preventable diseases, current immunisation status and dropout rate, and immunisation service readiness of monitoring systems sequentially with quantitative tools. The target population was all parents or caregivers, health facilities and healthcare providers working on immunisation in the Shebele Zone, Somali Region of Ethiopia. The study had a total of 300 participants and 64 health facilities for the quantitative strand and 12 participants for the qualitative strand. The study employed the SPSS Version 25.0 and Atlas ti 8 for quantitative and qualitative techniques, respectively. The study findings pointed to the necessity for healthcare professionals and vaccination implementing partners in Ethiopia, to produce guidelines for increasing children immunisation in the Pastoralist Community.

7.3 SUMMARY AND INTERPRETATION OF THE RESEARCH FINDINGS

This chapter provided a synthesis of the major findings from the quantitative and qualitative approaches, as well as an integration of the key findings by combining the two methodologies. Therefore, the important findings are provided here for a comprehensive understanding of the study's outcomes.

7.3.1 Evaluate immunisation coverage and its determinants among children aged 12 to 23 months.

Of the total sample, the proportion of children receiving valid full vaccination was 27% (95% CI: 21.0-31.0), partially vaccinated 7% (95% CI: 4.1-9.1) and not vaccinated 60% (95% CI: 55.1-66.1). Among children who had ever been vaccinated for regular vaccination, 79% (95% CI: 73.0 - 85.0%) of parents/caregivers reported that they had a child vaccination card. The Chi-square test was used in a bivariate study to discover correlations between socio-demographic and outcome variables. Among the socio-demographic variables, walking distance up to 30 minutes (x^2:1.8, p: 0.03), moderate economic position (x^2:0.17, p: 0.02) and ANC follow up (x^2:0.08, p: 0.00), showed relationship with the outcome variable. Fear of side reactions/effects on vaccination (x2:1.5, p: 0.04) and unawareness of the need to return for a subsequent dose of immunisation (x2:1.3, p: 0.03) had more association compared to other reasons of parents/caregivers of the respondents for not receiving the vaccination. Respondent parents/caregivers aged 25 to 29 were 2.67 times more likely to have a fully vaccinated child than parents/caregivers aged 35 and more (AOR: 2.67 95% CI: 1.21 - 5.89).

7.3.2 Assess knowledge and awareness of parents/caregivers on vaccine-preventable diseases and immunisation service.

Overall, 94.9% of the total respondents had heard of immunisation. Among these, health workers and community volunteers at 91% and 86%, respectively were the primary sources of information about immunisation, less than half, 46.3% (95% CI: 40.6-51.9) of the respondents had below the average value (poor knowledge) and 53.7% (95% CI: 48.02-59.30) had more than the mean value (good knowledge) of knowledge indicators, while nearly three fourth, 73.3% (95% CI: 68.3-78.3) were knowledgeable about the time of vaccination. This infers that most of the parents were not completely aware of the importance of specific vaccines but had the chance to know the time of immunisation. Parents or caregivers of the immediate older children, refusal of the vaccination cessation (x2:5.2 p: 0.00) and educational levels on ability to read or write (x2:0.6, p: 0.1) had an association on immunisation on the knowledge of parents or caregivers.

7.3.3 Assess immunisation health service readiness on monitoring system among the health facility in Shebele zones of Somali Region, Ethiopia.

From the total of 64, health facilities observed, 46% of them had availability of at least one trained staff and immunisation in practice guideline, 67.2% had availability of vaccine and other related commodities on immunisation, and nearly three quarter, 67.6% had availability of service delivery equipment. According to the WHO health facility readiness assessment recommendations, staff and training, vaccine equipment, commodities and supplies had dominant tracer components to evaluate the vaccination delivery at PHCUs. As a result, a readiness score of 50 indicated that, on average, or required inputs for providing the immunisation service were available (WHO, 2015:46). In this study, except for staffing and training, most of the tracer components were above the average or the recommended cut-off point.

7.3.4 Explore and describe the challenges and perception of HCWs on immunisation activities in the pastoralist community

It was discovered and determined that unvaccinated children and refusal of children vaccination services in the Pastoralist Community needed urgent attention and gave direction to healthcare providers' recommendations on which activities were more effective to improve low parents/caregivers' knowledge, unimmunised children and refusal of vaccination. Challenges to the EPI programs were clearly shown. Many of the healthcare providers had positive perceptions of who managed the vaccines and daily services of immunisation activities. The main challenges were staff shortages and turnovers, lack of activity documentation, capacity gaps in immunisation planning, vaccine supply and the general working condition of pastoralist areas.

7.3.5 Develop Immunisation Improvement Guidelines

Throughout the development process, the following directing standards were examined: evidence-based, vaccine availability and routine immunisation status, feasibility, cost-effectiveness, cultural acceptability, alignment with global 2030 immunisation agendas and Ethiopian priorities, to reach unimmunised children and those who missed immunisation. A rule for inoculation advancement programs within the Pastoralist Community was produced, based on discoveries from the quantitative and subjective ideal models of the research, calculating observed verification gaps and documented on purpose for the Pastoralist Community in vaccination programs.

