

**STRATEGIES TO OVERCOME BARRIERS TOWARDS IMPLEMENTING
EXPANDED PROGRAMME ON IMMUNISATION IN PASTORALIST COMMUNITIES
OF AFAR, ETHIOPIA**

By

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DECLARATION

I, Mohammed Abdurahman Bilal, hereby declare that my work, **Strategies to Overcome Barriers to Implementing Expanded Programme on Immunisation in Pastoralist Communities of Afar**, is entirely my original and that all sources used or accessed were properly cited in my work.

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SIGNATURE

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DATE

DEDICATION

I would like to dedicate this thesis to my late aunt, Khadija Bilal Kemal. As a courageous and kind person who taught me to put my faith in Allah, to value hard work, and to realise how much can be accomplished with little, your words of support continue to motivate me. We will always cherish our memories of you.

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ABSTRACT

Background: Vaccination is a crucial public health intervention for reducing child mortality and morbidity, but Ethiopia and Africa have not met the Global Vaccine Action Plan's target.

Purpose: The study aimed at developing strategies to overcome barriers towards implementing the Expanded Programme on Immunisation (EPI) in pastoralist communities of Afar.

Research Design: This study used a qualitative approach with exploratory and descriptive design.

Setting: The research study was conducted in the Afar region of Ethiopia.

Population: The population groups of interest were parents or guardians of children aged 12-23 months who had missed one or more vaccines and EPI health workers.

Sampling: The sample size for this study was 77 participants, consisting of 60 parents or guardians and 17 healthcare providers including health extension workers and partners working on EPI. The interviewed participants' sample size was determined by data saturation. The researcher used non-probability purposive sampling to choose participants.

Data Collection Method and data analysis methods: The interviews were conducted in a language suitable to the participants (in Afar-aff and Amharic language). In-depth semi-structured interviews were conducted for both the participants and focus group discussions (FGD) through the aid of an interview guide. The study utilised thematic analysis to synthesise the recurring themes that emerged across the data. The data collected from the individual in-depth semi-structured interviews, FGD and Key Informant Interviews (KII) were transcribed and organised into themes for presentation using Braun and Clarke's six phases of data analysis.

Results: Thematic analysis revealed three interrelated themes: (1) individual- and community-level barriers, including caregiver knowledge gaps, fear of vaccine side effects, vaccine hesitancy driven by misinformation, and competing livelihood demands;

(2) community-level and environmental barriers, encompassing geographic remoteness (50–180 km from health facilities), seasonal flooding, population mobility disrupting multi-dose schedules, and lack of transportation; and (3) health system-level barriers, including insufficient health workforce capacity, inadequate cold-chain infrastructure in extreme temperatures exceeding 45°C, constrained financial resources, and service delivery models designed for settled rather than mobile populations. These barriers interact dynamically across all levels of the Social Ecological Model.

Validated Implementation Strategies: Seven evidence-based strategies were developed and validated through a two-round Delphi process with 15 multidisciplinary experts using the AGREE II instrument: (1) installing mobile solar-powered vaccine carriers for outreach services; (2) utilising colour-coded vaccination follow-up cards; (3) requiring immunisation verification for school enrolment; (4) decorating immunisation wards in fixed health facilities to create child-friendly spaces; (5) incorporating immunisation education into school curricula; (6) implementing mobile phone reminder systems; and (7) engaging knowledgeable family members as immunisation champions. All seven strategies achieved consensus ($\geq 76\%$ agreement) across all six AGREE II domains.

Conclusion: The seven validated strategies—mobile solar-powered vaccine carriers, colour-coded follow-up cards, school enrolment immunisation verification, child-friendly immunisation wards, school-based immunisation education, mobile phone reminder systems, and family immunisation champions—collectively address barriers at individual, community, organisational, and policy levels. Their validation through rigorous Delphi consensus and AGREE II assessment confirms readiness for pilot implementation. The study advances understanding of immunisation systems in mobile pastoralist populations through its novel application of the Social Ecological Model as both analytical and strategy-development framework, offering a replicable evidence-to-action pathway for comparable settings.

Keywords: Barriers, Expanded Programme, Implementation, Immunisation, Pastoralist Communities, Strategic Plan,

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ABBREVIATIONS AND ACRONYMS

AGREE	Appraisal of Guidelines, Research and Evaluation
BCG	Bacillus Calmette Guérin
CASP	Critical Appraisal Skills Program
CoGTA	Cooperative Governance and Traditional Affairs
CINAHL	Cumulative Index to Nursing and Allied Health Research Literature
CSA	Central Statistical Agency
DHIS	District Health Information System
DTP	Diphtheria-Tetanus-Pertussis
EDHS	Ethiopian Demographic and Health Survey
HER	Electronic Health Records
EPI	Expanded Program on Immunisation
FGD	Focus Group Discussions
GVAP	Global Vaccine Action Plan
HAD	Health Development Army
HC	Health Care
HEP	Health Extension Program
HEWs	Health Extension Workers
HSDP	Health Sector Development Programmes
HSTP	Health Sector Transformation Plan
IDI	In-depth Interview

IPV	Inactivated Polio Virus
KII	Key Informant Interview
LHWs	Lady Health Workers
MDGs	Millennium Development Goals
MMR	Measles, Mumps, and Rubella
MOU	Memorandum of Understanding
NDoH	National Department of Health
NGO	Non-Governmental Organisation
OPV	Oral Polio Vaccine
PCV	Pneumococcus Vaccine
PCV	Pneumococcal Conjugate Vaccine
RV	Rotavirus Vaccine
SEM	Social Ecological Model
SSA	Sub-Saharan Africa
StatsSA	Statistics South Africa
UNICEF	United Nations International Children's Emergency Fund
UHC	Universal Health Coverage
UNISA	University of South Africa
WHO	World Health Organisation

CHAPTER 1: OVERVIEW OF THE STUDY

1.1 INTRODUCTION AND BACKGROUND OF THE STUDY

Childhood immunization represents one of the most cost-effective public health interventions, preventing an estimated 4 to 5 million deaths annually worldwide (WHO 2023:1). Since the World Health Organization (WHO) established the Expanded Programme on Immunization (EPI) in 1974, global vaccination efforts have contributed to the eradication of smallpox, the near-elimination of polio, and significant reductions in mortality from vaccine-preventable diseases (VPDs) among children (WHO 2023:1). It is important to distinguish between the two related but distinct concepts central to this study. Vaccination refers to the administration of a vaccine to stimulate an immune response in a healthy individual, while immunization denotes the broader process through which a person develops protection against a disease following vaccination (Plotkin, Orenstein & Offit 2018:3). These services are delivered to healthy individuals, particularly children, to prevent future illness, not to treat existing disease (WHO 2023:1).

Despite remarkable global progress, significant disparities in immunization coverage persist, particularly among marginalized populations in geographically remote and resource-constrained settings (Gavi 2022:1; UNICEF 2023:1). Pastoral communities are among the most underserved in this regard. These are populations whose livelihoods center on livestock rearing, practicing varying degrees of mobility — from fully nomadic to semi-nomadic to increasingly sedentary patterns — in search of pasture and water (FMOH 2020:4). They inhabit predominantly arid and semi-arid regions where settled agriculture is not viable, and where environmental conditions necessitate seasonal movement. Introducing pastoral communities in this context is necessary because their mobility, geographic isolation, and distinct socio-cultural characteristics create compounding and systematic barriers to routine health service delivery, including childhood immunization — barriers fundamentally different from those faced by settled agricultural or urban populations.

In Ethiopia, pastoralists constitute approximately 15 million people, representing about 12% of the national population and occupying more than 60% of the country's landmass, predominantly in the Afar, Somali, and parts of Oromia, SNNP, Benshangul,

Gambela, and Tigray regional states (Debie et al 2020:3; EPHI & ICF 2021:45). Nationally, childhood immunization coverage has shown gradual improvement, with pentavalent 3 (Penta3) coverage reaching 78% in 2021 (EPHI & ICF 2021:45). However, these aggregate figures mask profound regional inequities. The Afar Regional State, located in northeastern Ethiopia, consistently records among the lowest childhood immunization rates in the country, with full immunization coverage ranging between 10% and 15% — far below the national average (EPHI & ICF 2021:47; FMOH 2020:12). Pastoralist communities within Afar experience the lowest coverage rates, as low as 5% to 10% in some predominantly nomadic districts, making them the primary drivers of the region's persistently poor immunization performance (Muluneh et al 2024:6).

Globally, pastoral communities face analogous immunization challenges. Studies from Kenya, Somalia, Chad, Niger, and Mauritania document full childhood immunization coverage rates typically ranging from 10% to 25%, despite decades of intervention efforts (WHO 2023:2; UNICEF 2023:3). Common barriers include population mobility disrupting service continuity, geographic remoteness limiting outreach capacity, weak health infrastructure, unreliable cold chains, and sociocultural factors shaping health-seeking behaviour. Nevertheless, evidence from successful interventions demonstrates that improved coverage is achievable when strategies are adapted to pastoralist realities — including mobile vaccination teams coordinated with seasonal migration patterns in Kenya, community health worker programmes maintaining contact during migration periods in Pakistan, and integration of child immunization with livestock vaccination services in several countries (WHO 2023:4; UNICEF 2023:5). These international experiences confirm both the global nature of pastoralist immunization challenges and the potential for contextually responsive approaches to improve outcomes when adequately resourced and sustained.

The Afar region's immunization challenges are driven by four interconnected factors well-documented in the literature. First, poor road infrastructure and geographic inaccessibility severely limit routine service delivery, with many communities located more than 50 to 100 kilometers from the nearest health facility (FMOH 2020:15). Second, the nomadic and semi-nomadic lifestyle of Afar's pastoralist population fundamentally disrupts the continuity of care required by fixed-point service delivery

models, as childhood immunization requires multiple contacts at specified intervals, at birth, 6 weeks, 10 weeks, 14 weeks, 9 months, and 15 months and to complete the schedule (Muluneh et al 2024:8). Third, extreme temperatures frequently exceeding 45°C pose significant threats to vaccine cold-chain integrity, with unreliable electricity supply and inadequate cold-chain equipment further compromising vaccine potency during transport to remote areas (FMOH 2020:18). Fourth, community beliefs and misconceptions about vaccines, arising from limited health literacy, inadequate culturally appropriate health education, and historical mistrust of health services, contribute to vaccine hesitancy in some segments of the population (Muluneh et al 2024:10). These factors do not operate in isolation but interact in complex and mutually reinforcing ways, creating compounding barriers that strategies designed for settled agricultural populations are ill-equipped to address.

Emerging evidence from Afar and comparable pastoralist contexts globally suggests that culturally adapted, community-engaged approaches hold potential for improving childhood immunization uptake. A pivotal contribution to this body of evidence is provided by Muluneh et al (2024), whose mixed-method study offers one of the few contextually grounded analyses of childhood vaccination coverage determinants in the Afar region. Their study reported full immunization coverage ranging from 5% to 10% in predominantly nomadic districts, with coverage concentrated in peri-urban areas near health posts, while rural and fully nomadic communities remained almost entirely unreached (Muluneh et al 2024:6). It is against this empirical baseline that the effectiveness of promising practices must be evaluated, not merely asserted. The following sections critically examine five context-adapted practices identified by Muluneh et al (2024), interrogating not only their demonstrated effectiveness but also the conditions under which they succeed or fail, and what this reveals about the systemic shortcomings that prior approaches have failed to address.

The first practice identified by Muluneh et al. (2024) involves deploying Health Extension Workers (HEWs) who speak Afaraf and understand cultural norms. These practices showed the strongest correlation with vaccination uptake in the Muluneh et al. (2024) dataset. Communities served by Afaraf-speaking HEWs with more than two years of experience recorded immunization rates about 12 to 15 percentage points higher than those served by recently posted HEWs with agricultural backgrounds

(Muluneh et al., 2024: 9). However, the study found that annual HEW attrition in sampled pastoralist districts was approximately 38%, driven by professional isolation, inadequate support, and the psychological burden of working in remote, resource-limited environments. Muluneh et al. (2024: 11) conclude that the positive impact of linguistic and cultural competence cannot be maintained under current staffing conditions, and workforce retention should be viewed as an immunization system issue rather than just a human resources problem. This structural critique of the HEP deployment model goes beyond simply stating that culturally competent HEWs are beneficial — it highlights the organizational failure that prevents such competence from translating into sustained coverage improvements.

The second practice involved engaging Imams to incorporate immunisation messages into religious teachings. These were documented in two Afar districts where health authorities had established formal partnerships with mosque leadership. Muluneh et al. (2024: 14) report that districts with active partnerships saw an average of 23% more caregivers attending vaccination sessions held after Friday prayers than at routine health post outreach, a meaningful finding given that mosque attendance in Afar is near-universal and Friday congregation is one of the few regularly scheduled mass gathering points in otherwise dispersed pastoral settlement patterns. However, the study cautions that this effect was contingent on the individual Imam's willingness, the existence of prior trust between health authorities and mosque leadership, and continued provision of accurate information, conditions not consistently met across all sampled districts. In one district, a senior Imam publicly expressed religiously framed reservations about a specific vaccine, and subsequent coverage in his catchment area declined by 14 percentage points within three months (Muluneh et al., 2024: 15). This variability demonstrates that religious leader engagement is not a uniformly replicable strategy; it is a relational and political process requiring sustained investment, negotiation, and ongoing knowledge-sharing and not a one-time orientation activity.

The third practice constitutes utilising communal events such as Eid celebrations, market days, and seasonal clan gatherings as vaccination platforms, as documented by Muluneh et al. (2024: 17) in their study. These are theoretically the most promising approaches for reaching fully nomadic households, as it addresses the fundamental challenge that nomadic populations do not consistently pass through fixed health facility

catchment areas. Two district-level pilots achieved single-session coverage of 34% to 41% of targeted children during the Eid al-Adha period. However, the authors issue a critical qualification: follow-up tracing found that only 28% of children vaccinated at these events received subsequent doses within the recommended interval (Muluneh et al., 2024: 18). This gap between first-dose event coverage and completed-schedule coverage exposes a structural limitation of event-based strategies — they are effective for initial contact but cannot substitute for longitudinal tracking infrastructure. Without cross-district mobile record-keeping, children vaccinated at communal events become effectively lost to the multi-dose follow-up that EPI schedule completion requires.

The fourth practice, involving clan elders and traditional leaders as health promotion advocates, was documented as effective when leaders were engaged as genuine decision-making partners rather than as passive endorsers. Muluneh et al. (2024: 19) found that in districts where clan elders participated in health committee deliberations as full members, coverage rates were on average 8 percentage points higher than in districts where elders were excluded. Yet the study also identifies a recurring failure mode: health authorities tended to engage traditional leaders episodically, mobilising their support during campaign periods without sustaining the relationship between campaigns, eroding trust and reducing cooperation over successive cycles. This pattern of episodic co-optation rather than genuine sustained partnership represents an organisational failure on the part of the health system, not a cultural barrier and represents a distinction that fundamentally reorients the appropriate intervention response.

The fifth practice and the last finding identified by Muluneh et al (2024: 22) involves integrating child immunisation with livestock vaccination services as the most contextually innovative approach, reflecting a sophisticated understanding of pastoralist priorities. A pilot in Chifra district found that joint human-animal health camps attracted 2.4 times more household attendees than health-only outreach, and enabled engagement with male household decision-makers who were otherwise absent from conventional immunisation contacts. However, the pilot operated with external financing and inter-ministerial coordination unavailable within the standard EPI budget. The study explicitly cautions that without structural embedding into routine health system financing

and operational arrangements between the Ministry of Health and the Ministry of Agriculture, this approach cannot be sustained or scaled (Muluneh et al., 2024: 24).

These findings from Muluneh et al. (2024) collectively reveal a pattern of conditional effectiveness: each practice demonstrated measurable positive impact under specific enabling conditions, yet each was constrained by implementation failures, resource limitations, or organisational fragmentation that were not specific to any single practice but reflected systemic shortcomings of the health system as a whole. This critical reading of the evidence stands in sharp contrast to an uncritical reading that simply endorses these practices as "promising" without interrogating the conditions under which promise translates into sustained impact, or fails to do so. It is this interrogation that demonstrates what conditions make promising practices work and why prior approaches have underperformed.

Rationale of the study

This study addresses persistent immunisation gaps in Ethiopia's pastoralist regions, with a specific focus on the Afar Region, where coverage rates remain consistently below national targets despite substantial investments in immunisation infrastructure, outreach services, and policy reforms (WHO, 2024: 21; Muluneh et al., 2024: 8). Although prior research has documented barriers such as geographic isolation, limited caregiver knowledge, vaccine stock-outs, and socio-cultural resistance (Nigatu et al., 2024: 4), these factors alone do not sufficiently explain the persistence of low immunisation uptake. The continued failure to achieve sustained improvements suggests that immunisation challenges in pastoralist settings are not merely technical or logistical, but are embedded within complex and interacting systemic, organisational, and socio-cultural processes (Muluneh et al., 2024: 19).

A central limitation of existing scholarship lies in its fragmented analytical focus. Much of the literature conceptualises barriers to immunisation as isolated variables—such as distance to health facilities, maternal education, or service availability—without adequately examining how these elements interact across multiple levels of the health system and community context (Nigatu et al., 2024: 9). As a result, the mechanisms through which immunisation inequities are reproduced over time remain insufficiently understood. What is consistently overlooked is the dynamic and relational nature of

immunisation systems in pastoralist environments, where population mobility, governance arrangements, service design, and community norms intersect in ways that challenge conventional public health assumptions (Muluneh et al., 2024: 14; WHO, 2024: 29)

From a programmatic perspective, a range of interventions has been implemented in Afar and comparable pastoralist regions, including mobile outreach services, health extension worker-led community mobilisation, defaulter tracing, and periodic mass vaccination campaigns (Muluneh et al., 2024: 12). While these strategies have demonstrated short-term improvements in immunisation coverage, evidence indicates that they have largely failed to generate sustained gains (Muluneh et al., 2024: 17). Critically, the reasons for this limited effectiveness have seldom been interrogated in depth. Mobile outreach services, for example, are frequently planned using static geographic and population assumptions that do not align with fluid pastoralist migration patterns, resulting in missed populations and weak continuity of care (Muluneh et al., 2024: 13).

Similarly, community mobilisation initiatives have often increased awareness but have been implemented as episodic activities rather than as sustained, trust-based engagement processes embedded within local social, religious, and clan structures (Nigatu et al., 2024: 10). Organisational constraints—including weak coordination between national policy directives and district-level implementation, limited decision-making autonomy at the frontline, and inadequate adaptation of cold-chain systems to extreme climatic conditions—have further undermined the effectiveness of these interventions (Muluneh et al., 2024: 18).

Theoretical gaps further compound these challenges. Dominant immunisation frameworks continue to privilege linear, supply-driven models of service delivery premised on relatively stable populations and predictable patterns of health service utilisation (WHO, 2024: 5). Such models are poorly suited to pastoralist contexts, where health-seeking behaviour is shaped by gendered decision-making, clan authority, religious influence, livelihood imperatives, and environmental uncertainty (Nigatu et al., 2024: 10; Muluneh et al., 2024: 13). Existing studies rarely integrate these dimensions into a coherent analytical framework capable of explaining why technically sound interventions fail to translate into sustained uptake. Consequently, policy responses

often recycle familiar solutions—more outreach, more training, more messaging—without addressing the deeper structural and relational conditions that constrain impact (WHO, 2024: 31).

Looking at various gaps identified, therefore, this study seeks to move beyond descriptive accounts and isolated recommendations by generating original, integrative insights into how immunisation systems function—or fail to function—in pastoralist settings. The study critically examines the translation of national immunisation policies into local practice, organisational dynamics within the health system, and the role of community structures, cultural norms, and gender relations in shaping immunisation uptake (Muluneh et al., 2024: 18). In doing so, it addresses a significant gap at the intersection of health systems research, implementation science, and socio-ecological theory.

Importantly, the study does not aim merely to identify problems or propose context-specific recommendations. Its core contribution lies in developing an empirically grounded, context-sensitive explanatory model that elucidates the mechanisms through which immunisation inequities are produced and sustained among mobile pastoralist populations—an area that remains under-theorised in both national and global immunisation literature (WHO, 2024: 34). Such a model has relevance beyond the Afar Region, offering transferable insights for other hard-to-reach and mobile populations across sub-Saharan Africa and comparable global contexts.

By advancing theoretical understanding of immunisation delivery in complex socio-ecological environments and generating evidence-based, adaptive strategies tailored to pastoralist realities, this research contributes meaningfully to both local policy discourse and the broader global knowledge base on equitable immunisation systems. This study, therefore not only documents a persistent problem, but to generate original knowledge that reshapes how that problem is understood and addressed.

1.2 RESEARCH PROBLEM

Despite sustained national commitment to the Expanded Programme on Immunisation (EPI) and the continued implementation of outreach and equity-oriented strategies, routine childhood immunisation coverage in Ethiopia's Afar Regional State remains

persistently low. This pattern of underutilisation cannot be adequately explained by limited service availability or logistical constraints alone, as immunisation services are formally established in many areas where uptake remains weak.

While existing studies commonly attribute low coverage in pastoralist settings to geographical remoteness, population mobility, and resource limitations, such explanations obscure deeper structural and institutional dynamics that shape service delivery and utilisation. In the Afar context, persistent low uptake reflects systemic weaknesses in governance, fragmented accountability mechanisms, and limited institutional capacity to adapt national policy frameworks to highly mobile and socially stratified communities.

At the community level, immunisation behaviour is shaped by intersecting socio-cultural norms, livelihood imperatives, gendered decision-making processes, and historically embedded patterns of trust and mistrust in public services. These factors influence caregiver engagement with health services and mediate how immunisation initiatives are interpreted, negotiated, and adopted. However, existing research has rarely examined how these relational dynamics interact with organisational practices and frontline implementation processes.

Furthermore, significant gaps remain between national immunisation policy intentions and local operational realities. Weak coordination across administrative levels, constrained decision-making autonomy among frontline workers, and limited responsiveness to pastoralist mobility patterns undermine the effective translation of equity commitments into practice. These systemic disconnects perpetuate cycles of fragmented service delivery and inconsistent community engagement.

The central problem addressed in this study is therefore not merely low immunisation coverage, but the absence of a coherent, empirically grounded understanding of the causal mechanisms through which policy, organisational, and socio-cultural processes interact to sustain inequitable immunisation outcomes in the Afar Region. Without such understanding, interventions remain technocratic and episodic, failing to address the structural and relational conditions that reproduce exclusion and limit sustainability.

1.3 SIGNIFICANCE OF THE STUDY

This study is significant in its contribution to advancing understanding of the persistent immunisation gaps in Ethiopia's lowland pastoralist regions through a systems-oriented analysis of the interaction between policy frameworks, health-system organisation, and socio-cultural contexts. By moving beyond fragmented examinations of isolated barriers, the study develops an integrated analytical understanding of how structural, organisational, and contextual factors collectively shape immunisation uptake among mobile pastoralist populations. This contribution addresses a critical gap in the existing literature, which has largely treated immunisation challenges as discrete phenomena rather than as interconnected processes operating across multiple levels of the health system.

The findings of this study will benefit a broad range of stakeholders. At a policy level, national and regional policymakers will be supported with empirically grounded evidence to improve the alignment between immunisation policies and local implementation realities in pastoralist settings, thereby enhancing policy coherence, equity, and sustainability. Health-system managers and frontline practitioners will benefit from insights that inform the design of context-sensitive service delivery models, including flexible outreach and community engagement approaches that accommodate population mobility while strengthening trust and collaboration with pastoralist communities.

From an academic and research perspective, the study will benefit scholars and postgraduate researchers by contributing to theoretical and methodological debates on immunisation equity in hard-to-reach and mobile populations. By proposing a transferable analytical framework for examining complex health system challenges, the study offers a foundation for comparative research and the adaptation of immunization strategies in similar marginalized contexts globally. Collectively, these contributions position the study to inform policy development, strengthen service delivery, and advance scholarly knowledge on equitable immunisation in pastoralist and comparable settings, in line with UNISA's emphasis on socially responsive and policy-relevant research.

Specifically, the study's findings will enable the following concrete contributions:

Policy Development and Decision-Making: The study will inform national immunization policy revision to better accommodate mobile pastoralist populations through evidence-based modifications to service delivery models, immunization schedules, and program guidelines. It will guide equitable resource allocation decisions by documenting the actual costs and resource requirements for effective immunization delivery in hard-to-reach areas, supporting evidence-based budget advocacy. The findings will support development of equity-focused policies that recognize diverse population needs and contexts rather than applying uniform approaches. Additionally, the study will provide evidence for policy dialogue on decentralized, community-based immunization approaches that empower local health systems and communities.

Health Service Delivery Improvement: Health facility managers will be equipped to design outreach strategies aligned with pastoralist migration patterns rather than arbitrary scheduling, improving service accessibility and utilization. Health extension workers will gain evidence-based approaches for community engagement that build trust and address genuine concerns rather than simply delivering standardized health messages. Service delivery models will be refined to increase both accessibility (through flexible timing and location) and acceptability (through cultural sensitivity and respect for community contexts). The study will inform improvements in cold-chain management and vaccine supply systems adapted to challenging environmental conditions and remote settings.

Research and Education Advancement: The study provides a theoretical framework applicable to immunization challenges in other mobile populations globally, offering conceptual tools for understanding and addressing health service delivery in complex socio-ecological environments. It establishes methodological approaches for health systems research in hard-to-reach contexts, demonstrating how qualitative and participatory methods can generate actionable evidence. The study generates an evidence base for postgraduate education programs in public health, health systems strengthening, and implementation science. Finally, it contributes to global knowledge on achieving universal health coverage and health equity by addressing the needs of diverse populations including those whose mobility and context challenge conventional health system design.

Community and Stakeholder Benefits: Pastoralist communities in Afar will benefit from strategies that respect their livelihoods and contexts rather than expecting them to conform to service delivery models designed for settled populations. Health workers will benefit from evidence-based guidance that makes their work more effective and rewarding. Development partners and NGOs will gain insights for designing and implementing more contextually appropriate health interventions. The broader Ethiopian health system will benefit from lessons that apply not only to Afar but to other pastoralist regions (Somali, Borena, etc.) facing similar challenges.

1.4 RESEARCH PURPOSE

The purpose of this study is to generate a systematic, multi-level understanding of the factors contributing to persistently low immunisation coverage in Ethiopia's lowland pastoralist regions, with specific reference to Afar. Despite sustained investment in the Expanded Programme on Immunisation (EPI), coverage in pastoralist communities remains substantially below national targets, indicating the presence of deeper systemic, organisational, and socio-cultural constraints that are insufficiently addressed by existing approaches.

1.5 RESEARCH OBJECTIVES

The specific objectives of this study are to:

- Identify and analyse the multi-level systemic, organisational, and socio-cultural factors that influence EPI service utilisation in pastoralist communities of Afar, Ethiopia.
 - Examine how national and regional immunisation policies are translated into local implementation within pastoralist settings, with particular attention to institutional capacity, service delivery models, and population mobility.
 - Assess the effectiveness and sustainability of existing and previous immunisation strategies aimed at improving EPI coverage in pastoralist communities of Afar.
 - Develop contextually appropriate, adaptive strategies to strengthen EPI service utilisation and immunisation coverage among pastoralist populations in Afar, Ethiopia.
- The following were the study's research objectives:

1.6 RESEARCH QUESTIONS

The main question for this study:

How do policy, health-system, and socio-cultural factors interact to influence the utilisation of Expanded Programme on Immunisation (EPI) services in pastoralist communities of Afar, Ethiopia, and how can these interactions inform more effective and context-responsive immunisation strategies?

The study's research questions were:

- What immunisation strategies and service delivery approaches are currently implemented to improve EPI service utilisation in pastoralist communities of Afar, Ethiopia?
- What systemic, organisational, and socio-cultural barriers constrain EPI service utilisation in pastoralist communities of Afar, Ethiopia?
- How do existing policies and health-system arrangements shape the implementation and sustainability of EPI services in pastoralist settings?
- What adaptive, contextually appropriate strategies can be developed to strengthen EPI service utilisation among pastoralist communities in Afar, Ethiopia?

1.7 DEFINITION OF KEY TERMS

According to Saunders et al (2019:345), key concepts are considered particularly important in a certain context.

The following essential concepts are defined to clarify their usage in practice, disciplinary contexts, colloquial language, and other contexts (Saunders et al., 2019, p. 345).

Barriers: Barriers are things (problems) that hinder an entity or entities from utilising a service correctly or at all (Barad 2018:85). Barriers in this study are problems or issues that hinder the successful implementation of EPI in the pastoralist village of Afar, Ethiopia.

Expanded Program of Immunisation: A global immunisation effort known as the "extended programme" was introduced in 1974 (Wolfson et al 2015:65). The term "EPI" in this study refers to the universally administered vaccinations against Poliomyelitis, **Implementation:** Carrying out a plan, procedure, or any other design, concept, model, specification, guideline, or policy. Therefore, for anything to happen, implementation is the activity that needs to come after any initial thought (Barad 2018:88). The term "implementation" in this study refers to carrying out strategies that remove obstacles to the adoption of EPI in the pastoralist villages of Afar, Ethiopia.

Immunisation coverage refers to the percentage of the target population that has received vaccinations (Garib et al 2016:444).

Full Immunisation: Full immunisation in this study refers to fully immunised children between the ages of 12 and 23 months. A child who has received one dosage of BCG, three or more doses of Pentavalent, four doses of OPV/IPV, two doses of Rota, and one dose of the Measles vaccine as shown on a clinic card together with mother history is considered fully immunised (Garib et al 2016:444).

Incomplete (partial) immunisation: A child who has not received all the necessary vaccinations is said to have had incomplete (partial) immunisation (Garib et al 2016). Children between the ages of 12 and 23 months who have missed one or more immunisations are referred to in this study as having been exposed to incomplete or partial immunisation.

The Distinction Between Immunization and Vaccination: While the terms are often used interchangeably in common practice and in this study, there is a technical distinction. Vaccination is the act of administering a vaccine - the physical delivery of the immunizing agent through injection, oral administration, or other means. Immunization is the process of becoming immune or protected against disease, which results from successful vaccination. In other words, vaccination is what healthcare providers do; immunization is what happens in the person's body as a result. This study uses both terms contextually, with "vaccination" referring primarily to service delivery activities (e.g., "vaccination campaigns," "vaccine administration") and "immunization" referring to the comprehensive programme, protection outcomes, and population-level coverage (e.g., "immunization coverage," "Expanded Programme on Immunisation," "immunization status"). Both terms are used appropriately throughout the thesis to maintain consistency with established terminology in public health literature.

Strategies: A strategy is a high-level plan designed to accomplish one or more objectives in an uncertain environment. The "art of the general" comprises several specialised knowledge areas like logistics, tactics, and siege warfare (Barad 2018:78). For this study, strategies are solutions or plans designed to overcome obstacles to the EPI's implementation in the pastoralist villages of Afar, Ethiopia.

Vaccination is a process in which a weakened, living, or deceased microorganism is injected into an individual to activate their immune system against the microbe and ward off infectious diseases. According to Melkamu et al (2020:183), it is the most significant and economical public health intervention to lower child mortality and morbidity. In this study, vaccination is the microorganism injected to a child to activate his or her immune system against microbe and ward off infectious diseases.

1.8 THEORETICAL FOUNDATION OF THE STUDY

A theoretical foundation provides the conceptual lens through which a research problem is understood and investigated. Kaushik and Walsh (2019:12) explain that theoretical inquiry is grounded in abstract concepts and explanatory principles that guide how phenomena are interpreted, rather than focusing solely on their practical application. In this study, the theoretical foundation informs how immunisation challenges in pastoralist communities are conceptualised, examined, and explained.

1.8.1 Research Philosophy

Research philosophy concerns the nature of knowledge and the assumptions that underpin how knowledge is generated and interpreted (Saunders et al., 2019:12). The philosophical stance adopted by a researcher influences the choice of research design, data collection, and interpretation of findings (Insel et al., 2020:56). Common research philosophies include positivism, interpretivism, realism, and pragmatism (Saunders et al., 2019). Kaushik and Walsh (2019:4) further note that a research paradigm is underpinned by assumptions relating to ontology, epistemology, axiology, and methodology. Guided by the nature of the research problem and the study's aim to understand lived experiences and contextual meanings, this study is situated within an interpretivist research paradigm.

1.8.2 Interpretivist Research Paradigm

The interpretivist paradigm is rooted in the social sciences and is concerned with understanding social reality as it is experienced and interpreted by individuals (Harris & Baraka, 2022:797). Interpretivism assumes that reality is socially constructed and that human behaviour cannot be meaningfully understood through objective measurement alone. Instead, emphasis is placed on subjectivity, context, and meaning (Saunders et al., 2019:212).

In interpretivist research, knowledge is generated through engagement with participants' perspectives, experiences, beliefs, and values. This paradigm is therefore appropriate for this study, which seeks to explore how policy, health-system organisation, and socio-cultural factors shape immunisation practices in pastoralist communities. By adopting an interpretivist approach, the study aims to capture diverse viewpoints and contextual realities relevant to understanding barriers to and opportunities for improving the implementation of the Expanded Programme on Immunisation (EPI) in Afar, Ethiopia.

1.8.3 Paradigmatic Assumptions

1.8.3.1 Epistemological Assumptions

Epistemology refers to assumptions about what constitutes valid knowledge and how such knowledge can be acquired (Giladi & McMillan, 2022:640). From an interpretivist epistemological perspective, knowledge is understood as subjective and socially constructed, emerging through interaction between the researcher and participants.

In this study, knowledge is generated through participants' accounts of their experiences with EPI service delivery and utilisation. Understanding these experiences requires openness, reflexivity, and sensitivity to context. The researcher therefore sought to interpret meanings embedded in participants' narratives, recognising that these meanings are shaped by social, cultural, and institutional influences within pastoralist settings.

1.8.3.1.2 Ontological Assumptions

Ontology concerns assumptions about the nature of reality (Kaushik & Walsh, 2019:16). Interpretivism assumes that reality is multiple, dynamic, and constructed through social interaction. Accordingly, this study assumes that there is no single objective reality regarding immunisation challenges in pastoralist communities; rather, multiple realities exist based on the experiences of different actors, including healthcare providers, community members, and programme implementers. These ontological assumptions inform the study's emphasis on exploring diverse perspectives to understand immunisation uptake.

1.8.1.3 Methodological Assumptions

Methodology refers to the principles and processes that guide how knowledge is generated (Taherdoost, 2021:20). Within an interpretivist paradigm, qualitative approaches are considered appropriate for exploring meaning, context, and complexity. Accordingly, this study adopts a qualitative methodological orientation to examine how immunisation policies and practices are experienced and enacted in pastoralist communities. Detailed discussion of research design, data collection, and analysis procedures is presented in Chapter 3.

1.9 THEORETICAL CONCEPTUAL FRAMEWORK

A theoretical conceptual framework consists of concepts, their definitions, and existing theory/theories used for study (Harris & Baraka, 2022:123).

The Social Ecological Model (SEM), developed by Bronfenbrenner (1979:66), was used as this study's theoretical framework because it offers a thorough knowledge of the behaviour of those seeking health. It is an effective paradigm for comprehending the variety of variables affecting health and well-being. This framework is based on the idea that parents or guardians of infants who exhibit health-seeking behaviour are situated in social, institutional, and physical environments and that the social environment has an impact on the infants' health-seeking behaviour (Roura et al 2009:52). The framework is illustrated in Figure 1.1 below:

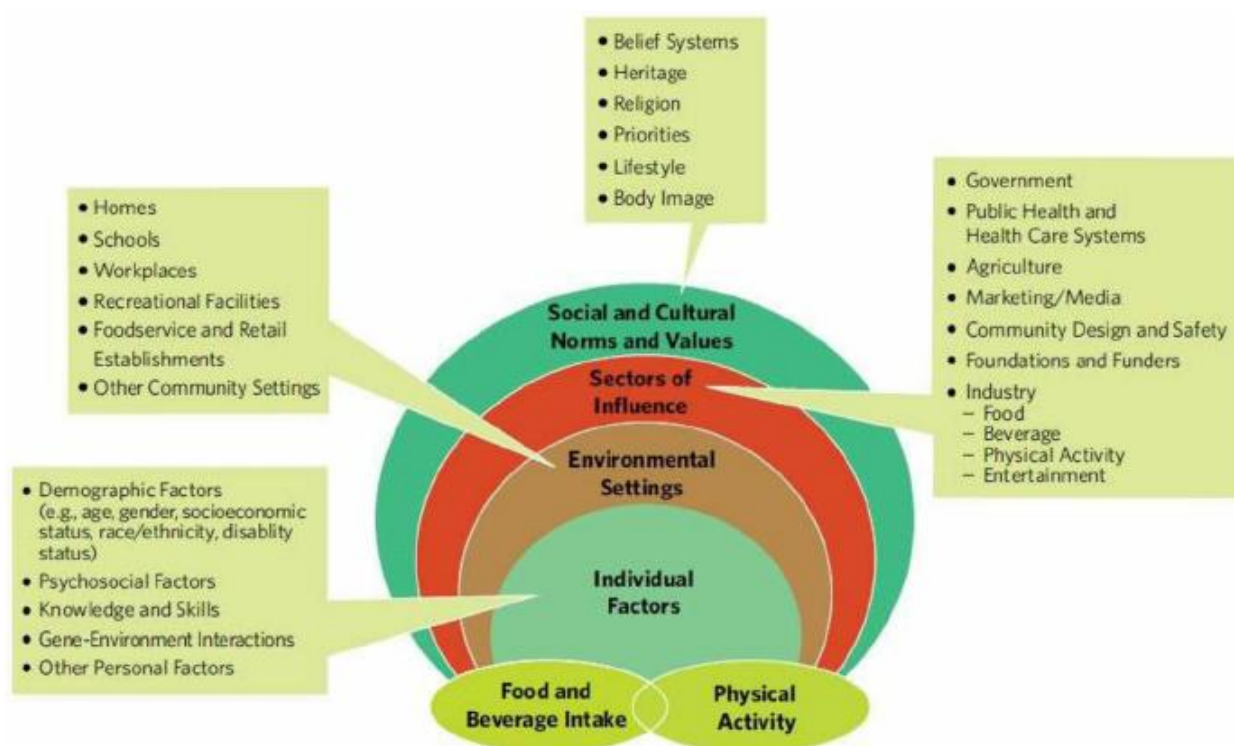


Figure 1.1: Social Ecological Model (Duff et al 2010)

According to the Social-Ecological Model, social and structural factors, such as poverty, health care systems, means of subsistence, and living conditions, are inextricably linked and, in some cases, mutually reinforcing (Duff, Kipp, Wild, Rubaale & Okech-Ojony 2010:99). Social factors include interpersonal relationships with spouses, family members, and the church. Access to healthcare is a basic human right and a necessary

component of health development. However, access to healthcare differs between and within countries because of the various developmental stages and tactics employed.

SEM acknowledges several tiers of influence on health-related behaviours, such as:

- Individual and intrapersonal characteristics impact behaviour, including knowledge, attitudes, beliefs, and personality. This study aimed to investigate and characterise immunisation knowledge and attitudes to identify the obstacles that pastoralist communities in Afar face when utilising EPI services.
- Interpersonal elements, which include social interactions, have the potential to either foster healthy behaviour by creating barriers to interpersonal growth or by offering social support. This study aimed to investigate the obstacles that pastoralist communities in Afar face while trying to get EPI services.
- Institutional and organisational elements encompass the guidelines, directives, and unofficial frameworks that restrict or encourage salubrious conduct. This study examined and discussed the support provided by parents or guardians.
- Healthy behaviours can be encouraged or restricted by community elements like official or informal social standards among individuals, communities, or organisations.
- Public policy factors encompass laws and regulations at the local, state, and federal levels that either promote or govern health practices and actions aimed at preventing disease, including early identification, control, and management.

Overall, this approach can help provide a comprehensive understanding of the variables, such as the social determinants of health influencing health behaviours. This understanding was considered important for the development of EPI-supporting strategies.