7.4 CONCLUSION

Most of the respondents had heard of immunisation. Among these, health workers and community volunteers were the primary sources of information about immunisation. Half of the respondents had good knowledge and awareness of immunisation indicators. Parents or caregivers of immediate older children, educational levels on being able to read or write ($x2:0.6$, $p: 0.1$) showed an association on vaccine knowledge of parents or caregivers.

Almost 60% (95% CI: 55.1-66.1) of the respondents had more than 50% of the proportion of children not receiving valid full vaccination. Parents/caregivers who had ANC follow-up for the last pregnancy were 5.94 times more likely to have a fully vaccinated child as compared with parents/caregivers who did not have ANC follow-up (AOR: 5.94 95% CI:2.77- 12.74). On the health facility assessment, most of the tracer components on this study were above the average or the recommended cut-off point of the readiness score according to the WHO recommendation.

7.5 RECOMMENDATIONS

Based on the study's findings, the following suggestions for policymakers, vaccination program implementers, healthcare professionals, and researchers were made in the following order:

7.5.1 Policymakers

- . New tactics are necessary to allow healthcare professionals and parents to collaborate so as to boost vaccination completion rates in the Pastoralist Community.
- Parents' or caregivers' knowledge on immunisation should contribute to the educational levels. this indicated that Ministry of Education works on the accessibility of formal and informal education to pastoralist communities. This is not a recommendation.
- The accessibility of immunisation services in various hard-to-reach communities should be improved to allow the population to utilise them without difficulties.
- Among several interlinked interventions, the involvement of Pastoral Community leaders in immunisation awareness creation should contribute to improving the knowledge and acceptance of vaccination service in the community.

7.5.2 Healthcare providers and immunisation program implementers

- Strengthen the capacity of vaccination providers for vaccine issued and received on standard immunisation ledger books.
- Strengthen immunisation campaigns and health education to the parents/caregivers on the importance of specific vaccines and time of vaccination.
- Apply appropriate bottom-up, reaching every community and Micro-planning to improve vaccination services and reach Pastoralist Communities.
- Strengthen ANC follow-up services during pregnancy, ANC follow-up for the pregnancy parents/caregivers were chance to start and complete vaccination.
- Select healthcare providers working in the Pastoralist Community.

- Implement Immunisation strategies in the local context to bring about further improvement in the knowledge level of parents/primary caregivers living in the Pastoralist Community.
- Strengthen collaboration with all involved in local stakeholders, and implement partners, Woreda health offices, and health facilities to address current barriers to immunisation and other vaccination-related strategy objectives in the local context.
- Immunisation program implementers should provide continuous technical support to the local government partners to maintain changes attained in the Pastoral Community.
- Ensure the uptake of immunisation and strengthen the EPI program.
- The assigned regional and Woreda level immunisation experts and implementers should assess gaps and opportunities in the vaccination service delivery and give direction, advice, and support to local experts engaged in the operation of vaccination services in their respective regions.
- Share and adopt the experience of other Pastoralist Communities in developed countries' immunisation –implement- strategies to improve vaccination service and parents/caregivers' knowledge of VPD.

7.5.3 Further research

For the country's benefit, further study should be performed in other pastoralist regions of Ethiopia. The current study's findings demonstrated that most parents/caregivers lacked knowledge and awareness of vaccines preventable diseases. This circumstance calls for further vaccination research fields to provide adequate health information to parents and other caregivers about the value of certain immunisations.

7.6 CONTRIBUTION OF THE STUDY

The primary commitment of the project was to collect relevant evidence, and the sensitisation of HCPs, managers, decision-makers, policymakers, and partners to vaccine enhancement initiatives in Pastoralist Communities, and formulation of applicable recommendations. The created immunisation improvement guideline is an important result that has the potential to enhance parents/caregivers' knowledge, awareness, and vaccine uptake of children in Pastoralist Communities, as well as appropriate directions for HCPs working in pastoralist settings. The outcomes of scientific data analysis on the concerns presented could assist implementers and decision-makers to analyse, learn, act, and repeat the research in other areas. Importantly, the findings of the study might boost public confidence and directions on the immunisation implementing partners.

7.7 LIMITATIONS OF THE STUDY

This research was confined to one of the Shebele Zone's pastoralist districts only. The study's findings are not applicable to other segments of Ethiopia's pastoralist population; rather, are limited to parents or caregivers with children aged 12 to 23 months and health facilities in the Shebele Zone. However, when specific strategic activities are done to enhance vaccination uptake and parents/caregivers’ awareness of immunisation, healthcare professionals and other immunisation implementers in different pastoralist regions, might utilise the immunisation improvement guideline as reference.

7.8 SUMMARY

This chapter detailed how the study's overarching purpose and objectives were accomplished. The study's findings backed up the importance of the created immunisation improvement guidelines in the Pastoralist Community in terms of improving healthcare professionals' responses to vaccine uptake and improving immunisation awareness and knowledge of individual immunisations. The study concluded with a set of suggestions for governments, healthcare providers, vaccine implementers, and researchers. For the principal investigator, who is also a healthcare specialist, the study was both demanding and rewarding.

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ANNEXURES

ANNEXURE A: RESEARCH APPROVAL FROM THE UNISA HEALTH STUDIES RESEARCH ETHICS COMMITTEE

UNISA university of south africa

COLLEGE OF HUMAN SCIENCES RESEARCH ETHICS REVIEW COMMITTEE

26 June 2021

Dear Mr. Melaku Tsehay Ayalneh

Decision:
Ethics Approval from 26 June 2021 to 26 June 2026

NHREC Registration # :
Rec-240816-052
CREC Reference # :
67126898_CREC_CHS_2021

Researcher(s): **Name: Mr. Melaku Tsehay Ayalneh**
Contact details: 67126898@mylife.unisa.ac.za
Supervisor (s) **Name: Prof TG Lumadi**
Contact details: lumadtg@unisa.ac.za

Title: ***Guidelines for improvement of childhood immunization programmes in pastoralist communities, Somali Region of Ethiopia.***

Degree Purpose: PhD

Thank you for the application for research ethics clearance by the Unisa College of Human Science Ethics Committee. Ethics approval is granted for five year.

The ***medium risk application*** *was reviewed by* College of Human Sciences Research Ethics Committee, in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the

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confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.

5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No fieldwork activities may continue after the expiry date (28 June 2026). Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

The reference number 67126898_CREC_CHS_2021 should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

Yours sincerely,

Signature :

Prof. KB Khan
CHS Research Ethics Committee Chairperson
Email: khankb@unisa.ac.za
Tel: (012) 429 8210

Signature : PP

Prof K. Masemola
Executive Dean : CHS
E-mail: masemk@unisa.ac.za
Tel: (012) 429 2298

ANNEXURE B: UNISA ETHIOPIA BRANCH SUPPORT LETTER TO THE SOMALI REGION ON RESEARCH DATA COLLECTION

UNISA university of south africa

16 July, 2021

UNISA-ET/KA/ST/29/16-07-2021

Somali Regional State Health Bureau

Jigjiga

Dear Madam/Sir,

The University of South Africa (UNISA) extends warm greetings. By this letter, we want to confirm that Mr. Melaku TsehayAyalneh(student number 67126898) is a PhD student in the Department of Health Studies at UNISA. Currently, he is at the stage of data collection on his doctoral research entitled "***Guidelines for improvement of childhood immunization programmes in pastoralist communities, Somali Region of Ethiopia***."

This is therefore to kindly request your cooperation in assisting the student in any way that you can. We would like to thank you in advance for all the assistance that you would provide to the student. Attached, please find the ethical clearance that the student secured from the Department.

Sincerely,

Dr. Tsige GebreMeskel Aberra
Director

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ANNEXURE C: SOMALI REGION, SHEBELE ZONE HEALTH DEPARTMENT DATA COLLECTION APPROVAL LETTER

Somali Regional State

Shabele Zonal Health Department

Ref No: X/C/G/Sh/478/2021

Date: 30 September 2021

To:- Whom It May Concern

Subject: **Data collection Approval**

Mr Melaku Tsehay who are student of UNISA with student number 67126898 submitted a research, entitled **Guidelines for improvement of childhood immunization programmes in pastoralist communities, Somali region of Ethiopia"** to be done in Shebele Zone which approved by UNISA Ethical committee written on 26 June, 2021 with REC -240816-052 (NHERC) for PhD qualification. Looking the benefit of the study and medium risk for the study participants the zone approved the student to collect the data from health care providers (the research participants) working from zone, woredas (districts) and health facilities (hospitals, health centers and health posts) located in Shebel Zone catchment.

With Regards,

Jelle Mahamed Khaliif
ጄሌ መሀመድ ከሊፍ
Wakiilka Xaf/Caafimaadka
Gobolka Shabeele
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ANNEXURE D: REQUEST TO PARTICIPATE IN THE STUDY

Ethics clearance reference number: REC -240816-052
Research permission reference number (if applicable):
Ethical approval date 26 June 2021

Title: Guidelines for improvement of childhood immunisation programs in pastoralist communities, Somali region of Ethiopia.

Dear Prospective Participant

I am Mr Melaku Tsehay Ayalneh, a PhD student in the Department of Health Studies at University of South Africa (UNISA). I am conducting research with Prof TG Lumadi, senior lecturer, and researcher at the University of South Africa. My research title is "Guidelines for improvement of childhood immunisation programs in pastoralist communities, Somali region of Ethiopia" and is self-funded.

PURPOSE OF THE STUDY

The purpose of this study will be to develop guidelines to optimize childhood immunisation programs in pastoralist communities, Somali Region of Ethiopia.

BEING INVITED TO PARTICIPATE

The estimated coverage from population-based household surveys among children aged 12 to 23 months following a review of survey methods and information is based on the combination of vaccination history from documented evidence or caregiver recall.