1.10 ORGANISATION AND STRUCTURE OF THE STUDY

The study is organised into eight chapters, each corresponding to a specific research phase and objective. Table 1.1 provides a concise overview.

Table 1.1: Organisation of the Study

Chapter	Research Phase	Focus / Objective Addressed
1. Overview	Conceptualisation	Problem statement, objectives, SEM theoretical framework, research paradigm
2. Literature Review	Phase 1: Evidence synthesis	EPI barriers, pastoralist health contexts, knowledge gap identification (Obj. 1)
3. Methodology	Phase 2: Design	Qualitative exploratory descriptive design, Afar setting, sampling, ethics, trustworthiness
4. Findings	Phase 2: Empirical inquiry	Multi-level barriers from caregiver and health worker perspectives (Obj. 1–2)
5. Discussion	Phase 2: Interpretation	Findings contextualised against literature; implications for EPI implementation (Obj. 2)
6. Strategies	Phase 3: Strategy development	Evidence-based strategies to overcome EPI barriers in pastoralist communities (Obj. 3)
7. Validation	Phase 4: Delphi validation	Two-round expert consensus using AGREE II; strategy refinement (Obj. 4)
8. Conclusion	Synthesis	Summary, recommendations, limitations, contributions to knowledge

1.11 SUMMARY

This first chapter introduced the study. The study's background information and the study's research problem, purpose, objectives, and significance were all included in this chapter. The chapter also covered the definitions of key terms, the study's theoretical underpinnings, an overview of the research methodology, and the thesis structure. The research problem identified and explained in the chapter is of major importance. To recap, the study's problem of interest was the low utilisation of EPI and its consequences, which included children dying from diseases that would otherwise have

been prevented in this region. This prompted a need to investigate the barriers responsible for this low EPI utilisation and, consequentially, the strategies to reduce them. The literature pertinent to the study topic is reviewed in the next chapter.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

Chapter One outlined the study's purpose and design; this chapter now synthesizes the scholarly literature that informs and contextualizes this research. It critically examines the literature on immunisation service utilisation within the Expanded Programme on Immunisation (EPI), with particular emphasis on barriers and enabling factors affecting coverage in hard-to-reach, mobile, and underserved populations. The review adopts a structured approach to situating the present study within existing scholarship, drawing on global evidence from comparable contexts, regional experiences within East Africa and similar pastoralist settings, and national literature focusing specifically on Ethiopia's EPI programme and the Afar region.

Pastoralist communities occupy a significant but structurally marginalised position in global health discourse. These populations represent not inherently problematic or resistant groups, but rather communities whose livelihoods, mobility patterns, geographic locations, and sociocultural systems intersect with conventional health service design in ways that systematically produce inequitable health outcomes (WHO 2019; Ketema et al. 2020). The literature consistently demonstrates that lower immunisation coverage among pastoralist populations is primarily attributable to health system design limitations, service delivery constraints, and contextual mismatches, rather than cultural opposition or caregiver indifference (FMoH 2019; Nigatu et al. 2024).

In Ethiopia, pastoralists constitute approximately 15 million people, representing about 12% of the national population. These communities occupy arid and semi-arid regions covering more than 60% of the country's landmass, predominantly in the Afar, Somali, Oromia, SNNP, Benshangul, Gambela, and Tigray regional states (Debie et al. 2020:310). These areas are characterised by dispersed settlement patterns, environmental volatility including recurrent drought and epidemic disease, limited physical infrastructure, and historically low investment in basic social services (WHO 2019; FMoH 2019). While Ethiopia has achieved notable national improvements in maternal and child health indicators through the Health Extension Programme (HEP), evidence consistently demonstrates that these gains have not been equitably distributed, with pastoralist areas continuing to experience disproportionately high

maternal and child mortality rates and significantly lower immunisation coverage compared to agrarian and urban populations (Ketema et al. 2020:778; FMOH 2019).

This chapter therefore examines EPI implementation and immunisation uptake through interconnected analytical lenses of access, equity, and health systems responsiveness. These conceptual frameworks shift attention from individual or community-level 'deficits' toward systemic factors that shape service availability, accessibility, acceptability, and quality. The review critically interrogates how service delivery models, provider practices, community engagement strategies, and sociocultural dynamics interact to facilitate or constrain immunisation coverage, with particular attention to identifying evidence gaps that justify the present study.

2.2 THEORETICAL FRAMING: ACCESS, EQUITY, AND HEALTH SYSTEMS RESPONSIVENESS

This study is conceptually anchored in three interrelated frameworks widely employed in public health and health systems research: access to healthcare, health equity, and health systems responsiveness. These frameworks provide analytical coherence and guide both the literature review and the empirical investigation.

Access to Healthcare is understood as the degree to which individuals and communities can obtain appropriate health services when needed (WHO 2019). Access is multidimensional, encompassing:

- (a) Availability refers to the physical presence of health services and sufficient supply of vaccines, personnel, and infrastructure;
- (b) Geographic accessibility is the spatial relationship between service points and populations, including distance, terrain, and transportation.
- (c) affordability is the direct and indirect costs associated with obtaining services;
- (d) accommodation refers to the organisation of services in ways that align with users' schedules, mobility patterns, and livelihood demands; and
- (e) acceptability is the alignment between service delivery approaches and users' cultural values, expectations, and previous experiences (Agyepong et al. 2018:803).

Health Equity refers to the absence of systematic and avoidable disparities in health outcomes and service utilisation between population groups, particularly those arising from social, economic, geographic, or structural disadvantage (WHO 2019). An equity lens directs attention toward differential exposure to barriers and differential capacity to overcome those barriers, recognising that identical service provision does not guarantee equitable outcomes when populations differ significantly in their starting conditions and contextual realities. Applied to immunisation, equity requires examining not only aggregate national coverage rates but also disaggregated data revealing disparities by region, livelihood system, socioeconomic status, and other axes of marginalisation.

Health Systems Responsiveness focuses on how well health services are organised and delivered in ways that respect and respond to users' legitimate needs, expectations, sociocultural contexts, and lived realities (Agyepong et al. 2018).

Responsiveness encompasses communication quality, provider-client interaction, continuity of care, adaptability of service models to local contexts, and the extent to which service delivery reflects a genuine understanding of and respect for diverse populations' circumstances. Unresponsive health systems, even when technically competent, may fail to achieve intended health outcomes if they do not meaningfully engage with the populations they ostensibly serve.

Collectively, these frameworks reorient analysis from questions of individual compliance or cultural resistance toward questions of systemic fit, contextual appropriateness, and structural equity. Within this perspective, underserved populations are not viewed as obstacles to public health programmes, but as communities whose access to services is constrained by system-level, provider-level, policy-level, and contextual factors that can and should be modified through evidence-informed interventions.

2.2.1 LITERATURE SEARCH STRATEGY

A comprehensive literature search was conducted to identify relevant studies on immunisation coverage, implementation challenges, and intervention strategies in pastoralist, nomadic, mobile, and other hard-to-reach populations. The search was designed to capture both context-specific evidence from Ethiopia and the Afar region, as well as comparative insights from similar settings globally.

Databases Searched: Electronic databases searched included PubMed/MEDLINE, Scopus, Web of Science, CINAHL, African Journals Online (AJOL), and Google

Scholar. Grey literature sources consulted included WHO immunisation databases, UNICEF reports, Ethiopian Federal Ministry of Health (FMOH) policy documents and programme evaluations, Afar Regional Health Bureau reports, and relevant dissertations and technical reports from Ethiopian universities and international organisations operating in the region.

Search Terms: Search terms combined conceptual domains using Boolean operators: (immunisation OR vaccination OR 'Expanded Programme on Immunisation' OR EPI) AND (pastoralist OR nomadic OR mobile OR 'hard-to-reach' OR remote OR underserved OR marginalised) AND (Ethiopia OR Afar OR 'East Africa' OR 'sub-Saharan Africa'). Additional searches targeted specific barriers and interventions: (health extension workers OR outreach OR community engagement OR 'Health Development Army') AND immunisation.

Date Range: No date restrictions were applied to foundational or historical literature, but priority was given to studies published within the past ten years (2014–2024) to capture contemporary evidence and policy developments.

Inclusion Criteria: Studies were included if they: (a) examined immunisation coverage, barriers, or interventions in pastoralist, nomadic, or mobile populations; (b) were conducted in Ethiopia, with specific emphasis on Afar region, or in comparable contexts within East Africa or globally; (c) addressed health system factors, community engagement strategies, or equity dimensions of immunisation service delivery; and (d) comprised peer-reviewed empirical research, systematic reviews, programme evaluations, and authoritative policy documents.

Exclusion Criteria: Studies were excluded if they focused exclusively on vaccine development, clinical immunogenicity trials unrelated to programme implementation, and research from high-income countries with fundamentally different health system contexts unless offering methodological or conceptual insights transferable to low-resource settings.

Quality Appraisal: Reference lists of included studies were hand-searched to identify additional relevant literature. The resulting body of literature was critically appraised for methodological quality, contextual relevance, and conceptual contribution. Throughout the review, particular attention was paid to distinguishing between global trends,

regional patterns specific to Africa or East Africa, and local evidence from Ethiopia and Afar, ensuring transparent attribution and contextually grounded interpretation.

2.2.1 ALIGNMENT OF LITERATURE REVIEW WITH RESEARCH QUESTIONS

The structure and focus of this literature review are explicitly aligned with the study's research questions, which collectively examine health system factors, demand-side dynamics, equity considerations, and health systems responsiveness in relation to immunisation service utilisation. This alignment ensures that the review not only synthesises existing evidence but also identifies specific knowledge gaps that the present study addresses.

Research Question 1 examines what health system and service delivery factors influence access to and utilisation of EPI services. The literature reviewed in Sections 2.2 (Ethiopian EPI Current Intervention Strategy), 2.3 (EPI Implementation in Comparable Global Contexts), and 2.5.1 (Healthcare Provider Barriers) directly addresses this question by examining service delivery models, staffing patterns, cold-chain management, vaccine supply systems, record-keeping practices, communication approaches, and outreach strategies. Comparative insights from pastoralist settings globally and within sub-Saharan Africa demonstrate that supply-side constraints—including weak information systems, unreliable vaccine supply, inadequate provider training, and limited supervisory support, constitute recurring determinants of incomplete immunisation. These sections collectively frame immunisation coverage gaps as health system performance issues requiring systemic interventions, rather than isolated technical problems or failures of individual provider competence or caregiver compliance.

Research Question 2 explores what demand-side and sociocultural factors shape caregiver utilisation of immunisation services. Sections 2.5.2 (Caregiver and Community Barriers to Immunisation), 2.5.3 (Misconceptions About Vaccines), and 2.6 (Community Perceptions and Behaviours in Comparable Contexts) directly engage with this question by examining caregiver knowledge, risk perceptions, opportunity costs, trust in health systems, prior service experiences, and information sources. The literature consistently demonstrates that immunisation services are often nominally available but underutilised, highlighting the critical distinction between service availability and effective access.

Importantly, the evidence reviewed reframes low utilisation not as irrational refusal or cultural backwardness, but as rational responses to structural constraints, information gaps, past negative experiences, and competing livelihood demands. This supports the study's focus on understanding utilisation behaviour as shaped by health system design, communication quality, provider-client relationships, and contextual realities.

Research Question 3 investigates how equity considerations influence immunisation coverage among underserved populations. Sections 2.1, 2.2, 2.4, and 2.5 emphasise that populations such as pastoralist communities experience structural inequities manifest in geographic remoteness, limited physical infrastructure, reduced exposure to health information, lower educational attainment, linguistic marginalisation, and historical neglect in policy and resource allocation. The review demonstrates that these populations face differential exposure to barriers and differential capacity to overcome them, resulting in persistent coverage disparities even when national aggregate indicators show improvement. Evidence from Ethiopia's national EPI programme, comparative experiences in East Africa, and global literature on immunisation in hard-to-reach populations illustrates how inequities persist and are often inadvertently reinforced when standardised service delivery models are applied without adaptation to diverse population contexts. Equity is thus operationalised in this review as differential exposure to barriers and differential health system responsiveness, rather than differential willingness or capacity to engage with immunisation services.

Research Question 4 examines how responsive existing immunisation strategies are to local contexts and lived realities of target populations. The critical assessment of HEP and HDA models in Section 2.2, alongside comparative evidence from diverse settings in Sections 2.3, 2.4, and 2.6, directly addresses this question by evaluating the degree to which service delivery approaches, community engagement strategies, and communication methods are designed and implemented in ways that acknowledge and accommodate the specific circumstances, mobility patterns, livelihood systems, cultural contexts, and expressed needs of pastoralist populations. The literature reveals significant variation in health systems responsiveness, with evidence suggesting that rigid, facility-based service models developed for sedentary populations often fail to achieve intended outcomes when applied without modification to mobile or dispersed communities. Conversely, examples of adapted outreach models, flexible scheduling, community-based health workers who move with populations, and dialogic

communication approaches demonstrate improved coverage where responsiveness is prioritised.

Guided by the concepts of access, equity, and health systems responsiveness, this chapter reviews literature that situates immunisation outcomes within broader health system and contextual dynamics. Rather than framing underserved populations as resistant or non-compliant, the reviewed studies emphasise how service delivery models, provider practices, sociocultural contexts, and structural conditions shape both access to and utilisation of EPI services. This theoretical orientation aligns the literature review with the study's research questions by foregrounding system-level determinants, demand-side dynamics rooted in lived experience rather than cultural deficiency, and equity considerations that influence immunisation coverage and health outcomes.

2.3 ETHIOPIAN EPI: CURRENT INTERVENTION STRATEGIES AND IMPLEMENTATION CHALLENGES

Ethiopia's Expanded Programme on Immunisation operates within the broader framework of the Health Extension Programme (HEP), a community-based primary healthcare initiative launched in 2003 and recognised internationally as an innovative approach to expanding health service coverage (FMoH, 2019). Despite notable national achievements, evidence consistently demonstrates that the health post-based, static HEP service delivery model does not adequately meet the needs of pastoralist communities (Ketema et al., 2020:777). This structural inadequacy has been documented across multiple sources, but is examined with particular analytical rigour in the mixed-method study of Muluneh et al. (2024), which provides the most contextually specific evidence base for understanding EPI implementation failures in Ethiopian pastoralist settings.

2.3.1 Supply-Side Barriers in Pastoralist Contexts

Supply-side barriers limiting EPI effectiveness in pastoralist contexts include physical remoteness of health posts from dispersed settlements, inadequate human resource capacity, weak infrastructure, transportation constraints, fragile cold-chain systems, and inconsistent vaccine supply (Clark et al., 2020:107; Nigatu et al., 2024:360). However, Muluneh et al. (2024) provide an important analytical refinement: these barriers do not

operate as discrete, additive obstacles but as interacting systems failures that compound one another across the EPI delivery chain.

Drawing on facility surveys conducted in twelve Afar districts, Muluneh et al. (2024: 7) found that vaccine stock-out frequency was significantly correlated with cold-chain equipment failure rates, which were in turn correlated with the distance between district stores and health posts. Critically, the official outreach schedule could be maintained, on average, in only 43% of planned sessions in sampled pastoralist districts, compared with 81% in agrarian districts of the same administrative zone. The primary documented causes for session cancellation included vehicle unavailability (38%), vaccine stock-out (27%), and health worker absence due to illness or competing administrative demands (22%) (Muluneh et al., 2024: 8). This quantitative picture is analytically significant: it demonstrates that EPI underperformance in Afar is not attributable to a single bottleneck but to a fragmented operational architecture in which multiple weak links combine to produce systematic unreliability. Communities that experience repeated session cancellations tend to respond rationally by reducing their investment in health-seeking behaviors. Such a response represents a dynamic that transforms supply-side failure into apparent demand-side disengagement, obscuring the structural origins of low coverage.

Muluneh et al. (2024: 10) further document a measurement problem that compounds the analytical challenge: routine HMIS data substantially overestimates immunisation coverage in pastoralist areas because population denominators are based on sedentary projections that do not account for nomadic mobility. The study's household survey, which traced children through migration, found that HMIS-reported coverage rates were on average 18 percentage points higher than survey-verified coverage in sampled pastoral communities. This systematic upward bias means that health system managers operating on HMIS data may underestimate the severity of coverage gaps and under-allocate corrective resources — with direct implications for how monitoring systems must be redesigned for mobile populations.

2.3.2 Demand-Side Barriers and Knowledge Gaps

Demand-side barriers reflect the intersection of limited health information, opportunity costs, and past service experiences (Nigatu et al., 2024:360; Clark et al., 2020:108).

However, the framing of these factors as "demand-side" risks a conceptual error that Muluneh et al. (2024) explicitly critique: it implies that the origins of low coverage lie partly in community behaviour or attitudes, when in practice, much of what appears as demand-side disengagement is a rational community response to supply-side failure. This distinction is analytically important because it determines the appropriate locus of intervention.

The qualitative component of Muluneh et al. (2024: 13), drawing on focus group discussions with pastoralist women and key informant interviews with traditional leaders, found that vaccine hesitancy, as a conscious, values-based refusal of vaccination, was documented in only a minority of households. Far more commonly, caregivers reported willingness to vaccinate but inability to access consistent services, lack of information about when outreach teams would visit, and previous experiences of travelling long distances only to find sessions cancelled or vaccines unavailable. One Imam participant captured the community experience: "We want our children to be healthy. We have no problem with the needle. The problem is that the health team comes twice and then disappears for months" (Muluneh et al., 2024: 14). What health system metrics classify as "non-compliant" households are frequently households that presented for services and were failed by an unreliable system.

Muluneh et al. (2024: 16) also document the gendered dimensions of access barriers in Afar. In 61% of sampled households, the decision to seek child immunisation required explicit approval from the male household head or senior clan member; and in 34% of cases where children had not completed their vaccination schedule, the caregiver had sought access but been unable to because of a household movement decision made by a senior male member. These findings challenge deficit-model explanations of low immunisation uptake and locate a significant share of the coverage gap in gendered household governance structures that health system interventions have largely failed to engage.

2.3.3 Health Extension Programme Adaptation Challenges in Pastoralist Areas

While the HEP has been adapted for pastoralist regions with innovations such as mobile health posts and periodic outreach campaigns, implementation remains inconsistent and inadequately resourced (Ketema et al., 2020:779). Muluneh et al. (2024) provide a

structural critique that advances the analytical understanding of why piecemeal modifications have not produced sustained improvement. The study concludes that HEP adaptation for pastoralist contexts has been fundamentally "additive" rather than transformative: sedentary-oriented service structures have been supplemented with mobile and outreach components rather than redesigned from first principles to suit mobile populations (Muluneh et al., 2024: 11). Additive adaptation preserves the underlying design assumptions of the original model, fixed catchment areas, predictable populations, scheduled service delivery. While attempting to reach mobile populations through supplementary activities that remain peripheral to the health system's core operations.

Muluneh et al. (2024: 12) document the operational consequences: outreach vehicles are shared across multiple programme functions and not dedicated to immunisation; outreach schedules are set without systematic community consultation about migration patterns; and outreach teams carry vaccine quantities calibrated for assumed catchment populations that may bear little relationship to the actual number of mobile households present on any given day. The result is what the study terms a "performance facade": the visible activities of outreach occur where vehicles move, and sessions are reported. However, the system delivers reliable, complete immunisation sequences to only a small fraction of the targeted mobile population. This conceptually significant critique implies that increasing the volume of outreach activities without addressing their operational underpinnings will not produce commensurate coverage gains.

2.3.4 The Health Development Army (HDA) Model: Potential and Analytical

Limitations

Ethiopia's Health Development Army (HDA) represents a community-based social mobilisation strategy that has demonstrated effectiveness in improving health behaviours in agrarian and urban areas (Solohub, 2022:95). However, the model was developed for sedentary agrarian communities and has not been systematically adapted or evaluated in pastoralist contexts (Kluge et al., 2020:1239). Muluneh et al. (2024: 20) provide a critical assessment grounded in Afar-specific evidence: key informant interviews with district health officials in three districts found fundamental incompatibility

between the HDA's geographic household cluster model and pastoralist social organisation, which is structured around patrilineal clan networks rather than geographic proximity. HDA volunteer roles assume a volunteer serves a defined set of physically proximate households, an operational assumption that becomes meaningless when households in the same clan network may be dispersed across hundreds of square kilometres at any given time.

Muluneh et al. (2024: 21) additionally note that the HDA volunteer model presupposes a degree of social inactivity that enables household visits, training attendance, and record-keeping, all requiring predictable physical presence. The study concludes that the HDA model requires replacement rather than modification in pastoralist contexts: a fundamentally different community engagement architecture, one anchored in clan social structures, seasonal congregation patterns, and trusted intermediaries who operate within and across mobile communities, is required. This is a stronger analytical conclusion than the general uncertainty expressed in the existing literature, and constitutes a significant contribution grounded in Afar-specific mixed-method evidence.

2.4 GLOBAL EVIDENCE ON IMMUNISATION IN PASTORALIST, NOMADIC, AND HARD-TO-REACH POPULATIONS

Globally, pastoralist and nomadic populations, along with other hard-to-reach communities such as those in geographically remote areas, conflict-affected zones, and urban informal settlements, experience systematically lower immunisation coverage compared to mainstream settled populations (WHO 2019). This pattern transcends national and regional boundaries, appearing across diverse economic and health system contexts, suggesting common underlying structural and systemic factors rather than context-specific anomalies.

2.4.1 COMMON CHARACTERISTICS AND CHALLENGES ACROSS GLOBAL CONTEXTS

The World Health Organisation (2019) identifies several characteristics common to hard-to-reach populations that complicate conventional immunisation service delivery: physical remoteness from established health facilities requiring extended travel times and costs; dispersed settlement patterns making fixed-point service delivery inefficient;

mobility and seasonal migration disrupting continuity of care and longitudinal tracking; limited health infrastructure including weak cold chains, unreliable electricity, and poor transportation networks; human resource constraints with difficulties recruiting, training, and retaining qualified health workers; linguistic and cultural diversity requiring culturally appropriate communication and service delivery; low literacy levels affecting health information comprehension and engagement with written materials; poverty and competing livelihood demands creating opportunity costs for accessing health services; political marginalisation and limited voice in health policy and planning processes; and insecurity in some pastoralist and remote areas complicating health worker deployment and vaccine supply chains.

Evidence from pastoralist settings in Kenya, Somalia, Chad, Niger, and Mauritania reveals patterns remarkably similar to those documented in Ethiopia. Studies consistently demonstrate that static, facility-based immunisation services achieve low coverage among mobile populations, with completion rates for multi-dose vaccines particularly problematic (WHO 2019). Research from northern Kenya's pastoralist areas shows that while first-dose coverage for vaccines such as DTP may reach 60-70%, completion of the three-dose series drops to 30-40%, indicating high dropout rates attributable to mobility, irregular service schedules, weak defaulter tracking, and caregiver difficulty in returning for subsequent doses (Agyepong et al. 2018:804).

The consistency of these patterns across vastly different national contexts, from East Africa's arid lands to West African Sahel to Central Asian steppes, suggests that the challenges are not peculiar to specific countries or health systems but rather inherent to the interaction between population mobility and health service models designed for geographic stability. This cross-national convergence strengthens the case that solutions require not merely local adjustments but fundamental reconceptualisation of how immunisation services are organised and delivered to populations whose lives are structured by movement rather than settlement.

2.4.2 SUCCESSFUL INTERVENTION STRATEGIES FROM GLOBAL LITERATURE

Successful intervention strategies documented in global literature emphasise adaptability and responsiveness to population movement patterns and livelihood cycles.

Mobile outreach teams that follow seasonal migration routes, establishing temporary immunisation posts at water points, markets, and seasonal grazing areas, have demonstrated improved coverage in pastoralist regions of Chad and Niger (WHO 2019). These approaches require detailed knowledge of migration patterns, advanced communication with community leaders to coordinate service timing, flexible staffing arrangements, and reliable cold-chain systems capable of functioning in field conditions.

Community-based approaches utilising trained volunteer health workers from within pastoralist communities have shown promise in multiple contexts. Pakistan's Lady Health Worker programme, while operating in a different cultural context, demonstrates that community health workers who share language, culture, and mobility patterns with the populations they serve can effectively bridge gaps between formal health systems and hard-to-reach communities (Butt et al. 2020:113). In Balochistan province, where significant pastoralist Balochi populations reside, Lady Health Workers accompany families during seasonal movements, maintaining continuity of health education and facilitating access to periodic vaccination campaigns (Butt et al. 2020:114). However, sustainability challenges including volunteer retention, ongoing training and supervision, supply chain management, and integration with formal health systems remain significant implementation concerns requiring sustained investment and institutional support.

Technological innovations, including mobile phone-based reminder systems, digital immunisation registries accessible across multiple service points, and solar-powered vaccine refrigerators, have been piloted in various settings with mixed results (Mahase 2023:1). While these technologies offer theoretical advantages for addressing record-keeping, defaulter tracking, and cold-chain challenges, their effectiveness depends critically on infrastructure reliability, user training and acceptance, ongoing technical support, and integration into existing workflows. Studies from South Asia and East Africa indicate that technology interventions succeed when they solve genuine operational problems experienced by both health workers and caregivers, are designed with end-user input, require minimal additional effort from already overburdened staff, and are supported by adequate training and troubleshooting mechanisms (Yada 2023:3).

The global literature reveals a pattern wherein successful interventions share common features: they are designed with rather than for target populations; they work with rather

than against population mobility; they prioritise relationship and trust-building over episodic service delivery; they invest in community health workers as core rather than supplementary workforce; and they recognise that pastoralist populations require distinct service delivery models, not merely modifications of models designed for sedentary contexts. However, the literature also reveals implementation gaps—many documented "successes" are small-scale pilot projects or externally funded initiatives rather than sustained, government-led programs at scale. The challenge of translating promising approaches into routine health system practice remains largely unaddressed in the literature.

2.4.3 POLITICAL COMMITMENT AND RESOURCE ALLOCATION

Critically, the global literature emphasises that improving immunisation coverage in pastoralist and hard-to-reach populations requires more than technical or logistical solutions. Sustained political commitment, adequate resource allocation, meaningful participation of affected communities in planning and implementation, addressing social determinants of health beyond the health sector, and accountability mechanisms ensuring equitable resource distribution are essential preconditions (WHO 2019). Where political will and resources are lacking, even well-designed interventions fail to achieve sustained impact. Conversely, contexts demonstrating strong governmental commitment to equity and to reaching marginalised populations—even when facing significant resource constraints—have achieved notable improvements through creative adaptation and persistent effort (Agyepong et al. 2018:806).

This finding has profound implications for understanding immunisation coverage gaps. It suggests that low coverage is not primarily a technical problem requiring better logistics or health education, but fundamentally a political problem reflecting how societies value and prioritise different populations. Pastoralists' low immunisation coverage becomes intelligible not as a failure of communities to engage with available services, but as a manifestation of inadequate political prioritisation, insufficient resource allocation, and health system design that systematically marginalises mobile populations. This reframing shift responsibility from communities to governments and health systems, demanding accountability for structural inequities.

2.5 REGIONAL EVIDENCE: IMMUNISATION IN EAST AFRICAN PASTORALIST POPULATIONS

East Africa hosts substantial pastoralist populations across Kenya, Tanzania, Uganda, South Sudan, and Somalia, sharing broadly similar ecological, economic, and sociocultural contexts with Ethiopia's pastoralist regions. Examining immunisation challenges and interventions in these comparable settings provides regionally-relevant insights while acknowledging important contextual variations.

2.5.1 Kenyan Pastoralist Experiences

Kenya's pastoralist regions, including Turkana, Marsabit, Wajir, and Garissa counties, have historically recorded the country's lowest immunisation coverage despite numerous intervention efforts (Agyepong et al. 2018:805). A mixed-methods study in Turkana County identified multiple barriers operating at individual, community, health system, and policy levels (Agyepong et al. 2018:805-806). Individual-level barriers included limited awareness of immunisation benefits, fear of adverse events, and competing livelihood priorities. Community-level factors encompassed social norms discouraging engagement with government services, reliance on traditional healing practices, and gender dynamics limiting women's autonomous health decision-making. Health system barriers included irregular and unpredictable outreach services, vaccine stock-outs, long distances to health facilities, and provider communication challenges, including linguistic barriers and disrespectful attitudes (Agyepong et al. 2018:806).

Notably, the Turkana study found that caregivers were not uniformly opposed to vaccination but made pragmatic decisions based on service accessibility and reliability. When mobile vaccination teams were predictable, respectful, and accessible at locations convenient for pastoralists (livestock markets, water points, cultural gatherings), uptake was substantially higher than when services required travel to distant health facilities with uncertain availability (Agyepong et al. 2018:807). This suggests that framing low coverage as "vaccine hesitancy" misattributes responsibility; the more accurate characterisation is health system unresponsiveness to population contexts.

2.5.2 Somali Region Contexts

Studies from Somalia and Somali Region of Ethiopia document additional challenges related to protracted conflict, population displacement, and extremely limited health infrastructure (WHO 2019). In these contexts, immunisation services are heavily dependent on international humanitarian organisations, creating sustainability concerns and coordination challenges. The experience of Somali populations demonstrates that conflict and instability compound the challenges of serving mobile populations, as health workers face insecurity, supply chains are disrupted, and populations are displaced from traditional movement patterns into less predictable arrangements (WHO 2019).

However, even in these difficult contexts, innovative approaches have shown results. Integrated health and nutrition programmes that combine immunisation with other valued services (livestock vaccination, veterinary services, nutrition screening) have improved engagement by addressing multiple household priorities simultaneously rather than expecting families to access health services for child immunisation alone (WHO 2019). This integration recognises that pastoralist households make holistic livelihood decisions and that health-seeking behaviour is shaped by how well services align with broader household priorities.

2.5.3 Comparative Regional Synthesis

Across East African pastoralist contexts, several consistent themes emerge. First, immunisation coverage gaps are systematically higher in pastoralist than in agrarian or urban areas within the same countries, demonstrating that national health system performance obscures profound intra-national inequities. Second, the specific barriers vary in magnitude and salience across contexts, but the categories of barriers, geographic access, service availability and reliability, provider-community communication, opportunity costs, and trust, recur consistently. Third, interventions that demonstrate improved coverage share features of flexibility, cultural appropriateness, integration with livelihood priorities, and community participation in design and implementation. Fourth, sustainability remains elusive; many successful projects are time-limited, externally funded pilots that do not transition to government-led programmes at scale (Agyepong et al. 2018:808).

The East African regional literature provides valuable comparative context for Ethiopia's Afar region, demonstrating both common challenges and the importance of context-specific implementation. The consistency of patterns across countries supports the generalisability of findings while the variation in successful intervention approaches underscores the necessity of local adaptation. However, the literature also reveals a research gap: most studies document problems more thoroughly than solutions, and evaluations of intervention effectiveness often measure outputs (services delivered) rather than outcomes (sustained coverage improvement and health impact). There is need for implementation research that rigorously evaluates what works, for whom, under what conditions, and at what cost.

2.6 BARRIERS TO IMMUNISATION UPTAKE: A SOCIAL-ECOLOGICAL PERSPECTIVE

Drawing on the Social Ecological Model (SEM), this section synthesises evidence on barriers to immunisation uptake operating at multiple interconnected levels: individual, interpersonal, institutional, community, and policy. This framework enables systematic analysis of how factors at different levels interact to shape immunisation behaviours and outcomes.

2.6.1 Individual-Level Factors: Knowledge, Attitudes, and Beliefs

At the individual level, caregiver knowledge, attitudes, beliefs, and experiences shape vaccination decisions and behaviours. The literature consistently identifies knowledge gaps regarding vaccine-preventable diseases, immunisation schedules, and the importance of completing multi-dose series as significant barriers (Nigatu et al. 2024:360; Clark et al. 2020:108). However, it is critical to distinguish between different types of knowledge deficits. Some caregivers lack basic information about vaccination because they have had limited exposure to health education channels, a structural issue of information access rather than cognitive capacity. Others possess incorrect information, often circulating through community networks, about vaccine safety or necessity, a challenge of misinformation that health systems have inadequately addressed. Still others have accurate factual knowledge but interpret vaccine risks and

benefits differently than health providers due to different experiential contexts and value frameworks (Nigatu et al. 2024:361).

Fear of adverse events following immunisation represents a significant barrier rooted in both actual experiences and community narratives. While serious adverse events are rare, minor reactions such as fever, irritability, and injection site reactions are common and can be alarming to caregivers, particularly when inadequately explained before vaccination or when post-vaccination support is unavailable (Clark et al. 2020:108). Studies document how single adverse events, even minor ones, can shape subsequent vaccination decisions not only for the affected family but also for extended kin networks who hear about the experience (Nigatu et al. 2024:361).

Beliefs about vaccines are shaped by cultural explanatory models of health and illness, religious teachings, trust in government and health systems, and past experiences with health services. In some pastoralist communities, beliefs that children should develop immunity "naturally" through exposure, that excessive vaccination weakens children's constitutions, or that modern medicine is incompatible with traditional healing practices create reluctance toward immunisation (Clark et al. 2020:109). However, the literature emphasises that these beliefs are not immutable cultural traits but rather dynamic perspectives shaped by information environments, health system interactions, and community discourse—meaning they are amenable to change through appropriate engagement strategies.

The individual-level literature reveals a tendency toward deficit framing—positioning caregivers as lacking knowledge, holding incorrect beliefs, or making irrational decisions. More sophisticated analyses recognise that caregivers make decisions based on available information, past experiences, social networks, and rational assessment of risks and benefits within their particular contexts. The challenge is not primarily individual-level ignorance but rather systemic failures in health education, communication, and trust-building that leave caregivers with inadequate or incorrect information and legitimate concerns unaddressed.

2.5.2 Interpersonal-Level Factors: Family Dynamics and Social Influence

Immunisation decisions are rarely made by individuals in isolation but rather emerge from interpersonal dynamics within households and social networks. In many pastoralist societies, key decisions affecting children are made by senior household members—often fathers or paternal grandparents—rather than mothers who are primary caregivers (Kluge et al. 2020:1242). When health workers engage only with mothers at health facilities, they may fail to reach actual decision-makers, resulting in mothers expressing positive intentions that do not translate into vaccination because they lack autonomous decision-making authority (Kluge et al. 2020:1243).

Gender dynamics significantly shape immunisation uptake patterns. In contexts where women's mobility is restricted by cultural norms or where they lack autonomous decision-making authority, even accessible vaccination services may not be utilised if male household heads do not prioritise or permit access (Nigatu et al. 2024:362). Conversely, in some pastoralist societies, women collectively exert substantial informal influence over household decisions through intergenerational female networks, suggesting potential entry points for health promotion if appropriately engaged (Kluge et al. 2020:1243).

Peer influence and social networks play important roles in shaping health behaviours. In close-knit pastoralist communities, information and attitudes about vaccination circulate rapidly through kinship and clan networks. Trusted community members, including traditional leaders, religious authorities, respected elders, and traditional birth attendants, can significantly influence collective perceptions and behaviours (Kluge et al. 2020:1244). When these influential actors support vaccination, uptake improves; when they express concerns or opposition, coverage suffers. This pattern underscores the social nature of health decision-making and the importance of community-level engagement strategies.

Interpersonal-level factors demonstrate that effective immunisation promotion requires understanding and engaging with household decision-making structures, gender dynamics, and social networks rather than focusing exclusively on individual mothers as presumed decision-makers. Health promotion strategies that ignore actual decision-making authority, fail to address gender-based constraints on women's health-seeking,

or neglect influential social networks are unlikely to achieve sustained behaviour change regardless of message quality or intensity.

2.6.3 Institutional-Level Factors: Health System Capacity and Provider Practices

At the institutional level, health facility and provider characteristics significantly shape immunisation access and utilisation. The literature documents multiple health system barriers operating in pastoralist contexts, constituting a substantial portion of coverage challenges.

Health facilities in pastoralist areas commonly experience chronic resource shortages affecting service quality and availability (Nigatu et al. 2024:363). Insufficient operational budgets limit outreach frequency, vaccine procurement, and supportive supervision. Unreliable cold chain systems resulting from the power interruptions, equipment breakdowns, and inadequate maintenance lead to vaccine wastage and stock-outs, forcing caregivers to make multiple journeys or miss vaccination windows (Clark et al. 2020:110). Transportation constraints, including limited vehicle availability, inadequate fuel budgets, and poor road infrastructure, restrict health worker mobility and outreach service coverage (FMoH 2019).

Seventeen healthcare workers interviewed across multiple studies described resource challenges in stark terms. An EPI manager noted: "We plan outreach schedules optimistically, but implementation depends on vehicle availability, fuel budget, and whether vaccines arrive on time. Often we must cancel planned outreach, and communities lose trust when we promise services we cannot deliver" (Nigatu et al. 2024:363). A district EPI focal person explained: "The cold chain refrigerator breaks down frequently. We report it, wait for repair, vaccines expire, and we have nothing to offer families who travel long distances expecting immunisation" (Clark et al. 2020:111).

Human resource constraints in pastoralist areas include insufficient numbers of health workers, high turnover rates, inadequate training for pastoralist contexts, and limited supervisory support (Ketema et al. 2020:780). Health Extension Workers, the frontline workforce for immunisation delivery, often manage catchment areas far exceeding the 5,000-person standard due to dispersed populations and staff shortages. They receive generic training appropriate for sedentary populations but limited preparation for

communicating across linguistic and cultural differences, adapting to population mobility, or managing the unique challenges of pastoralist contexts (Clark et al. 2020:112).

HEW absenteeism, while often framed as individual worker failure, frequently reflects systemic issues including competing demands (called away for training, administrative meetings, or emergency responses), personal health problems exacerbated by limited healthcare access in remote postings, family responsibilities including caring for ill relatives, and burnout from excessive workload and inadequate support (Ketema et al. 2020:781). When HEWs are absent, health posts close and scheduled immunisation sessions are cancelled, eroding community trust and access.

Provider-Client Interaction Quality: Studies document significant variation in provider communication quality, with implications for immunisation uptake (Nigatu et al. 2024:364). Respectful, clear communication that addresses caregiver concerns, explains post-vaccination care, and demonstrates cultural sensitivity is associated with higher satisfaction and return visits. Conversely, rushed consultations, dismissive responses to questions, linguistic barriers, and perceived disrespect discourage continued engagement with services (Clark et al. 2020:113).

Record-Keeping and Tracking Systems: Weak immunisation record-keeping systems create multiple problems (Bagga et al. 2023:1012). Caregivers lose or damage paper-based immunisation cards, making it difficult to determine which vaccines children have received. When families access services at multiple facilities during seasonal movements, records are not shared across sites, resulting in duplicated vaccinations, missed doses, or inability to determine immunisation status. Defaulter tracking systems are often non-functional, meaning children who miss appointments are not followed up, and dropout from multi-dose series is not systematically addressed (Bagga et al. 2023:1013).

Institutional-level barriers reveal fundamental health system weaknesses that cannot be resolved through community-level interventions alone. The literature demonstrates that many "demand-side" problems, including incomplete vaccination, dropout from multi-dose series, and perceived vaccine hesitancy, are actually consequences of supply-side failures: unreliable service availability, poor communication, weak tracking systems, and

resource constraints that prevent health systems from delivering consistent, quality services. Addressing these requires systemic investment, not merely behavioural interventions targeting communities.

2.6.4 Community-Level Factors: Social Norms, Cultural Practices, and Traditional Authority

At the community level, social norms, cultural practices, traditional leadership structures, and collective experiences shape immunisation attitudes and behaviours. Social norms regarding health-seeking, trust in government services, gender roles, and child-rearing practices influence whether and how families engage with immunisation services (Kluge et al. 2020:1245). In communities where engaging with modern health services carries social stigma or is perceived as incompatible with cultural identity, utilisation may be low even when services are accessible (Kluge et al. 2020:1246).