There are three parts to this study including parents/caregivers' interviews at household, health facility observational interview and health care in-depth interview. Parents/caregivers household selection in each selected kebeles will be done by choosing a random direction from central direction of the kebele. The number of households in that direction to the edge of the kebele will be counted, and one household will be randomly chosen to be the first household. Subsequent households will be chosen by visiting the nearest households. In each Woreda cluster, one or two health posts will be randomly selected using lottery method based on the availability of health posts. All hospitals and HC in two zones will be included study populations.

PARTICIPATION IN THIS STUDY

My data collection approaches are qualitative and quantitative using questionnaires, in-depth interview techniques and observational checklist in the immunisation health service activity. The data will be collected at community and health facility levels. Individuals specifically assigned in EPI focal/immunisation focal persons, immunisation data reviews and parentss/caregivers of children aged 12 to 23 months will be interviewed.

WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE

Participation is voluntary. You have the right not to answer any question and to stop answering questions at any time. This interview should last no more than 30/40 minutes. The information that you volunteer to provide will help the development of community level immunisation guidelines which will assist in the improvement of childhood immunisation program in Somali regions of Ethiopia. You may decide not to take part or to withdraw from the questionnaire at any time without losing any benefits that you, your family, or your community might be entitled.

POTENTIAL BENEFITS

You may get no direct benefit from participating in this questionnaire, but you may get benefit indirectly after a longer period. Through reading the questions and asking for questions, you may improve childhood immunisation and expanded program for immunisation.

POTENTIAL RISK or CONSEQUENCES

The risk to participating in the interview are minimal. Using a face-to-face interview questionnaire may transmit the COVID-19, but cautious will keep physical distance and use a face mask while conducting the interview. In addition, using sanitizer will be made at the end of completing the response.

CONFIDENTIALITY

Anything you tell us during this interview or when we take measurements will be kept confidential. It will not be shared with other co-workers or with anyone else. We will never use your name on any document, only a coded number. No one will know that the coded number identifies you. All the information obtained from you will be kept confidential.

SECURITY OF DATA

Hard copies of your answers will be stored for a minimum period of five years in a locked cupboard/filing cabinet in my house and my computer will be stored on a protected password. We will never use your name on any document, only a coded number. No one will know that the coded number identifies you. All the information obtained from you will be kept confidential.

PAYMENT OR ANY INCENTIVES FOR PARTICIPATING

There is no cost to you for being part of the study. You will not be paid.

HAS THE STUDY RECEIVED ETHICS APPROVAL?

This study has received written approval from the Research Ethics Review Committee of Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

THE FINDINGS/RESULTS OF THE RESEARCH STUDY

If you would like to be informed of the final research findings, please contact:

Melaku Tsehay

Address: Addis Ababa, Ethiopia, Mobile phone +251912876207; Fax: +251112758634 E-mail 67126898@mylife.unisa.ac.za

Should you require any further information or want to contact the research advisor or supervisor about any aspect of this study, please contact

Prof Lumadi TG, Office phone 012 429 6513; E-mail lumadtg@unisa.ac.za

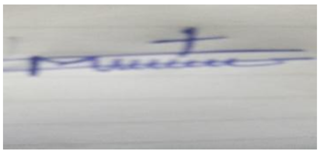
Should you have concerns about the way in which the research has been conducted, you may contact

Office Telephone +27 12 429 6513, Email: lumadtg@unisa.ac.za

Contact the research ethics chairperson of the CREC, Dr KJ Malesa, maleskj@unisa.ac.za, 012 429 6054 if you have any ethical concerns.

Thank you for taking time to read this information sheet and for participating in this study.

Kind regards,



Melaku Tsehay

ANNEXURE E: CONSENT TO PARTICIPATE IN THE STUDY

I am a student at UNISA and currently studying for my doctoral research study entitled “Development of immunisation improvement guidelines to optimize childhood immunisation programs in pastoralist community, Somali Region of Ethiopia”

It is known that childhood immunisation is routinely provided in all health care facility in Somali region of Ethiopia, but not all children receive these immunisations. This study is aimed to optimize childhood immunisation in pastoralist community of Ethiopia, through auditings of maternal/household factors, immunisation monitoring systems and service delivery factors. Participants will be asked questions related to childhood immunisation. The interview will last for 30 to 40 minutes.

The information you provide will only be used for this study and we strictly maintain confidentiality will be strictly maintained. Data will be recorded using codes and will be kept under the control of the investigators and will not be used for other purposes other than this study. Participants also have the right to withdraw from the study at any time they want, but your response will contribute a lot to our study. No harm will come to you, nor will you get benefit because of participating in this study.

If you have any questions and/or confusion regarding the questions you have the right to ask the interviewer but if it goes beyond you can contact the investigator of this study on the following address:

Participant Name & Surname…………………………………. (Please print)
Participant Signature……………………………………………. Date…………………
Researcher’s Name & Surname……………………………… (Please print)
Researcher’s signature…………………………………………. Date…………………

ANNEXURE F: COMMUNITY LEVEL QUESTIONNAIRE FOR WOMEN OR CAREGIVERS HAVING A CHILD BETWEEN 12 AND 23 MONTHS OLD

Development of immunization improvement guidelines to optimize childhood immunization program in pastoralist community, Somali region of Ethiopia *This questionnaire should be filled only for women or caregivers having a child between 12 and 23 months old*	
Section 1: Identification and Consent	
Questionnaire ID (Supervisor-Interviewer-Zone-Woreda Codes)	[___|___]-[___|___]-[___|___]-[___|___]
Area Identification: Region: ______________________________ Zone: __________________ Zone Code: [___|___] Woreda : _____________________________ Woreda Code: [___|___] Village/Gote: ________________	
Interviewer's Name: ____________________________________ Interviewer's Code: [___|___] Supervisor's Name: ____________________________________ Supervisor's Code: [___|___] Date of Interview: [_____|_____| ______| DD |MM |YYYY	
Signature of Supervisor: __________________________________ Date Reviewed: [_____|_____| ______| DD |MM |YYYY	

Section 2: Sociodemographic Characteristics

No.	Questions	Response	Skip
01	What is the birth date of the child (NAME)? ***VERIFY THE CHILD'S DATE OF BIRTH BY UNSING* VACCINATION CARD** to know BCG & OPV-0 vaccinations at the time of birth	[______/______/______] DD / MM / YYYY	
02	Who is the primary caregiver of the child (NAME)?	1. Parents 2. Father 3. Grand Parents	

		4. Other care taker, Specify______________[___]	
03	Age of the respondent in years	[___|___]	
04	Residence	1. Rural 2. Urban	
05	Are you able to read or write?	3. Yes 4. No [___]	**→07**
06	What is your educational status?	1. Informal Education 2. 1-4 Grade 3. 5-8 Grade 4. 9-12 Grade 5. Diploma 6. Degree 7. Above Degree [___]	
07	What is your occupation? **CIRCLE ALL RESPONSES**	1. Housewife 2. Business/shop/office 3. House maid 4. Selling in street/market 5. Farming 6. Pastoralist 7. Other, Specify………………… [___]	
08	What is your religion?	1. Orthodox 2. Catholic 3. Protestant 4. Muslim 5. Traditional 6. Other, Specify________________ [___]	
09	Marital status	1. Married 2. Not married 3. Divorced 4. Separated 5. Widowed 6. Living together [___]	
10	How long does it take you to walk to the immunization site? ***IF LESS THAN AN HOUR, RECORD IN MINUTES***	Minutes [__|___] Hours [__|___] 88 = Don't know the time required to reach 99 = Don't know the immunization site 00 = No immunization site in the kebele	

11	Are you a mobile resident?	1. Yes 2. No [___]	→ **13** → **12**
12	If no, how long have you lived continuously in this area? **IF LESS THAN A YEAR, ENTER "00"**	Response in years, [___|___]	
13	If yes, specify the area you are frequently moving	Specify________________________	
14	Who takes care of your children when you are not at home?	1. Respondent's parents 2. Respondent's parents-in-law 3. Husband/partner 4. Older children 5. Neighbours/friends 6. Other, Specify ………………….……. [___]	
15	Number of other children	[___|___]	
16	Is the immediate older child fully vaccinated	1. Yes 2. No	
17	Perceived economic position compared to neighbors?	1. Low 2. Moderate 3. High	
Section 3: Knowledge and Awareness on Immunization			
18	Where is your source of information about immunization? **CIRCLE MULTIPLE RESPONSES**	1. Radio 2. TV 3. Family 4. Friend/Neighbour 5. Community Volunteer 6. Printed materials/poster/banner 7. Health workers 8. Community leader 9. Church/mosque 10. Other, Specify …………………	
19	What messages have you heard about immunization? **CIRCLE MULTIPLE RESPONSES**	1. About campaigns 2. Importance of vaccination 3. Where to get routine vaccination 4. Age to get routine vaccination 5. Return to next doses of the routine vaccination 6. Adverse events following immunization	

		7. About new vaccinations (pneumococcal/ Rota vaccine) 8. Other, specify________________ [___] 99 = Don't know	
20	Do you think immunization prevents against childhood illnesses?	1. Yes 2. No	
21	Can you tell us vaccine preventable diseases? **ASK ANYTHING ELSE** **CIRCLE ALL RESPONSES**	1. Tuberculosis 2. Polio 3. Diphtheria 4. Pertussis (Whooping Cough) 5. Tetanus 6. Measles 7. Pneumonia 8. Meningitis 9. Hepatitis B Infection 10. Diarrheal Diseases 11. Don't Know 12. Other, Specify, __________________	
22	When do you think a child should start immunization?	1. At Birth 2. First two weeks 3. After two weeks 4. After 45 days 99 = Don't Know [___]	
23	Do you think vaccines are harmful?	1. Yes 2. No	
24	Do you think child with fever be vaccinated	1. Yes 2. No	
25	Do you think child with diarrhea be vaccinated	1. Yes 2. No	
26	Do you believe some children not receive vaccination?	1. Yes 2. No	
27	Which children should not receive vaccination? **CIRCLE MULTIPLE RESPONSES**	1. New-borns 2. Sick children 3. Physically handicapped children 4. Other, Specify _________________________ [___]	
Section 4: Childhood Immunization status			
28	Was your child (NAME) ever vaccinated for routine immunization?	1. Yes 2. No	**→29** **→38**