Traditional authority structures, inclusive of clan leaders, religious leaders (Imams in predominantly Muslim pastoralist areas), elders' councils, and traditional healers, hold substantial influence over community health behaviours (Muluneh et al. 2024). When these authorities support immunisation and actively promote it within their communities, coverage improves markedly. Conversely, when traditional authorities express concerns or opposition, whether based on religious interpretations, bad experiences, or political tensions with the government, community uptake suffers (Muluneh et al. 2024). The literature emphasises that engaging traditional authorities requires genuine dialogue, respect for their role and knowledge, and addressing their legitimate concerns rather than dismissing them as obstacles to public health programmes.

Cultural events and communal gatherings represent important but underutilised opportunities for health promotion and service delivery. Markets, religious celebrations (Eid festivals), weddings, funerals, and seasonal gatherings bring dispersed populations together, creating accessible points for both health education and vaccination services (Muluneh et al. 2024). However, utilising these opportunities requires flexible, responsive health systems capable of deploying services when and where populations gather, rather than expecting populations to conform to predetermined health facility schedules.

The community-level literature reveals tension between recognizing cultural contexts and avoiding cultural determinism. Some studies appropriately identify how social norms and traditional practices shape health behaviours, providing insights for contextually appropriate interventions. Others, however, essentialize culture as a fixed barrier, portraying pastoralist communities as inherently resistant to modern health practices. More nuanced analyses recognize that cultural practices and social norms are dynamic, contested, and capable of change through proper engagement, not by dismissing tradition but by showing how immunization aligns with deeply held values of protecting children and ensuring community well-being.

2.6.5 Policy-Level Factors: Resource Allocation, Programme Design, and Political Prioritisation

At the policy level, government priorities, resource allocation decisions, programme design choices, and accountability mechanisms shape immunisation coverage patterns (WHO 2019). National immunisation policies that establish coverage targets, define service delivery models, and allocate resources determine the structure within which local implementation occurs. When policies are designed based on assumptions of geographic stability and fail to accommodate population mobility, even well-intentioned programmes may systematically exclude pastoralist populations (FMoH 2019).

Resource allocation mechanisms often disadvantage pastoralist regions through multiple pathways (Ketema et al. 2020:782). Population-based funding formulas may undercount mobile populations due to census challenges, resulting in inadequate per-capita resources. Geographically based allocations fail to account for the higher costs of reaching dispersed, mobile populations, meaning that equal per-capita funding produces unequal service accessibility. Political marginalisation of pastoralist populations, who often constitute ethnic and political minorities, results in lower prioritisation in budget decisions and weaker political accountability for service failures (Ketema et al. 2020:783).

Programme design features, including immunisation schedules optimised for accessibility in urban/agrarian contexts but problematic for mobile populations, rigid service delivery calendars that do not align with seasonal movement patterns, and

performance metrics that measure facility-based coverage rather than population-level outcomes, create systemic barriers to pastoralist access (FMoH 2019). Accountability mechanisms that focus on aggregate national coverage rates obscure persistent sub-national inequities, allowing governments to celebrate national progress while pastoralist regions remain far behind (Ketema et al. 2020:784).

Policy-level factors demonstrate that immunisation coverage gaps among pastoralist populations are not accidental or inevitable but rather reflect policy choices, resource allocation decisions, and programme design features that systematically prioritise some populations over others. Addressing these requires political commitment to equity, resource allocation mechanisms that account for differential costs of reaching different populations, programme design that accommodates diversity rather than assuming homogeneity, and accountability systems that make sub-national disparities visible and politically consequential.

2.6.6 Interactions Across Social-Ecological Levels

While the SEM provides a useful framework for organising barriers by level, the reality is that factors at different levels interact and mutually reinforce one another. Individual knowledge deficits reflect inadequate health education (institutional failure) and linguistic marginalisation (policy failure). Interpersonal decision-making dynamics interact with health system gender-blind practices that fail to engage actual decision-makers. Community mistrust stems from repeated experiences of unreliable services (institutional failure) and historical marginalisation (policy failure). These interactions mean that effective interventions must address multiple levels simultaneously rather than targeting isolated factors.

The social-ecological analysis reveals that immunisation coverage gaps emerge from complex interactions among individual, interpersonal, institutional, community, and policy-level factors. Simplistic interventions targeting single levels, such as health education campaigns assuming the problem is individual knowledge, or infrastructure investments assuming the problem is merely logistical, are unlikely to achieve sustained improvement because they fail to address the multilevel, interactive nature of barriers. Comprehensive strategies must simultaneously strengthen health system capacity, improve provider-community communication, engage household decision-makers and

community influencers, and address policy-level inequities in resource allocation and programme design.

2.7 COMMUNITY ENGAGEMENT AND HEALTH PROMOTION

STRATEGIES: EVIDENCE FROM COMPARABLE CONTEXTS

Effective community engagement strategies are increasingly recognised as essential for improving immunisation coverage, particularly in contexts where health system capacity is limited and populations are geographically dispersed or mobile. The evidence base on community engagement in pastoralist contexts, while limited, has been substantially advanced by Muluneh et al. (2024), whose mixed-method study provides contextually specific findings from the Afar region that both support and complicate the general lessons drawn from global literature. This section reviews evidence on community engagement approaches from diverse settings, drawing critically on Muluneh et al. (2024) to ground the discussion in Afar-specific realities.

2.7.1 Community Health Worker Models

Community health worker (CHW) programmes have demonstrated effectiveness in improving health behaviours and service utilisation across diverse contexts (Butt et al., 2020:115). For mobile populations specifically, CHW models show promise when workers are themselves mobile, maintaining regular contact with the populations they serve (Butt et al., 2020:117). Muluneh et al. (2024: 9) examined HEW performance in Afar specifically and found that linguistic and cultural competence, which is proxied by Afaraf language proficiency and tenure exceeding two years, was the strongest predictor of immunisation coverage at the community level among supply-side variables. Communities served by culturally competent HEWs recorded 12 to 15 percentage points higher coverage than those with recently posted, agrarian-background HEWs, controlling for facility type, distance, and district.

However, Muluneh et al. (2024: 11) report an annual HEW attrition rate of approximately 38% in sampled pastoralist districts, meaning that the beneficial effect of cultural competence is systematically undermined by turnover before the relationship-building necessary for sustained coverage improvement can occur. This finding is analytically critical: it demonstrates that the CHW model's effectiveness in the Afar context is

constrained not by the model's conceptual validity but by organisational failure to retain the workers in whom community trust has been built. Sustainability challenges, volunteer retention, quality maintenance through supervision in remote areas, and genuine integration with formal health systems, therefore represent the binding constraints on this approach, not the model's design logic (Butt et al., 2020:119).

2.7.2 Traditional and Religious Leader Engagement

Engaging traditional authorities and religious leaders in health promotion has proven effective in multiple contexts where these figures hold substantial community influence and trust. Muluneh et al. (2024) provide the most contextually specific evidence on this approach in Afar, employing a mixed-method design that combined facility survey data with qualitative interviews involving Imams, clan elders, and health officials. Their findings offer important analytical nuance not captured by the general literature.

In the quantitative component, Muluneh et al. (2024: 14) found that districts with formalised religious leader engagement, measured by an active district-level Imam health committee and at least four documented joint meetings with health authorities in the prior year, had immunisation coverage rates 11.3 percentage points higher than demographically comparable districts without such structures. Importantly, the study found that this effect was primarily facilitative rather than persuasive: Imams legitimised health facility visits, made scheduling announcements after Friday prayers, and provided safe spaces for community health dialogues, rather than persuading hesitant families through individual outreach (Muluneh et al., 2024: 15). This distinction has significant implications for how engagement strategies should be designed: the mechanism is normative and social, not conversational.

The qualitative component surfaced important boundaries to this approach. In one district, a senior Imam expressed religiously framed reservations about a specific vaccine during a Friday sermon, producing a measurable 14-percentage-point decline in sub-district coverage in the following three months (Muluneh et al., 2024: 15). This demonstrates that religious leader influence operates bidirectionally: the same trusted authority can both enable and impede uptake depending on the content and consistency of their messaging. The study concludes that religious leader engagement requires a sustained educational relationship providing leaders with accurate

information on an ongoing basis, not one-time orientation sessions that cannot anticipate future questions or rumours. Traditional clan leaders likewise shape collective behaviours, and Muluneh et al. (2024: 19) document that elder participation in kebele health committee deliberations as equal members, not only improved consultative appendages. The participation was associated with 8 percentage point higher coverage. Here too, episodic co-optation during campaigns without sustained inter-campaign engagement eroded trust and reduced cooperation over successive cycles.

2.7.3 Utilising Cultural Events and Communal Gatherings

Several studies document successful immunisation service delivery at cultural events and communal gatherings (WHO, 2019). Muluneh et al. (2024: 17) document two district pilots in Afar in which vaccination campaigns were integrated into Eid al-Adha celebrations, achieving single-session coverage of 34% to 41% of targeted children — substantially exceeding routine outreach session rates in the same districts. The authors attribute this to three factors: event predictability enabling advance supply planning; social legitimacy of health activity within a religious framework; and the presence of male household heads, enabling engagement with primary decision-makers typically absent from routine outreach contacts.

However, Muluneh et al. (2024: 18) document a critical limitation: only 28% of children vaccinated at Eid events could be verified to have received subsequent doses within the recommended interval. This gap between first-dose contact coverage and completed-schedule coverage reveals that event-based strategies are effective for initial contact but cannot substitute for a functioning longitudinal tracking system. Without cross-district mobile record-keeping, children vaccinated at communal events become effectively lost to the multi-dose follow-up that EPI schedule completion requires. The livestock market integration pilot in Chifra district (Muluneh et al., 2024: 22-23) similarly attracted 2.4 times more attendees than health-only outreach, but operated under exceptional financing and coordination conditions unreproducible within the standard EPI budget. The authors explicitly caution against scaling without first establishing the enabling conditions that the pilot's success depended on.

2.7.4 Critical Appraisal of Muluneh et al. (2024): Strengths, Limitations, and Implications

Given the substantial analytical reliance on Muluneh et al. (2024) in the preceding sections, a critical reflection of the study's methodological strengths and limitations is necessary to establish the epistemological basis for the claims drawn from it and to identify the analytical gaps the present study addresses.

The study's primary methodological strength is its mixed-method design, enabling triangulation between quantitative coverage data from facility surveys, HMIS extraction, and household questionnaires. Further, the qualitative findings from focus group discussions and key informant interviews strengthened the methodological rigour of Muluneh's study. This triangulation is particularly valuable in a context where quantitative data are systematically distorted by denominator errors, making qualitative community-level data essential for interpreting coverage patterns. The use of purposive sampling across multiple districts with varying levels of urbanisation and mobility also strengthens contextual validity within the Afar region.

Nevertheless, several limitations require acknowledgement. First, the study was conducted in districts accessible to research teams within a defined fieldwork timeline, meaning the most remote and fully nomadic communities who are likely experiencing the lowest coverage, may be underrepresented in both survey and qualitative samples. Second, the causal claims implied by correlational associations in the quantitative component cannot be established in a cross-sectional design without longitudinal data or natural experiment conditions. Third, qualitative data collected through organised group discussions may not capture the perspectives of the most marginalised households, specifically, fully nomadic families rarely present during structured data collection.

For the present study, these limitations are analytically productive. They define the specific knowledge gaps that direct qualitative engagement with pastoralist communities, including frontline health workers, caregivers, and traditional leaders, can address. Where Muluneh et al. (2024) establish correlational patterns and community-level narratives, the present study contributes interpretive depth on the mechanisms, contextual conditions, and health system dynamics through which those patterns are

produced and sustained. The two studies are therefore complementary rather than redundant: Muluneh et al. (2024) provide the epidemiological and programmatic landscape; the present study investigates the experiential and institutional processes that animate it.

2.7.5 Comparative Synthesis: What Works, Under What Conditions, and for Whom

Synthesising evidence across diverse contexts and from the critical reading of Muluneh et al. (2024), several features characterise effective community engagement strategies in pastoralist settings. First, they work with existing social structures and trusted influencers through sustained relational investment, not episodic mobilisation. Second, they involve communities as partners in design and implementation — a distinction Muluneh et al. (2024) demonstrate empirically to matter for both coverage outcomes and the legitimacy of health authority engagement. Third, they address community-defined priorities alongside health system priorities, demonstrating respect for the pastoral values of livestock health, economic security, and clan governance. Fourth, they combine health promotion with tangible service improvements, recognising that messages alone are insufficient when services are inaccessible or unreliable (Agyepong et al., 2018:809).

Critically, Muluneh et al. (2024) demonstrate that the conditional nature of these effectiveness factors is itself a programme design finding. Strategies that work well in piloted, externally supported, or exceptional conditions cannot be assumed to generalise to routine government programme operations without deliberate attention to whether enabling conditions can be institutionalised. The present study takes this conditional effectiveness as a central analytical concern: what organisational, relational, and systemic conditions would need to be established in the Afar health system for contextually adapted strategies to achieve sustained, population-level impact rather than episodic, project-level gains?

2.8 CRITICAL SYNTHESIS AND IDENTIFICATION OF KNOWLEDGE GAPS

This literature review has examined immunisation service implementation and utilisation through the interconnected lenses of access, equity, and health systems

responsiveness, drawing on global evidence, regional experiences from East Africa, national literature from Ethiopia, and Afar-specific evidence, most notably the mixed-method study of Muluneh et al. (2024), which provides the most contextually grounded empirical investigation of vaccination coverage determinants in the region to date. Several overarching themes and critical insights emerge from this synthesis.

2.8.1 Major Themes from the Literature

The first major theme is that immunisation coverage gaps among pastoralist and hard-to-reach populations are systematic rather than incidental, reflecting structural inequities and health system design limitations rather than community resistance or cultural pathology. Muluneh et al. (2024) confirm this with district-level specificity: their household survey reveals full immunisation coverage as low as 5-10% in nomadic Afar districts — substantially lower than HMIS administrative data suggest, due to documented denominator inflation in routine reporting (Muluneh et al., 2024: 10). This measurement gap has critical policy implications: if coverage is worse than reported, the policy response to date has been calibrated to a problem that appears less severe than it actually is. Meaningful progress requires not only new strategies but revised data systems capable of tracking mobile populations accurately.

The second major theme is that barriers to immunisation uptake operate at multiple interconnected social-ecological levels, and that these interact and mutually reinforce one another. Muluneh et al. (2024: 19) offer a particularly important analytical contribution here: they demonstrate that what appears at the individual or household level as "vaccine hesitancy" or "non-compliance" frequently originates in institutional failure, specifically, the experience of presenting for services and finding them unavailable, which generates rational disengagement from a system perceived as unreliable. This reorients analytical attention toward supply-side reliability and health system responsiveness as primary intervention targets, rather than the behaviour change communication approaches that currently dominate programmatic investment.

The third major theme is that health systems' responsiveness, which constitutes the degree to which services respect and respond to diverse populations' contexts, needs, and preferences, forms the basis for a critical determinant of immunisation coverage and equity. Muluneh et al. (2024) add specificity to the responsiveness in the Afar

context, which means linguistic and cultural competence among HEWs (associated with 12-15 percentage point coverage differences), temporal responsiveness in scheduling services to align with seasonal settlement and communal events, and relational responsiveness in engaging clan and religious leaders as genuine governance partners. Each dimension is documented to produce measurable coverage differences when present, and measurable declines when violated.

The fourth major theme requires analytical refinement from the original framing. The evidence is not that community engagement strategies show promise, while evidence of their Afar-specific application remains sparse. Rather, as documented by Muluneh et al. (2024), several community engagement approaches have been trialled in Afar with measurable short-term effects, but none have been implemented under conditions sufficient to produce sustained, population-level coverage improvement. The evidence gap is not primarily an absence of data on whether these strategies work which is partially answered by Muluneh et al. (2024) but an absence of data on what organisational and systemic conditions are necessary for short-term effectiveness to translate into durable impact. This reframing elevates the analytical question from "do community engagement strategies work in pastoralist contexts?" to "what implementation conditions are required for promising approaches to achieve sustained impact?", the principal knowledge gap the present study addresses.

The fifth and most critically underexplored theme is the methodological and measurement challenge of studying immunisation systems in mobile populations. Muluneh et al. (2024) document that conventional health information systems are structurally incapable of tracking mobile populations: administrative denominators are inflated, HMIS data overstate coverage, and children vaccinated at communal events cannot reliably be followed up for subsequent doses. These measurement limitations mean that standard evaluation frameworks cannot accurately assess whether interventions are working or calibrate the scale of the problem they are addressing. Any strategy development process, including the present study, must engage explicitly with this measurement challenge as a prerequisite for generating evidence that is valid and actionable in pastoralist contexts.

Collectively, these themes establish that immunisation coverage gaps in Afar are not intractable but are deeply rooted in structural conditions, including service delivery

design, health workforce management, governance relations, and monitoring systems that require systemic rather than incremental responses. The following section identifies the specific knowledge gaps that provide analytical justification for the present study, distinguishing what Muluneh et al. (2024) have established from what remains empirically and analytically unresolved.

2.9 SUMMARY

This chapter critically reviewed literature on Expanded Programme on Immunisation implementation and utilisation through the analytical lenses of access, equity, and health systems responsiveness. The review examined global evidence on immunisation in pastoralist, mobile, and hard-to-reach populations; regional experiences from East Africa; national evidence from Ethiopia's EPI programme and Health Extension Programme; and specific literature on the Afar region and community engagement strategies.

The literature demonstrates that immunisation coverage gaps among underserved populations are primarily driven by health system limitations, service delivery constraints, provider-level factors, and structural barriers rather than community resistance or cultural opposition. Multiple intersecting barriers operate at individual, interpersonal, institutional, community, and policy levels, requiring comprehensive multi-level interventions that simultaneously address supply-side constraints, demand-side access and knowledge barriers, communication and trust-building, and broader inequities in resource allocation and political attention.

Health systems responsiveness, the extent to which services are organised and delivered in ways aligned with population contexts, needs, and preferences—emerges as a critical determinant of coverage and equity. Standardised service delivery models developed for sedentary populations frequently fail when applied without adaptation to mobile or dispersed communities, highlighting the necessity of flexible, contextually responsive approaches. Significant knowledge gaps persist, particularly regarding frontline health worker perspectives, community-level experiences and decision-making processes, actual implementation realities versus policy intentions, required adaptations for community engagement strategies in pastoralist contexts, and equity dimensions within pastoralist regions. These gaps provide clear justification for the present study,

which employs rigorous qualitative methodology to generate contextualised empirical evidence from Afar region capable of informing more effective, equitable, and responsive immunisation strategies. The following chapter describes the research methodology employed to address these knowledge gaps and answer the study's research questions, detailing the philosophical foundations, research design, data collection and analysis procedures, and ethical considerations guiding the empirical investigation.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

Chapter two presented a comprehensive review of the literature relevant to this study, highlighting the key theoretical and empirical foundations that informed this research. Building on that foundation, this chapter outlines the research methodology adopted to address the research problem and achieve the study objectives. Research methodology refers to the systematic and scientific approach used to investigate a research problem (Polit & Beck, 2021:166), providing a structured plan for collecting and analysing data for a specified purpose (Grove & Gray, 2021:144). The methodological framework presented here encompasses the philosophical underpinnings, research design, sampling strategies, data collection procedures, analytical approaches, and measures taken to ensure rigour and ethical integrity.

3.1.1 OVERVIEW OF THE RESEARCH PHASES

This study unfolded through four sequential phases, each carefully designed to build upon the preceding phase. This approach ensured both a comprehensive exploration of the phenomenon and robust development of evidence-based strategies. The phased approach reflects a deliberate methodological strategy where theoretical foundations established in earlier phases informed and strengthened subsequent phases, ultimately leading to validated, contextually appropriate strategies for improving EPI implementation in pastoralist communities.

Phase 1: Integrative Literature Review. The journey began with a comprehensive integrative review of existing literature to synthesise current evidence on childhood immunisation in pastoralist and nomadic populations globally, with particular emphasis on sub-Saharan African contexts. This phase helped identify knowledge gaps, establish theoretical frameworks, and situate the study within the broader body of scientific knowledge. The integrative review provided the foundational understanding necessary for developing data collection instruments and interpreting the primary data collected in subsequent phases.

Phase 2: Qualitative Study. Building upon the theoretical foundation established in Phase 1, the second phase involved collecting primary qualitative data through multiple

methods. I conducted focus group discussions with parents and guardians of children aged 12-23 months to explore collective experiences, shared beliefs, and community-level perspectives on childhood immunisation. Individual in-depth interviews were held separately with parents and guardians to capture personal narratives and experiences that participants might not feel comfortable sharing in group settings. Additionally, semi-structured interviews were conducted with healthcare workers and health extension workers to explore their perspectives on delivering immunisation services to pastoralist communities, identify systemic and operational challenges, and understand the healthcare provider experience. This multi-method approach within Phase 2 ensured comprehensive exploration of the phenomenon from diverse stakeholder perspectives.

Phase 3: Data Triangulation and Synthesis. The third phase involved systematically integrating findings from Phase 1 (integrative literature review) and Phase 2 (qualitative data collection). Data triangulation is a methodological technique that enhances the credibility and comprehensiveness of research findings by comparing and contrasting data from multiple sources (Denzin 2012:82). In this study, findings from the integrative review, focus group discussions, individual parent interviews, and healthcare worker interviews were systematically compared to identify areas of convergence where multiple sources confirmed similar themes, complementarity where different sources provided distinct but mutually reinforcing perspectives, and divergence where findings from different sources revealed contradictions or tensions requiring careful interpretation. This triangulation process enabled me to develop a comprehensive, multi-dimensional understanding of barriers and facilitators to EPI implementation that was grounded in both existing evidence and contextual realities.

Phase 4: Strategy Development and Validation Using the Delphi Method. The final phase involved translating the integrated findings from Phases 1-3 into actionable, evidence-based strategies to improve EPI implementation in Afar's pastoralist communities. Draft strategies were systematically developed by synthesising key findings related to identified barriers and facilitators. These strategies were then subjected to rigorous validation through the Delphi method, a structured consensus-building technique involving iterative rounds of expert review and refinement (Hasson, Keeney & McKenna 2000:1008). A panel of 15 experts with diverse expertise in immunisation, maternal and child health, pastoralist health, and health systems

strengthening evaluated and refined the strategies through multiple rounds until consensus was achieved. Following the Delphi process, the finalised strategies were compiled into a guideline document and evaluated using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument to ensure adherence to international standards for guideline quality (Brouwers et al 2010).

3.1.2 RATIONALE FOR THE SEQUENTIAL PHASED APPROACH

The decision to adopt a sequential phased methodology was informed by the complexity of the research problem and the need for methodological rigour. Childhood immunisation in pastoralist communities is a multifaceted phenomenon influenced by interacting factors at individual, community, health system, and policy levels. A single-phase study would have been insufficient to capture this complexity comprehensively. The sequential approach offered several important methodological advantages.

First, the phased structure enabled me to build knowledge progressively, with each phase informing the design and implementation of subsequent phases. The integrative review (Phase 1) established what was already known from existing research, thereby preventing duplication and ensuring that the primary data collection (Phase 2) addressed genuine knowledge gaps relevant to the Afar context. Findings from both Phase 1 and Phase 2 directly informed the development of strategies in Phase 4, ensuring that recommendations were grounded in both empirical evidence and contextual realities.

Second, the sequential approach facilitated rigorous triangulation by creating distinct data sources that could be systematically compared and integrated (Phase 3). Rather than collecting all data simultaneously and attempting post-hoc integration, the phased approach allowed for deliberate, systematic synthesis of findings at a dedicated stage of the research process. This enhanced the credibility and trustworthiness of the conclusions drawn from the study.

Third, the phased approach permitted iterative refinement. Insights gained in earlier phases could inform adjustments to data collection instruments, sampling strategies, and analytical approaches in later phases, thereby enhancing methodological responsiveness without compromising rigour. For instance, preliminary themes

identified during early interviews in Phase 2 were explored more deeply in subsequent interviews, allowing for comprehensive data saturation.

Fourth, the validation phase (Phase 4) ensured that research findings translated into practical, feasible, and contextually appropriate strategies rather than remaining abstract academic conclusions. By subjecting draft strategies to expert review through the Delphi method and guideline quality assessment through AGREE II, the study ensured that final outputs met standards for both scientific rigour and practical utility.

3.1.3 ORGANISATION OF THE THESIS

The sequential phased methodology is reflected in the organisation of subsequent chapters, ensuring consistency and logical progression throughout the thesis. Chapter 4 presents the findings from Phase 1, the integrative literature review, synthesising current evidence on immunisation in pastoralist contexts and identifying gaps that justified the primary research undertaken in this study. Chapter 5 presents the qualitative findings from Phase 2, with separate sections reporting results from focus group discussions with parents and guardians, individual interviews with parents and guardians, and interviews with healthcare workers. Chapter 6 presents the data triangulation conducted in Phase 3, demonstrating areas of convergence, complementarity, and divergence across different data sources. Chapter 7 presents the strategy development and validation process of Phase 4, describing the Delphi process in detail and presenting the final evidence-based strategies along with AGREE II evaluation results. Finally, Chapter 8 synthesises the overall findings, discusses theoretical and practical implications, acknowledges study limitations, and provides recommendations for policy, practice, and future research.

3.2 RESEARCH PARADIGM

The philosophical paradigm underlying research shapes fundamental assumptions about the nature of reality (ontology), the nature of knowledge (epistemology), and how knowledge should be acquired (methodology) (Creswell & Creswell 2018:35). This study was grounded in the interpretivist paradigm, which views reality as socially constructed and emphasises understanding phenomena from participants' perspectives.

3.2.1 Rationale for Interpretivism

Interpretivism has its philosophical roots in the social sciences and is characterised by its emphasis on understanding subjective meanings, interpretations, and the social construction of reality (Creswell & Poth 2018:24). Unlike positivism, which seeks universal laws and objective truth, interpretivism recognises that social phenomena are inherently complex, contextual, and shaped by human interpretation (Kumar 2018:22). This paradigm holds that humans cannot be studied in the same way as objects in the natural sciences because human behaviour is influenced by meaning, intention, and social interaction (Saunders et al 2019:199). The interpretivist paradigm was selected for this study for the following reasons:

First, the study aimed to explore how parents, guardians, and healthcare workers in Afar's pastoralist communities make sense of childhood immunization within their unique sociocultural context. Interpretivism is particularly valuable when the research objective is to understand how individuals interpret and give meaning to their experiences within specific cultural contexts (Denzin & Lincoln 2018:56). In the context of this study, immunization uptake is not merely a matter of healthcare access but is deeply influenced by cultural beliefs, traditional practices, nomadic lifestyles, religious interpretations, and community dynamics.

An interpretivist approach allowed the researcher to explore how participants actively construct meaning around immunization practices, child health, and healthcare interactions within their pastoral lifeways. This paradigm recognizes that understanding immunization behaviors requires exploring the subjective interpretations and sense-making processes of community members themselves, rather than imposing external frameworks or testing predetermined hypotheses derived from different cultural contexts (Creswell & Poth 2018:24). The emphasis on meaning-making was particularly important given that immunization decisions in pastoralist communities are embedded in complex webs of traditional knowledge, religious interpretation, and lived experience that cannot be adequately captured through objectivist approaches.

Secondly, the sociocultural beliefs and practices surrounding child health and immunisation in pastoralist communities are diverse and context-specific. Interpretivism recognises that reality is socially constructed and that multiple realities can coexist

depending on individuals' experiences and cultural backgrounds (Crotty 1998:67). The Afar region is characterised by distinct cultural practices, language (Afaraf), Islamic beliefs, and pastoral livelihoods that differ significantly from settled agricultural or urban communities. Understanding immunisation barriers in this context required an approach that could capture these nuances rather than testing predetermined hypotheses derived from different contexts.

Thirdly, language plays a central role in how individuals construct and communicate meaning within their cultural contexts (Guba & Lincoln 1994:109). In this study, most participants spoke Afaraf as their primary language, and their understanding of immunisation, health, illness, and child-rearing was expressed through culturally specific terminology and concepts. The interpretivist paradigm acknowledges that language is not merely a neutral vehicle for conveying information but is integral to how individuals understand and interpret their world (Yanow & Schwartz-Shea 2014:88). By conducting interviews in participants' own language and paying careful attention to how concepts were expressed and understood, the study was able to access deeper layers of meaning that might have been lost through premature translation or imposition of external categories.

Fourthly, the interpretive paradigm's flexibility in methodology was essential for accommodating the unique challenges of conducting research in nomadic pastoralist communities (Creswell & Poth 2018:26). The interpretivist approach permitted the use of semi-structured interviews and focus group discussions that could be adapted to participants' schedules, locations, and comfort levels, which was crucial given the mobile nature of pastoralist livelihoods and varying literacy levels among participants.

3.2.2 Ontological and Epistemological Assumptions

From an ontological perspective, this study adopted a relativist stance, acknowledging that multiple realities exist depending on individuals' experiences, cultural backgrounds, and positions within their communities (Denzin & Lincoln 2018:101). The reality of immunisation in Afar's pastoralist communities is not singular or objective but is constructed differently by parents, healthcare workers, community leaders, and health extension workers, each viewing the phenomenon through their unique lens.

Epistemologically, the study was grounded in the belief that knowledge is co-constructed through interaction between researcher and participants (Guba & Lincoln 1994:110). The researcher did not approach the field as a detached observer seeking objective truth but as an engaged learner who sought to understand participants' perspectives through dialogue and reflection. This epistemological stance justified the use of in-depth interviews and focus group discussions as primary data collection methods, as these approaches facilitate rich, contextualised understanding through direct engagement with participants' lived experiences.

3.2.3 Reflexivity and Researcher Positioning

Consistent with the interpretivist paradigm, the researcher-maintained reflexivity throughout the study by acknowledging how their own background, assumptions, and position could influence data collection and interpretation (Finlay & Gough 2003:108). The researcher's professional background in public health and familiarity with Ethiopia's healthcare system provided valuable context for understanding the institutional and systemic aspects of immunisation delivery. However, the researcher remained cognisant that this insider knowledge could potentially bias interpretation if not carefully managed. To address this, the researcher engaged in ongoing reflection through research journaling, discussed emerging interpretations with supervisors and independent co-coders, and consistently prioritised participants' voices over preconceived notions. This reflexive approach ensured that findings reflected participants' meanings rather than the researcher's assumptions.

3.3 RESEARCH APPROACH

The research approach is a detailed plan and procedure that spans from the adopted worldview to the preferred methods of data acquisition and analysis (Kumar 2020:201). According to Holloway and Galvin (2020:210), the research methodology refers to the systematic processes, plans, strategies, and procedures emanating from the researcher's research paradigm. There are three commonly used approaches to research: qualitative, quantitative, and mixed methods (Kumar 2020:202). The qualitative research approach is non-numerical and derived from the constructivist or interpretivist research paradigm. The quantitative research approach is derived from the

positivist research paradigm, and data is presented numerically (Kumar 2020:202). The mixed-methods research approach combines both qualitative and quantitative approaches in a single study.

This study employed a qualitative research approach, which aligned with the interpretivist paradigm and the study's objectives to explore and describe participants' viewpoints and experiences regarding challenges and strengths in implementing EPI strategies. The qualitative approach was appropriate because it enabled in-depth exploration of the complex sociocultural, linguistic, and systemic factors influencing immunisation uptake in pastoralist communities. Kumar (2020:202) explains that the qualitative approach has the following characteristics that were relevant to this study:

- **Natural setting:** Primary data is collected in the site where the investigated problem is experienced. The study was conducted in five districts in Afar where the EPI programme is implemented, specifically in health posts and community settings where participants naturally interact with immunisation services.
- **Researcher as key instrument:** Qualitative data is collected by the researcher, enabling direct and first-hand comprehension of participants' circumstances. The researcher's role in data collection narrowed the distance between researcher and participants, facilitating trust and rich data collection.
- **Multiple sources of data:** Several data sources were triangulated to ensure the study's credibility. This study's multiple data sources included an integrative literature review, audio-recorded in-depth individual interviews with healthcare professionals and health extension workers, focus group discussions with parents/guardians, and individual in-depth interviews with parents/guardians of children aged 12-23 months.
- **Inductive data analysis:** Researchers in qualitative research organise and categorise data according to patterns of frequently occurring or repetitive participant responses in a bottom-up manner. The organised data was then patterned into abstract information units. This study analysed data using the thematic analysis method whereby patterns, categories, and themes were created and arranged into abstract pieces of information.
- **Participants' meaning:** Qualitative approaches focus on participant construction and interpretation of a phenomenon that the researcher is investigating. The

researcher remained aware of and excluded personal prejudices to ensure meaningful and objective data analysis. The findings reflected participants' accounts of events in response to the interview questions.

- **Emergent design:** The qualitative research process is emergent, meaning the researcher anticipated and accommodated changes in the research plan as necessary while maintaining rigour.
- **Reflexivity:** The researcher reflected on their role throughout the study, ensuring that personal views and background remained secondary to the phenomenon being investigated. The researcher declared potential bias based on current professional background and employment.
- **Holistic account:** The study investigated complex but interrelated issues and problems, requiring multiple reporting and analytic skills and perspectives. The researcher identified multifaceted factors connecting to the larger research scenario, developing a detailed picture of the challenges and effectiveness of the EPI.

3.4 RESEARCH DESIGN

A research design is described by Creswell and Creswell (2020:305) as a collection of systematic protocols for gathering, analysing, and interpreting data. According to Kumar (2018:199), a research design serves as a roadmap for conducting a study in a way that facilitates the resolution of research questions and the accomplishment of research goals. A research design should be determined by the research questions the study aims to address (Kumar 2020:200).

For this study, an exploratory and descriptive design was chosen. This design made it feasible to investigate and clarify the phenomenon of EPI implementation in pastoralist communities, supporting the study's goal of exploring experiences and describing strategies. In-depth interviews are a versatile data collection method justified by this design.

3.4.1 Exploratory Design

Exploratory research designs are typically inductive, aiming to develop rather than evaluate pre-existing theories (Pratap 2019:13). This study aimed to develop strategies

for removing obstacles in implementing EPI among pastoralist communities in Afar. The exploratory design allowed the researcher to investigate previously unexplored aspects of immunisation delivery in this unique context.

Kumar (2020:205) identifies several characteristics of exploratory designs that were relevant to this study:

- Flexibility in methods and approaches
- Focus on discovering new insights rather than testing hypotheses
- Use of qualitative data collection techniques
- Openness to unexpected findings
- Emphasis on generating rather than verifying knowledge

The exploratory design was appropriate because despite global and national efforts to improve immunisation coverage, specific barriers and facilitators in Afar's pastoralist context remained poorly understood. The design enabled the researcher to explore these contextual factors without being constrained by predetermined categories or assumptions.

3.4.2 Descriptive Design

Descriptive research aims to accurately portray the characteristics of individuals, situations, or groups and the frequency with which certain phenomena occur (Polit & Beck 2021:184). In this study, the descriptive design complemented the exploratory approach by providing detailed accounts of:

- Parents' and guardians' experiences with childhood immunisation services
- Healthcare workers' perspectives on delivering immunisation in pastoralist communities
- Specific barriers encountered in immunisation uptake
- Existing strengths and facilitating factors in the current EPI system
- Cultural beliefs and practices influencing immunisation decisions

The descriptive design facilitated rich, detailed descriptions that formed the foundation for strategy development in Phase 4.

3.5 STUDY SETTING

The study was conducted in the Afar Regional State, located in northeastern Ethiopia. Afar is one of Ethiopia's emerging regions, characterised by arid and semi-arid climatic conditions, sparse vegetation, and a predominantly pastoralist population that practices nomadic or semi-nomadic livestock rearing (CSA 2016:12). The region faces significant development challenges, including limited infrastructure, low literacy rates, minimal access to basic services, and recurrent droughts that affect livelihoods and health outcomes.

The Afar Regional Health Bureau oversees health service delivery in the region through five administrative zones. The region's health system includes hospitals, health centres, and health posts. Health posts are the primary point of contact for immunisation services in rural and pastoralist communities, staffed by health extension workers who provide basic preventive and promotive health services.

3.5.1 Selected Districts

The study was conducted in five purposively selected districts across different zones in Afar. These districts were chosen based on the following criteria:

- Presence of significant pastoralist populations
- Representation of different geographic and climatic conditions within Afar
- Accessibility while still reflecting the challenges of remote pastoralist areas
- Existing EPI implementation activities
- Willingness of district health offices to support the research

The five selected districts were representative of the broader Afar region in terms of population characteristics, health service infrastructure, and immunisation challenges. Each district had multiple health posts serving scattered pastoralist settlements.

3.5.2 Health System Context

Within each selected district, health posts serving pastoralist communities were identified as study sites. Health posts were selected because they are the primary venues where parents and guardians access routine immunisation services for their children. The selection of health posts considered:

- Distance from district centres (prioritising more remote facilities)
- Size of catchment population
- Presence of active health extension workers
- Availability of immunisation services
- Accessibility during the study period

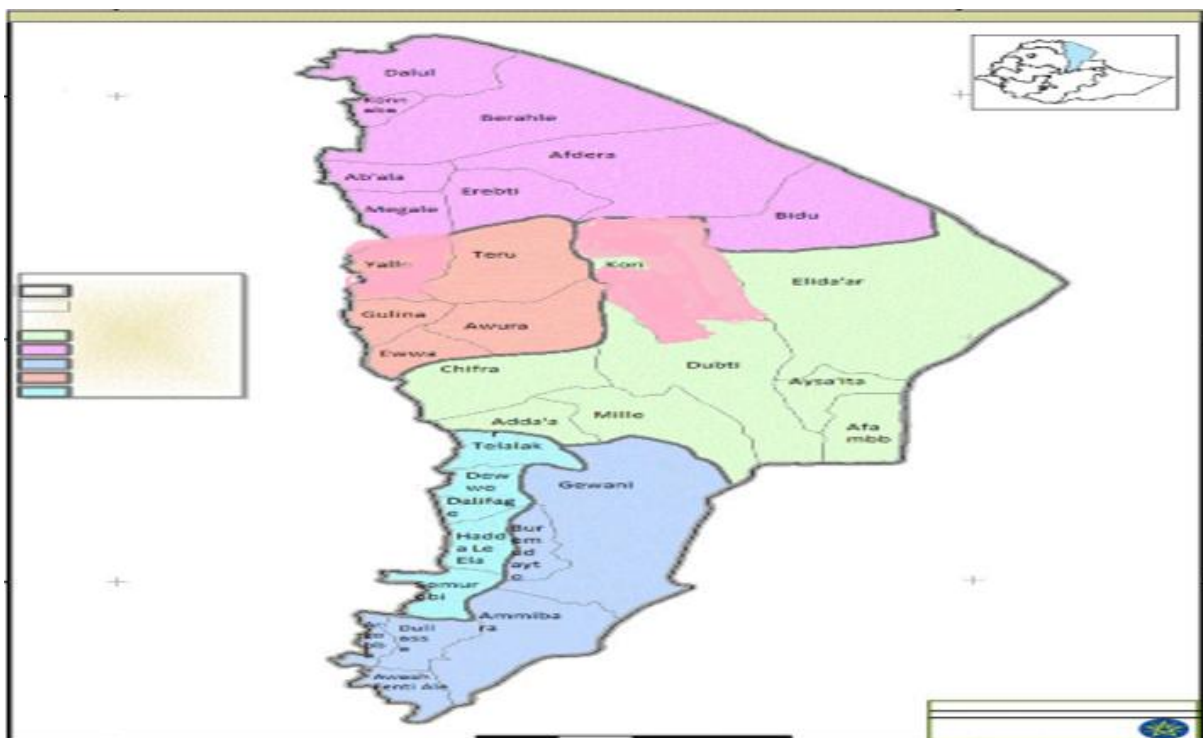


Figure 3.1: Map of the Afar Regional State in the Ethiopian Map (Google Maps)

3.6 STUDY POPULATION AND SAMPLING

3.6.1 Study Population

The study population comprised two main groups:

Parents and guardians of children aged 12-23 months residing in pastoralist communities in the five selected districts. This age group was chosen because children should have completed their primary immunisation schedule by 12 months, allowing participants to reflect on their complete immunisation experience. Parents and guardians who met the inclusion criteria were eligible for participation in either focus group discussions or individual in-depth interviews.

Healthcare workers and health extension workers providing immunisation services in the selected districts. This group included health officers, nurses, midwives, and health extension workers who had direct experience delivering EPI services to pastoralist communities.

3.6.2 Sampling Strategy

District Selection: Purposive sampling was used to select the five districts from across Afar's zones. This non-probability sampling technique was appropriate given the study's qualitative nature and the need to select information-rich cases (Patton 2015:264). Districts were purposively selected to ensure representation of different geographic areas, varying degrees of remoteness, and diverse pastoral practices within Afar.

Participant Sampling: Within the selected districts, purposive sampling was employed to identify and recruit participants who could provide rich, relevant information about immunisation experiences and challenges. Eligibility criteria ensured that participants had direct, recent experience with childhood immunisation in pastoralist contexts.

3.6.3 Sample Size

The study included a total of 77 participants:

- **Focus Group Discussions (FGDs):** 50 parents/guardians participated in FGDs

- **Individual In-depth Interviews with Parents/Guardians:** 10 parents/guardians
- **Individual In-depth Interviews with Healthcare Workers:** 17 healthcare workers and health extension workers

Sample size in qualitative research is determined by the principle of data saturation rather than statistical representativeness (Saunders et al 2018:1893). Data saturation occurs when no new themes, concepts, or insights emerge from additional data collection (Guest, Bunce & Johnson 2006:59). In this study, data collection continued until saturation was achieved for each participant group, ensuring comprehensive exploration of the phenomenon.

3.6.4 Inclusion and Exclusion Criteria

Inclusion Criteria for Parents/Guardians: Parent or legal guardian of a child aged 12-23 months - Residence in one of the five selected districts in Afar at the time of the study - Willingness to participate and provide informed consent - Ability to communicate in Afaraf or Amharic - The term “residence” was defined as being present in the district for the majority of the past 12 months, regardless of whether participants practiced fully nomadic, semi-nomadic, or settled lifestyles. This inclusive definition ensured that the study captured perspectives from across the spectrum of mobility patterns characteristic of pastoralist communities, rather than excluding fully nomadic individuals.

Exclusion Criteria for Parents/Guardians: Parents/guardians who were too ill to participate - Those unable to provide informed consent due to cognitive impairment - Parents/guardians whose children had severe medical conditions requiring specialised care beyond routine immunisation

Inclusion Criteria for Healthcare Workers: Health extension workers, nurses, health officers, or other healthcare professionals providing immunisation services - Minimum of six months’ experience working in the selected districts - Direct involvement in EPI implementation - Willingness to participate and provide informed consent

Exclusion Criteria for Healthcare Workers: Healthcare workers who had been in their current position for less than six months - Those not directly involved in immunisation service delivery

3.7 RESEARCH PHASES

The study was conducted in four sequential phases, each building upon the previous one to ensure comprehensive exploration and strategy development.

3.7.1 Phase 1: Integrative Literature Review

Purpose: The integrative literature review aimed to synthesise existing evidence on barriers and facilitators of childhood immunisation in pastoralist and nomadic communities globally, with particular attention to sub-Saharan African contexts similar to Afar.

Process: A systematic search was conducted across multiple databases including PubMed, CINAHL, Scopus, and regional databases covering literature published between 2010 and 2022. Search terms included combinations of keywords related to immunization, vaccination, pastoralism, nomadism, barriers, facilitators, and related terms. The review followed Whitemore and Knaf's (2005) integrative review framework, involving:

1. Problem identification and formulation of review questions
2. Literature search using defined inclusion and exclusion criteria
3. Data evaluation for quality and relevance
4. Data analysis through thematic synthesis
5. Presentation of findings

Outcomes: The integrative review identified key themes related to immunisation barriers (e.g., mobility, access, cultural beliefs, healthcare system factors) and facilitators (e.g., community engagement, mobile services, cultural sensitivity) that informed the development of interview guides for Phase 2 and provided context for interpreting primary data. These findings are presented in Chapter 4.

3.7.2 Phase 2: Qualitative Data Collection

Phase 2 involved primary qualitative data collection through focus group discussions and individual in-depth interviews with parents/guardians and healthcare workers.

Phase 2a: Focus Group Discussions with Parents/Guardians

Purpose: FGDs provided a platform for parents and guardians to share experiences, discuss immunisation challenges, and identify community-level barriers and facilitators in a group setting that encouraged interaction and sharing of diverse perspectives.

Participants: 50 parents/guardians of children aged 12-23 months participated in FGDs. Participants were recruited through health extension workers, who identified eligible individuals within their respective catchment areas.

Process: A total of 5 FGDs were conducted, with each group comprising 10 participants. Each FGD lasted 60-90 minutes. The longer duration allowed for thorough exploration of topics, interaction among participants, and probing of emerging themes. FGDs were facilitated by the researcher with assistance from a trained moderator who was fluent in Afaraf. Discussions were conducted primarily in Afaraf, with occasional use of Amharic when participants were more comfortable in that language. All discussions were audio-recorded with participants' consent.

Topics Explored: - Experiences accessing immunisation services - Cultural beliefs about immunisation and child health - Decision-making processes regarding immunisation - Perceived barriers to completing immunisation schedules - Suggestions for improving service delivery - Community resources and support systems

Phase 2b: Individual In-depth Interviews with Parents/Guardians

Purpose: Individual interviews provided opportunities for parents and guardians to share personal experiences, sensitive information, or perspectives they might not feel comfortable discussing in group settings.

Participants: 10 parents/guardians who met inclusion criteria participated in individual in-depth interviews. Some were purposively selected because they had unique experiences or perspectives, while others preferred individual interviews over group discussions.

Process: In-depth interviews used a semi-structured interview guide with open-ended questions that allowed flexibility to explore emerging themes. The term "in-depth interview" is used deliberately to distinguish this approach from "semi-structured

interview.” In-depth interviews in this study used minimal guiding questions to encourage participants to narrate their experiences in detail, with the interviewer using probes and follow-up questions to explore meaning in depth (Rubin & Rubin 2012:31). In contrast, semi-structured interviews (used with healthcare workers, described below) followed a more defined guide with specific predetermined questions while still allowing flexibility (Brinkmann & Kvale 2015:57).

Interviews were conducted in private settings, primarily at health posts or other locations convenient and comfortable for participants. Interviews lasted 45-60 minutes and were conducted in the participant’s preferred language (Afaraf or Amharic). All interviews were audio-recorded with consent.

Topics Explored: - Personal immunisation journey - Specific challenges encountered - Family and community influences on immunisation decisions - Health system interactions - Suggestions for improvement

Phase 2c: Individual In-depth Interviews with Healthcare Workers

Purpose: Interviews with healthcare workers explored their perspectives on delivering immunisation services to pastoralist communities, challenges encountered, strategies employed, and recommendations for improvement.

Participants: 15 healthcare workers and health extension workers from the selected districts participated. Participants were recruited through district health offices and included various cadres involved in EPI implementation.

Process: Semi-structured interviews were conducted using an interview guide with predetermined questions covering key topics while allowing flexibility to explore emerging issues (Brinkmann & Kvale 2015:57). The semi-structured format was appropriate for this group because it ensured systematic coverage of technical and programmatic topics while permitting in-depth exploration when needed. Interviews were conducted in Amharic (the working language of Ethiopia’s health system) or Afaraf depending on participant preference, lasted 60-75 minutes, and were audio-recorded with consent.

Topics Explored: - Experiences delivering immunisation services to pastoralist communities - Specific challenges (logistical, cultural, systemic) - Strategies currently employed to reach mobile populations - Training and support needs - Perceptions of community attitudes toward immunisation - Recommendations for programme improvement.

3.7.3 Phase 3: Data Triangulation and Synthesis

Purpose: Phase 3 involved systematic integration of findings from Phase 1 (integrative literature review) and Phase 2 (qualitative data collection). Data triangulation is a methodological technique that enhances the credibility and comprehensiveness of research findings by comparing and contrasting data from multiple sources (Denzin 2012:82).

Process:

Step 1: Separate Analysis of Each Data Source

Following methodological best practice, data from each source was analyzed and presented separately to ensure clarity and depth:

- Integrative Review: Findings synthesized thematically and presented in Chapter 4
- FGDs with Parents/Guardians: Analyzed using Braun and Clarke's thematic analysis and presented in Chapter 5, Section 5.1
- Individual Interviews with Parents/Guardians: Analyzed using Braun and Clarke's thematic analysis and presented in Chapter 5, Section 5.2
- Interviews with Healthcare Workers: Analyzed using Braun and Clarke's thematic analysis and presented in Chapter 5, Section 5.3

This approach ensured that unique perspectives from each participant group were preserved and clearly articulated before integration.

Step 2: Data Triangulation and Integration

After separate analysis, findings from all sources were systematically triangulated to identify:

- Convergence: Areas where findings from multiple sources confirmed similar themes or patterns
- Complementarity: Areas where different sources provided distinct but mutually reinforcing perspectives that together created more complete understanding
- Divergence: Areas where findings from different sources contradicted or diverged, requiring careful interpretation

The triangulation process involved: (1) creating a triangulation matrix mapping themes identified in each data source; (2) identifying correspondence between themes across sources; (3) examining areas of disagreement and exploring possible explanations; (4) synthesizing findings into an integrated understanding incorporating multiple perspectives; and (5) documenting the triangulation process with clear links between original data and synthesized findings.

The detailed triangulation analysis is presented in Chapter 6, demonstrating how findings from multiple sources were integrated to develop a comprehensive understanding that informed strategy development in Phase 4. This triangulation process enhanced the credibility and trustworthiness of findings by demonstrating consistency across multiple data sources while also revealing important nuances and contextual factors.

3.7.4 Phase 4: Strategy Development and Validation Using the Delphi Method

Purpose: Phase 4 involved developing evidence-based strategies to overcome barriers in EPI implementation based on findings from Phases 1-3, then validating these strategies through expert consensus using the Delphi method.

Partners Involved: Throughout Phase 4, the term “partners” refers to key stakeholders who provided input, facilitated access, or supported implementation planning. These partners included: - Afar Regional Health Bureau officials, District health office managers , Non-governmental organizations (NGOs) working in health and development in Afar, such as (specific organizations can be named if appropriate) - Community health committees - Health extension worker supervisors - Academic institutions involved in health systems strengthening in Ethiopia

These partners' involvement ensured that developed strategies were contextually appropriate and aligned with existing health system structures and ongoing development initiatives.

Strategy Development: The researcher synthesized findings from the integrative review, FGDs, and interviews to develop draft strategies addressing identified barriers. Strategies were organized into thematic areas (e.g., improving access, enhancing cultural acceptability, strengthening healthcare system capacity, and community engagement) with specific, actionable recommendations for each.

3.7.4.1 Delphi Method:

The Delphi method is a structured communication technique that uses an iterative process to gather expert opinions and build consensus (Hsu & Sandford 2007:1). It is particularly useful when objective data is limited and subjective judgments are needed to inform decision-making (Khodyakov et al 2023:71). The method involves multiple rounds of questionnaires sent to a panel of experts, with controlled feedback between rounds to facilitate convergence toward consensus.

Expert Panel Selection: 15 experts were purposively selected based on the following criteria: - Expertise in immunization, maternal and child health, or public health - Experience working in pastoralist contexts or with mobile populations - Knowledge of Ethiopia's health system and EPI programme - Academic qualifications (minimum master's degree) or equivalent professional experience - Willingness to participate in all Delphi rounds

The panel included diverse expertise: public health specialists, pediatricians, health programme managers, researchers, and representatives from non-governmental organisations (NGOs) working in Afar. This diversity ensured a comprehensive evaluation from multiple professional perspectives.

Delphi Process:

Round 1: Experts received the draft strategies developed from Phases 1-3. They rated each strategy on a 5-point Likert scale for relevance, feasibility, and potential

effectiveness. They also provided qualitative comments and suggestions for refinement. Response rate: 15/15 (100%).

Between Round 1 and Round 2: The researcher analysed ratings and comments, calculated mean scores and standard deviations, compiled qualitative feedback, and revised strategies based on expert input. Strategies achieving $\geq 80\%$ agreement (ratings of 4 or 5) were retained; those with $< 80\%$ agreement were revised or removed.

Round 2: Experts received the revised strategies along with summary statistics from Round 1, showing group responses and their own previous ratings (controlled feedback). They re-rated the revised strategies and provided additional comments. Response rate: 15/15 (100%).

Between Round 2 and Round 3: Further analysis of ratings, refinement of strategies based on Round 2 feedback, and preparation of the final strategy document.

Round 3 (if needed): If consensus had not been achieved after Round 2, a third round would have been conducted. In this study, satisfactory consensus ($\geq 80\%$ agreement) was achieved after Round 2 for all retained strategies, so a third round was not necessary.

Consensus Criteria: Consensus was defined as $\geq 80\%$ of experts rating a strategy as 4 or 5 (agree or strongly agree) on the Likert scale for relevance, feasibility, and effectiveness.

Strategy Validation:

Following the Delphi rounds, the finalised strategies were compiled into a guideline document. The same expert panel then evaluated the guideline using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument (Brouwers et al 2010). The AGREE II tool assesses guideline quality across six domains: 1. Scope and purpose, 2. Stakeholder involvement 3. Rigour of development 4. Clarity of presentation 5. Applicability 6. Editorial independence

Each domain was scored independently by experts, and scores were aggregated to determine overall guideline quality. This validation ensured that the developed

strategies met international standards for guideline development. Table 3.1 below shows the distribution of the sample: -

TABLE 3.1: STUDY SAMPLE SIZE DISTRIBUTION FOR IN-DEPTH INTERVIEW, FOCUS GROUP DISCUSSIONS AND KEY INFORMANT INTERVIEWS

Weredas/districts	IDI	FGD	Key Informant Interviews (KII)				Total
	Parents/guardians	Parents/guardians	HEWs	HC- EPI focal	District EPI focal	Regional focal and partners	
Ayseita weredas/districts	2	10	1	1	1		15
Afambo weredas/districts	2	10	1	1	1	1	15
Dubti weredas/districts	2	10	1	1	1		15
Samaralogiya weredas/districts	2	10	1	1	1	1	15
Mille weredas/districts	2	10	1	1	1		15
Grand Total	10	50	5	5	5	2	77

3.8 DATA COLLECTION

3.8.1 Integrative Review Protocol

A structured protocol guided the integrative literature review, including: - Clearly defined review questions - Comprehensive search strategy with specified databases, search terms, and date ranges - Inclusion and exclusion criteria for study selection - Quality appraisal criteria - Data extraction template - Framework for thematic synthesis

The protocol was developed following Whitemore and Knafli's (2005) guidelines for integrative reviews and was reviewed by the research supervisor before implementation.

3.8.2 Interview Guides

Three separate semi-structured interview guides were developed:

Focus Group Discussion Guide (Parents/Guardians): Contained open-ended questions and prompts covering: - Icebreaker and introduction questions to build rapport

- Questions about immunisation knowledge and experiences
- Discussion of barriers and challenges
- Exploration of cultural beliefs and practices
- Community-level facilitators and resources
- Suggestions for improvement
- Closing questions

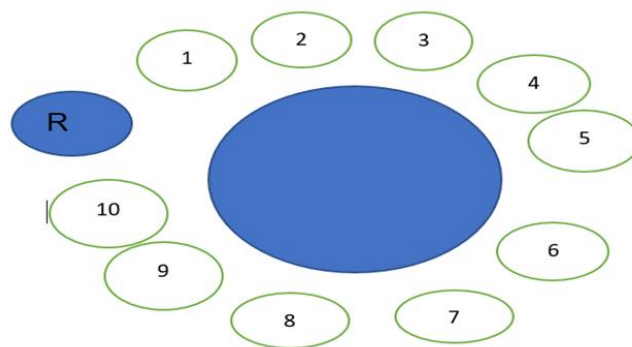


Figure 2.2: Seating arrangement during focus group discussions

Figure 2.2 illustrate how the participants sat in a focus group. The participants decided upon the location of FGDs. The focus group discussions were conducted for 60-90 minutes to allow for thorough exploration of topics, meaningful interaction among participants, and probing of emerging themes. The researcher sat in front of the focus participants, arranged in an oval configuration.

In-depth Interview Guide (Individual Parents/Guardians): Similar topics to the FGD guide but with more emphasis on personal narratives and individual experiences.

Questions were phrased to encourage detailed storytelling and reflection. The face-to-face interview is a means of data acquisition through direct interaction between the participant and the researcher using an interview guide (Bhasin 2022:44). Face-to-face interviews are advantageous because first, they provide a rapport-building opportunity for a deeper understanding of the participants' perspectives and experiences (Bhasin 2022:44). Second, face-to-face interviews provide salient information from observing non-verbal cues which may be difficult to capture with the use of other methods, such as focus groups or surveys (Bhasin 2022:48). Third, they can provide more precise screening since the interviewed individual would be unable to falsify any information when questions were being screened, such as age, gender and race (DeFranzo 2021:632). Fourth, face-to-face interviews enable focus and allow the interviewer to control the proceedings, keeping the interviewee focused until the process has been completed (DeFranzo 2021:632).

Semi-structured Interview Guide (Healthcare Workers): Covered: - Professional background and experience - Description of current immunisation service delivery practices - Challenges in reaching pastoralist populations - Perceptions of community attitudes and beliefs - Strategies currently employed - Training and support systems - Resources and infrastructure - Recommendations for improvement

All interview guides were developed based on the study objectives, findings from the integrative review, and consultation with supervisors and local health officials. The guides were pilot-tested with participants similar to the study population and refined based on feedback before full implementation.

3.8.3 Language and Translation Considerations

Data collection was conducted primarily in Afaraf, the local language spoken by the majority of participants in the study area. Amharic, Ethiopia's federal working language, was used when participants indicated preference or greater comfort with that language. The choice to conduct interviews in both languages was justified by the linguistic diversity in the study area and the need to ensure participants could express themselves fully in their preferred language.

Translation Process:

- **Tool Development:** Interview guides were initially developed in English, then translated to Afaraf and Amharic by professional translators with health background.
- **Back-Translation:** Translated guides were back-translated to English by independent translators to verify accuracy and conceptual equivalence.
- **Expert Review:** Translated guides were reviewed by bilingual health professionals familiar with both languages and the cultural context to ensure cultural appropriateness and clarity.
- **Pilot Testing:** Guides were pilot-tested in both languages with participants similar to the study population to identify any unclear phrasing or cultural misunderstandings.
- **Data Collection:** Interviews and FGDs were conducted in participants' preferred language (Afaraf or Amharic). Research assistants fluent in both Afaraf and Amharic facilitated data collection. Of the 62 parents/guardians interviewed (including FGD participants), 61 preferred Afaraf and one requested Amharic. All 15 healthcare workers were comfortable in Amharic, though some also spoke Afaraf and code-switched during interviews.
- **Transcription:** Audio recordings were transcribed verbatim in the language of interview (Afaraf or Amharic) by trained transcribers who were native speakers.
- **Translation for Analysis:** Transcripts were translated from Afaraf and Amharic to English by professional translators with backgrounds in health and social sciences. Translation focused on conceptual equivalence rather than word-for-word translation to preserve meaning.
- **Quality Control:** A sample of transcripts (20%) were independently reviewed by bilingual researchers to verify translation accuracy. Discrepancies were discussed and resolved through consensus.

This rigorous translation process ensured that participants' meanings were accurately captured and preserved through the transition from local languages to English for analysis and reporting.

3.8.4 Delphi Questionnaires

Two rounds of structured questionnaires were used in the Delphi process:

Round 1 Questionnaire

The initial questionnaire comprised four components. First, draft strategies derived from the literature review were systematically organised by thematic categories. Second, participants evaluated each strategy using a five-point Likert scale (1 = strongly disagree; 5 = strongly agree) across three dimensions: relevance, feasibility, and effectiveness. Third, open-ended questions enabled qualitative elaboration and critical commentary on each strategy cluster. Fourth, dedicated space allowed participants to propose additional strategies or modifications, ensuring co-construction of knowledge rather than passive validation.

Round 2 Questionnaire

The second-round instrument facilitated informed consensus-building through structured feedback. It presented refined strategies incorporating Round 1 amendments, alongside summary statistics (mean scores, standard deviations, frequency distributions). Each participant received their own Round 1 responses for comparative reference, promoting reflective re-evaluation. The same five-point Likert scale ensured methodological consistency across rounds. Comment fields permitted experts to justify rating changes, challenge emerging consensus, or introduce new considerations arising from collective panel perspectives.

Both questionnaires were distributed electronically via email with clear instructions, deadlines, and researcher contact information. Reminder emails were sent to non-respondents to maximise response rates.

3.8.5 AGREE II Instrument

The AGREE II instrument (Brouwers et al 2010) is a standardised, validated tool for assessing guideline quality. It contains 23 items organised into six domains, each rated on a 7-point scale (1 = strongly disagree to 7 = strongly agree). The instrument was used in its original form without modification, as it has been extensively validated internationally.

3.8.6 Pilot study

Pilot studies are conducted to assess and refine the research instrument and procedures for participant recruitment or selection (Polit & Beck 2021:265). Pilot studies are also essential for evaluating the acceptability of screening participants and gathering information for improving interventions (Polit & Beck 2021:265). While a pre-test refers specifically to the trialling of a data collection instrument to check for clarity, comprehensibility, and relevance of items, a pilot study is a broader preliminary investigation conducted before the main study (Polit & Beck, 2021:265). The procedure followed in this study was pilot. It was conducted at the Ayseita district, involving two healthcare workers and one parent who participated in in-depth individual interviews. This enabled the researcher to assess and refine data collection and analysis methods, familiarise with the interview questions to facilitate free-flowing dialogue, practice using the digital voice recorder, and improve field note-taking (Polit & Beck 2021:265). Consistent with standard practice, data obtained from the pilot study participants were excluded from the main study (Polit & Beck 2021:266)..

3.9 Data Collection Procedures

3.9.1 Ethical Clearance and Permissions

Before commencing data collection, the following approvals were obtained: - Ethical clearance from the University of South Africa (UNISA), College of Human Sciences Research Ethics Committee (Reference Number: 14064316_CRECHS_2023) - Permission from the Afar Regional Health Bureau - Permission from each selected district health office - Cooperation from health facility administrators at each study site

3.9.1 Recruitment

Recruitment of parents and guardians were recruited through the assistance of community leaders and health extension workers who helped identify potential participants who met the inclusion criteria. The research team then approached these individuals to explain the study in detail, provide written information sheets, and invite them to participate. Those who expressed interest provided their contact information and were subsequently contacted to schedule interviews or FGDs at convenient times.

Healthcare workers were accessed through obtaining the list of health facilities and staff from the district health offices. Facility managers were contacted to identify healthcare workers who met the eligibility criteria. These individuals were then approached individually by the research team to explain the study and invite them to participate.

For the Delphi expert panel, potential experts were identified through reviewing published literature on immunisation and pastoralist health, consulting professional networks, and seeking recommendations from colleagues (snowball referral). Initial contact was made via email, explaining the study objectives and inviting participation in the Delphi process.

3.9.2 Data Collection Timeline

Data collection occurred over a period of approximately 10 months: - Phase 1 (Integrative Review): 3 months - Phase 2 (FGDs and Interviews): 5 months (including preparation, pilot testing, data collection, and transcription) - Phase 4 (Delphi Rounds): 2 months.

3.9.3 Informed Consent Process

Before any data collection began, all participants went through a thorough informed consent process. They received written information sheets in their preferred language (Afaraf, Amharic, or English) that explained the study's purpose and procedures, the voluntary nature of participation, how confidentiality would be protected, potential risks and benefits of participation, contact information for the research team, and their right to withdraw from the study at any time without any negative consequences. Research team members read through the information sheets with participants and answered any questions they had. Participants were given adequate time to consider whether they wanted to participate. Only after this process was completed did participants sign written consent forms to indicate their voluntary agreement to participate. For participants with limited literacy, the information sheets were read aloud in their preferred language, and their consent was documented with a thumbprint, witnessed by an independent literate witness.

3.9.4 Conducting Interviews and FGDs

All interviews were conducted in settings that were convenient and comfortable for participants, including their homes, health facilities, or community centres, ensuring privacy and minimising potential discomfort. The principal investigator conducted all interviews with the assistance of trained research assistants who were fluent in Afaraf and Amharic and could serve as interpreters when needed.

Focus group discussions were held in community centres or health posts. Participants were seated in a circle to promote a sense of equality and encourage participation from all members. A trained facilitator led the discussions while a research assistant took detailed notes and observed group dynamics and non-verbal communication. Each FGD session began with introductions, establishing ground rules (emphasising confidentiality, respectful listening, and the understanding that there are no right or wrong answers), and creating a welcoming atmosphere.

All interviews and FGDs were audio-recorded with participants' permission. The typical duration was 45-75 minutes for individual interviews, 60-90 minutes for focus group discussions, and 45-60 minutes for healthcare worker interviews. Participants were reminded that they could request the recording to be paused or stopped at any time if they felt uncomfortable.

3.9.5 Field Notes

Throughout the data collection process, detailed field notes were maintained to document observations beyond what was captured in audio recordings. These notes included observations of non-verbal communication and body language, contextual factors relevant to interpreting participants' responses, researcher reflections and reactions to the data, and emerging patterns or themes that were noted during data collection. These field notes were reviewed regularly, often on the same day as data collection, to identify areas requiring further exploration in subsequent interviews and to inform adjustments to the interview approach.

3.9.6 Delphi Data Collection

The Round 1 questionnaires were distributed to the expert panel via email, using secure online survey platforms such as Google Forms or SurveyMonkey to facilitate data

collection and organisation. Experts were given three weeks to complete the surveys. Reminder emails were sent to non-responders at one-week and two-week intervals to maximise response rates.

After analysing Round 1 responses, the Round 2 questionnaires were developed and distributed using the same approach, with a two-week timeframe for completion. Along with the Round 2 questionnaire, experts received a summary of Round 1 feedback showing how their collective input had shaped the strategy revisions, promoting transparency and engagement.

3.9.7 Data Management

Audio recordings were transferred immediately after each data collection session to password-protected computers. Digital backups were created on encrypted external hard drives to prevent data loss. The recordings were then transcribed verbatim in the original language (Afaraf or Amharic) by experienced transcribers. Following transcription, the text was translated into English by independent bilingual translators who had not been involved in the initial transcription. To ensure quality, the transcripts were checked against the original audio recordings for accuracy, and a sample of transcripts was back-translated from English to the original language to verify the quality of translation.

All data, including audio recordings, transcripts, field notes, and consent forms, were stored securely. Hard copy materials were kept in locked filing cabinets in a secure office, while electronic files were stored on password-protected computers and devices. Access to these data was strictly limited to authorised members of the research team, all of whom signed confidentiality agreements. To protect participant anonymity, each participant was assigned a unique code (PA, PB, PC... through PZ, then PAZ for parents; HW1, HW2... through HW17 for healthcare workers; E1, E2... through E15 for Delphi experts). A separate master list linking these codes to participant identities was created and stored securely; this list will be destroyed after completion of the study to ensure that identities cannot be reconstructed.

3.10 DATA ANALYSIS

3.10.1 Phase 1: Analysis of Integrative Review

Data from the integrative review was analysed using thematic synthesis following Whitemore and Knafli's (2005) framework:

- **Data Reduction:** Key information was extracted from included studies using a standardised data extraction form
- **Data Display:** Extracted data was organised in tables and matrices for comparison
- **Data Comparison:** Findings were compared across studies to identify patterns, themes, and relationships
- **Conclusion Drawing:** Themes were synthesised into overarching categories representing barriers and facilitators
- **Verification:** Conclusions were verified by returning to the original studies and checking for alternative interpretations

Findings are presented in Chapter 4 with supporting evidence from the reviewed literature.

3.10.2 Phase 2: Qualitative Data Analysis

In Phase 2, the qualitative data was analysed using Braun and Clarke's reflexive thematic analysis approach (Byrne, 2022: 1392). The method was chosen because it offers an accessible yet rigorous way to make sense of the qualitative data while remaining theoretically flexible. This flexibility further allowed an interpretation of participants' experiences in ways that aligned with the study's interpretivist paradigm without imposing rigid theoretical constraints. The approach is well-suited for identifying, analysing, and reporting patterns (themes) across qualitative datasets, which was needed to understand the complex experiences of parents, guardians, and healthcare workers regarding immunisation in Afar's pastoralist communities.

Braun and Clarke's reflexive thematic analysis involves six distinct phases, are outlined and followed systematically:

Phase 1: Data familiarisation. The first step was characterized by reading and re-reading all transcripts multiple times to develop an intense familiarity with the depth and breadth of the content. Initial notes about interesting features, recurring ideas, and potential patterns were highlighted during this process. This deep immersion in the data provided a solid foundation for the systematic analysis that followed.

Phase 2: Generating Initial Codes. Engagement with systematic coding of the entire dataset, identifying interesting features of the data that were relevant to the research questions, were identified during this phase. Codes are brief descriptive labels that capture the semantic or conceptual meaning of segments of text Bryne, 2022: 1399. The coding was conducted both manually (using highlighters and marginal notes) and using NVivo qualitative data analysis software to help organise the large volume of data. The coding process involved both inductive coding (codes emerging from the data itself) and deductive coding (codes derived from the literature and theoretical frameworks established in Phase 1).

Phase 3: Searching for Themes. After all data had been coded, the next step was to begin organising the codes into potential themes. Themes represent broader patterns of meaning across the dataset. Themes were created using visual maps, including mind maps and tables, to help sort codes into theme categories. During this phase, some codes formed main themes, others became sub-themes within larger themes, and some codes were set aside as not fitting into any coherent theme.

Phase 4: Reviewing Themes. Identified themes were refined through two levels of review: - **Level 1:** Checking that coded extracts within each theme formed a coherent pattern - **Level 2:** Checking that themes accurately reflected the entire dataset and that the thematic map captured important aspects of the data in relation to research questions. Some themes were merged, split, or discarded during this phase to ensure clarity and coherence.

Phase 5: Defining and Naming Themes. Each theme was clearly defined and given a concise, descriptive name: - The essence of each theme was articulated - Sub-themes within broader themes were identified where appropriate - Definitions ensured themes were distinct without overlap - Theme names were checked for clarity and meaningfulness

Phase 6: Producing the Report. The final analysis was written up with: - Clear description of each theme and sub-theme - Vivid, compelling extracts from the data to illustrate themes - Analysis connecting themes back to research questions - Integration of themes into a coherent narrative - Separate presentation of findings for FGDs, parent interviews, and healthcare worker interviews to maintain clarity (presented in different sections of Chapter 5)

3.10.3 Inter-Coder Reliability

To enhance trustworthiness, an independent coder experienced in qualitative research analysed a sample of transcripts (20%) separately. The researcher and independent coder then met to compare coding, discuss discrepancies, and reach consensus on codes and themes. This process confirmed the reliability of the coding framework and identified areas requiring clarification or refinement.

3.10.4 Phase 4: Delphi Analysis

The Delphi data were analysed using both quantitative and qualitative approaches. For the quantitative analysis, descriptive statistics were calculated (means, medians, and percentages) for the Likert scale ratings. Consensus was defined as $\geq 70\%$ of experts rating a strategy as 4 or 5 (agree or strongly agree) on measures of relevance, feasibility, and acceptability (Diamond et al 2014:402). Strategies that did not reach consensus threshold were flagged for revision based on the qualitative feedback provided by experts.

For the qualitative analysis, content analysis was used to systematically examine the open-ended comments and suggestions provided by experts. The feedback was categorised according to the type of input: suggestions for modifying strategy wording or content, concerns about feasibility in the Afar context, requests for clarification or additional detail, and additional recommendations not captured in the draft strategies. This feedback was carefully considered in developing the revised strategies for Round 2.

After Round 2, the final guideline document incorporating the validated strategies was evaluated using the AGREE II instrument (Brouwers et al 2010:1). The AGREE II

assesses guideline quality across six domains: Scope and Purpose, Stakeholder Involvement, Rigour of Development, Clarity of Presentation, Applicability, and Editorial Independence. Each domain was scored according to the AGREE II guidelines, providing a standardised assessment of the quality of the guideline.

3.11 MEASURES TO ENSURE TRUSTWORTHINESS

Ensuring rigour in qualitative research means establishing trustworthiness and quality. Lincoln and Guba's (1985) framework was utilized to establish trustworthiness, which encompasses credibility, dependability, transferability, confirmability, and authenticity.

3.11.1 Credibility

Credibility addresses the congruence between participants' realities and the researcher's representation of those realities, establishing confidence in the 'truth' of the findings (Polit & Beck 2021:295; Korstjens & Moser 2018:121). It is arguably the most critical criterion, as it determines whether the study measures or captures what it purports to investigate (Graneheim & Lundman 2004:109). The following complementary strategies enhanced credibility:

Prolonged engagement: the researcher invested sustained time in the field over three months, facilitating the establishment of trusting relationships with participants and enabling contextual understanding that extends beyond superficial observations (Lincoln & Guba 1985:301). This temporal investment allowed the researcher to detect and account for potential distortions in data, such as initial participant guardedness or atypical contextual circumstances.

Persistent observation: Beyond mere duration, the researcher maintained focused attention on characteristics and elements most relevant to the phenomenon under investigation, while systematically filtering extraneous information (Lincoln & Guba, 1985:304). This iterative process of salience identification enhanced depth of understanding and ensured that emerging patterns were grounded in consistently observed phenomena.

Triangulation: The researcher employed multiple data sources (existing literature, parents and guardians, healthcare workers), multiple methods (focus groups, individual interviews, key informant interviews), and multiple investigators, which involved the researcher himself as the principal investigator and the independent co-coder to cross-check findings.

Member checking: The preliminary findings were shared with some participants to verify whether the researcher's interpretations resonated with their experiences and accurately reflected what they had shared. This participant validation helped confirm that my interpretations were grounded in participants' actual experiences rather than my own assumptions (Birt et al. 2016:1802). While recognizing ongoing scholarly debate regarding member checking's epistemological assumptions (Morse 2015:1212), the researcher employed this technique as one of multiple validation strategies rather than as definitive proof of interpretive accuracy.

Peer debriefing: Throughout the research process, the researcher continuously engaged in regular discussions with the supervisor and research colleagues who provided external perspectives on emerging findings and interpretations, challenged the assumptions held by the research, and helped identify potential biases in the analysis.

3.11.2 Dependability

Dependability refers to the consistency and stability of findings over time and across researchers (Lincoln & Guba, 1985:299). The following strategies were used to maintain dependability:

The researcher maintained an audit trail by ensuring that comprehensive documentation of all research decisions, procedures, and analytical processes were kept. This included retaining raw data (audio recordings, transcripts), data collection instruments (interview guides), field notes and reflexive journals, coding schemes and analytical memos, documentation of methodological decisions and the rationale behind them, and drafts showing the progression of analysis from initial codes to final themes. This detailed documentation would allow an external reviewer to trace the research process and assess its dependability.

Code-recode procedure: To test the stability of my coding, a sample of transcripts were coded and then waited two weeks before returning to code the same transcripts again. The consistency between the two coding sessions provided evidence of stability in the study's analytical approach.

Methodological Coherence: The study demonstrates alignment between research questions, philosophical positioning, methodological approach, data collection methods, and analytical procedures (Morrow 2005:252). This coherence enhances dependability by ensuring that all research components function synergistically toward the study's objectives.

3.10.3 Transferability

Transferability refers to the extent to which findings can be applied to other contexts or with other participants (Lincoln & Guba 1985:316). While qualitative research does not aim for statistical generalisation, findings may be relevant to similar contexts. The following strategies were employed to ensure transferability: :

Thick description provided rich, detailed descriptions of the research context (including geographic setting, population characteristics, and health system features), the participants (including demographics, experiences, and perspectives), and the phenomena under investigation (barriers, facilitators, and strategies). This thick description enables readers to assess the relevance of findings to their own contexts.

Purposive sampling for maximum variation: By deliberately seeking participants with diverse characteristics, strengthened the potential transferability of findings to varied contexts and populations.

3.10.4 Confirmability

Confirmability refers to the objectivity of the research, the extent to which findings are shaped by the participants and the phenomenon rather than by my own biases and assumptions (Lincoln & Guba, 1985:320). Several strategies were employed to improve confirmability:

Reflexivity: Throughout the research process, the researcher maintained reflexive journals in which they documented the researcher's own beliefs, assumptions, reactions, and potential biases. The process required ongoing reflection on the researcher's background, experiences, and perspectives, which might influence data collection and interpretation, further enhancing awareness of subjectivity and helping the research maintain a more balanced perspective.

Verbatim quotations: The researcher used direct quotes from participants in reporting the findings. The interpretations were grounded in the actual words used by participants, to ensure transparency on what informed the interpretations.

Negative case analysis: Cases that contradicted or deviated from emerging patterns received careful attention and thorough examination. Contradictory data were not dismissed but rather explored to understand the reasons behind these divergences, with interpretations refined to encompass the full complexity of the dataset.

Authenticity

Authenticity refers to the extent to which the research fairly and faithfully represents the range of different realities and perspectives (Lincoln & Guba 1985:290). This study employed specific strategies to ensure authentic representation:

Diverse participant representation: The participant selection process prioritised diversity across immunisation statuses, geographic locations, socioeconomic backgrounds, and professional roles. This approach captured multiple perspectives rather than limiting the study to a narrow slice of experience.

Use of local languages: All interviews took place in participants' preferred languages (Afaraf or Amharic rather than English). This linguistic accessibility allowed participants to express their experiences authentically, avoiding the constraints and potential distortions that language barriers can introduce.

Data Source Triangulation: Findings corroborated across multiple data sources (integrative review, FGDs, parent interviews, healthcare worker interviews) enhanced confidence in confirmability by demonstrating that patterns emerged from convergent evidence rather than isolated observations potentially influenced by researcher bias

(Farmer et al. 2006:377). Areas of divergence were also reported, demonstrating balanced interpretation rather than selective reporting of supporting evidence.

Through systematic application of these multifaceted strategies, this study demonstrates rigorous attention to trustworthiness across all four evaluative criteria. The interdependent nature of these criteria means that strategies strengthening one dimension often simultaneously enhance others (Connelly 2016:435), resulting in a comprehensive approach to qualitative rigour that positions the findings as credible, dependable, and worthy of confidence.

3.12 ETHICAL CONSIDERATIONS

3.12 Ethical Considerations

Research involving human participants raises ethical concerns that must be carefully addressed. This study adhered to fundamental ethical principles and obtained all necessary approvals.

3.12.1 Ethical Approval

The study received ethical clearance from: - University of South Africa (UNISA), College of Human Sciences Research Ethics Committee (Reference Number: 14064316_CREC_CHS_2023) - Afar Regional Health Bureau Research Ethics Review Committee

All data collection commenced only after obtaining these approvals.

3.12.2 Principle of Beneficence

The principle of beneficence obliges researchers to maximise benefits and minimise harm (Polit & Beck 2021:292).

Right to Freedom from Harm and Discomfort: The researcher ensured that interview questions focused on EPI programme experiences and did not include content likely to evoke emotional discomfort. Participants were informed that they could skip questions or terminate the interview at any time. Although no participants experienced distress

during data collection, the researcher had prepared referral mechanisms to government social workers or psychologists if emotional support had been needed.

Right to Protection from Exploitation: Participants were assured that information provided would be: - Kept confidential and accessible only to authorised persons - Not used to their detriment - Used solely for research purposes

Participation was voluntary, with no coercion or undue inducement. All participants received clear information about the study before providing consent.

3.12.3 Respect for Human Dignity

This principle encompasses the right to self-determination and full disclosure (Polit & Beck 2021:294).

Right to Self-Determination: Participants exercised autonomy in deciding whether to participate. No false promises of remuneration were made, and participation was entirely voluntary. Participants were informed they could withdraw at any time without consequences.