29	Do you have a vaccination card where (NAME's) vaccinations are written down?	1. Yes 2. No	**→30** **→31**
30	May I see the vaccination card, please?	1. Seen 2. Not seen	 **→31**
31	If not seen, why?	1. I did not receive it 2. It is kept in the health facility 3. It is missed 4. It is locked in other place 5. Other, specify__________________________	
32	Does the child have a scar from BCG vaccination? ***CHECK FOR BCG SCAR***	1. Yes 2. No	
4.1.	***Routine Immunization By Card: COPY VACCINATION DATE VACCINE FROM THE CARD: WRITE "44" IN "DAY" COLUMN IF CARD SHOWS THAT A VACCINAT GIVEN, BUT NO DATE IS RECORDED***		
33	a) BCG b) Polio 0 c) Polio 1 d) Polio 2 e) Polio 3 f) Penta 1 g) Penta2 h) Penta3 i) PCV1 j) PCV2 k) PCV3 l) Rota1 m) Rota2 n) Measles	**Yes** **No** BCG [___|___][___|___] Polio 0 [___|___][___|___] Polio 1 [___|___][___|___] Polio 2 [___|___][___|___] Polio 3 [___|___][___|___] Penta1 [___|___][___|___] Penta2 [___|___][___|___] Penta3 [___|___][___|___] PCV1 [___|___][___|___] PCV2 [___|___][___|___] PCV3 [___|___][___|___] Rota1 [___|___][___|___] Rota2 [___|___][___|___] Measles [___|___][___|___]	**If fully vaccinated, then go to 501**
4.2.	**Routine Immunization By History: ASK IF (NAME) RECEIVED ANY OF THE FOLLOWING VACCINATIONS, DON'T COUNT DOSES OF IMMUNIZATION CAMPAIGNS: READ QUESTIONS 40 418**		
34	Birth date of the child (NAME)	[______/______/______] DD / MM / YYYY	

35	First estimated vaccine in weeks after birth. ***Convert in to weeks***	[___]	
36	Are you certified to complete vaccination	1. Yes 2. No	
4.3. **Routine Immunization from Health Facility's Record/registrations: FOR CARD NOT SEEN, COPY THE VACCINATION DATE FROM THE HEALTH FACILITIES CARD FOR EACH VACCINATION.** ***WRITE "44" IN "DAY" COLUMN IF RECORD SHOWS THAT A VACCINATION WAS GIVEN, BUT NO DATE IS RECORDED***			
37	a) BCG b) Polio 0 c) Polio 1 d) Polio 2 e) Polio 3 f) Penta 1 g) Penta2 h) Penta3 i) PCV1 j) PCV2 k) PCV3 l) Rota1 m) Rota2 n) Measles	**Yes No** BCG [___|___][___|___ Polio 0 [___|___][___|___] Polio 1 [___|___][___|___] Polio 2 [___|___][___|___] Polio 3 [___|___][___|___] Penta1 [___|___][___|___] Penta2 [___|___][___|___] Penta3 [___|___][___|___] PCV1 [___|___][___|___] PCV2 [___|___][___|___] PCV3 [___|___][___|___] Rota1 [___|___][___|___] Rota2 [___|___][___|___] Measles [___|___][___|___]	
Section 5: Parents barriers and enabling factors Immunization Failure			
38	***IF CHILD NEVER IMMUNIZED OR NOT FULLY IMMUNIZED, ASK THE FOLLOWING QUESTION:*** What are the reasons for the child (NAME) not receiving any vaccine? **WITHOUT PROBING, CIRCLE ALL RESPONSES MENTIONED**	**Lack of Information** 1. Unaware of need for immunization 2. Unaware of need to return for subsequent dose 3. Place and/or time of immunization Unknown 4. Fear of side reactions 5. Wrong ideas about contra-indications **Lack of motivation** 6. Postponed until another time 7. No faith in immunization 8. Rumours **Obstacles** 9. Place of immunization too far 10. Time of immunization inconvenient 11. Vaccinators absent 12. Vaccine not available 13. Parents too busy 14. Family problem, including illness of the parents	

		15. Child ill -- not brought 16. Child ill - brought but not given immunization 17. Long waiting time **18.** Other, Specify ____________________ ____________________	
39	If the child received any routine vaccination, where did (NAME) receive last routine vaccination?	1. Hospital 2. Health centre 3. Health post 4. Private clinic 5. Outreach 6. Other specify…………………………… **99** = Don't know [___]	
40	When you were pregnant with (NAME), did you go to a health facility for antenatal care **(ANC)?**	1. Yes 2. No	
41	Do you have any suggestions that could be done that would make you or others more likely to get your child vaccinated?	1. Friendly vaccinator 2. Vaccination site with reasonable walking distance 3. Shorter waiting time at the vaccination site 4. Clean vaccination site 5. Free or inexpensive services 6. Availability of all antigens 7. Other, Specify ________________ 99 = Don't know/no suggestions	
42	Are you satisfied with the way in which vaccination is provided?	1. Yes 2. No	→ **44** → **43**
43	What happened? **CIRCLE MULTIPLE RESPONSES**	1. Vaccinator not friendly 2. Vaccinator drunk 3. Adverse effect from vaccine 4. Long waiting time 5. Vaccination site is dirty/not clean 6. Vaccination site closed 7. No vaccine at the vaccination 8. Vaccinator absent 9. Vaccination is expensive Other, Specify ____________________	
44	Have you ever refused vaccination for this child (Child Name)?	1. Yes 2. No	

THIS IS THE END OF OUR INTERVIEW. THANK YOU VERY MUCH FOR TAKING PART IN THIS INTERVIE

ANNEXURE G: CHECKLIST ON IMMUNIZATION MONITORING SYSTEMS TOOLS (OBANEWA, 2019:256).

Questionnaire no ____________

Type of HF: Health Center [__]
Health Post [__]
Woreda Health Office [__]

Interviewer name: ____________________________ DATE: ________________________

Respondent Position: ________________________________

Planning and Management of resources			
		Availability	
		Yes	No
101	Is there is an immunization session schedule display on the wall?		
102	Is the immunization session schedule being conducted as displayed?		
103	Does the health facility have a defined catchment area map?		
104	Does the HF have at least one (1) qualified HW		
105	Is there a management of defaulter tracking system in place? (Yes/no)		
106	Have all monthly reports for the previous year been dated and signed by the person authorized to submit the HF report?		
107	Does the HF monitor the implementation of planned immunization sessions?		
Cold-chain and Vaccine Management			
108	Are vaccines received and recorded in a vaccine ledger book?		
109	Are all vaccines available during the immunization sessions (BCG, Polio, Penta, MCV, PCV, Rota and IPV)		
	BCG		
	Polio		

	Penta		
	PCV		
	Rota		
	MCV		
110	If fridge Tag available, do they record all variables correctly?		
111	Is the cold-chain temperature monitoring chart completed twice daily (including public holidays and weekends)?		
112	Check all available vaccines and cross checks the available diluents and droppers to ascertain whether there are equal and correct if there are correct answer' yes' otherwise 'no'		
113	Is there equal number of Auto disposable (AD) and re-constitution syringes to match the vaccines available?		
114	Is there adequate number of safety boxes to match the number of AD and re-constitution syringes (Y/N).		
115	Is the foam pad in the vaccine carrier used for holding vaccines while in session?		
116	Do all vaccines have readable labels and have not expired and with VVM stage 1 & 2?		
Service Delivery			
117	Are all vaccines available during the immunization sessions (Yes/No)		
118	Does the officer use correct diluents for reconstituting each vaccine?		
119	Does the officer use one sterilized syringe/needle for reconstituting each vial of Measles, BCG?		
120	Does the HF provide adequate benches for clients to seat comfortably?		
121	Is there a water bowl and stand for washing hand in the vaccination room or nearby (Yes/No)		
122	Did the officer give the vaccine at the correct site, route, and dose?		
123	Did the officer use ONLY one syringe/needle for each dose of antigen given?		
124	Does the service provider enter on the card the date of next visit and explain to caregiver		
125	Does the service provider give the 6 key messages to the caregiver?		

126	Is there a safety box used for discarding used syringe/needle (Yes/No)?		
127	Is the immunization register being used with correct entries?		
Supportive Supervision			
128	Has the HF received support supervision from higher level (National, State, LGA) in the last one month (check for evidence)		
129	Was Written feedback/reports provided to the HF?		
130	Were the recommendations/Action points of the supervision specific to the HF carried		

ANNEXURE H: INTERVIEW GUIDE FOR IMMUNIZATION FOCAL PERSONS

Introduction

Good morning/afternoon. My name is …………………. I am from……………….

Thank you for agreeing to speak with me. The reason for our interview is we are conducting a doctoral study entitled Learning about **optimizing childhood immunization in the pastoralist community**. This should take no more than 30 minutes. I will not write your name or your health facility name, and what you as an individual say will not be shared with anyone outside this study. We will report only what EPI focal in general has said. There is no right or wrong answer, and we are hopeful that you will be free with your opinions and feedback.

Are you willing to answer a few questions?