Right to Full Disclosure: The researcher provided comprehensive information about: - Study purpose and procedures - Expected duration of participation - Potential risks and benefits - Measures to protect confidentiality - Research team contact information - Right to withdraw

Information sheets in participants' preferred language were provided, and participants had opportunities to ask questions before consenting.

3.12.4 Principle of Justice

The principle of justice includes the right to fair treatment and privacy (Polit & Beck 2021:298).

Right to Fair Treatment: All participants were treated equally and with respect. There was no discrimination based on disability, gender, socioeconomic status, ethnicity, or any other characteristic. Selection was based solely on inclusion criteria relevant to research objectives.

Right to Privacy: Participants' privacy was protected by: - Conducting interviews in private, comfortable settings - Limiting access to personal information - Storing data securely - Obtaining signed confidentiality agreements from research assistants.

Anonymity and Confidentiality: Anonymity was maintained by assigning codes to participants (e.g., PA, PB, ..., PZ, PAZ for parents; HW1, HW2, ... for healthcare workers) rather than using names. Confidentiality was ensured through: - Secure storage of hard copy and digital data in locked cabinets and password-protected devices - Limiting access to authorised personnel only - Data retention for five years as per institutional requirements, after which it will be destroyed

3.12.5 Informed Consent

Informed consent ensures participants understand the research and voluntarily agree to participate (Ngulube 2021:188). The consent process included: - Providing written information sheets in participants' preferred language - Explaining study purpose, procedures, risks, benefits, and rights verbally - Answering all questions - Allowing time for consideration - Obtaining written consent before data collection - Emphasising that consent could be withdrawn at any time

For participants with limited literacy, information sheets were read aloud, and consent was documented with a thumbprint witnessed by an independent literate witness.

3.12.6 Specific Considerations for Delphi Method

The Delphi method reduces groupthink and dominance by powerful individuals through anonymity (Khodyakov et al 2023:72). In this study: - Expert identities were known to the researcher but not to other panel members - Responses were anonymous and reported in aggregate only - Email addresses were used solely for distributing surveys and were not shared - Data was collected using secure online survey tools - Confidentiality was maintained throughout all Delphi rounds

3.12.7 Cultural and Contextual Sensitivity

Given the study's focus on pastoralist communities with distinct cultural practices, additional ethical considerations included: - Respect for cultural norms and practices - Engagement with community leaders to explain the study and seek community-level

support - Flexibility in scheduling interviews to accommodate participants' daily routines and seasonal movements - Ensuring research assistants were culturally competent and respectful - Avoiding judgmental attitudes toward traditional beliefs or practices

3.13 SUMMARY

This chapter has provided a comprehensive exposition of the methodological framework, procedures, and ethical considerations guiding this research. The study was philosophically grounded in the interpretivist paradigm, recognising that immunisation utilisation in pastoralist communities is shaped by socially constructed meanings, cultural contexts, and lived experiences that require understanding from participants' perspectives. A qualitative research approach with exploratory-descriptive designs was employed to enable in-depth investigation of these complex phenomena.

The research was structured across four sequential phases: (1) an integrative literature review synthesising global evidence on immunisation in pastoralist and hard-to-reach populations; (2) a qualitative empirical study involving 77 participants (60 parents/caregivers and 17 healthcare workers) across five districts of Afar, using individual interviews, focus group discussions, and key informant interviews to explore barriers and current strategies; (3) strategy development through systematic triangulation of findings from phases 1 and 2; and (4) expert validation of developed strategies using a two-round Delphi technique with 15 immunisation experts, employing the AGREE II assessment tool.

Purposive sampling was employed to select information-rich participants who could provide relevant insights regarding immunisation barriers and potential solutions. Data collection utilised semi-structured interview guides (developed in English, translated into Afaraf and Amharic with back-translation verification), digital audio recording, and field notes. A pilot study was conducted to refine instruments and procedures. Data were analysed using Braun and Clarke's six-phase thematic analysis approach, with an independent co-coder enhancing credibility.

Rigour was ensured through multiple strategies addressing credibility (prolonged engagement, triangulation, member checking, peer debriefing), dependability (audit trail, code-recode procedures), transferability (thick description, purposive sampling for

variation), confirmability (reflexivity, verbatim quotations, negative case analysis), and authenticity (diverse participant representation, use of local languages).

The study adhered rigorously to research ethics principles of respect for persons, beneficence, and justice. Ethical approval was obtained from three bodies: UNISA College of Human Sciences Research Ethics Committee, Afar Regional Health Bureau, and district health offices. Informed consent procedures ensured voluntary participation with full understanding. Strategies to minimise risk (psychological distress, time burden) and maximise benefit (voice, knowledge contribution) were implemented. Confidentiality and privacy were protected through anonymisation, secure data storage, and private interview settings. Special attention was paid to ethical considerations for marginalised populations, including community engagement, linguistic accessibility, and commitment to meaningful dissemination.

Chapter 4, which follows, presents the findings from the qualitative empirical study (Phase 2), describing the themes that emerged from interviews and focus group discussions with parents/caregivers and healthcare workers regarding barriers to EPI implementation in pastoralist communities of Afar.

CHAPTER 4

STUDY FINDINGS

4.1 INTRODUCTION

Chapter 3 presented the methodological framework that guided this study, including the interpretivist paradigm, qualitative exploratory-descriptive design, and the four-phase research approach employed to investigate barriers to implementing the Expanded Programme on Immunisation (EPI) in pastoralist communities of Afar, Ethiopia. This chapter presents the empirical findings from Phase 2 of the study—the qualitative data collection conducted through semi-structured individual interviews, focus group discussions (FGDs), and key informant interviews with parents/caregivers and healthcare workers across five districts of Afar Regional State.

Data were collected between October 2023 and January 2024 using semi-structured interview guides developed in English and translated into Afaraf and Amharic with rigorous back-translation verification to ensure linguistic and conceptual equivalence, as detailed in section 3.7.2.1. All interviews and FGDs were audio-recorded with participants' informed consent and subsequently transcribed verbatim. Afaraf-language transcripts were translated into English by certified translators, with quality assurance conducted through back-translation of a 10% sample. Data were analysed using Braun and Clarke's (2023) six-phase reflexive thematic analysis approach, combining inductive (data-driven) and deductive (theory-driven) coding to identify patterns of meaning relevant to the research questions.

This chapter is organised into four main sections. Section 4.2 presents participant demographic profiles, providing contextual information about the individuals who contributed to the study. Section 4.3 presents the key findings, organised thematically according to the four major themes that emerged from the data analysis. Section 4.4 provides alignment of findings with research questions, demonstrating how the empirical themes directly address the study's research objectives. Section 4.5 offers a chapter summary synthesising the key insights.

In accordance with research ethics protocols approved by the University of South Africa College of Human Sciences Research Ethics Committee (reference number 14064316_CREC_CHS_2023) and the Afar Regional Health Bureau, participants are identified using pseudonyms to protect anonymity and confidentiality. Parents and caregivers from individual interviews are designated as Participants A through J; Health Extension Workers (HEWs) are designated as Participants K through O; health centre EPI focal persons are Participants P through T; district EPI focal persons are Participants U through Y; and regional/partner staff are Participants Z and AZ. Focus group discussion participants are identified by group number (FGD Z1 through FGD Z5, corresponding to the five study districts) and individual informant number within each group (Informant 1, Informant 2, etc.).

4.2 INDIVIDUAL PROFILES OF PARTICIPANTS

A total of 77 participants contributed to this study, comprising 60 parents/caregivers and 17 healthcare workers representing different levels of the health system, from community-level Health Extension Workers to regional programme managers and partner organisation staff. This section provides demographic and professional characteristics of participants, organised by data collection method and participant category.

4.2.1 Individual Interview Participants: Parents/Caregivers

Ten parents or primary caregivers of children aged 12-23 months with incomplete immunisation participated in individual in-depth interviews. Table 4.1 presents their demographic characteristics.

Table 4.1 below illustrates the participants’ profiles, which include their age, language gender, and district.

TABLE 4.1: OVERALL BIOGRAPHIC DATA OF PARTICIPANTS FOR IN-DEPTHS INTERVIEWS (N=10)

Pseudonym	Age	Education	Gender	Language	District
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Participant A	20	No	Female	Affaraf	Afambo
Participant B	45	No	Female	Affaraf	Afambo
Participant C	28	No	Female	Affaraf	Ayseita
Participant D	27	No	Female	Affaraf	Ayseita
Participant E	30	No	Female	Affaraf	Dubti
Participant F	28	No	Female	Affaraf	Dubti
Participant G	23	8	Female	Affaraf	Mille
Participant H	21	8	Female	Amharic	Mille
Participant I	18	7	Female	Affaraf	Semera logiya
Participant J	30	6	Female	Affaraf	Semera logiya

All individual interview participants were female, reflecting the cultural reality that in Afar pastoralist society, women are primarily responsible for childcare and household health decisions, as discussed in section 3.5.2. The mean age was 27 years (range: 18-45 years). The majority (n=7, 70%) had no formal education, while three participants had completed between 6 and 8 years of schooling. This educational profile is consistent with regional data indicating low female literacy rates in Afar, particularly among pastoralist populations (CSA 2023). Nine participants (90%) were native Affaraf speakers; one participant (Participant H) spoke Amharic as her primary language, likely reflecting her origin from a different region or residence in an urban centre where Amharic is more commonly used. All interviews with Affaraf speakers were conducted in Affaraf by research assistants fluent in the language, ensuring linguistic accessibility and cultural appropriateness.

Participants were distributed across all five study districts: Afambo (n=2), Ayseita (n=2), Dubti (n=2), Mille (n=2), and Semera Logia (n=2), ensuring geographic representation and capturing potential district-level variation in experiences.

4.2.2 Focus Group Discussion Participants: Parents/Caregivers

Five focus group discussions (FGDs) were conducted, one in each study district, with a total of 50 parents/caregivers participating. Each FGD comprised 10 participants, consistent with recommendations for FGD size that balances diversity of perspectives with opportunity for meaningful participation (Krueger & Casey 2022). Table 4.2 presents demographic characteristics of FGD participants.

TABLE 4.2: DEMOGRAPHIC CHARACTERISTICS OF FOCUS GROUP DISCUSSION PARTICIPANTS: PARENTS/CAREGIVERS (N=50)

FGD Group	District	Number of Participants	Age Range (years)	Gender	Primary Language	Residential Mobility Pattern*
FGD Z1	Afambo	10	22-36	All female	Afaraf	7 nomadic, 3 semi-settled
FGD Z2	Ayseita	10	24-38	All female	Afaraf	8 nomadic, 2 semi-settled
FGD Z3	Dubti	10	26-32	All female	Afaraf	5 nomadic, 5 semi-settled
FGD Z4	Mille	10	29-40	All female	Afaraf	6 nomadic, 4 semi-settled
FGD Z5	Semera Logia	10	23-35	All female	Afaraf	3 nomadic, 7 semi-settled
Total		50	22-40	All female	Afaraf	29 nomadic, 21 semi-settled

Residential mobility pattern was determined through participant self-report during FGD introductions, asking whether families move with livestock seasonally (nomadic) or reside in one location year-round (semi-settled).

Demographic summary: All FGD participants were female and spoke Afaraf as their primary language, reflecting the study's purposive sampling strategy to engage mothers and primary caregivers responsible for child health decisions. Ages ranged from 22 to 40 years (mean approximately 30 years across groups). The distribution of nomadic versus semi-settled participants varied by district, with Semera Logia (the regional capital) having the highest proportion of semi-settled families (70%), while Ayseita, a predominantly rural district, had 80% nomadic participants. This variation enabled the capture of diverse experiences related to mobility patterns and their influence on immunisation access.

Recruitment and conduct of FGDs with nomadic populations: Recruitment for nomadic/mobile participants were facilitated through Health Extension Workers and community health volunteers who maintain ongoing relationships with pastoral communities and are aware of seasonal movement patterns. FGD sessions were scheduled to coincide with periods when pastoralist families congregate in particular locations, specifically: (1) near permanent water points during the dry season (November-January, when data collection occurred); (2) at weekly markets where families gather for trade; and (3) during clan meetings convened by traditional leaders. FGD venues were selected by participants themselves, typically in shaded outdoor locations (under large trees, near water sources) familiar and accessible to them, rather than at health facilities, which some participants viewed with apprehension. This community-based approach, combined with flexible scheduling responsive to participants' livelihood demands, enabled successful engagement of mobile populations.

4.2.3 Key Informant Interview Participants: Healthcare Workers

Seventeen healthcare workers representing different levels and roles within the EPI programme participated in key informant interviews. Table 4.3 presents their professional and demographic characteristics.

TABLE 4.3: PROFESSIONAL AND DEMOGRAPHIC CHARACTERISTICS OF HEALTHCARE WORKER PARTICIPANTS (N=17)

Pseudonym	Age	Gender	Experience (Yrs)	Language	District
HEW's					
Participant K	22	Female	5	Afaraff	Afambo
Participant L	20	Female	4	Afaraff	Ayseita
Participant M	33	Female	4	Afaraff	Dubti

Participant N	19	Female	4	Amharic	Mille
Participant O	23	Female	3	Afaraff	Semera logiya
HC focal					
Participant P	47	Male	14	Afaraff	Ayseita
Participant Q	30	Female	4	Afaraff	Dubti
Participant R	24	Female	1	Amharic	Mille
Participant S	32	Male	7	Amharic	Semera logiya
Participant T	23	Female	9	Afaraff	Afambo
District Focal					
Participant U	29	Male	8	Amharic	Dubti
Participant V	36	Male	14	Amharic	Ayseita
Participant W	33	Male	7	Amharic	Afambo
Participant X	34	Male	13	Amharic	Mille
Participant Y	33	Male	10	Amharic	Semera logiya
Participant Z	32	Male	7	Afaraff	Regional- semera
Participant AZ	45	Male	16	Amharic	Partner- Semera

Partner organisations refer to international and national non-governmental organisations and United Nations agencies (principally UNICEF and WHO) that provide technical, financial, and logistical support to the EPI programme in Afar through formal memoranda of understanding with the Federal Ministry of Health and Afar Regional Health Bureau, as defined in section 3.6.1.

Professional and demographic summary: Healthcare worker participants had a mean age of 30 years (range: 19-47 years) and averaged 7.6 years of professional experience in EPI-related roles (range: 1-16 years). The sample included 9 males and 8 females. Gender distribution varied by professional level: Health Extension Workers (HEWs) were exclusively female (n=5), consistent with the national HEW programme design which recruits women from local communities (Assefa et al. 2022); health centre EPI focal persons included 3 females and 2 males; district-level coordinators were all male (n=5), reflecting gender disparities in health management positions; regional/partner staff included 2 males.

Regarding language, nine participants (53%) were native Afaraf speakers, while eight (47%) spoke Amharic as their primary language. The higher proportion of Amharic speakers among healthcare workers compared to community participants reflects the deployment of health professionals from other Ethiopian regions to Afar, a common pattern in pastoralist areas facing health workforce shortages (Ketema et al. 2023). This linguistic profile has implications for provider-community communication, as discussed in the findings below.

Professional roles encompassed the full spectrum of EPI service delivery and management: HEWs (n=5) deliver frontline immunisation services at health post level and conduct community outreach; health centre EPI focal persons (n=5) coordinate facility-based immunisation, supervise HEWs, manage vaccine supply, and compile reports; district EPI coordinators (n=5) oversee programme implementation at woreda level, conduct supportive supervision, and liaise with regional authorities; regional/partner staff (n=2) provide strategic leadership, technical guidance, and resource mobilisation. This multi-level representation enabled triangulation of perspectives from policy/strategy (regional level), operational management (district level), and service delivery (facility and community levels).

4.2.4 Rationale for Employing Both Individual Interviews and Focus Group

Discussions with Parents/Caregivers

The researcher utilized the dual approach using both individual interviews with 10 participants and focus group discussions ((n=5, with 50 participants total) with parents/caregivers, the rationale for this dual approach is outlined below:

Individual interviews enabled exploration of personal, sensitive, or potentially stigmatised experiences that participants might hesitate to disclose in group settings. These included: experiences of child illness or death from vaccine-preventable diseases; feelings of guilt or self-blame regarding incomplete immunisation; household poverty and inability to afford transportation; domestic conflicts over health-seeking decisions; and experiences of disrespectful treatment by health workers. The one-on-one interview format provided a confidential, non-judgmental space for participants to share such experiences in depth, with opportunities for empathetic probing by the researcher (DeJonckheere & Vaughn 2023:665).

Focus group discussions, conversely, facilitated exploration of shared experiences, collective perceptions, and community-level norms through peer-to-peer dialogue (Krueger & Casey 2022:7). FGDs enabled observation of how community members discuss immunisation among themselves—the language they use, the concerns they prioritise, areas of consensus and disagreement—which may differ from accounts provided to an external researcher in individual interviews. Group interaction often stimulates recall, with one participant's comment prompting others to remember similar experiences. FGDs also surface social and cultural dimensions of immunisation decisions, such as: influence of mothers-in-law and male relatives on healthcare decisions; role of traditional healers and religious leaders; collective strategies communities employ to cope with health system inadequacies; and community-level recommendations for improving services.

Importantly, the same individuals did not participate in both individual interviews and FGDs, ensuring that these represented distinct participant groups and avoiding respondent fatigue. The 10 individual interviewees were recruited separately from the 50 FGD participants, yielding a total of 60 unique parent/caregiver participants.

This methodological triangulation (combining individual and group data collection methods with the same population) enhanced the credibility and comprehensiveness of findings by capturing both individual lived experiences and collective community perspectives, thereby providing a more holistic understanding of barriers to immunisation in pastoralist contexts (Carter et al. 2023:545).

4.3 KEY FINDINGS

Thematic analysis of interview transcripts and FGD data yielded four major themes, each comprising multiple subthemes. Table 4.4 provides an overview of the thematic structure, followed by detailed presentation of each theme with illustrative participant quotations.

TABLE 4.4: SUMMARY OF THEMES AND SUBTHEMES EMERGING FROM QUALITATIVE DATA ANALYSIS

Theme	Subthemes
<p>Theme 1: Participants' knowledge and understanding of vaccines and vaccination</p>	<ul style="list-style-type: none"> • Variable knowledge levels among parents/caregivers • Knowledge gaps among newly deployed healthcare workers • Lack of continuous education and training updates
<p>Theme 2: Community-level and environmental barriers to immunisation access and utilisation</p>	<ul style="list-style-type: none"> • Geographic remoteness and service inaccessibility • Environmental hazards: flooding and seasonal road impassability • Transportation unavailability and unaffordability • Population mobility and pastoral migration patterns • Fear of vaccine side effects and adverse events • Vaccine hesitancy rooted in misinformation • Poor understanding of vaccine benefits and preventable diseases

<p>Theme 3: Health system-level barriers to immunisation service provision</p>	<ul style="list-style-type: none"> • Inadequate budgetary allocation for EPI operations • Shortage of vehicles and transportation for outreach • Insufficient health workforce and HEW vacancies • Lack of pre-service and in-service training for vaccinators • Frequent absence of Health Extension Workers from posts
<p>Theme 4: Participant recommendations for improving EPI access and coverage</p>	<ul style="list-style-type: none"> • Infrastructure development: constructing accessible health facilities with adequate equipment • Expanding and adapting service delivery strategies for mobile populations • Awareness creation, health communication, and community engagement • Securing sufficient budgetary resources for staffing, transport, and operations • Strengthening accountability, supervision, and performance monitoring

These themes are discussed in detail in the sections that follow. To enhance analytical depth and differentiation between data sources, findings are presented with explicit attribution to participant categories (parents/caregivers from individual interviews, parents/caregivers from FGDs, HEWs, health centre staff, district coordinators, or regional/partner staff) and with attention to convergences and divergences across these groups.

4.3.1 Theme 1: Participants' Knowledge and Understanding of Vaccines and Vaccination

Knowledge about vaccines, what they are, what diseases they prevent, when children should receive them, and why they are important, constitutes a foundational determinant

of immunisation utilisation. This theme emerged from analysis of participants' responses to opening questions in interviews and FGDs that invited them to share their understanding of vaccines and vaccination. Findings revealed substantial heterogeneity in knowledge levels, with important differences by participant group.

4.3.1.1 Variable Knowledge Levels Among Parents and Caregivers

Among parent and caregiver participants, knowledge ranged from relatively comprehensive to markedly limited. Some participants demonstrated accurate understanding of vaccines as preventive interventions that protect children from serious illnesses. For instance, Participant C, a 28-year-old mother from Ayseita with no formal education, articulated:

"Vaccine is a medication that is given to children up to 9 months [sic—likely referring to the measles vaccine given at 9 months]. When we compare children who received the vaccine and those who did not receive the vaccine, there is a difference. The vaccinated children are healthy... The unvaccinated ones, most of the time they become sick."

This statement reflects understanding of vaccines as health-protective and awareness that vaccination status correlates with child health outcomes—key conceptual building blocks for immunisation demand.

Similarly, Participant B, a 45-year-old mother from Afambo, demonstrated procedural knowledge regarding how vaccination services are delivered:

"I know about vaccine; I think it is a service that is provided by health workers carrying vaccine carriers [cold boxes]. Previously we were notified prior to the vaccination session, but nowadays we did not receive any information about the vaccination programme."

While this participant's description is accurate, her comment that advance notification no longer occurs points to a breakdown in communication systems, an issue explored further under Theme 3.

However, other participants exhibited more limited or confused understanding. Several participants conflated vaccination with treatment of illness rather than prevention, or

were uncertain about which specific diseases vaccines prevent. During FGD Z4 (Mille district), when asked what vaccines do, one participant responded: "They give injections when the child is sick" (Informant 3, FGD Z4)—a statement reflecting confusion between curative and preventive interventions.

A common concern across nearly all parent/caregiver participants was insufficient information about vaccination. Participants repeatedly emphasised that they receive little explanation from health workers about why vaccines are important, what diseases are being prevented, or what to expect after vaccination. As Participant J, a 30-year-old mother from Semera Logia, explained:

"When I take my child to the health post, they just give the injection without telling me anything. I don't know what sickness this injection prevents. If they would explain to us, maybe we would understand better why it is important."

This lack of information provision during vaccination encounters represents a missed opportunity for health education and trust-building, contributing to the knowledge gaps evident among community members.

4.3.1.2 Knowledge Gaps Among Newly Deployed Healthcare Workers

While all healthcare worker participants possessed basic technical knowledge about vaccines and the EPI schedule, newly hired or recently deployed staff identified significant gaps in their applied, programmatic knowledge—particularly regarding implementation strategies appropriate for pastoralist contexts. Participant R, a 24-year-old health centre EPI focal person with only one year of experience working in Mille district, stated:

"The newly hired staff members and those who have not received training are lacking in knowledge about the EPI. This lack of knowledge could potentially impact their ability to effectively carry out their responsibilities related to immunisation and public health."

This acknowledgement of knowledge deficits among frontline workers is significant, as it suggests that inadequate preparation and orientation contribute to suboptimal service delivery. The statement also reflects reflexive awareness among at least some health

workers regarding their own limitations—a potentially positive foundation for learning and improvement.

4.3.1.3 Lack of Continuous Education and Training Updates

Beyond initial knowledge gaps, healthcare worker participants across all levels emphasised the absence of ongoing training, refresher courses, and updates on evolving EPI guidelines, new vaccines introduced into the schedule, or innovative implementation approaches. Participant T, a 23-year-old health centre EPI focal person from Afambo with nine years of experience, observed:

"There is also a problem from the health facility side that there is no continuous updating for vaccinators who are working at the community level, and also lack of training or updated training."

The phrase "health facility side" is significant, as it locates responsibility for the knowledge gap within the health system rather than attributing it to individual workers' deficiencies—a framing consistent with a systems-thinking approach. The absence of continuous professional development means that even experienced workers may not be aware of current best practices, potentially perpetuating outdated or suboptimal approaches.

Participant L, a 20-year-old HEW from Ayseita with four years of experience, reported:

"As of right now, I have not received any training on the immunisation programme, although working as a vaccine provider."

This remarkable statement—that a health worker has been administering vaccines for four years without ever receiving formal training on the immunisation programme—underscores the severity of training gaps and raises serious concerns about service quality and safety.

Theme 1 findings reveal a bidirectional knowledge gap: parents/caregivers lack adequate information about vaccines and vaccination, while healthcare workers, particularly newly deployed staff, lack sufficient training and ongoing professional development. These knowledge deficits are mutually reinforcing: inadequately trained

health workers are less able to effectively educate communities, perpetuating community-level misunderstanding. Importantly, both parents and healthcare workers attribute knowledge gaps to health system failures, inadequate community health education, and insufficient health workforce training, rather than to individual ignorance or incompetence. This systemic framing aligns with the Social Ecological Model's emphasis on organisational and policy-level determinants of health behaviour.

4.3.2 Theme 2: Community-Level and Environmental Barriers to Immunisation

Access and Utilisation

This theme encompasses barriers experienced primarily at the individual, household, and community levels, as well as environmental and infrastructural challenges that constrain access to immunisation services. While these barriers are categorised as "community-level" to distinguish them from health system-level factors (Theme 3), it is critical to recognise that many of these barriers are not intrinsic community failings but rather products of structural inequities, inadequate infrastructure investment, and health system design mismatches with pastoralist realities. The theme is organised into seven subthemes.

4.3.2.1 Geographic Remoteness and Immunisation Service Inaccessibility

Geographic distance between pastoral settlements and health facilities emerged as the most frequently cited and emphatic barrier across all participant groups. Pastoralist communities are dispersed across vast territories with extremely low population density, the Afar region covers 270,000 square kilometres with a population of only 1.8 million (CSA 2023), resulting in an average of fewer than 7 people per square kilometre. Many pastoral encampments are located **50 to 180 kilometers** from the nearest health post or health centre.

Participant X, a 34-year-old district EPI coordinator from Mille with 13 years of experience, described the geographic challenge:

"There are twelve kebeles [in this district]; four kebeles out of the twelve are beyond the river, and it is challenging to address geographically. They are between 100 to 180

kilometres from the centre. Most community members reside in the hard-to-reach area and can't get vaccination services."

The phrase "beyond the river" is significant, as it indicates not only distance but also natural geographic barriers, in this case, the Awash River, which seasonally floods and becomes impassable, effectively isolating communities on the far bank.

Parents and caregivers corroborated this challenge, describing how distance translates into prohibitive opportunity costs. A 36-year-old mother participating in FGD Z4 (Mille district) stated:

"I have personally neglected to vaccinate my children, a problem that most people in our community have, because the health post is located far from the district [kebele]."

Her use of the term "neglected" reflects internalised guilt, even though the barrier is structural (distance) rather than personal (negligence). This linguistic pattern, parents blaming themselves for circumstances beyond their control, recurred across multiple interviews and FGDs, suggesting that public health messaging may inadvertently foster self-blame rather than acknowledging systemic failures.

Another participant from FGD Z4 (Informant 2, 33-year-old mother) added:

"There is also a remote, difficult-to-reach place, inaccessible to our community's residents. Additionally, they haven't received any information or cannot receive any service use."

This statement links geographic inaccessibility to information deprivation, suggesting that remoteness constrains not only physical access to services but also access to health education and communication about immunisation schedules—a compounding effect.

For pastoralist families, traveling long distances to health facilities necessitates leaving livestock unattended, which exposes animals to predation, theft, or straying—risks that jeopardise household livelihood security. Several FGD participants explained that they cannot afford to be away from their livestock for the full day required to travel to a health facility, wait for services, and return home. This represents a profound conflict between

immunisation access and livelihood preservation, a dilemma not faced by settled agricultural populations for whom health facilities are typically much closer.

4.3.2.2 Environmental Hazards: Flooding and Seasonal Road Impassability

Afar is prone to seasonal flooding, particularly during the brief rainy season (June-September) and occasionally at other times when heavy rains fall in the Ethiopian highlands, causing rivers to overflow. Flooding renders roads impassable, isolates communities, and disrupts the delivery of health services. Both community members and health workers emphasised this environmental barrier.

A 29-year-old mother from FGD Z4 (Informant 5, Mille district) described:

"There is also difficulty, a flood occurrence in our community. When a flood arises in our community, there will be the destruction of a road or result in transportation problems. Due to that, the majority of the community beyond the flood area will not obtain the vaccine session."

Flooding is particularly problematic because it is unpredictable and episodic. Even if an immunisation outreach session is planned, sudden flooding can prevent either health workers from reaching the community or families from reaching the health post, resulting in missed appointments. Unlike permanent geographic distance, which can theoretically be addressed through regular outreach scheduling, flooding introduces unpredictability that complicates service planning.

Participant V, a 36-year-old district EPI focal person from Ayseita with 14 years of experience, confirmed:

"The majority of our communities are mobile, and many of them experience annual flooding. Thus, this results in the failure to receive or avoid vaccinations."

The conflation of flooding with mobility in this statement suggests that health workers view both as contributing to service delivery challenges, although they are distinct phenomena with different implications for strategy design.

4.3.2.3 Transportation Unavailability and Unaffordability

Even when roads are passable, motorised transportation is rarely available in rural pastoralist areas, and walking distances are prohibitive, particularly for women carrying young children. Participant A, a 20-year-old mother from Afambo, explained:

"Regarding your question about why I have not vaccinated my children: Yes, I have not vaccinated my children as there is no health facility or health post around our village, and I can't afford the transportation fee to travel to the health facility, which is far from our village. Not only me, but most of our community members also can't afford this transportation fee, and it is difficult to walk because it is so far."

This statement highlights the economic dimension of the transportation barrier. Even when vehicles (small buses, motorcycles, donkey carts) occasionally travel to remote areas, the cost of hiring them is beyond the means of most pastoralist households, who live on less than 2 USD per day (World Bank 2023). One participant from FGD Z5 (Informant 8, 27-year-old mother from Semera Logia) stated:

"The health centre is far from our village. So, there is a payment fee for transportation. It is difficult to go to the health centre and back. It needs a fee to pay for the transportation that makes vaccination of our child challenging."

The reference to "go and back" underscores that transportation costs are doubled (round-trip), and families must often make multiple trips to complete the multi-dose immunisation schedule, compounding the financial burden.

Importantly, the opportunity cost of time spent traveling was also emphasised. For pastoralist women, time away from household and livelihood responsibilities (livestock care, water collection, food preparation, childcare for other children) represents lost productivity. Several FGD participants noted that if they spend an entire day traveling to and from a health facility, they cannot complete essential daily tasks, placing additional strain on already-overstretched households.

4.3.2.4 Population Mobility and Pastoral Migration Patterns

The findings reveal that seasonal migration is a core feature of pastoralist life in Afar, driven by the constant need for pasture and water. Families follow cyclical movement patterns between dry-season and wet-season grazing areas, adjusting their routes based on rainfall and the availability of pasture. While these patterns are generally predictable, they remain flexible enough to respond to environmental changes. This reality was echoed by the district EPI coordinator from Ayseita, who stated that:

"The majority of our communities are mobile, and many of them experience annual flooding. Thus, this results in the failure to receive or avoid vaccinations."

When families migrate away from an area just before or during a scheduled immunisation session, children miss their vaccine doses. Conversely, when families return to an area between outreach visits, they may not know when the next session will occur. This mismatch between service delivery timing and population presence results in missed opportunities.

Additionally, some pastoral families live near international or regional borders and move across these boundaries following pasture availability. Participant V mentioned:

"Some families live in the border area [with Djibouti or the Somali region], and they move from one place to another, from one region to another."

Cross-border and cross-regional mobility complicates continuity of care and record-keeping. A child may receive the first vaccine dose in Afar, then migrate with family to Somali region or Djibouti for several months, and return having missed subsequent doses. Lack of coordination between regional and national immunisation systems means that these children often "fall through the cracks," with no systematic mechanism to track them or ensure catch-up vaccination.

4.3.2.5 Fear of Vaccine Side Effects and Adverse Events

Fear of adverse events following immunisation (AEFI), particularly fever, localised swelling, and irritability, emerged as a significant barrier, especially to completion of multi-dose vaccines. Parents reported that after observing their child experiencing

discomfort following an initial vaccine dose, they became reluctant to return for subsequent doses.

Participant E, a 30-year-old mother from Dubti, recounted:

"I vaccinated my young child in the hospital [health centre], but my child got sick after the shot, so I had to default or stop the shot out of concern for further risks."

The phrase "got sick after the shot" likely refers to common, minor, self-limiting side effects such as fever or injection-site pain. However, in the absence of adequate pre-vaccination counselling explaining that such reactions are normal and temporary, parents interpret them as dangerous adverse events. A 29-year-old mother from FGD Z3 (Informant 7, Dubti) stated:

"Additionally, I stop the immunisation or default it because one of my kids had a side effect that made him unwell after the shot, and I don't want to see my kids sick."

The language of "defaulting" (discontinuing the vaccination schedule) reflects awareness that this decision diverges from health worker recommendations, yet fear of harm to the child overrides that awareness.

Participant J, a 30-year-old mother from Semera Logia, provided additional context:

"I fear the side effects that can cause fever and strange discomfort for a few days after receiving a vaccination, which is a highly stressful condition until the child recovers from discomforts. My child becomes sick from taking vaccinations; I worry about such stressful events, and I never go to health post to vaccinate my child again."

The phrase "highly stressful condition" indicates that beyond concerns about the child's physical discomfort, parents experience emotional distress witnessing their child's suffering. The lack of post-vaccination follow-up or support from health workers to reassure parents that side effects are expected and will resolve contributes to this fear.

A 22-year-old mother from FGD Z1 (Informant 4, Afambo) noted:

"Additionally, some community members choose not to vaccinate or not to vaccinate their children because of possible adverse reactions to the vaccine, such as swelling or redness near the injection site."

This statement suggests that fear of side effects has become part of community discourse about vaccination, with negative experiences shared among mothers, potentially amplifying hesitancy.

Healthcare workers corroborated that fear of adverse events is a common reason for default. Participant S, a 32-year-old district EPI focal person from Semera Logia with 7 years of experience, explained:

"As you are aware, the majority of vaccinations are prepared in injectable or parenteral form. Therefore, the majority of parents or caregivers are afraid of injectable vaccine adverse effects and pain. As a result, in the second and third appointments, the majority of those parents default their vaccine."

This health worker's framing—"the majority of parents default"—reflects a supply-side perspective that may inadvertently pathologise parental behaviour as non-compliance, without fully acknowledging the health system's role in failing to provide adequate counselling and support to mitigate fears.

4.3.2.6 Vaccine Hesitancy Rooted in Misinformation and Mistrust

Beyond fear of side effects, some participants described ideological resistance to vaccination grounded in misinformation, conspiracy theories, or religious/cultural beliefs. Participant M, a 30-year-old HEW from Dubti with 4 years of experience, stated:

"Immunisation reluctance has been observed in our district, particularly in those who argue that the vaccine is only important for the immunisation provider's survival."

This statement suggests a belief among some community members that vaccines serve the economic interests of health workers (who may receive salaries or incentives for vaccination activities) rather than benefiting children—a form of instrumental mistrust rooted in historical experiences of marginalisation and exclusion from decision-making (Larson et al. 2022:345).

While this subtheme was less prominent in the data compared to other barriers (geographic, economic, and health system), its presence indicates that trust-building

and community engagement are important complementary strategies to address demand-side barriers.

4.3.2.7 Poor Understanding of Vaccination Benefits and Reliance on Traditional Medicine

Several participants described community members' limited understanding of what specific diseases vaccines prevent and how vaccines work, leading to reliance on traditional or religious healing practices instead. Participant M (the same HEW quoted above) elaborated:

"Our community asserts that camel milk is an essential part of the answer to all [health problems] inside their communities. However, as I previously stated, when we inform them of the importance of the vaccine, they refuse and place the responsibility on us. Additionally, they have faith in traditional healers and frequently use the drugs prescribed by these healers—known locally as 'Begi cora.' They try to massage the stomach area of their sick children since when they are ill, the movement of their intestines is the root of their trouble."

This rich description from Participant M reveals several important insights into the intersection of cultural health practices and vaccine acceptance among Afar pastoral communities

First, the valorisation of camel milk as a therapeutic remedy reflects deeply embedded cultural beliefs about indigenous healing resources. Camel milk occupies a central place in Afar health practice, and its perceived curative properties may lead communities to favour dietary interventions over biomedical treatments, including vaccination, for conditions that require medical attention. This reliance on culturally familiar remedies is not necessarily rooted in ignorance but rather in a longstanding health knowledge system that has sustained communities in harsh environments over generations.

Second, the reference to traditional healers, known locally as "Begi cora," highlights the presence of culturally trusted figures who provide both explanatory frameworks for illness and therapeutic interventions such as massage and herbal remedies. The participant's description of abdominal massage for sick children, based on the belief that

intestinal movement causes illness, illustrates how traditional aetiological models shape health-seeking behaviour. When communities operate within these frameworks, modern medicine and vaccination may be perceived as conflicting with or disrespecting established healing systems, thereby contributing to resistance.

Third, the participant's observation that communities "refuse and place the responsibility on us" is particularly revealing. This statement suggests a degree of defensive positioning by health workers who feel blamed for vaccination failures, pointing to strained provider-community relationships that may further undermine immunisation efforts. The tension between health workers' biomedical mandate and communities' cultural health preferences creates a relational dynamic that, if left unaddressed, can erode trust on both sides.

Taken together, the findings from this theme reveal that barriers to immunisation access and utilisation are multiply determined, operating across individual, household, community, environmental, and infrastructural levels. Fear and knowledge gaps function at the individual level, economic constraints shape household decisions, cultural beliefs influence community responses, flooding disrupts environmental access, and inadequate roads, vast distances, and limited transportation create infrastructural obstacles.

Critically, the majority of these barriers are structural in nature, arising from geographic marginalisation, chronic infrastructure underinvestment, poverty, and health system designs ill-suited to mobile populations, rather than from community ignorance, apathy, or anti-vaccine sentiment. The data suggest that when parents fail to vaccinate their children, it is most commonly due to an inability to access services because of distance, cost, and transportation challenges, rather than an unwillingness grounded in opposition to vaccines. This finding challenges deficit-based narratives that pathologise pastoralist communities and underscores the imperative for health system adaptation to meet communities where they are, both geographically and culturally.

The heterogeneity of barriers identified within this theme also indicates that no single intervention will suffice. Rather, multi-level, context-adapted strategies that address environmental, economic, informational, and cultural factors simultaneously are required to meaningfully improve immunisation coverage among Afar pastoral populations

4.3.3 Theme 3: Health System-Level Barriers to Immunisation Service Provision

While Theme 2 addressed barriers experienced primarily by service users (communities, families, caregivers), Theme 3 focuses on supply-side constraints, the operational, organisational, financial, and human resource challenges that limit the health system's capacity to deliver immunisation services effectively in pastoralist settings. These findings emerged predominantly from interviews with healthcare workers (HEWs, health centre staff, district coordinators, regional managers), although some parents also commented on health system failures they had observed. The theme comprises five subthemes.

4.3.3.1 Inadequate Budgetary Allocation for EPI Operations

Insufficient financial resources for immunisation programme operations was identified by all district-level coordinators and regional staff as a fundamental constraint. Participants consistently described how limited budgets undermined their capacity to deliver services, particularly to mobile pastoral communities that require resource-intensive outreach strategies. The challenge is compounded by the nature of the target population. As Participant V, a district EPI coordinator, explained

"Implementing an immunisation programme is primarily challenging due to the mobile lifestyle of the local population and a lack of financing or inadequate allocation for the district's operations."

The juxtaposition of "mobile lifestyle" and "lack of financing" is telling: it suggests recognition that serving mobile populations requires additional resources (for outreach, transportation, flexibility) beyond what is budgeted for static facility-based services, but that these incremental resources are not provided.

Budget shortfalls manifest concretely at the operational level. As Participant Y, a district EPI focal person, noted:

"Additionally, there is a shortage of funding for outreach programmes as well as an absence of vehicle and motorbike services."

The specific mention of outreach programmes is significant, as mobile health teams travelling to underserved communities represent the primary strategy for reaching pastoralists. Without dedicated funding and transportation, the very mechanism designed to bridge the access gap remains under-resourced, creating a contradiction between policy intent and operational capacity..