Yes ☐   No ☐

Part I Sociodemographic Characteristics

Tell me about your background (probe)

I. Working area/district? ________________
II. Sex______ Age_________
III. Education______
IV. Profession___________,
V. Current Position/Responsibility______________
VI. Length of work experience________

Part II- working attitude and adequacy

1. How does the immunization system work (is it a daily immunization service or special days)? Is there stress in this job?
    - How do you feel about your work in vaccinating children or representing immunization focal? … Are there any aspects that you enjoy and aspects that you do not enjoy?
    - Challenges with the immunisation system

2. In the quantitative part of this study, most of the community respondents mentioned that they heard of immunisation. However, there was low routine immunisation coverage, with implications of varieties of challenges.
    - Barriers and challenges related to childhood immunisation
        - Demand side challenges:
        - Supply-side challenges
    - Suggestions of health providers to improve immunisation uptake
    - Possible reasons and health provider suggestions to reduce the high dropout rate

3. On the quantitative part of this study, the result showed that most of the community participants have relatively high knowledge and awareness of polio (92%) and measles (89%) vaccines, as compared to other vaccines for preventing other diseases. The researcher was interested to know the reasons for the participants' high knowledge and awareness of measles and polio vaccines than of other vaccines.
    - The possible reason for low knowledge of other VPD
    - Possible suggestions for improving the knowledge of other VPD
4. The results of the quantitative part of this research study showed low community linking plans at health facility levels. This was a matter of what the challenges and possible suggestions to engage communities in the EPI program were.

    - Challenges to community engagement
    - Heath providers’ suggestions on community engagement
    - Contribution of community involvement in the EPI Program.

This concludes our discussion. Is there anything we have not discussed that you would like to mention?

Thank you for your time and information.

ANNEXURE I: LETTER OF CONFIRMATION ON QUANTITATIVE AND QUALITATIVE ANALYSIS

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF PREVENTIVE MEDICINE

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Date: - March 05, 2022

To whom it may concern

Dear Madam/ Sir

This letter confirms the assessment of a thesis work of Melaku Tsehay Ayalneh, whose title is 'Guidelines for Improvement of Childhood Immunization Programmes in Pastoralist Communities, Somali Region of Ethiopia submitted to fulfill the degree of Doctor of Literature and Philosophy. I have gone through the document mainly on the methods, the analysis, and the results session. The assumption made to calculate the sample size for quantitative data has given the good research control of the power. The analysis session described the assumptions behind the analysis of continuous and categorical variables, the analysis thought of multivariable analysis to suppress the confounding effect of independent variables make the research work strong. The research work's use of factor analysis to reduce and group variables by construct is another part of the research superiority. Finally, the candidate has practiced the analysis in the result session as planned in the methods. Therefore, I would like to confirm that Melaku Tsehay Ayalneh has done his job well.

Sincerely,

Negussie Deyessa, (MD, MPH, Ph.D, Prof)
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ANNEXURE J: LETTER OF CONFIRMATION ON QUALITATIVE ANALYSIS

SANKOFA Research and Consulting Plc
ሣንኮፋ ሪሰርች ኤንድ ኮንሰልቲንግ ኃ/የተ/የግ/ማ

Reference No SRC/ RL- 138/2022
Date 03 June 2022

To whom it may concern

Dear Madam/ Sir,

This letter confirms the assessment of a thesis work of Melaku Tsehay Ayalneh, whose title is ***'Guidelines for Improvement of Childhood Immunization Programmes in Pastoralist Communities, Somali Region of Ethiopia*** submitted to fulfill the degree of Doctor of Literature and Philosophy. I have gone through the document mainly on the qualitative part on recoding, grouping, and regrouping Following that, coding and thematic analysis. The data analysis revealed four primary themes with associated sub-themes and each primary theme and its associated sub-themes were reinforced by appropriate verbatim statements from the participants. Finally, the candidate has practiced the analysis in the result session as planned in the methods. Therefore, I would like to confirm that Melaku Tsehay Ayalneh has done his job well.

Sincerely

Tesfalem Teshome
ተስፋዓለም ተሾመ
Managing Director
ማኔጂንግ ዳይሬክተር

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E-mail: sankofaconsultingplc@gmail.com/ infosankofaconsultingplc@gmail.com

ANNEXURE K: LANGUAGE APPROVAL CERTIFICATE

THOTHI

WRITING AND EDITING SOLUTIONS

Registration Number:2018/578658/07

Certificate

This serves to certify that

MELAKU TSEHAY AYALNEH

Who has written a THESIS titled:

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As a requirement for a________

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at the

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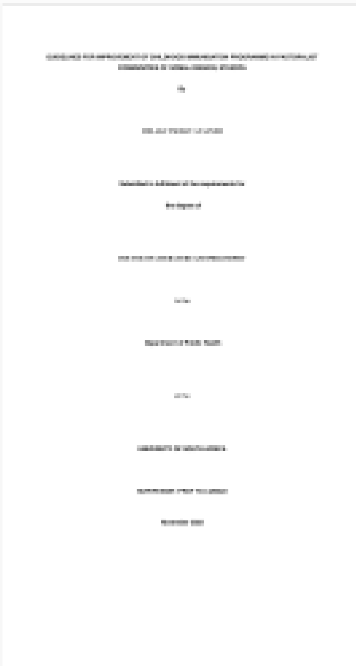

GUIDELINES FOR IMPROVEMENT OF CHILDHOOD IMMUNISATION PROGRAMME IN PASTORALIST COMMUNITIES OF SOMALI REGION, ETHIOPIA

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