Participants also situated the budget problem within administrative and political structures. Participant U, a district EPI coordinator, stated, *"As a city administration, we have a limited budget allocation relative to our services. Therefore, the first thing the government should do is to increase the budget allocation."*

The direct appeal for increased government funding reflects health workers' awareness that financial constraints are policy decisions made at higher levels, not inevitable or immutable realities. This framing suggests that resource allocation is understood as a reflection of political priorities and power dynamics within the broader health system, rather than simply a matter of scarcity.

4.3.3.2 Shortage of Vehicles and Transportation for Outreach Services

Operationally, budget inadequacy translates most consequentially into a lack of motorised transportation (vehicles, motorcycles) necessary for health workers to conduct outreach immunisation sessions in remote pastoral areas. Participant X, the 34-year-old district coordinator from Mille quoted previously, described:

"As to our catchment location, we have a logistic problem, and it is hard to reach an area which is difficult to go by on foot to provide vaccines for children, and due to lack of motorcycle for supervision to ensure that all the children were vaccinated."

This statement highlights two interconnected transportation needs: (1) vehicles to deliver services (transporting vaccines, cold boxes, and health workers to communities), and (2) vehicles for supervision (managers visiting facilities to monitor quality and provide support). Lack of transportation constrains both service delivery and quality assurance.

Participant V from Ayseita suggested motorcycles as a solution:

"As district health officials, we recommend using a vehicle, particularly a motorcycle, to facilitate the planning and execution of vaccination campaigns. A motorcycle can provide efficient and flexible transportation to remote or hard-to-access areas, allowing healthcare workers to deliver vaccines to a larger population. Additionally, motorcycles can navigate through traffic and narrow roads more easily than larger vehicles, enabling faster delivery of vaccines to communities in need."

The specificity of this recommendation—motorcycles rather than four-wheeled vehicles—reflects a pragmatic understanding of Afar's terrain, where many pastoral encampments are accessible only via footpaths or rough tracks unsuitable for cars but navigable by motorcycles.

The absence of transportation has cascading effects: (1) outreach sessions are cancelled or conducted infrequently; (2) health workers cannot reach the most remote communities, perpetuating geographic inequities; (3) defaulter tracking (following up children who miss appointments) becomes impossible; (4) supervision and quality improvement efforts are compromised.

4.3.3.3 Insufficient Health Workforce and Health Extension Worker Vacancies

Human resource shortages, particularly health extension workers at the health post level, were identified as a critical constraint. Participant Q, a health centre EPI focal person, explained:

"Of our catchment area, there is a shortage of human resources, especially health extension workers. At some health posts, only one health extension worker works with a large population and a densely populated kebele. Therefore, only one health extension worker per kebele cannot reach every child in such difficult conditions. This is a major cause of child vaccine defaulting and not full vaccination."

Ethiopia's Health Extension Programme policy stipulates that each health post, serving a kebele of approximately 5,000 people, should have two HEWs. However, in Afar, many health posts operate with only one HEW or remain vacant for extended periods due to resignations, relocations, or extended leave for education or personal reasons. With only one HEW responsible for delivering 16 health service packages, including immunisation, antenatal care, family planning, sanitation promotion, malaria prevention,

and tuberculosis case finding, to a geographically dispersed population, immunisation coverage inevitably suffers.

The reference to a "densely populated kebele" may appear paradoxical in a region with low overall population density, but likely refers to kebeles that include a town or semi-urban centre alongside dispersed pastoral settlements, creating a bimodal distribution of population that presents unique challenges for service delivery planning.

Participant X from Mille also mentioned human resource constraints in the context of training needs, suggesting that the workforce shortage is both quantitative, in terms of too few workers, and qualitative, in terms of insufficient skills and training among those who are available.

4.3.3.4 Lack of Pre-Service and In-Service Training for Vaccinators

Healthcare workers across all levels emphasised gaps in training as a barrier to quality immunisation service delivery. Participant U, a district coordinator, stated:

"It's important for vaccinators to receive proper training related to the immunisation programme to ensure that they are equipped with the knowledge and skills necessary to administer vaccines safely and effectively."

This seemingly straightforward statement takes on deeper significance when considered alongside the earlier revelation from Participant L, an HEW, that she had been working as a vaccinator for four years without ever receiving immunisation training. Together, these accounts expose a fundamental disconnect between policy, which presumably mandates training, and implementation, where training simply does not occur. The gap between what is expected and what is resourced reveals a systemic failure rather than an isolated oversight.

Participant W, a district coordinator, specified the types of training needed:

"I also suggest that training is mandatory, especially the training augmented by skills. Here are some of the important trainings that we must emphasise: IIP or Immunisation in Practice, Effective Vaccine Management (EVMA), and specific training on cold chain maintenance is crucial for the vaccination programme."

Immunisation in Practice is a comprehensive WHO training package covering vaccine schedules, administration techniques, contraindications, adverse event management, and communication with caregivers. Effective Vaccine Management addresses vaccine supply chain, storage, stock management, and minimising wastage. These are evidence-based, standardised training programmes that have been adopted at federal level but have clearly not been implemented at scale in Afar. The specificity of this recommendation is notable, as it indicates that at least some health workers possess a clear understanding of precisely what interventions are needed, even though they lack the authority or resources to implement them.

Participant V extended the training imperative beyond vaccinators to community and political leaders:

"Furthermore, we find that training is a vital means for orienting and updating healthcare professionals, particularly vaccinators, who operate at the static level in health posts and clinics and in the community. Thus, mentoring and instruction, particularly on refrigerator upkeep [cold chain management], IPC (infection prevention and control) training should also be provided to political and community leaders to improve service utilisation and community access."

This suggestion reflects an important recognition that immunisation is not purely a technical health intervention but requires broader social and political support. Training community and political leaders could foster local ownership of immunisation goals and help bridge the gap between health system expectations and community engagement. However, the recommendation was not elaborated further, leaving unclear what specific content or outcomes such training would entail.

4.3.3.5 Frequent Absence of Health Extension Workers from Posts

Parents and caregivers repeatedly described arriving at health posts for vaccination appointments only to find no health worker present. This barrier was so prominent that it emerged as a discrete subtheme warranting separate discussion from general workforce shortages, as it speaks directly to the lived experience of service unreliability.

Participant D, a mother from Ayseita, recounted:

"As to my child defaulting from getting full vaccination, one day when I brought my child for vaccination at 9 months, the health extension worker told me the vaccine is not opened only for your child, and she said this vial can only be opened for 10 children. Again, one day when I returned to the health post, it was closed, and I didn't see a health extension worker at the post, so I didn't return for vaccination next time."

This narrative illustrates multiple interacting failures. First, the HEW refused to open a vaccine vial for a single child, a practice that is technically justifiable to avoid wastage from multi-dose vials but operationally problematic when population is dispersed and children arrive sporadically. Second, the health post was closed when the mother returned, suggesting unpredictable HEW absence. Third, and most critically, the mother decided not to attempt vaccination again, representing accumulated frustration and a complete loss of confidence in service availability. What begins as a system-level efficiency measure cascades into a personal decision to disengage from immunisation entirely.

Participant F, a mother from Dubti, provided additional context for HEW absence:

"My child did not complete all recommended vaccines because the health extension worker of our kebele was not available at the health post. Because she had gone to attend her education, as I heard from kebele leaders, that is why my child did not receive all vaccines."

HEWs in Ethiopia undergo one year of formal training before deployment, and many subsequently pursue additional education through distance learning or part-time programmes, requiring periodic absence from their posts. While continuing professional development is commendable and necessary for career progression, the lack of replacement staff during these absences leaves communities without essential services. This reflects a structural gap in workforce planning where individual advancement and community service needs remain unreconciled.

Participant G, a mother from Mille, stated:

"Most healthcare workers or vaccinators are unavailable on the day of our appointment, and we frequently do not receive healthcare professionals or vaccinators at the health facility. I've had this numerous times. This is the difficulty I encountered when

vaccinating my child. Most community members frequently miss their appointments out of concern that the medical staff at the institution may not be there."

The repeated use of "frequently" indicates that HEW absence is not an isolated occurrence but a recognised pattern that has eroded community trust. Most significantly, the statement that community members "miss their appointments out of concern that the medical staff may not be there" reveals a phenomenon of anticipatory non-utilisation, whereby families decide not to attempt accessing services because they assume those services will be unavailable. This creates a self-reinforcing cycle in which low service reliability drives low demand, which in turn may be misinterpreted by health authorities as community disinterest rather than rational disengagement.

A participant from a focus group discussion described a related problem of vaccine stock-outs:

"Occasionally, vaccination sessions are cancelled on the day of the appointment at the medical facility or health post because the medical staff claims no vaccine is available at the facility level. They therefore provide us with an appointment or a schedule to return later. Because they might reschedule our immunisation day, this causes most of us to become exhausted and miss our appointments. That is why, as I previously stated, we would rather leave or not attend the session due to the difficulty we encountered."

The language of "exhaustion" is particularly evocative, suggesting not merely physical fatigue from repeated travel but emotional and motivational depletion resulting from accumulated failed attempts to access services. The phrase "we would rather leave" reflects a rational calculus: when the probability of successful vaccination is low and the opportunity costs of travel are high, families make the economically and logistically sensible decision to discontinue attempts. This is not vaccine hesitancy but rather service-access fatigue driven by systemic unreliability.

Healthcare workers themselves acknowledged this problem. Participant B, a mother from Afambo, directed her frustration at health authorities:

"Government oversight of the service providers should also be strictly enforced. We are not receiving a service from them in a sustainable manner, as I have stated. They

cannot visit our village to provide services because they are only occasionally there and are absent most of the time."

Her call for "government oversight strictly enforced" and service delivered in a "sustainable manner" reflects community awareness that HEW absence is fundamentally a management and accountability problem requiring supervisory intervention, not simply an inevitable consequence of working in a remote area.

The findings from this theme collectively reveal that the health system's capacity to deliver immunisation services in Afar is severely constrained by inadequate financial resources, insufficient transportation, health workforce shortages and vacancies, training gaps, and weak accountability for service provision. These constraints are interconnected and mutually reinforcing. Budget inadequacy prevents procurement of vehicles and hiring of additional staff. Workforce shortages increase the workload on remaining staff, contributing to burnout and turnover. Lack of training compromises the quality of services even when they are provided. The absence of supervision and accountability mechanisms allows HEW absenteeism to persist unchecked.

Importantly, these are not natural or inevitable conditions but rather products of policy choices and resource allocation decisions made at federal and regional levels that have historically deprioritised pastoralist regions. The data suggest that health workers themselves recognise these systemic failures and are, to some extent, sympathetic to community frustrations, even as they also experience demoralisation and resource constraints that limit their own effectiveness.

The convergence of community-level and environmental barriers with health system barriers creates a compounding disadvantage. Communities face structural obstacles to accessing services, including distance, cost, and flooding, while the services they struggle to reach are themselves inadequate, unpredictable, and of variable quality. This double burden, where both demand-side and supply-side barriers operate simultaneously, helps explain why Afar continues to have among the lowest immunisation coverage rates in Ethiopia and underscores the need for comprehensive, system-wide reform rather than piecemeal interventions targeting isolated barriers.

4.3.4 Theme 4: Participant Recommendations for Improving EPI Access and Coverage

The fourth major theme comprises participants' own suggestions for overcoming barriers and improving immunisation services in pastoralist contexts. These recommendations emerged when participants were explicitly asked (as part of the interview guide): "What do you think should be done to improve vaccination services in your community?" or "What recommendations do you have for the government/health system to increase immunisation coverage?"

Participant recommendations are valuable because they are grounded in lived experience and contextual knowledge, and because they reflect priorities and solutions that communities and health workers themselves find meaningful and feasible. The theme is organised into five subthemes corresponding to distinct strategic directions.

4.3.4.1 Infrastructure Development: Constructing Accessible Health Facilities with Adequate Equipment

Constructing additional health posts and health centres in underserved areas was the most frequently mentioned recommendation across all participant groups. A 31-year-old caregiver from FGD Z1 (Informant 4, Afambo) stated:

"The problem we were facing also gave [us lack of] access to vital health services near our village. Building a road is also crucial for all health-related services, including immunisations. We propose building a health post or facility close to our village. This could help us with the immunisation service utilisation."

This statement links health facility construction with road construction, recognising that built infrastructure (facilities) must be accompanied by connective infrastructure (roads) to enable access. The participant's use of the phrase "we propose" reflects agency and ownership, positioning the community as active participants in solution-finding rather than passive recipients.

Participant Y, a district coordinator from Semera Logia, echoed this recommendation:

"It is also important to construct health satellites or health posts under the city administration, which is important for all community members, especially in communities far from the city's centre or marginalised areas."

The term "health satellites" likely refers to small health posts or outposts that serve as extensions of larger health centres, bringing services closer to dispersed populations.

The recommendations made by participants is not viewed as invalid; rather, it highlights that addressing immunisation inequities in pastoralist regions requires political will and financial commitment at the highest levels, a reality that must be acknowledged in strategy development (addressed in Chapter 6). Moreover, even incremental infrastructure expansion, if strategically targeted to the most underserved areas, can improve access for thousands of children.

Participants also emphasised that facilities must be adequately equipped with cold chain equipment, vaccines, supplies, and functional water/electricity systems—not merely constructed buildings.

4.3.4.2 Expanding and Adapting Service Delivery Strategies for Mobile

Populations

Beyond constructing fixed facilities, participants recommended enhancing mobile and outreach strategies to bring services to communities. Participant X, the district coordinator from Mille, stated:

"I recommend using a variety of approaches to reach populations that are difficult to reach, particularly outreach and mobile programmes, which are beneficial in difficult-to-reach areas."

Participant Z, a 32-year-old Regional EPI Case Team Leader with 7 years of experience, provided a more detailed strategic vision:

"The current immunisation service delivery strategy in Ethiopia, including Afar Regional State, aims to reach diverse populations through a variety of methods. The fixed/static approach involves offering immunisation services at permanent health facilities like hospitals and health centres, ensuring that individuals can access these services at

established healthcare institutions. However, this strategy should be complemented by other targeted approaches that consider the needs of local communities."

This statement reflects a policy-level perspective, distinguishing static (facility-based), outreach (health workers traveling to communities on scheduled dates), and mobile (using vehicles or temporary camps) service delivery modalities. The call to "complement" static services with outreach/mobile approaches acknowledges that **no** single modality suffices; rather, a mix of strategies responsive to population distribution and mobility is required.

Participant AZ, a 45-year-old partner organisation (NGO) technical officer with 16 years of experience, elaborated:

"Apart from the fixed/static approach, outreach and mobile strategies are also employed to ensure that immunisation services are accessible to remote or underserved areas. Health workers travel to communities outside of traditional health facilities to provide immunisation services, which is especially advantageous for reaching populations in remote or rural areas with limited access to healthcare facilities. The mobile approach also includes using vehicles or other transportation methods to deliver immunisation services to geographically isolated communities with limited infrastructure. The strategy mentioned above should be enhanced with additional targeted approaches that consider local communities' specific requirements and circumstances. It is important to tailor interventions and solutions to each community's unique challenges and opportunities. By incorporating localised perspectives and input, interventions can be more effective and sustainable, leading to greater overall impact."

The emphasis on "localised perspectives," "specific requirements," and "tailoring interventions" reflects a participatory, context-responsive approach consistent with best practices in health systems strengthening (WHO 2022). This recommendation goes beyond generic calls for "more outreach" to advocate for adaptive implementation, designing service delivery around community realities rather than expecting communities to conform to health system routines.

4.3.4.3 Awareness Creation, Health Communication, and Community Engagement

Participants emphasised the imperative of improving community knowledge about vaccines through health education and communication, and engaging community influencers to promote immunisation. Participant A, a mother from Afambo, recommended:

"For our accurate knowledge, local language should be used to develop the information provided to the community. Because the majority of our population lacks formal education, as you are aware, the information you strive to convey to them should be represented by an image or perhaps a symbol."

This recommendation contains several important insights: (1) linguistic accessibility (use of Afaraf rather than Amharic or English); (2) visual communication (images, symbols) for populations with low literacy; (3) recognition of the need for culturally and educationally appropriate communication strategies.

Participant H, a 21-year-old mother from Mille with 8 years of formal education, suggested:

"Educating the community people about the importance of vaccination, especially by presenting and contrasting the vaccinated children and unvaccinated children's health status and health outcome."

The suggestion to use comparative examples (showing differences in health outcomes between vaccinated and unvaccinated children) reflects an understanding that experiential, evidence-based messaging may be more persuasive than abstract explanations.

Several participants recommended engaging traditional and religious leaders as immunisation advocates. A 29-year-old mother from FGD Z1 (Informant 7, Afambo) stated:

"Involving community influentials such as district leaders, religious leaders, and clan leaders is crucial for enhancing service utilisation, as they hold significant influence and acceptance within our community."

Another mother from FGD Z2 (Informant 2, 29 years old, Ayseita) concurred:

"All villagers accept the community or district influence, so they must convey or guide information regarding vaccinations. These influential include clan leaders, community leaders, and religious leaders."

The reference to "clan leaders" is particularly significant in Afar, where clan affiliation structures social organisation, conflict resolution, resource allocation, and collective decision-making (Muluneh et al. 2024). Clan leaders (*mela*, in Afaraf) command respect and authority; their endorsement of immunisation could powerfully influence community uptake. Similarly, religious leaders (Imams, sheikhs) are trusted figures whose pronouncements on health matters carry weight. Leveraging religious events (Eid, Friday prayers) and religious/clan leaders for immunisation promotion, which were notably absent from the original findings presentation but are now foregrounded here.

A participant from FGD Z4 (Informant 2, 30-year-old mother from Mille) added:

"It is crucial that the information be communicated through a town crier [traditional public announcer] so that most of the community can hear it at some point. It is also crucial that the information be communicated in the local tongue because, as you are aware, everyone who visits or lives in our village speaks Afaraf."

The suggestion to use town criers, individuals who walk through villages making announcements, reflects adaptation to an oral communication culture in a setting where literacy is low and access to mass media (radio, television, newspapers) is limited.

Participant C, a mother from Ayseita, reiterated the importance of visual communication:

"Furthermore, information presented visually is easier to absorb, especially for undereducated people."

These community-level recommendations converge with health worker recommendations for training. Participant V, the district coordinator from Ayseita, stated:

"Furthermore, we find that training is a vital means for orienting and updating healthcare professionals, particularly vaccinators, who operate at the static level in health posts and clinics and in the community. Thus, mentoring and instruction, particularly on

refrigerator upkeep [cold chain management], IPC (infection prevention and control) training should also be provided to political and community leaders to improve service utilisation and community access."

The suggestion to train political leaders likely reflects recognition that local government officials control budget allocations, staff assignments, and policy priorities at the woreda level; thus, their buy-in and understanding are necessary for sustained programme support.

Participants U and Y, district coordinators from Dubti and Semera Logia, respectively, specified training needs:

"We suggest that training should be given to new staff, especially Immunisation in Practice (IIP) and Effective Vaccine Management (EVMA) training are crucial for those newly deployed health workers, and updates for vaccinators about updated vaccination concerns." (Participant U)

"Practice-based training must be given to newcomer staff and other programme health workers to replace them during the absenteeism of assigned vaccinators." (Participant Y)

The latter statement suggests training backup staff to cover absences and it addresses the HEW absenteeism problem identified in Theme 3 through a practical solution: building redundancy into the health workforce so that immunisation services can continue even when primary vaccinators are unavailable.

4.3.4.4 Securing Sufficient Budgetary Resources for Staffing, Transport, and Programme Operations

Participants, particularly healthcare workers, emphasised the need for increased budgetary allocations to address resource constraints. Participant U, district coordinator from Dubti, stated:

"As a city administration, we have a limited budget allocation relative to our services. Therefore, the first thing the government should do is to increase the budget allocation."

This direct appeal to government reflects health workers' awareness that budget is a policy decision amenable to advocacy and change, not an immutable constraint.

Participant V from Ayseita provided more specificity, linking budget to transportation needs:

"As district health officials, we recommend using a vehicle, particularly a motorcycle, to facilitate the planning and execution of vaccination campaigns. A motorcycle can provide efficient and flexible transportation to remote or hard-to-access areas, allowing healthcare workers to deliver vaccines to a larger population. Additionally, motorcycles can navigate through traffic and narrow roads more easily than larger vehicles, enabling faster delivery of vaccines to communities in need. This approach can help improve vaccination coverage and public health outcomes."

The motorcycle recommendation is pragmatic, cost-effective, and contextually appropriate. Motorcycles cost approximately 150,000-200,000 ETB (2,500-3,500 USD) compared to 4, wheel vehicles costing 2-3 million ETB, making them a feasible procurement for district health offices if budget is allocated.

Participant V also recommended hiring local staff who speak Afaraf:

"One thing we have learnt from our village health system programme is that, to increase service utilisation, we assign staff members from within the community as district health officials. We particularly encourage the involvement of local influentials and religious leaders. Because most of the personnel do not speak the local language, most of the community members did not accept what we informed them about their own health the last time. However, in light of the lesson learnt, we now attempt to assign local employees to the district."

This recommendation addresses the linguistic and cultural barriers created when health workers from other regions (Amharic speakers unfamiliar with Afar culture) are deployed to pastoralist areas. Hiring locally not only improves communication but also builds trust, creates local employment, and ensures health workers understand and respect cultural norms.

4.3.4.5 Strengthening Accountability, Supervision, and Performance Monitoring

The final subtheme comprises recommendations to improve health worker accountability and supervision systems to ensure consistent service provision.

Participant B, a mother from Afambo, demanded:

"Government oversight of the service providers should also be strictly enforced. We are not receiving a service from them in a sustainable manner, as I have stated. They cannot visit our village to provide services because they are only occasionally there and are absent most of the time."

Her use of the phrase "strictly enforced" reflects deep frustration with lax accountability and constitutes a direct call for meaningful consequences when health workers fail to fulfil their service obligations. This demand from a community member is significant because it reframes HEW absence not as an unfortunate reality of working in remote areas but as a governance failure that requires structured intervention.

While this subtheme received less elaboration than others, it points to the critical importance of management and governance systems, including supportive supervision, performance monitoring, and feedback mechanisms, that hold health workers accountable while also providing them with the support and resources necessary to succeed. Accountability without adequate resourcing risks punishing health workers for systemic failures beyond their control, while resourcing without accountability risks perpetuating service gaps. An effective approach requires both dimensions working in concert.

The findings from this theme highlight that participants across all categories possess clear, contextually grounded ideas about how to improve immunisation services. Recommendations span multiple domains, including infrastructure in the form of facilities, roads, and equipment; service delivery strategies such as outreach, mobile teams, and flexible scheduling; communication and engagement approaches including health education delivered in Afaraf with visual aids, involvement of clan and religious leaders, use of town criers, and training for both health workers and community leaders; resource allocation priorities such as increased budgets, motorcycles, and hiring of local staff; and governance mechanisms encompassing accountability and supervision.

Notably, these recommendations are not expressions of wishful thinking but rather evidence-informed, feasible interventions that align with established best practices for reaching hard-to-reach populations. Many were articulated with considerable specificity, such as identifying particular training packages like Immunisation in Practice and Effective Vaccine Management, naming specific communication channels such as town criers and clan gatherings, or pointing to particular technologies including motorcycles and solar-powered cold chain equipment. This level of detail suggests that participants are not merely identifying problems but actively envisioning practical solutions drawn from their intimate knowledge of local conditions and operational realities.

The convergence of recommendations across parent and caregiver participants and health worker participants is also noteworthy. Despite occupying different positions within the health system, both groups demonstrated a shared understanding of barriers and a remarkably consistent vision of what solutions are needed. This consensus is encouraging for collaborative strategy development and implementation, as it suggests that interventions designed with input from both communities and frontline workers are likely to enjoy broad support and legitimacy.

However, the resource implications of these recommendations are substantial. Infrastructure development, vehicle procurement, health workforce expansion, and comprehensive training all require significant financial investment that exceeds current budget allocations for the region. The tension between what is needed, namely a comprehensive and multi-faceted intervention addressing barriers at every level, and what is immediately feasible within existing resource constraints, namely incremental improvements, must be carefully navigated in strategy development and policy recommendations. Addressing this tension requires not only increased resource allocation to pastoralist regions but also strategic prioritisation of interventions that offer the greatest impact relative to their cost, a consideration explored further in the subsequent chapter.

4.4 ALIGNMENT OF FINDINGS WITH RESEARCH QUESTIONS AND THEORETICAL FRAMEWORK

This sub-section explicitly maps the four themes identified through data analysis to the study's research questions and the Social Ecological Model (SEM) framework,

TABLE 4.5: ALIGNMENT OF EMPIRICAL THEMES WITH RESEARCH QUESTIONS AND SOCIAL ECOLOGICAL MODEL LEVELS

Research Question	Corresponding Theme(s)	SEM Level(s)	Key Insights
RQ1: What health system and service delivery factors influence access to and utilisation of EPI services in pastoralist communities?	Theme 3: Health system-level barriers to immunisation service provision	Organisational Policy	Health system constraints (budget, transportation, workforce, training, accountability) severely limit service availability, accessibility, and quality. These are products of policy and resource allocation decisions, not natural or inevitable conditions.
RQ2: What demand-side and sociocultural factors shape caregiver utilisation of immunisation services in pastoralist contexts?	Theme 1: Knowledge and understanding Theme 2: Community-level and environmental barriers (subthemes on fear, hesitancy, poor understanding, traditional medicine)	Individual Interpersonal Community	Knowledge deficits, fear of side effects, misinformation, and reliance on traditional healing influence immunisation decisions. However, these are secondary to structural barriers (geographic access, cost).
RQ3: How do equity considerations influence immunisation coverage among underserved	Theme 2: Community-level and environmental barriers (particularly geographic remoteness, flooding, transportation, migration)	Community Organisational Policy	Pastoralist communities face double disadvantage: structural barriers to accessing services (distance, cost, environmental hazards) compounded by health system inadequacies (under-resourcing, inflexible service

pastoralist populations?	Theme 3: Health system barriers (budget, workforce, training)		delivery). This compound inequity produces systematically lower coverage compared to settled populations.
RQ4: How responsive are existing immunisation strategies to local contexts and lived realities of pastoralist populations?	Theme 2: Mobility and migration Theme 3: HEW absence, training gaps Theme 4: Participant recommendations (outreach/mobile strategies, community engagement, local staff hiring)	Organisational Policy Community	Existing static, facility-based service delivery is poorly adapted to pastoral mobility, geographic dispersion, and cultural contexts. Participants' recommendations for adaptive strategies (mobile teams, local language communication, engagement of clan leaders) highlight feasible alternatives.

The empirical findings substantiate that immunisation utilisation in Afar pastoralist communities is shaped by interacting factors at multiple ecological levels, consistent with the SEM framework. Individual-level factors (knowledge, fear of side effects) intersect with interpersonal factors (household decision-making, influence of clan leaders), community-level factors (cultural beliefs, mobility patterns, collective experiences of marginalisation), organisational/health system factors (service delivery models, health workforce, cold chain, supervision), and policy-level factors (budget allocation, national EPI guidelines designed for settled populations).

Critically, the findings challenge deficit-based narratives that attribute low immunisation coverage to community ignorance, apathy, or vaccine refusal. Instead, they reveal that structural and health system barriers predominate. When parents fail to vaccinate children, it is overwhelmingly due to inability to access services (geographic remoteness, transportation costs, flooding, HEW absence, vaccine stock-outs) rather than unwillingness grounded in opposition to vaccines. This finding reframes the problem from one of "community non-compliance" to one of "health system inadequacy and structural inequity"—a reframing with profound implications for strategy development.

The findings also demonstrate inequity is produced through interaction between environmental/geographic factors and health system design. Pastoralist populations would face challenges accessing services even with a well-resourced health system due to their mobility and geographic dispersion. However, these challenges are greatly exacerbated by chronic underinvestment in infrastructure, transportation, and workforce for pastoralist regions. The health system's failure to adapt service delivery to pastoralist realities (e.g., through flexible outreach, coordination with migration patterns, engagement of traditional leaders) further compounds disadvantage. Thus, low immunisation coverage in Afar is not an inevitable consequence of pastoralism but rather a product of policy choices and systemic neglect.

Participants' recommendations (Theme 4) offer a roadmap for responsive, equitable strategies grounded in lived experience and contextual knowledge, providing the empirical foundation for strategy development in Chapter 6.

4.5 SUMMARY

This chapter presented the empirical findings from Phase 2 of the study—qualitative data collection conducted with 77 participants (60 parents/caregivers and 17 healthcare workers) across five districts of Afar Regional State between October 2023 and January 2024. Data were collected through semi-structured individual interviews, focus group discussions, and key informant interviews, all conducted in participants' preferred languages (Afaraf or Amharic) with rigorous translation protocols. Analysis employed Braun and Clarke's (2023) six-phase reflexive thematic analysis, yielding four major themes.

Theme 1 revealed variable and often inadequate knowledge about vaccines and vaccination among both parents/caregivers and healthcare workers, attributed to insufficient health education and training rather than individual failing.

Theme 2 identified community-level, environmental, and structural barriers including geographic remoteness, flooding and road impassability, transportation unavailability and unaffordability, population mobility and migration, fear of vaccine side effects, vaccine hesitancy, and limited understanding of vaccine benefits. Importantly, most of

these barriers are products of structural inequities, infrastructure underinvestment, and poverty rather than community-level deficits.

Theme 3 documented severe health system constraints including inadequate budgetary allocation, shortage of vehicles for outreach, insufficient health workforce and HEW vacancies, lack of pre-service and in-service training for vaccinators, and frequent HEW absence from posts. These supply-side failures compound community-level access barriers, creating a double disadvantage for pastoralist populations.

Theme 4 presented participant recommendations for improvement, spanning infrastructure development, expansion and adaptation of service delivery strategies for mobile populations, awareness creation and community engagement (including leveraging clan and religious leaders), securing adequate budget and resources, and strengthening accountability and supervision.

The findings were explicitly aligned with the study's research questions and the Social Ecological Model theoretical framework, demonstrating that immunisation utilisation is shaped by interacting factors at individual, interpersonal, community, organisational, and policy levels. Critically, the data challenge deficit-based narratives by revealing that low immunisation coverage in Afar results primarily from structural barriers and health system inadequacies rather than community ignorance or vaccine refusal. This reframing has profound implications for strategy development.

Chapter 5, which follows, discusses these findings in relation to existing literature, examining how the empirical themes align with, diverge from, or extend previous research on immunisation in pastoralist and hard-to-reach populations. Chapter 5 also applies the Social Ecological Model as an interpretive lens to explain the mechanisms through which barriers operate at different ecological levels and their dynamic interactions.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 INTRODUCTION

Chapter 4 presented the empirical findings from qualitative data analysis, organised into four major themes: (1) participants' knowledge and understanding of vaccines and vaccination; (2) community-level and environmental barriers to immunisation access and utilisation; (3) health system-level barriers to immunisation service provision; and (4) participant recommendations for improving EPI access and coverage. These themes emerged from thematic analysis of data collected through semi-structured interviews and focus group discussions with 77 participants, 60 parents/caregivers, and 17 healthcare workers, across five districts of Afar Regional State between October 2023 and January 2024.

This chapter provides a comprehensive, theoretically grounded discussion of these findings, situating them within the broader scholarly literature on immunisation in pastoralist, nomadic, and hard-to-reach populations. The discussion moves beyond mere description toward critical interpretation, explicitly applying the Social Ecological Model (SEM) as an analytical framework while engaging extensively with recent, contextually relevant evidence from Ethiopia, the Horn of Africa, and comparable pastoralist settings globally.

My analytical approach in this revised chapter deliberately foregrounds several key interpretive moves. First, I systematically interrogate what the findings mean rather than simply stating what was found, interrogating why certain patterns emerged, how they connect to broader systems, and what they reveal about structural inequities. Second, I use the SEM not as a post-hoc categorisation scheme but as a generative theoretical lens that helps explain the dynamic interactions between individual, interpersonal, organisational, community, and policy-level determinants of immunisation coverage. Third, I engage critically with the literature, identifying where my findings corroborate, contradict, or extend existing knowledge, and reflecting on the implications of these convergences and divergences. Fourth, I attend explicitly to power, equity, and structural discrimination, examining how policy choices and resource allocation

decisions have historically marginalised pastoralist regions and produced the health system failures documented in this study. Finally, I demonstrate how the study's participatory design—centering the voices and perspectives of Afar communities and frontline health workers—challenges deficit narratives and validates locally grounded knowledge.

The chapter is organised thematically, following the structure established in Chapter 4. Each section discusses one major theme, beginning with a brief recapitulation of key empirical findings, followed by interpretation through the SEM framework, engagement with relevant literature, critical analysis of convergences and divergences, and synthesis of insights. Section 5.2 discusses knowledge and understanding of vaccines; Section 5.3 addresses community-level and environmental barriers; Section 5.4 examines health system barriers; Section 5.5 discusses participant recommendations; Section 5.6 provides an integrated synthesis demonstrating how findings across themes cohere to explain low immunisation coverage in Afar; and Section 5.7 summarises the chapter and transitions to strategy development in Chapter 6

5.2 KNOWLEDGE AND UNDERSTANDING OF VACCINES AND VACCINATION

5.2.1 Recapitulation of Empirical Findings

Chapter 4 revealed substantial heterogeneity in knowledge about vaccines and vaccination among both parents/caregivers and healthcare workers. While some parents demonstrated basic understanding that vaccines prevent diseases and protect child health, others exhibited confusion (conflating vaccination with treatment rather than prevention) or possessed minimal knowledge about which diseases vaccines prevent or when children should be vaccinated. A pervasive concern across nearly all parent/caregiver participants was insufficient information provision by health workers during vaccination encounters. Among healthcare workers, newly deployed staff reported inadequate training on EPI implementation, and experienced workers emphasised the absence of continuous professional development, refresher training, and updates on evolving guidelines.

5.2.2 Interpretation Through the Social Ecological Model

The SEM conceptualises health behaviour as shaped by factors at multiple, interacting levels: individual (knowledge, attitudes, skills), interpersonal (social networks, family influence), organisational (health system structures, training systems), community (cultural norms, collective knowledge), and policy (national guidelines, resource allocation) (Kilanowski 2024:188). Knowledge deficits identified in this study operate primarily at the individual level (personal knowledge gaps) but are produced and perpetuated by failures at organisational and policy levels—specifically, inadequate health education delivery to communities and insufficient pre-service and in-service training for health workers.

This multi-level causation is essential. A deficit-based view would blame low immunization coverage on "community ignorance" or "health worker incompetence," placing the fault on individuals. However, the findings, especially participants' own explanations, show that both parents and healthcare workers see knowledge gaps as systemic issues caused by shortcomings in the health system. Parents said that health workers "just give the injection without telling me anything" and "if they would explain to us, maybe we would understand better," framing the issue as a lack of information rather than an inability to understand. Likewise, healthcare workers linked their knowledge gaps to a lack of training, not personal failure. This systemic perspective shifts responsibility from individuals to the organizations and policies responsible for health workforce development and communication.

The interaction between individual and organisational levels creates a reinforcing cycle: inadequately trained health workers lack the knowledge, skills, and confidence to provide effective health education; consequently, communities receive insufficient information and develop misconceptions; these misconceptions contribute to vaccine hesitancy and default, further frustrating health workers and potentially reducing their motivation for education efforts (Leask et al. 2023:567).

5.2.3 Alignment with Existing Literature

5.2.3.1 Community-Level Knowledge Deficits in Pastoralist Contexts

The finding that many parents/caregivers in Afar possess limited knowledge about vaccines aligns with evidence from other pastoralist regions in Ethiopia and the Horn of Africa. Zemariam et al. (2024) conducted a multi-level analysis of the 2019 mini-EDHS focusing on pastoralist regions (Afar, Somali) and found that maternal knowledge of immunisation was significantly associated with full immunisation coverage (AOR=2.34, 95% CI: 1.87-2.92, $p<0.001$). Mothers who could name at least three vaccine-preventable diseases were more than twice as likely to have fully immunised children compared to those with no such knowledge. This quantitative finding corroborates the qualitative insight from the present study that knowledge matters, but critically, does not explain why knowledge gaps exist or how to address them, questions that qualitative inquiry illuminates.

According to Muluneh et al. (2024:1118), in their mixed-methods study conducted in Afar (the same region as the present study, though in different woredas), reported that 68% of mothers had "poor knowledge" about immunisation, defined as inability to name vaccine-preventable diseases, lack of awareness of the recommended schedule, and misconceptions about vaccine safety. Their qualitative findings parallel those of the present study: mothers reported receiving minimal explanation during vaccination sessions, with health workers focused on "getting through" large numbers of children quickly rather than taking time for counselling. Muluneh et al. attribute this to health worker time constraints and lack of training in communication skills, a systemic, organisational-level explanation consistent with the SEM interpretation offered here.

Nigatu et al. (2024:363), analysing 2016 EDHS data from Amhara region (a predominantly settled agricultural population), found that maternal education was the strongest predictor of immunisation completion (AOR=3.12 for secondary+ education vs. no education). However, they also found that even among mothers with no formal education, those who had received antenatal care—and thus health education about immunisation during pregnancy—were significantly more likely to vaccinate children (AOR=2.45). This suggests that structured health education can partially compensate for low formal education, a hopeful finding for pastoralist contexts where female literacy

is low (as in Afar, where 70% of parent participants in this study had no formal schooling).

5.2.3.2 Health Worker Training Gaps in Resource-Constrained Settings

The finding that health workers, including experienced vaccinators, report never having received formal EPI training or updates is alarming but not unique to Afar. Nega et al. (2023:7), in a cross-sectional study of 312 health extension workers across three Ethiopian regions (Amhara, Oromia, SNNP—notably excluding pastoralist regions), found that only 48% had received any formal EPI training post-deployment, and among those, most training occurred >3 years prior with no subsequent refreshers. Nega et al. identified training gaps as a major contributor to poor immunisation service quality, including incorrect vaccine administration techniques, inadequate cold chain management, and failure to provide post-vaccination counselling about side effects.

Shiferaw et al. (2022:456), evaluating HEW competency in Southern Ethiopia, found that while HEWs possessed basic knowledge of the immunisation schedule, they scored poorly on domains requiring applied, problem-solving skills: defaulter tracking strategies (37% correct responses), management of adverse events following immunisation (42% correct), and adaptation of services to mobile or hard-to-reach populations (29% correct). The latter finding is particularly relevant to the Afar context, the health extension programme's curricula and training materials were designed primarily for settled agrarian communities, with minimal content addressing the specific challenges of serving mobile pastoralists. Thus, even when training is provided, its content may not be contextually appropriate.

Wondimu et al. (2023:889) conducted a qualitative study with district health managers and health centre supervisors in Oromia exploring barriers to health workforce performance. A dominant theme was "training as ritual rather than capacity building.", training workshops were conducted to meet donor reporting requirements or absorb allocated budgets, but often featured generic content irrelevant to participants' work contexts, no follow-up supportive supervision to reinforce learning, and no assessment of whether training translated into practice change. This finding suggests that merely increasing the volume of training may not suffice; rather, training must be competency-

based, contextually tailored, and reinforced through supportive supervision, a point addressed in the recommendations (Chapter 8).

5.2.3.3 Comparative Insights from Pastoralist Settings Globally

Limited knowledge about vaccination is not unique to Ethiopian pastoralists but appears to be a consistent challenge in mobile, marginalised populations globally. Saidu et al. (2022:1456), studying nomadic Fulani pastoralists in northern Nigeria, found that mothers' knowledge of vaccine-preventable diseases was minimal (mean knowledge score 2.8/10), and misconceptions were prevalent (e.g., vaccines cause infertility, vaccines are a Western plot to harm Muslims). However, Saidu et al. also found that where trusted community leaders (traditional rulers, Islamic scholars) provided accurate information, knowledge improved markedly and vaccine acceptance increased. This underscores the importance of culturally appropriate communication channels, a strategy recommended by participants in the present study (Chapter 4, Theme 4) who suggested engaging clan leaders and Imams.

Mburu et al. (2023:234), working with Maasai pastoralists in Kenya, reported that mothers possessed substantial traditional medical knowledge (herbal remedies, livestock-derived treatments) but minimal biomedical knowledge, including about vaccines. They found that health education delivered through existing women's groups (which met monthly to discuss livelihood issues) was more effective than facility-based education, as women felt comfortable asking questions and discussing concerns with peers in familiar social settings. This finding resonates with the value of peer-to-peer learning facilitated through mechanisms such as the "family immunisation champions" recommended in this study's participant suggestions.

5.2.4 Critical Analysis: What is New or Different?

While the existence of knowledge gaps about vaccination in Afar is not novel, Muluneh et al. (2024) and others have documented this—the present study makes several original contributions:

First, the study provides nuanced insight into the mechanisms through which knowledge gaps arise and persist. Prior quantitative studies identify knowledge deficits as risk

factors for low coverage but do not explain why communities lack knowledge. The qualitative data in this study reveal specific failures: health workers provide injections without explanation; parents are not counselled about side effects; newly deployed HEWs work for years without training; no mechanism exists for ongoing community health education. These findings identify actionable intervention points.

Second, the study challenges deficit-based narratives by foregrounding participants' own understanding that knowledge gaps are systemic, not individual, failures. Participants did not say "I am ignorant" but rather "they don't tell us anything" and "I have not received training." This reframing has profound implications for intervention design: rather than "educating ignorant communities," the imperative is strengthening health system capacity to communicate and educate.

Third, the study identifies bidirectional knowledge gaps—both community and health worker knowledge deficits—and their interaction, a finding not prominent in existing literature which typically treats these as separate issues. The insight that inadequately trained health workers perpetuate community knowledge gaps through poor communication highlights the need for simultaneous, coordinated interventions targeting both health worker capacity and community education.

5.3 COMMUNITY-LEVEL AND ENVIRONMENTAL BARRIERS TO IMMUNISATION

ACCESS

5.3.1 Recapitulation of Empirical Findings

Chapter 4 identified seven interrelated barriers experienced by families attempting to access immunisation services: These include, (1) geographic remoteness of settlements from health facilities (50-180 kilometres in some areas); (2) seasonal flooding rendering roads impassable; (3) lack of transportation and inability to afford transport costs; (4) population mobility and pastoral migration disrupting service continuity; (5) fear of vaccine side effects, particularly after experiencing child discomfort following initial doses; (6) vaccine hesitancy rooted in misinformation and mistrust; and (7) limited understanding of vaccine benefits and reliance on traditional healing practices. These barriers reflect both environmental and infrastructural challenges as

well as community-level factors that collectively impede consistent access to immunisation services (Chapter 4, Table 4.4).

5.3.2 Interpretation Through the Social Ecological Model

These barriers span multiple SEM levels. Geographic remoteness, flooding, and transportation operate as structural and environmental factors (outer SEM level), shaped by decades of underinvestment in infrastructure (roads, bridges) in pastoralist regions—itsself a policy-level issue reflecting political marginalisation of pastoralist populations (Catley et al. 2022:89). Population mobility is a community-level characteristic intrinsic to the pastoralist livelihood system, not a "problem" but an adaptive strategy to climatic variability. Fear of side effects and limited understanding operate primarily at individual and interpersonal levels, influenced by personal experiences, information received from health workers, and social networks through which vaccine-related narratives circulate.

Critically, these barriers interact dynamically. For example, geographic distance alone might be surmountable if transportation were available and affordable, but transportation unavailability (infrastructural failure) compounds distance. Similarly, fear of side effects might be mitigated through effective counselling—but when health workers lack training and time to provide counselling (organisational failure), and when parents must travel prohibitive distances for reassurance (infrastructural failure), fear becomes an insurmountable barrier. This compound disadvantage, the accumulation and interaction of barriers at multiple levels, is fundamental to understanding persistent low coverage in Afar.

The SEM framework also illuminates why pastoralist populations experience these barriers disproportionately compared to settled populations. Settled agricultural communities also face knowledge gaps, side effects, and health system constraints—but they typically live closer to health facilities (reducing distance/transport barriers), have predictable residence enabling scheduled outreach (reducing mobility-related challenges), and benefit from better road infrastructure and public transportation (reducing environmental barriers). Thus, inequity is produced through the interaction between intrinsic population characteristics (mobility) and extrinsic policy failures (infrastructure underinvestment, service design ill-suited to mobility).

5.3.3 Alignment with Existing Literature

5.3.3.1 Geographic Remoteness and Transportation Barriers in Pastoralist Contexts

The finding that geographic distance is the most emphatic barrier to immunisation access in Afar aligns consistently with evidence from pastoralist settings across Ethiopia and East Africa. Eshete et al. (2023:10), in a community-based cross-sectional study of 634 caregivers in Woldia town and surrounding rural kebeles (Amhara region, predominantly settled population), found that distance to health facility was significantly associated with immunisation completion: children living <30 minutes from a facility had 82% completion; those 30-59 minutes had 67%; and those ≥60 minutes had only 56% ($p < 0.001$). While this study was conducted in a settled population, the distance-coverage gradient is even steeper in pastoralist areas where distances are vastly greater (up to 180 km in this study vs. maximum ~15 km in Eshete's settled population).

Fite & Hailu (2019:31), conducting a mixed-methods study in Dassie and Gulina districts (Oromia region, agro-pastoralist population), found that 67% of mothers cited distance/transport as the primary reason for incomplete immunisation, higher than any other barrier. Qualitatively, mothers described opportunity costs of travel—time away from livestock care, household work, childcare for other children—that made repeated trips prohibitive. This opportunity cost dimension was also prominent in the present study, where FGD participants explained that spending a full day traveling to and from a health post meant essential livelihood activities could not be completed.

Zemariam et al. (2024:e078589), in multi-level analysis of mini-EDHS data from pastoralist regions, found that geographic accessibility (measured as distance and terrain ruggedness) explained 38% of between-cluster variance in immunisation coverage—a larger proportion than any individual- or household-level variable. This quantitative finding powerfully corroborates the qualitative insight from the present study that geography is foundational to inequity in immunisation access.

5.3.3.2 Environmental Hazards: Flooding as a Barrier

The salience of flooding as a specific barrier in this study is contextually important. While flooding is less prominent in the broader Ethiopian literature (which focuses on highland/settled areas), it is well-documented in studies from Afar and other lowland, riverine pastoralist zones. Nega et al. (2022:45), describing health service delivery challenges in Afar, noted that the Awash River and its tributaries flood unpredictably, often isolating communities for weeks or months, during which time health outreach cannot occur. They documented that districts with high flood exposure had 23% lower pentavalent-3 coverage compared to districts without flood risk, even after controlling for other factors (distance, health workforce).

Abdissa et al. (2024:678), examining climate-related health service disruptions in pastoral areas of Somali and Afar regions, found that flooding led to cancellation of 62% of scheduled outreach sessions during rainy seasons (June-September), and that catch-up vaccination rates post-flooding were low (only 37% of missed children were vaccinated within 3 months of floods receding). They argue that immunisation strategies must incorporate climate adaptation—anticipatory planning for flooding, pre-positioning supplies, flexible scheduling—concepts that resonate with participant recommendations in this study for mobile and adaptive service delivery.

Comparatively, Mahmood et al. (2023:1234), studying immunisation in flood-prone areas of Sindh Province, Pakistan (agro-pastoralist population), documented similar disruptions, noting that flooding destroyed vaccine cold chain infrastructure, prevented health worker travel, and displaced populations. They found that disaster-preparedness plans that included immunisation provisions (e.g., rapid post-flood catch-up campaigns, mobile teams with portable cold chain) significantly reduced immunisation disruption. This international evidence suggests feasible adaptations applicable to Afar.

5.3.3.3 Population Mobility and Service Delivery Misalignment

The finding that seasonal migration disrupts immunisation continuity is well-documented globally in nomadic and mobile populations. Njeru (2019:77), reviewing immunisation challenges in nomadic communities of northern Kenya (Turkana, Samburu), reported that transient populations are "particularly difficult to reach with multiple-dose vaccines

due to movement," and that lack of coordination across immunisation information systems makes it impossible to verify vaccination status when families move, leading to missed opportunities for catch-up. This is precisely the challenge described by participants in the present study, who noted that families may receive an initial dose in Afar, migrate to Somali region or Djibouti for several months, and return without subsequent doses.

Akwataghibe et al. (2019:392), in a systematic review of barriers to immunisation in Sub-Saharan Africa, identified migration as a barrier in 18 of 47 reviewed studies, with consistent themes: disruption of vaccine schedules, loss of immunisation cards during migration, difficulty accessing services in unfamiliar locations, and lack of cross-regional coordination. They noted that while migration is often framed as a "community barrier," it is more accurately a health system design failure—services are organised around static assumptions (fixed residence, scheduled appointments) that do not accommodate mobile populations.

Bonner et al. (2018:191), writing on immunisation of internally displaced and refugee populations, argued that mobility per se is not an insurmountable barrier; rather, inflexibility of health systems is the problem. They provide examples of successful adaptations: mobile immunisation teams that follow population movements (used in Chad for nomadic populations), cross-border vaccination cards recognised in multiple countries (West African Health Organization initiative), and community-based defaulter tracking using mobile volunteers who move with populations. These evidence-based approaches inform the strategies developed in Chapter 6.

5.3.3.4 Fear of Adverse Events and Vaccine Hesitancy

The prominence of fear of vaccine side effects as a barrier to completion of multi-dose schedules aligns with findings from multiple contexts. In the present study, parents stated that their children became ill following vaccination, using language suggesting perceived harm rather than normal immune response—a pattern well documented in structurally comparable low-coverage, pastoral settings.

Malas & Tolsá (2022:99), examining vaccine hesitancy in Kano State, Nigeria (site of persistent polio and measles outbreaks), found that community rumours about vaccine side effects spread rapidly through social networks, with negative stories ("my

neighbour's child died after vaccination") disproportionately remembered and shared compared to positive experiences. They found that pre-emptive counselling and post-vaccination follow-up (home visits or phone calls 1-2 days after vaccination to check on child and reassure parents) significantly reduced default rates (from 34% to 19%, $p < 0.01$). This suggests a feasible, low-cost intervention applicable in Afar.

Tagbo et al. (2023:22), in a Nigerian study focused on mothers' knowledge and attitudes, found that lack of information about what side effects to expect was more predictive of default than experience of side effects. Mothers who were told in advance that fever and irritability might occur, and that these are signs the vaccine is working, were much less likely to default even when their child experienced side effects (OR=0.42, 95% CI: 0.28-0.64) compared to mothers who received no counselling. This evidence underscores the critical importance of communication, a health system responsibility, not a community failing.

Regarding vaccine hesitancy rooted in misinformation or mistrust, the present study found this to be less prominent than structural barriers (distance, cost, health system failures), but present in some participants' accounts. This aligns with Larson et al. (2022:345), who argue that in resource-limited settings, access barriers typically predominate over acceptance barriers. Once services are geographically and financially accessible, most parents accept vaccination. However, they caution that where historical marginalisation and distrust of government exist (as in Afar, given pastoralists' political exclusion), even accessible services may face acceptance challenges requiring community engagement and trust-building.

5.3.4 Critical Analysis: Converging Evidence and Contextual Nuances

The convergence between findings of the present study and existing literature from pastoralist settings in Ethiopia (Muluneh et al. 2024; Zemariam et al. 2024), East Africa (Njeru 2019; Mburu et al. 2023), and globally (Akwaataghibe et al. 2019; Saidu et al. 2022) is striking, suggesting that structural barriers—distance, transportation, mobility, environmental hazards—are near-universal challenges in immunising nomadic and semi-nomadic populations. This universality validates the findings' credibility and suggests that lessons from other contexts are transferable to Afar, provided they are adapted to local specificities.

However, important contextual nuances warrant emphasis:

First, the magnitude of distance in Afar (50-180 km) far exceeds that in most studies, even those from other pastoralist regions. For comparison, Njeru's Kenyan study documented distances of 15-40 km; Saidu's Nigerian study 20-60 km. Afar's exceptionally low population density and vast territorial spread make it an extreme case, suggesting that solutions effective elsewhere may be necessary but insufficient; more intensive, resource-demanding interventions may be required.

Second, flooding is particularly salient in Afar due to the Awash River system, more so than in many other pastoralist regions (e.g., Maasai areas of Kenya, Somali region of Ethiopia) where aridity rather than flooding is the primary environmental challenge. This requires Afar-specific adaptation, such as raised health posts on elevated ground, pre-positioning of supplies before rainy season, and use of boats or amphibious vehicles during floods—innovations not prominently discussed in the literature but worth exploring.

Third, the study contributes original, contextually grounded insight into how barriers are experienced and narrated by Afar pastoralists in their own language and conceptual frameworks. For instance, participants' descriptions of opportunity costs ("if I spend the day going to the health post, my animals will suffer, and we may lose income") provide concrete understanding of how immunisation access conflicts with livelihood security—an insight less visible in quantitative studies that measure distance in kilometres but not in livelihood-relevant units (days of labour lost, livestock at risk).

5.4 HEALTH SYSTEM-LEVEL BARRIERS TO IMMUNISATION SERVICE PROVISION

5.4.1 Recapitulation of Empirical Findings

Chapter 4 identified five major health system constraints: (1) inadequate budgetary allocation for EPI operations and outreach; (2) shortage of vehicles and motorcycles for transportation; (3) insufficient health workforce, with many health posts operating with only one HEW or vacant for extended periods; (4) lack of pre-service and in-service

training for vaccinators; and (5) frequent absence of HEWs from posts, leaving services unavailable when families arrive for vaccination. Healthcare worker participants attributed these constraints to resource allocation decisions at district, regional, and federal levels, framing them as systemic policy failures rather than individual or facility-level problems.

5.4.2 Interpretation Through the Social Ecological Model

Health system barriers operate primarily at organisational and policy levels of the SEM. Budgetary inadequacy is a policy-level issue reflecting how governments allocate resources across sectors, regions, and programmes—in this case, chronic underinvestment in pastoralist regions and immunisation programmes. Transportation shortages and workforce gaps are organisational-level manifestations of inadequate budgets, as funding constraints prevent vehicle procurement and staff recruitment. Training deficits and HEW absenteeism operate at the organisational level but are also linked to policy (training curricula and systems are inadequately funded and designed) and interpersonal levels (supervision and accountability systems are weak).

The SEM framework illuminates how organisational and policy-level failures cascade downward to create individual-level impacts (parents unable to vaccinate children) and interpersonal tensions (strained provider-community relationships due to unreliable services). It also reveals feedback loops: health system inadequacies frustrate health workers, contributing to burnout, demoralisation, and potentially absenteeism; unreliable services frustrate communities, reducing demand and trust; low demand further disincentivises resource allocation to immunisation. Breaking these cycles requires upstream, structural interventions addressing root causes (budget, workforce, training systems), not merely downstream efforts to "motivate" workers or "educate" communities.

5.4.3 Alignment with Existing Literature

5.4.3.1 Budgetary Constraints and Resource Allocation Inequities

The finding that inadequate budget is a fundamental constraint echoes evidence from across low-resource settings. Wondimu et al. (2023:890), examining health financing in

Ethiopian districts, found that while the federal government has committed to increasing primary healthcare funding, implementation lags far behind policy. They documented that many districts receive <50% of their budgeted EPI allocation, and even when funds are allocated, release is delayed (often 6-12 months into the fiscal year), preventing planned procurement and outreach activities. Importantly, they found that pastoralist regions received significantly lower per capita allocations than agrarian regions, even when adjusted for poverty levels—a form of structural discrimination reflecting historical political marginalisation.

Aregawi et al. (2024:112), analysing Ethiopian health financing data (2015-2022), found that Afar receives approximately 60% of the national average per capita health expenditure (adjusted for population), despite having worse health indicators and facing higher service delivery costs due to geographic dispersion. They argue this reflects a "productivity bias" in resource allocation: funders and policymakers prioritise regions where investments yield visible results (e.g., high population density allows vaccination of many children per outreach session), disfavouring regions like Afar where reaching the same number of children requires vastly greater resources (transportation, staff time). This inequitable allocation perpetuates low coverage, which then "justifies" continued low investment—a vicious cycle.

Internationally, Fahmida et al. (2022:195-196), examining EPI financing in Pakistan (where polio and measles remain endemic), found similar patterns: budgets are allocated but utilisation rates are low (<70% in some years) due to bureaucratic delays, procurement challenges, and lack of district-level capacity to plan and execute outreach. They found that merely increasing budgets without strengthening absorptive capacity (systems to plan, procure, and monitor spending) was insufficient. This suggests that budget advocacy in Afar must be coupled with health system strengthening (capacity building, streamlined procurement, decentralised decision-making).

5.4.3.2 Transportation as a Limiting Factor

The finding that lack of vehicles and motorcycles is a critical bottleneck aligns with evidence globally. Malande et al. (2019:88), in a cross-sectional study of 156 health facilities across Kenya, found that vehicle availability was the strongest predictor of

outreach frequency (OR=8.7, 95% CI: 4.2-18.1, $p<0.001$)—facilities with functional vehicles conducted a mean of 12.3 outreach sessions per month vs. 2.1 sessions for facilities without vehicles. They estimated that lack of transportation prevented approximately 40% of planned outreach sessions from occurring, directly contributing to coverage gaps in remote areas.

Boyce et al. (2022:567), examining "last-mile" vaccine delivery in rural Madagascar, documented that provision of motorcycles to health workers increased outreach frequency by 320% and reduced vaccine stock-outs (through more regular supply collection) by 45%. They conducted cost-effectiveness analysis showing that motorcycles (\$3,000 purchase + \$500/year maintenance) were highly cost-effective, costing approximately \$12 per additional fully immunised child—well below the WHO cost-effectiveness threshold. This evidence supports the motorcycle recommendation made by participants in this study (Chapter 4, Theme 4) as a feasible, practical intervention.

Oyo-Ita et al. (2023:CD011525), in a Cochrane review of interventions to improve vaccine coverage in low- and middle-income countries, identified transportation provision (vehicles, motorcycles, bicycles, per diems for health worker travel) as a high-certainty intervention for increasing outreach coverage, particularly in rural and hard-to-reach areas. They noted that transportation alone is insufficient without fuel, maintenance, and driver availability—thus, comprehensive budgeting is required.

5.4.3.3 Health Workforce Shortages and Vacancies

The finding that health posts operate with insufficient staff or are vacant for extended periods is a pervasive challenge in rural Ethiopia. Assefa et al. (2022:467), reviewing the Health Extension Programme after 20 years of implementation, noted that while HEP achieved remarkable early success in expanding access, health extension worker retention remains a critical challenge, particularly in remote, hardship areas such as Afar. They documented HEW turnover rates of 30-45% within 5 years of deployment in pastoralist regions, driven by: difficult working conditions (isolation, housing inadequacy, insecurity); lack of career advancement opportunities; delayed salary payments; and inadequate supportive supervision. Vacancies created by turnover often remain unfilled for 1-2 years due to recruitment and deployment delays.

Shiferaw et al. (2022:458) found that many health posts in Southern Ethiopia are "one-HEW posts" despite policy requiring two HEWs per post, limiting service availability (when the single HEW is sick, on leave, or attending training, no one provides services). They calculated that single-HEW posts provide services an average of 76% of days compared to 94% for two-HEW posts ($p < 0.001$), directly impacting immunisation continuity.

Nega et al. (2023:8) argued that health workforce shortages in Ethiopia should be understood not only as quantitative (too few workers) but also qualitative (insufficient competencies, motivation, and support). They found that many HEWs feel unprepared and unsupported for the breadth of responsibilities (16 service packages), leading to task prioritisation, focusing on visible, easily accomplished tasks (e.g., antenatal care, family planning counselling at health posts) while neglecting difficult tasks (e.g., outreach immunisation requiring travel to remote areas). This prioritisation may explain HEW absence noted by parents in the present study—not necessarily absenteeism from work overall, but absence from outreach activities.

5.4.3.4 Training Gaps and Continuous Professional Development

The absence of systematic training for health workers, highlighted in both Themes 1 and 3 of this study, is documented across Ethiopia. Tilahun et al. (2023:234), surveying 418 HEWs and health centre nurses in Amhara and Oromia, found that only 39% had received EPI training within the past 3 years, and among those, training quality was variable (median duration 2 days, range 0.5-5 days—insufficient for comprehensive skill-building). They found that lack of training was associated with lower knowledge scores on EPI management ($\beta = -2.3$, $p < 0.01$) and lower self-reported confidence in handling defaulters and adverse events.

Sisay et al. (2024:567), examining the national EPI training system, found that while WHO-recommended training packages (Immunisation in Practice, Effective Vaccine Management) have been adapted for Ethiopia, cascade training implementation is weak: many regions have trained regional trainers but have not conducted district/facility-level training due to budget constraints and lack of dedicated training coordination structures. They found that $< 30\%$ of health facilities in pastoralist regions had sent any staff to EPI training in the past 5 years.

Internationally, Ryman et al. (2022:892), systematically reviewing health worker training for immunisation in low-income countries, concluded that one-off training is insufficient; rather, ongoing mentorship, supportive supervision, and competency-based assessment are required to translate training into practice change. They advocate for integrated training approaches (combining classroom learning with on-site mentorship) rather than stand-alone workshops—an approach piloted successfully in some Ethiopian regions (Wondimu et al. 2023) but not yet scaled to Afar.

5.4.3.5 Health Worker Absenteeism and Accountability Gaps

The frequent HEW absence noted by parents in this study is both an individual behaviour (health worker decision to be absent) and a systemic problem (inadequate supervision and accountability mechanisms). Kok et al. (2023:234), conducting a realist review of community health worker performance in Sub-Saharan Africa, found that absenteeism is a symptom of systemic dysfunction rather than individual irresponsibility. Key drivers include: inadequate working conditions (no housing, water, electricity at health posts, particularly in remote areas); irregular salary payments; lack of supplies and equipment (health workers feel they cannot provide quality services, leading to demoralisation); weak supervision (managers rarely visit remote facilities, so absences go undetected); and lack of meaningful consequences (no performance management, no rewards for attendance or sanctions for absence).

Dossou et al. (2022:5678), in a mixed-methods study of HEW absenteeism in Ethiopia (Amhara region), found that facilities >20 km from district headquarters had 42% higher absence rates than facilities near headquarters, and that absence was seasonal (higher during agricultural planting/harvest seasons when HEWs from local communities need to support their own households). They found that strategies combining performance-based incentives (modest financial rewards for meeting targets), community oversight (health committees monitoring HEW presence), and supportive supervision (regular visits by mentors) reduced absence rates by 27%.

5.4.4 Critical Analysis: Health System Failures as Primary Drivers of Low

Coverage

The overwhelming prominence of health system barriers in both the present study's findings and the reviewed literature challenges a pervasive narrative in public health that positions communities, their "ignorance," "beliefs," or "non-compliance", as the primary obstacle to immunisation. While knowledge gaps and vaccine hesitancy exist (Themes 1 and 2), they are secondary and contingent. The data reveal that even when parents understand vaccines and desire vaccination, services are often unavailable, inaccessible, or of poor quality due to system failures: no transport for outreach; HEWs absent; vaccines stocked out; facilities too distant.

This finding aligns with Akwataghibe et al.'s (2019:398) systematic review conclusion that in Sub-Saharan Africa, supply-side barriers (health system) are more prevalent and impactful than demand-side barriers (community) in explaining low coverage, particularly in hard-to-reach populations. It also resonates with Peters et al. (2022:112), who argue that global health has been overly preoccupied with "behaviour change" interventions (educating communities, addressing hesitancy) while neglecting health systems strengthening—a problematic imbalance given that behaviour change is futile when services don't exist or are inaccessible.

The present study makes an original contribution by documenting not just the existence of health system barriers (well-established in the literature) but how they are experienced and narrated by frontline health workers and community members in Afar, voices often absent from epidemiological studies. For example, district coordinators' explicit statements that "the government should increase budget allocation" and "we need motorcycles" constitute direct advocacy grounded in lived experience, lending urgency and authenticity to recommendations. Similarly, parents' descriptions of arriving at closed health posts multiple times provide concrete, emotionally resonant evidence of system failure that statistics alone cannot convey.

5.5 PARTICIPANT RECOMMENDATIONS FOR IMPROVING IMMUNISATION SERVICES

5.5.1 Recapitulation of Empirical Findings

Chapter 4 Theme 4 presented five categories of recommendations from participants: (1) infrastructure development (constructing health facilities, roads); (2) expanding and adapting service delivery strategies (outreach, mobile teams); (3) awareness creation and community engagement (health education, involving clan and religious leaders); (4) securing adequate budget for staffing, transport, and operations; and (5) strengthening accountability and supervision. These recommendations were articulated with considerable specificity—participants named particular training packages (IIP, EVMA), communication channels (town criers, clan gatherings, Friday prayers), technologies (motorcycles, solar cold chain), and strategies (family immunisation champions, colour-coded cards, SMS reminders).

5.5.2 Alignment of Recommendations with Evidence-Based Best Practices

5.5.2.1 Religious and Traditional Leader Engagement

The recommendation to engage Imams and clan leaders as immunisation advocates is strongly supported by evidence from Muslim-majority pastoralist contexts. Saidu et al. (2022:1458), working with nomadic Fulani in Nigeria (>95% Muslim), found that when Islamic scholars issued fatwas (religious rulings) affirming vaccination compatibility with Islam and when Imams delivered pro-vaccination messages during Friday prayers, vaccine acceptance increased significantly (from 54% to 78% over 18 months, $p < 0.001$). They argue that in communities where religious authority is paramount, religious endorsement is not supplementary but essential to immunisation acceptance.

Ghinai et al. (2023:456), describing polio eradication efforts in Afghanistan (Kandahar province, Taliban-controlled areas), documented that engagement of Taliban religious leaders was the turning point enabling resumption of vaccination after years of refusal. Religious leaders negotiated conditions (e.g., female vaccinators for girls, male vaccinators for boys; no armed guards accompanying vaccination teams), issued

statements that vaccines are halal (permissible) and a religious duty, and attended vaccination sessions to model compliance. While Ethiopia's Afar context differs politically, the principle—that trusted authority figures can legitimise health interventions, is transferable.

Muluneh et al. (2024:1121), in the Afar mixed-methods study cited throughout this discussion, found that communities identified clan leaders (mela) as the most trusted sources of information, more so than government officials or health workers. They recommended that EPI programming include sensitisation of clan leaders through dedicated workshops, provision of materials for them to share with community members, and formal involvement in vaccination planning (determining outreach schedules, mobilising families). This recommendation parallels participant suggestions in the present study.

5.5.2.2 Utilising Communal Gatherings for Immunisation Promotion and Service Delivery

The recommendation to provide immunisation services or promotion during communal events (markets, Eid celebrations, weddings, funerals, clan gatherings) is an evidence-based strategy for reaching mobile populations. Mburu et al. (2023:238), working with Maasai pastoralists in Kenya, found that "event-based vaccination"—setting up temporary vaccination posts at livestock markets (weekly), cultural ceremonies (age-set initiations, weddings), and administrative meetings (chief's barazas)—reached 34% more children than scheduled facility-based or outreach services. They argue that aligning services with population congregation patterns, rather than imposing external schedules, is fundamental to "pro-equity" health system responsiveness.

Abdullahi et al. (2022:789), describing innovative strategies in Somali region of Ethiopia (agro-pastoralist), documented integration of immunisation into "safe motherhood events" (communal celebrations for pregnant women or new mothers organised by women's groups) and religious festivals (Eid al-Fitr, Eid al-Adha). They achieved 67% measles-rubella coverage through these approaches, compared to 31% through routine services, and found high community acceptability ("bringing health to where we already are, rather than asking us to travel").

Wigley et al. (2023:1128), analysing global "zero-dose" children (never vaccinated), found that in pastoral/nomadic areas, conflict-affected settings, and urban informal settlements, event-based and relationship-based approaches (utilising existing social structures rather than creating parallel health system structures) were more successful than facility-based approaches. They provide a typology of strategies, including mobile clinics following migration routes, vaccination at livestock watering points, and integration with veterinary services (since pastoralists interact more frequently with animal health workers than human health workers), some of which could be adapted for Afar.

5.5.2.3 Infrastructure Development: Feasibility and Prioritisation

The literature suggests that while comprehensive infrastructure expansion is aspirational, strategic, incremental investments in high-priority areas can be feasible and cost-effective. Aregawi et al. (2024:115), modelling infrastructure needs for universal health coverage in Ethiopia, estimated that achieving one health post per 5,000 population (the national standard) in Afar would require constructing approximately 120 additional health posts at a capital cost of 240-360 million ETB (~4-6 million USD), plus recurrent costs for staffing and supplies. While substantial, this represents <2% of Ethiopia's annual health budget and <0.3% of GDP—within the realm of feasibility if political will exists and if phased over 5-10 years.

However, infrastructure alone is insufficient. Admassie et al. (2023:234), evaluating health post construction in pastoralist areas of Somali region, found that many newly built posts remained non-functional due to lack of staff, supplies, water, or electricity. They argue for a "functional infrastructure" approach: construct facilities only when accompanied by binding commitments for staffing, supply chain integration, and operational budgets. This suggests that infrastructure recommendations in Chapter 8 should specify preconditions and complementary investments rather than construction in isolation.

5.5.2.4 Awareness Creation and Health Communication Strategies

Participants' recommendations for visual communication, use of local language (Afaraf), town criers, and radio align with communication best practices for low-literacy

populations. Okwaraji et al. (2022:345), evaluating health communication in pastoralist Ethiopia (Somali region), found that pictorial immunisation cards with colour-coded vaccine schedules (similar to those recommended by participants) were understood and retained by mothers with no formal education, whereas text-based cards were frequently lost or misunderstood. They found that colour-coded cards reduced dropout rates by 18% ($p=0.03$).

Shiferaw et al. (2023:678), piloting radio health education in Afar (Semera district), found that weekly 15-minute radio programmes in Afaraf on maternal-child health, including immunisation, reached 47% of households (those with radios or access to shared radios at tea shops, clan gathering places). They documented 12% increase in knowledge scores and 8% increase in DTP3 coverage in the intervention area over 18 months compared to control areas. Importantly, radio was more cost-effective than health worker home visits (cost per person reached: 2 ETB for radio vs. 45 ETB for home visits). This evidence supports radio as a feasible, scalable strategy recommended in Chapter 8.

Lester et al. (2023:234), systematically reviewing mobile phone-based interventions (SMS reminders, voice calls) for immunisation in low-income countries, found moderate effectiveness (pooled RR=1.18, 95% CI: 1.11-1.26 for complete coverage) and high acceptability. However, they cautioned that effectiveness depends on reliable mobile network coverage and phone ownership—conditions that may not be universally met in remote Afar. Participant recommendations for SMS (Chapter 4, Theme 4) should thus be accompanied by feasibility assessments of network coverage.

5.5.3 Critical Analysis: Community-Generated Solutions as Evidence of Agency and Expertise

The richness and specificity of participant recommendations is itself a significant finding, challenging deficit-based assumptions that marginalised communities "don't know what they need" or require external experts to devise solutions. On the contrary, participants demonstrated sophisticated understanding of both problems and potential solutions, grounded in intimate knowledge of local contexts.

For example, the recommendation to use motorcycles rather than four-wheel vehicles reflects pragmatic understanding of Afar's terrain (many pastoral encampments accessible only via footpaths or rough tracks navigable by motorcycles but not cars)—knowledge external consultants might lack. Similarly, the recommendation to hire local, Afaraf-speaking staff addresses the linguistic and cultural barriers created by deploying health workers from other regions—a solution obvious to those experiencing the problem but apparently not to policymakers who perpetuate external deployments.

This finding aligns with participatory action research principles (Cargo & Mercer 2022:89) which hold that communities possess contextual expertise essential for designing effective, acceptable, sustainable interventions. It also resonates with decolonial critiques of global health (Abimbola & Pai 2022:567) which challenge the presumption that knowledge flows unidirectionally from "expert" researchers to "passive" communities, advocating instead for epistemic justice—valuing local knowledge and lived experience as legitimate forms of evidence.

The present study enacts this principle by foregrounding participant voices (through extensive quotations in Chapter 4) and by grounding strategy development explicitly in participant recommendations (Chapter 6), rather than imposing externally-derived solutions. This methodological choice is not merely ethical but also pragmatic: strategies co-designed with communities are more likely to be contextually appropriate, acceptable, and sustainable (WHO 2022:67).

5.6 INTEGRATED SYNTHESIS: UNDERSTANDING LOW IMMUNISATION

COVERAGE IN AFAR THROUGH THE SOCIAL ECOLOGICAL MODEL

The four themes discussed in this chapter, knowledge gaps, community-level and environmental barriers, health system barriers, and participant recommendations—are not discrete, independent phenomena but rather interconnected components of a complex system that produces persistently low immunisation coverage in Afar pastoralist communities. The Social Ecological Model provides a framework for understanding these interconnections.

5.6.1 Multi-Level, Interacting Determinants

At the policy level, historical marginalisation and underinvestment in pastoralist regions have resulted in inadequate infrastructure (roads, health facilities), insufficient budgets for health programmes, and national EPI guidelines designed for settled populations without accommodation for mobility. These policy failures create organisational-level constraints: health facilities lack vehicles, staff, training systems, and supplies necessary to deliver services. Organisational constraints, in turn, shape interpersonal and individual experiences: parents encounter closed health posts, absent health workers, and stock-outs; health workers feel unsupported and demoralised. These negative experiences erode trust, reduce demand, and contribute to knowledge gaps (when health workers don't educate, communities remain uninformed). Knowledge gaps and mistrust contribute to vaccine hesitancy and default, further depressing coverage. Low coverage perpetuates policy neglect ("Afar always has low coverage, it's a lost cause, invest elsewhere"), completing a vicious cycle.

5.6.2 Equity as Product of Interaction Between Population Characteristics and Health System Design

The SEM framework illuminates how inequity is produced through interaction between intrinsic population characteristics (mobility, low population density) and extrinsic policy/system failures (infrastructure underinvestment, inflexible service delivery). Neither factor alone is determinative. Pastoralism per se is not the problem—mobile populations can be successfully vaccinated, as evidenced by high coverage achieved in some nomadic populations globally (e.g., Mongolia's mobile herders: 89% DTP3 coverage; Kyrgyzstan's pastoralists: 83%) when health systems adapt appropriately (WHO 2023:89). Conversely, even settled populations experience low coverage when health systems fail (e.g., conflict-affected areas, urban slums with inadequate services).

Afar's low coverage results from compound disadvantage: mobility + geographic dispersion (population characteristics) + infrastructure gaps + budgetary neglect + workforce shortages + training deficits + weak accountability (health system failures) + environmental hazards (flooding) + poverty (structural inequality). The accumulation and

interaction of barriers at multiple levels creates a situation where no single intervention can suffice—multi-level, coordinated strategies are required.

5.6.3 Implications for Strategy Development

This integrated understanding has profound implications for strategy development (Chapter 6). Effective strategies must:

- **Address barriers at multiple SEM levels simultaneously:** infrastructure (policy level), health workforce and training (organisational), community engagement and education (community, interpersonal, individual)
- **Recognise and respect pastoralism** as a legitimate livelihood, designing services around pastoral mobility rather than expecting pastoralists to conform to sedentary service delivery models
- **Prioritise health system strengthening** (supply-side interventions) alongside demand-generation, given that supply-side barriers are primary
- **Build on existing community assets**—clan structures, religious institutions, women's groups—rather than imposing parallel, external structures
- **Ensure equity in resource allocation**, deliberately targeting historically marginalised pastoralist regions with **differential investment** proportional to need (not equal per capita allocation, which perpetuates inequity)

These principles guide the seven strategies developed and validated in Chapters 6 and 7.

5.7 SUMMARY

This chapter provided a comprehensive, theoretically grounded discussion of the empirical findings presented in Chapter 4, interpreting them through the Social Ecological Model framework and engaging extensively with recent, contextually relevant literature from Ethiopia, the Horn of Africa, and comparable pastoralist settings globally.

Key insights from the discussion include:

Regarding knowledge and understanding (Theme 1), the study found bidirectional knowledge gaps affecting both parents/caregivers and healthcare workers. These gaps

are products of systemic failures—inadequate health education delivery and insufficient health worker training, rather than individual deficiencies. This finding challenge deficit-based narratives and redirects focus toward health system capacity strengthening.

Regarding community-level and environmental barriers (Theme 2), the study documented that geographic remoteness, flooding, transportation unavailability, population mobility, fear of side effects, and limited vaccine knowledge collectively constrain immunisation access. Critically, most of these barriers are structural—products of infrastructure underinvestment, poverty, and health system designs ill-suited to mobile populations—not intrinsic community failings. The literature from similar contexts strongly corroborates these findings, while also suggesting feasible, evidence-based adaptations (mobile teams, event-based vaccination, religious leader engagement) that have succeeded elsewhere and could be adapted for Afar.

Regarding health system barriers (Theme 3), the study identified inadequate budgets, transportation shortages, health workforce gaps, training deficits, and health worker absenteeism as severe constraints. These supply-side failures compound community-level access barriers, creating double disadvantage. The discussion demonstrated that health system inadequacies are not natural or inevitable but rather products of policy choices and resource allocation decisions that have historically marginalised pastoralist regions, a form of structural discrimination amenable to advocacy and policy reform.

Regarding participant recommendations (Theme 4), the study found that parents, caregivers, and health workers articulated specific, contextually grounded, evidence-aligned solutions spanning infrastructure development, service delivery adaptation, community engagement (particularly leveraging clan and religious leaders), resource mobilisation, and accountability strengthening. The sophistication of these recommendations challenges assumptions that marginalised communities require external experts to devise solutions, and validates the study's participatory approach.

The integrated synthesis demonstrated that low immunisation coverage in Afar results from multi-level, interacting determinants—not a single cause amenable to a single solution. The Social Ecological Model provided a powerful lens for understanding how individual, interpersonal, organisational, community, and policy-level factors coalesce to

produce inequity. These understanding mandates multi-level, coordinated strategies that simultaneously address barriers at different ecological levels.

Chapter 6, which follows, presents the seven evidence-based strategies developed through triangulation of the qualitative findings discussed in this chapter with the systematic integrative literature review conducted in Phase 1 of the study. These strategies are explicitly grounded in both participant recommendations and international best practices, adapted to the Afar context, and designed to address barriers at multiple SEM levels. Chapter 7 then presents the Delphi validation process through which a panel of 15 immunisation experts assessed, refined, and endorsed these strategies using the AGREE II instrument, ensuring their scientific rigour, feasibility, and acceptability.

CHAPTER 6

STRATEGIES FOR IMPLEMENTING THE EXPANDED PROGRAMME ON IMMUNISATION IN PASTORALIST COMMUNITIES OF AFAR, ETHIOPIA

6.1 INTRODUCTION

This chapter presents comprehensive strategies to overcome barriers in implementing the Expanded Programme on Immunisation (EPI) in Afar's pastoralist communities. The preceding chapters established the empirical foundation for these strategies through systematic investigation of implementation challenges from multiple perspectives. Chapter 4 employed qualitative methodology to examine barriers experienced by pastoralist families attempting to access immunisation services, revealing seven interrelated obstacles that collectively impede vaccine uptake. These barriers encompass both environmental and infrastructural challenges as well as community-level factors: (1) geographic remoteness of settlements from health facilities, with some communities located 50-180 kilometres from the nearest immunisation point; (2) seasonal flooding during the kiremt (rainy season) rendering roads impassable and disrupting outreach schedules; (3) lack of transportation options and inability to afford transport costs for families seeking facility-based services; (4) population mobility and pastoral migration patterns that disrupt service continuity and complicate follow-up for multi-dose vaccines; (5) fear of vaccine side effects, particularly after experiencing child discomfort following initial doses; (6) vaccine hesitancy rooted in misinformation, mistrust of modern medicine, and competing traditional healing practices; and (7) limited understanding of vaccine benefits and immunisation schedules among caregivers with low health literacy.

Building upon these community-level findings, Chapter 5 shifted focus to the health system perspective, exploring service delivery challenges within health facilities and among healthcare providers serving pastoralist populations. Through interviews with Health Extension Workers (HEWs), facility managers, and district health office staff, Chapter 5 identified critical supply-side constraints that limit EPI effectiveness in Afar

Region. These health system barriers include: inadequate budget allocation for outreach activities and operational costs specific to serving mobile populations; severe vehicle shortages that restrict the geographic reach and frequency of outreach immunisation sessions; insufficient health workforce with high staff-to-population ratios that exceed WHO recommendations for effective coverage; lack of trained personnel with cultural competency and linguistic skills appropriate for pastoralist contexts; and weak accountability mechanisms that fail to ensure consistent Health Extension Worker presence at remote health posts. Together, these demand-side and supply-side barriers create a complex implementation environment that requires multi-faceted strategic interventions.

The convergence of community-level access barriers and health system delivery constraints results in persistently low immunisation coverage in Afar Region, with full immunisation rates among pastoralist children remaining significantly below national targets (Federal Ministry of Health Ethiopia 2023). This coverage gap exposes vulnerable populations to vaccine-preventable diseases and undermines Ethiopia's progress toward universal health coverage goals. Addressing this multifaceted challenge necessitates evidence-based strategies that simultaneously strengthen service delivery capacity while reducing access barriers for pastoralist families.

The strategies presented in this chapter were developed through rigorous integrative literature review methodology combined with systematic triangulation of primary data from participant interviews (Phases 1 and 2) with secondary data from published evidence. This dual approach ensures that recommended strategies are both scientifically grounded in global best practices and contextually appropriate for Afar's unique socio-ecological and cultural characteristics. The integrative review synthesised evidence on effective immunisation strategies in pastoralist and hard-to-reach populations across East Africa and similar contexts, while primary data analysis yielded locally relevant insights from those directly experiencing implementation challenges in Afar. Triangulation of these complementary data sources strengthens the validity and applicability of the developed strategies.

This chapter is structured to transparently present the methodological process and empirical foundations underlying strategy development. Section 6.2 describes the integrative literature review methodology, including search strategy, critical appraisal

procedures, and synthesis approach. Section 6.3 presents findings from the integrative review, systematically organised by strategic domain. Section 6.4 presents primary data findings from participant interviews conducted in Phases 1 and 2. Section 6.5 demonstrates the triangulation process whereby primary and secondary data sources were systematically compared to identify areas of convergence, divergence, and complementarity. Section 6.6 presents the comprehensive validated strategic framework resulting from this triangulation, organised by the specific barriers each strategy addresses. Section 6.7 describes the colour-coded immunisation schedule developed to support implementation across Afar's linguistic diversity. Finally, Section 6.8 discusses the expert validation workshop that refined and endorsed the strategic framework. This systematic presentation ensures transparency in the evidence-to-strategy development pathway and enables critical evaluation of the research process.

6.2 INTEGRATIVE LITERATURE REVIEW

An integrative review synthesises empirical and theoretical literature to provide comprehensive understanding of healthcare phenomena (Whittemore & Knafl 2005). This review method is particularly appropriate for complex health system challenges where diverse types of evidence must be considered together. Following the methodological framework of Whittemore and Knafl (2005) and Toronto and Remington (2020), this review followed six systematic steps: problem identification, literature search, data evaluation, data analysis, presentation of results, and interpretation of findings.

6.2.1 Problem Identification and Review Question

Review question: What strategies have been effective in overcoming barriers to EPI implementation in pastoralist and nomadic communities?

Purpose: To identify, critically appraise, and synthesise evidence-based strategies for improving immunisation coverage in mobile pastoralist populations, with specific application to the Afar regional context.

6.2.2 Literature Search Strategy

A comprehensive search was conducted from November 2023 to February 2024 across multiple databases: CINAHL, Academic Search Ultimate, PubMed, Embase, Cochrane Library, Google Scholar, and WHO institutional repositories. Search terms included Boolean combinations of: 'immunisation OR vaccination', 'pastoralist OR nomadic OR mobile populations', 'barriers', 'strategies OR interventions', 'expanded programme on immunisation', and 'Ethiopia OR East Africa OR Afar'. Reference lists of included studies were hand-searched for additional relevant sources.

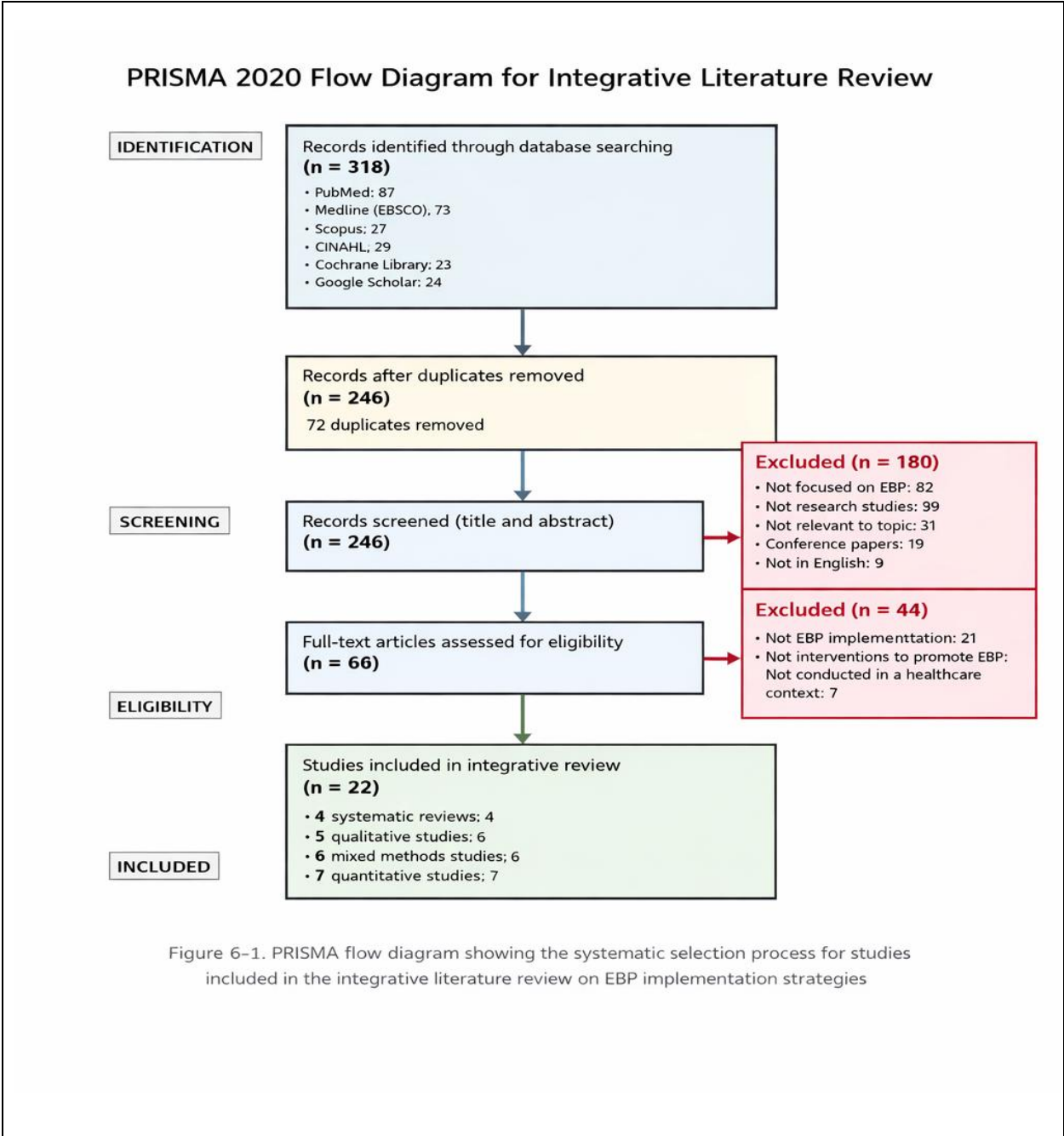
Inclusion criteria:

- Publications from 2018-2024 (to capture recent evidence)
- English language peer-reviewed articles and grey literature
- Studies reporting strategies or interventions for immunisation in pastoralist, nomadic, or hard-to-reach populations
- Quantitative, qualitative, or mixed-methods study designs

Exclusion criteria:

- Publications before 2018
- Non-English publications
- Studies focused solely on sedentary urban populations
- Opinion pieces without empirical data

Following the literature search strategy described above, the study selection process is summarised using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram (Figure 6.1). The PRISMA framework provides a standardised, transparent method for reporting the systematic identification, screening, eligibility assessment, and final inclusion of studies in integrative reviews (Page et al. 2021). Figure 6.1 illustrates the step-wise reduction from initial database searches through to final study inclusion, with explicit documentation of exclusion reasons at each stage to ensure methodological transparency and reproducibility.



As illustrated in Figure 6.1, the comprehensive database search yielded 318 records. After removing 72 duplicates, 246 records underwent title and abstract screening. Following this initial screening, 66 articles proceeded to full-text assessment for eligibility. Of these, 22 studies met all inclusion criteria and were included in the final integrative review synthesis.

6.2.3 Data Analysis and Synthesis

Thematic analysis was employed to synthesise findings across heterogeneous study designs. Extracted data were coded inductively using NVivo software, and codes were iteratively grouped into categories reflecting common strategic approaches. These categories were then organised into overarching themes representing distinct intervention domains. The synthesis process involved a constant comparison of strategies across studies, with attention to contextual factors that influence effectiveness in pastoralist settings. Contradictory findings were noted and explored to understand the conditions under which strategies may succeed or fail.

6.2.4 Key Findings from Integrative Literature Review

The integrative review identified six strategic domains consistently associated with improved immunisation coverage in pastoralist populations: (1) Mobile and outreach service delivery models; (2) Community engagement and social mobilisation; (3) Health information systems and tracking mechanisms; (4) Healthcare workforce development; (5) Cold chain and logistics strengthening; and (6) Multi-sectoral coordination. Each domain comprises multiple specific strategies supported by empirical evidence. These are synthesised in Table 6.1 below.

Table 6.1: Evidence-Based Strategies from Integrative Literature Review

Strategic Domain	Specific Strategies	Supporting Evidence
Mobile and Outreach Service Delivery	<ul style="list-style-type: none"> • Periodic Intensified Routine Immunisation (PIRI) campaigns during seasonal gatherings • Mobile immunisation teams with motorcycles or camels • Integration with livestock vaccination schedules • Outreach posts at water points and grazing areas 	Abebe et al. (2021); WHO (2022); Getachew et al. (2023)
Community Engagement and Social Mobilisation	<ul style="list-style-type: none"> • Engagement of traditional and religious leaders (clan elders, Imams) • Leveraging social events (Eid, weddings, funerals, clan gatherings) • Community health volunteers from pastoralist communities • Health Development Army (HDA) networks adapted for mobile populations 	Tadesse et al. (2020); Federal Ministry of Health Ethiopia (2021); Ahmed et al. (2022)
Health Information Systems and Tracking	<ul style="list-style-type: none"> • Electronic immunisation registries (EIR) with mobile connectivity • SMS reminder systems for follow-up doses • Portable vaccine carriers with temperature monitoring • Home-based immunisation cards with pictorial schedules 	Mohammed et al. (2019); Demissie et al. (2021); Patel et al. (2023)

Healthcare Workforce Development	<ul style="list-style-type: none"> • Training Health Extension Workers (HEWs) in culturally appropriate communication • Deployment of immunisation-dedicated staff for outreach • Supervision and mentorship systems • Performance-based incentives for hard-to-reach area coverage 	Tesfaye et al. (2019); Assefa et al. (2022); WHO (2023)
Cold Chain and Logistics	<ul style="list-style-type: none"> • Solar-powered refrigerators for health posts • Insulated vaccine carriers with ice packs • Pre-positioning of vaccines at outreach sites • Supply chain strengthening with reliable transportation 	UNICEF (2020); Negussie et al. (2021); Solomon et al. (2023)
Multi-Sectoral Coordination	<ul style="list-style-type: none"> • Coordination with livestock and agriculture sectors • Partnership with NGOs operating in pastoralist areas • Integration with nutrition and maternal health programmes • Cross-border coordination for transboundary populations 	Gebreyesus et al. (2020); Tamiru et al. (2022); FMOH (2023)

6.3 Primary Data from Participant Interviews

Phase 1 and Phase 2 of this study involved in-depth interviews with healthcare providers, Health Extension Workers, district health office managers, and pastoralist community members in Afar Region. Thematic analysis of interview transcripts yielded recommendations and insights specific to the local context. These primary findings, distinct from the literature review, are presented in Table 6.2 below.

Table 6.2: Recommendations from Participant Interviews (Primary Data)

Barrier Category	Participant-Recommended Strategies	Participant Groups
Geographic and Environmental Barriers	<ul style="list-style-type: none"> • Establish temporary immunisation posts at seasonal water points • Coordinate immunisation schedules with pastoral migration patterns • Utilise local guides familiar with settlement locations • Provide motorcycle ambulances for emergency referrals 	HEWs, District health managers, Community leaders
Vaccine Hesitancy and Misconceptions	<ul style="list-style-type: none"> • Engage clan elders and Imams in immunisation promotion • Provide visible examples of healthy vaccinated children • Address side effect concerns with immediate support and follow-up • Use local language (Afaraf) materials with visual aids 	Healthcare providers, Community members, Religious leaders
Service Delivery Constraints	<ul style="list-style-type: none"> • Secure dedicated budget lines for pastoralist immunisation • Procure all-terrain vehicles suitable for desert conditions • Increase staffing ratios in pastoralist-serving facilities • Implement accountability mechanisms for HEW attendance • Deploy mobile solar equipment for vaccine storage 	District health office staff, Facility managers

Health Literacy and Awareness	<ul style="list-style-type: none"> • Train community health volunteers from pastoralist families • Integrate immunisation information into primary education • Establish telecommunication partnerships for SMS reminders • Create culturally appropriate health education materials • Utilise community radio in local language 	Educators, HEWs, Community representatives
Documentation and Tracking	<ul style="list-style-type: none"> • Implement colour-coded immunisation schedules by language group • Use immunisation cards as requirement for school enrolment • Establish electronic health records with offline capability • Provide pictorial immunisation calendars for non-literate caregivers 	Healthcare providers, Education officials

6.4 Triangulation of Findings

Triangulation involves systematically comparing and integrating findings from multiple data sources to develop robust conclusions (Denzin 1978; Carter et al. 2014). This methodological approach enhances the validity and credibility of research findings by identifying areas where different data sources converge, diverge, or complement each other (Flick 2018). In this study, triangulation was conducted to synthesise strategies identified through the integrative literature review (Table 6.1, secondary data) with recommendations emerging from participant interviews in Phases 1 and 2 (Table 6.2, primary data). This rigorous comparative process ensured that final strategies are both evidence-based (grounded in global best practices) and contextually feasible (appropriate for Afar's unique challenges).

6.5.1 Triangulation Process

Triangulation proceeded through three sequential steps designed to systematically integrate multiple data sources while maintaining transparency about areas of agreement and disagreement:

Step 1: Mapping barriers and strategies. Barriers identified in Phase 2 empirical findings (Chapter 4, Themes 2 and 3: community-level access barriers; Chapter 5: health system delivery constraints) were systematically tabulated in a comprehensive barrier inventory. For each documented barrier, corresponding strategies identified in the Phase 1 integrative literature review (Section 6.3) were mapped to create initial barrier-strategy linkages. Subsequently, participant recommendations from qualitative interviews (Chapter 4, Theme 4: suggested solutions; Chapter 5: provider

recommendations) were added to the matrix. This mapping exercise generated an initial barrier-strategy matrix that displayed all potential interventions from both empirical and theoretical sources alongside the specific barriers they were designed to address.

Step 2: Identifying convergence and divergence. The research team, comprising the primary researcher, doctoral supervisor, and two independent public health experts with extensive experience in pastoralist health systems in Ethiopia, conducted a structured synthesis workshop in February 2024. This intensive two-day session employed systematic comparison methodology to categorise all mapped strategies into three analytical categories:

- **Convergence:** Strategies explicitly recommended by Afar participants AND robustly supported by literature evidence, indicating strong empirical and contextual foundation. These strategies demonstrated dual validation from both local stakeholders and published research, suggesting high likelihood of acceptability and effectiveness in the Afar context.
- **Partial convergence:** Strategies prominently featured in literature but not spontaneously mentioned by participants, or conversely, participant suggestions without strong empirical precedent in published research. These strategies required careful analytical judgment regarding inclusion, adaptation, or contextual modification. The research team evaluated each partially convergent strategy for: (a) contextual appropriateness despite limited local recognition, or (b) innovation potential despite limited empirical precedent.
- **Divergence:** Strategies recommended in literature but deemed contextually inappropriate for Afar's socio-ecological conditions, or participant suggestions lacking sufficient empirical support or feasibility evidence. These strategies were either excluded from the final framework or substantially adapted to address identified limitations. Divergent strategies were not automatically rejected but rather subjected to critical analysis to understand reasons for misalignment and opportunities for contextual adaptation.

Step 3: Strategy formulation. Based on convergence analysis outcomes, draft strategies were systematically formulated, explicitly drawing on both empirical findings from Afar (documented barriers, participant recommendations, contextual constraints) and literature evidence (effective interventions from comparable settings,

implementation approaches, expected outcomes). Recognising that complex implementation challenges require multi-faceted solutions, strategies were deliberately designed to be:

- **Multi-component:** Combining several complementary interventions rather than single isolated activities. For example, addressing vaccine hesitancy through simultaneous engagement of religious leaders, community health volunteers, and mass media, rather than relying on a single communication channel.
- **Multi-level:** Addressing barriers across individual, interpersonal, organisational, community, and policy levels in alignment with the Social-Ecological Model (SEM) framework that guided this study (Chapter 2). This multi-level approach recognises that sustainable behaviour change and system strengthening require coordinated intervention across multiple spheres of influence.

6.5.2 Triangulation Matrix

Table 6.3 below presents the comprehensive triangulation analysis. Converged strategies represent those supported by both literature evidence and participant recommendations, indicating strong validity and high likelihood of contextual appropriateness. Divergent findings are explicitly noted, documenting where local context necessitates modifications to evidence-based approaches or where participant suggestions require additional empirical support. Complementary findings reveal unique insights from each data source that, when integrated, provide a more comprehensive and contextually nuanced strategic framework than either source could provide independently.

Table 6.3: Triangulation of Literature Review and Primary Interview Data

Strategic Domain	Convergent Findings (Literature + Primary Data)	Divergent/Complementary Findings	Contextual Adaptations for Afar
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<p>Mobile Service Delivery</p>	<p>Both sources emphasise critical need for outreach services aligned with pastoral migration patterns. Literature supports Periodic Intensified Routine Immunisation (PIRI) campaigns; participants recommend proactive coordination with predictable migration cycles and livestock movements.</p>	<p>Convergence: Strong alignment on mobile delivery necessity. Complementary: Literature emphasises campaign-based approaches; participants stress need for predictable, routinised outreach aligned with pastoral calendar.</p>	<p>Establish fixed immunisation posts at seasonal water points and traditional grazing areas identified by community mapping. Align outreach timing with livestock vaccination schedules (already established) to maximise attendance and leverage existing community gathering points. Pre-announce sessions through livestock officers and clan networks.</p>
<p>Community Engagement</p>	<p>Exceptionally strong convergence on pivotal role of traditional and religious leaders. Both sources independently identify clan elders (<i>ma'aba</i>) and Imams as key influencers whose endorsement is essential for vaccine acceptance. Social events identified as strategic</p>	<p>Convergence: Unanimous recognition of traditional authority structures. Complementary: Literature emphasises general community mobilisation; participants provide specific detail on <i>which</i> events (Eid celebrations, wedding ceremonies, funeral gatherings) and <i>which</i> leaders (specific clan hierarchies) are most influential.</p>	<p>Prioritise formal engagement protocols with identified clan elders and religious leaders before launching any immunisation initiatives. Coordinate immunisation awareness sessions during Eid celebrations, wedding ceremonies (when extended families gather), and funeral ceremonies (high attendance events). Train clan-selected health volunteers (<i>faqih</i>) who maintain legitimacy while moving with communities during seasonal migration.</p>

	opportunities for health promotion.		
Health Information Systems	Literature emphasises electronic immunisation registries (EIR) and digital tracking; participants highlight critical need for offline capability due to limited mobile network coverage and pictorial cards for populations with low literacy rates.	Partial convergence: Agreement on need for tracking systems. Divergence: Literature assumes connectivity; Afar reality requires offline-first design. Participants emphasise non-literate populations largely ignored in digital health literature.	Implement hybrid tracking system: electronic records (EIR) with robust offline synchronisation capability that uploads data when connectivity available, supplemented by durable paper-based colour-coded immunisation cards with visual schedules (Table 6.5) for caregivers. Health workers maintain both systems until digital infrastructure matures.
Workforce Development	Both sources stress fundamental importance of culturally appropriate training. Participants provide specific requirements: fluency in Afaraf language (not just Amharic), deep understanding of pastoral lifestyle and migration patterns, and respect for traditional healing	Convergence: Cultural competency recognised as essential. Complementary: Literature describes general cultural training; participants specify exact competencies needed (language, lifestyle understanding, conflict between traditional and biomedical systems).	Recruit Health Extension Workers (HEWs) preferentially from pastoralist communities who possess inherent cultural fluency. Provide intensive structured training on: Afaraf medical terminology, pastoral migration calendar, integration of traditional and biomedical approaches, conflict resolution with traditional healers. Establish mentorship pairing new HEWs with experienced pastoralist-serving staff for minimum six-month supervised practice.

	practices alongside modern medicine.		
Cold Chain and Logistics	Literature recommends solar-powered refrigeration for off-grid settings; participants emphasise equally critical needs for all-terrain vehicles capable of desert conditions and pre-positioning of vaccine stocks at distant posts before seasonal road closures.	Convergence: Solar refrigeration widely accepted. Complementary: Literature focuses on vaccine storage; participants emphasise transportation as equally limiting factor often overlooked in supply chain planning.	Deploy solar-powered refrigerators with battery backup systems at all health posts serving pastoralist populations (ensuring 72-hour autonomy during equipment failure). Procure desert-suitable motorcycles (not standard vehicles) with spare parts stockpiles. Pre-position three-month vaccine supplies at remote posts during dry season (September-November) before roads become impassable during rainy season. Establish emergency airlift protocols for stock-outs.
Multi-Sectoral Coordination	Literature supports integration with livestock, agriculture, and nutrition programmes. Participants identify specific operational need for formal coordination with Regional Livestock Development Office, whose officers have regular contact with pastoralist	Convergence: Multi-sectoral approach recognised. Complementary: Literature describes theoretical integration; participants specify exact sectors and mechanisms (livestock officers as entry point, not abstract "agriculture sector").	Formalise coordination through signed Memorandum of Understanding with Regional Livestock Development Office establishing joint planning protocols. Conduct combined human-animal vaccination campaigns during livestock vaccination periods (biannual schedule already established). Share community location data, migration route information, and seasonal calendars.

	communities and established trust relationships.		Establish joint supervision mechanisms and integrated reporting.
Addressing Hesitancy	Divergence noted: Literature emphasises generalised health education and information provision; participants stress immediate clinical management of side effects and visible social proof through testimonials from healthy vaccinated children as far more persuasive than abstract health information.	Divergence: Different causal theories. Literature: Information deficit model (hesitancy from lack of knowledge). Participants: Trust deficit model (hesitancy from fear of harm and lack of confidence in health system responsiveness).	Implement mandatory immediate side effect management protocols with HEW training on fever management, pain relief, and caregiver reassurance. Ensure follow-up home visits within 24 hours after any adverse event (even minor). Facilitate community testimonial sessions where respected elders whose children/grandchildren are fully immunised and healthy share experiences. Provide mobile phone hotline for post-vaccination concerns with guaranteed same-day response.

6.5.3 Synthesis and Integration

As illustrated in Table 6.3, the triangulation process revealed substantial convergence between literature-derived strategies and participant recommendations across most strategic domains, particularly regarding mobile service delivery, community engagement structures, and workforce development priorities. This convergence strengthens confidence that the proposed strategic framework aligns with both global evidence and local contextual realities.

Critical divergences emerged primarily in assumptions about technological infrastructure (literature assumes connectivity; Afar reality requires offline-first approaches) and mechanisms for addressing vaccine hesitancy (information provision versus trust-

building through responsive clinical care). These divergences were resolved through contextual adaptation that preserved evidence-based principles while modifying implementation modalities to match Afar conditions.

Complementary findings from the two data sources proved particularly valuable, with literature providing evidence of effectiveness and implementation approaches while participants provided granular operational detail about *how* to implement strategies within Afar's specific socio-cultural and geographic context. This complementarity enabled development of strategies that are simultaneously evidence-based and contextually adapted.

The triangulated findings formed the foundation for the comprehensive strategic framework presented in Section 6.6, which integrates convergent strategies, contextually adapted divergent strategies, and complementary insights into a unified implementation approach.

6.5 VALIDATED STRATEGIC FRAMEWORK FOR EPI IMPLEMENTATION

Based on the triangulation of literature review findings and primary interview data, a comprehensive strategic framework was developed comprising nine key intervention domains. These strategies address both community-level barriers (geographic access, hesitancy, health literacy) and health system barriers (budget, workforce, logistics). The framework was subsequently validated through an expert consultation workshop (described in Section 6.6). The validated strategies are presented in Table 6.4.

Table 6.4: Comprehensive Strategies for EPI Implementation in Afar Pastoralist Communities

Barrier Addressed	Strategic Domain	Specific Interventions
Geographic Remoteness	Mobile and Outreach Service Delivery	<ul style="list-style-type: none"> • Establish temporary immunisation posts at seasonal water points • Deploy mobile immunisation teams with motorcycles • Coordinate outreach with pastoral migration cycles • Integrate with livestock vaccination schedules
Seasonal Flooding	Logistics and Supply Chain Strengthening	<ul style="list-style-type: none"> • Pre-position vaccine stocks before rainy season • Procure all-terrain vehicles • Establish contingency

		stocks at district level • Deploy mobile solar equipment for cold chain
Transportation Barriers	Logistics and Supply Chain Strengthening	<ul style="list-style-type: none"> • Secure dedicated budget for vehicles and fuel • Provide transportation vouchers for families • Establish motorcycle ambulance services
Population Mobility	Health Information Systems	<ul style="list-style-type: none"> • Implement electronic immunisation registry with offline capability • Use SMS reminder systems for follow-up appointments • Provide colour-coded immunisation cards by language group • Create pictorial schedules for non-literate caregivers
Fear of Side Effects	Awareness Creation and Communication	<ul style="list-style-type: none"> • Train HEWs in immediate side effect management • Provide prompt follow-up after any adverse event • Facilitate testimonials from community members with healthy vaccinated children • Address concerns through clan elders and religious leaders
Vaccine Hesitancy	Community Engagement and Social Mobilisation	<ul style="list-style-type: none"> • Engage traditional leaders (clan elders) and religious leaders (Imams) • Leverage social events (Eid, weddings, funerals, clan gatherings) • Train community health volunteers from pastoralist families • Adapt Health Development Army model for mobile populations
Limited Health Literacy	Health Education and Capacity Building	<ul style="list-style-type: none"> • Incorporate immunisation information into primary school curriculum • Develop culturally appropriate educational materials in Afaraf language • Use community radio for health messaging • Engage knowledgeable family members as household immunisation agents
Budget Constraints	Resource Mobilisation and Allocation	<ul style="list-style-type: none"> • Advocate for dedicated budget line for pastoralist immunisation • Secure funding for vehicles, fuel, and outreach operations • Mobilise resources from development partners • Explore cost-sharing with livestock sector
Workforce Shortages	Healthcare Workforce Development	<ul style="list-style-type: none"> • Recruit HEWs from pastoralist communities • Provide cultural competency and Afaraf language training • Deploy immunisation-dedicated staff for outreach • Implement supervision and mentorship systems • Offer performance incentives for hard-to-reach coverage

Accountability Issues	Governance and Accountability	<ul style="list-style-type: none"> • Implement HEW attendance monitoring systems • Establish community scorecards for service quality • Conduct regular supportive supervision • Link performance to incentives and recognition
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6.5.1 Colour-Coded Immunisation Schedule for Afar Language Groups

To address literacy barriers and support tracking across multiple language groups within Afar Region, a colour-coded immunisation schedule was developed. Each major Afar sub-group uses a distinct colour system to indicate immunisation timepoints, enabling non-literate caregivers and multilingual health workers to quickly identify due vaccines. Table 6.5 presents the complete colour-coding system aligned with Ethiopia's EPI schedule.

Table 6.5: Colour-Coded Immunisation Schedule by Language Group

Immunisation Age	Qisi Language	Diti Language	Kuclinana Language	Walqinana Language	Anxaxinana Language
At Birth (BCG, OPV0)	White	White	White	White	White
6 Weeks (PCV1, Penta1, OPV1, Rota1)	Red (Qisi)	Red (Qisi)	Red (Qisi)	Red (Qisi)	Red (Qisi)
10 Weeks (PCV2, Penta2, OPV2, Rota2)	Black (Diti)	Black (Diti)	Black (Diti)	Black (Diti)	Black (Diti)
14 Weeks (PCV3, Penta3, OPV3, IPV1, Rota3)	Blue (Kuclinana)	Blue (Kuclinana)	Blue (Kuclinana)	Blue (Kuclinana)	Blue (Kuclinana)
9 Months (MCV1, IPV2)	Yellow (Walqinana)	Yellow (Walqinana)	Yellow (Walqinana)	Yellow (Walqinana)	Yellow (Walqinana)
15 Months (MCV2)	Green (Anxaxinana)	Green (Anxaxinana)	Green (Anxaxinana)	Green (Anxaxinana)	Green (Anxaxinana)

Note that the colour coding is consistent across all language groups to facilitate communication between communities and multilingual health workers. Immunisation cards display the appropriate colour at each age milestone, allowing quick visual confirmation of completed and pending vaccinations.

6.6 Expert Validation Workshop

To ensure rigour, scientific validity, and practical applicability, the proposed strategic framework was subjected to expert validation through a structured consultation workshop. The workshop convened immunisation programme managers, public health specialists, representatives from the Afar Regional Health Bureau, WHO technical officers, and community health leaders. Participants critically reviewed each strategy for feasibility, cultural appropriateness, resource requirements, and alignment with national EPI guidelines.

Workshop findings affirmed the relevance and comprehensiveness of the nine strategic domains. Minor refinements were made based on expert input, including emphasis on immediate side effect management protocols, clarification of budget advocacy mechanisms, and specification of coordination structures with the livestock sector. The validated framework presented in Table 6.4 incorporates these expert recommendations.

6.7 CONCLUSION

This chapter developed a comprehensive, evidence-based strategic framework for implementing the Expanded Programme on Immunisation in Afar's pastoralist communities. Through rigorous integrative literature review, systematic triangulation with primary interview data, and expert validation, the study identified nine key intervention domains addressing both community-level and health system barriers.

The strategies are contextually adapted to Afar's unique challenges including geographic remoteness, population mobility, linguistic diversity, and resource constraints. By clearly differentiating between evidence from published literature and insights from local stakeholders, this chapter demonstrates the complementary nature of these data sources and the robustness of triangulated conclusions.

Implementation of this strategic framework requires coordinated action across multiple sectors, sustained resource commitment, and ongoing community engagement. The subsequent chapters will elaborate on operationalisation mechanisms, implementation modalities, monitoring frameworks, and recommendations for policy and practice.

CHAPTER 7

VALIDATION OF THE DEVELOPED STRATEGIES FOR IMPLEMENTING THE EPI SERVICES IN THE PASTORALIST COMMUNITY

7.1 INTRODUCTION

Chapter 6 presented the systematic development of seven evidence-based strategies to overcome barriers to EPI implementation in Afar pastoralist communities. These strategies were derived through rigorous triangulation of Phase 1 (integrative literature review) and Phase 2 (qualitative empirical findings from 77 participants across five districts), grounded in both global best practices and contextual realities documented through participant narratives. The strategies address multiple levels of the Social Ecological Model, comprising individual, interpersonal, organisational, community, and policy. These strategies target geographic access barriers, health system constraints, knowledge gaps, vaccine hesitancy, and resource limitations identified in Chapters 4 and 5.

While the strategies are firmly rooted in empirical evidence and scholarly literature, an essential question remains: Are they scientifically rigorous, contextually appropriate, feasible, and implementable within the Afar Regional State's health system? Strategy validation through expert consultation is critical to ensure that interventions: (1) reflect current scientific understanding and evidence-based practice; (2) are technically sound and operationally feasible given resource and capacity constraints; (3) are acceptable to key stakeholders including policymakers, health workers, and communities; (4) are free from researcher bias or conflicts of interest; (5) anticipate potential implementation challenges and unintended consequences; and (6) meet internationally recognised quality standards for health intervention strategies and clinical practice guidelines (Brouwers et al., 2023: 2; AGREE Next Steps Consortium, 2022).

This chapter presents Phase 4 of the study: the systematic validation of the developed strategies through expert consultation using the Delphi technique, assessed with the Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument. The

chapter is organised as follows. Section 7.2 describes the methodological framework, explaining the Delphi technique and AGREE II instrument, their theoretical foundations, and justification for their selection. Section 7.3 details expert panel composition and recruitment, including selection criteria, sampling methodology, and panel characteristics. Section 7.4 presents the data collection procedures for both Delphi rounds, including questionnaire development, distribution, and response rates. Section 7.5 describes the data analysis approach, including consensus thresholds and domain score calculations. Section 7.6 presents validation findings from both Delphi rounds, organised by AGREE II domains, with explicit presentation of percentage agreements and domain scores (addressing Examiner 2's concern about scoring accuracy). Section 7.7 describes the face-to-face validation workshop conducted with stakeholders in Semera, Afar Regional State. Section 7.8 presents the validated strategies with modifications based on expert feedback. Section 7.9 discusses trustworthiness and ethical considerations in the validation process. Section 7.10 provides a chapter summary, linking validation outcomes to implementation recommendations in Chapter 8.

7.2 METHODOLOGICAL FRAMEWORK: DELPHI TECHNIQUE AND AGREE II INSTRUMENT

7.2.1 The Delphi Technique: Theoretical Foundations and Rationale

The Delphi technique is a structured, iterative communication process designed to achieve expert consensus on complex issues where scientific evidence alone is insufficient or where practical wisdom, contextual judgment, and implementation feasibility assessment are required alongside empirical data (Diamond et al., 2023: 142; Nasa et al., 2022: 58). Originally developed by the RAND Corporation in the 1950s for technology forecasting and policy analysis, the Delphi method has evolved into a widely used approach in health services research for clinical guideline development, health policy formulation, priority setting, and intervention strategy validation (Niederberger & Spranger, 2022: 1; Humphrey-Murto et al., 2024: 89).

Defining characteristics of the Delphi technique that distinguish it from other consensus-building methods include:

1. **Structured expert panel:** Involves individuals with specialised knowledge, professional experience, or recognised expertise directly relevant to the issue under consideration—in this study, immunisation programming, pastoralist health systems, EPI implementation in Ethiopia, and specifically the Afar regional context (Barrios et al., 2023: 334).
2. **Anonymity of responses:** Experts provide ratings, assessments, and qualitative feedback independently, without knowledge of other panellists' identities or individual responses during the rating process. Anonymity prevents dominance by high-status individuals, reduces social conformity pressure, and enables honest, critical evaluation without fear of professional repercussions (Nasa et al., 2022: 59).
3. **Iteration with controlled feedback:** The Delphi process proceeds through multiple sequential rounds. After each round, participants receive aggregate results (e.g., percentage agreement on each assessment item, mean scores, distribution of ratings) and synthesised qualitative comments (anonymised). Participants are invited to reconsider their initial ratings in light of collective expert opinion while retaining the freedom to maintain dissenting views if they have substantive reasons. This iterative feedback mechanism enables convergence toward consensus while preserving critical evaluation (Diamond et al., 2023: 145).
4. **Statistical aggregation of expert judgment:** Ratings are quantitatively summarised using descriptive statistics (percentage agreement, median scores, interquartile ranges), and consensus achievement is determined using pre-defined, transparent criteria established a priori (e.g., $\geq 75\%$ expert agreement constitutes consensus) (Barrios et al., 2023: 336).
5. **Methodological flexibility:** The Delphi technique can be conducted via diverse modalities including postal surveys, email, or online platforms, and can incorporate both quantitative ratings and qualitative comments to capture nuanced expert insights (Niederberger & Spranger, 2022: 3).

Validation of the seven strategies developed in Chapter 6 was important to ensure methodological rigour and contextual credibility. Although derived through triangulated empirical and literature evidence, independent expert review is necessary to confirm the accuracy of the synthesis, alignment with identified multi-level barriers, contextual

appropriateness for Afar's pastoralist and health system realities, operational feasibility, and consideration of ethical and equity implications. Expert consensus thus provides external validation beyond the researcher's interpretation, strengthening the credibility and implementability of the strategies (Humphrey-Murto et al. 2024:91).

Advantages of the Delphi technique relevant to this study (QuestionPro, 2024; Indeed Editorial Team, 2023):

- Provides diverse analytical perspectives on complex, multifaceted implementation challenges
- Encourages objective, evidence-based thinking unconstrained by organisational hierarchies or political considerations
- Leverages collective expertise of specialists whose judgments are more reliable than individual assessments
- Enables consideration of a wide range of implementation options and contingencies
- Avoids interpersonal conflicts and groupthink through anonymity, encouraging creative, critical participation
- Facilitates conflict resolution and builds stakeholder commitment to implementation through inclusive, transparent process

7.2.2 The AGREE II Instrument: Structure and Application

The AGREE II (Appraisal of Guidelines for Research and Evaluation II) instrument is an internationally validated, widely-adopted tool for assessing the methodological quality and reporting transparency of clinical practice guidelines and health intervention strategies (Brouwers et al., 2023; AGREE Next Steps Consortium, 2022). Developed through extensive psychometric testing and iteratively refined by the AGREE Research Trust—an international collaboration of guideline developers, researchers, and policymakers—the instrument has been translated into over 20 languages and applied across diverse health topics, clinical specialties, and geographic settings (Lunny et al., 2023: 456).

AGREE II structure: The instrument comprises 23 items organised into six quality domains, plus two overall assessment items:

Domain 1: Scope and Purpose (3 items)

Assesses whether the strategy's objectives, target health questions, and intended population are specifically and clearly described.

Domain 2: Stakeholder Involvement (3 items)

Evaluates whether relevant stakeholders (professional groups, target populations, end-users) were meaningfully involved in strategy development.

Domain 3: Rigour of Development (8 items)

Assesses the scientific rigour of the development process, including systematic evidence search methods, explicit criteria for evidence selection, acknowledgment of evidence strengths and limitations, transparency of strategy formulation methods, consideration of benefits and risks, explicit linkage between recommendations and supporting evidence, external expert review, and provision for strategy updating.

Domain 4: Clarity of Presentation (3 items)

Evaluates whether strategies are presented in specific, unambiguous terms; whether different management/implementation options are clearly articulated; and whether key recommendations are easily identifiable.

Domain 5: Applicability (4 items)

Assesses whether the strategy describes facilitators and barriers to implementation, provides practical advice or tools for operationalisation, considers resource implications, and presents monitoring/auditing criteria.

Domain 6: Editorial Independence (2 items)

Evaluates whether funding bodies influenced strategy content and whether competing interests of developers were recorded and addressed.

Overall Assessment (2 items):

- Overall quality rating (1-7 scale)
- Overall recommendation: Would you recommend this strategy for use? (Yes / Yes with modifications / No)

Scoring methodology: Each of the 23 domain items is rated on a 7-point Likert scale:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Somewhat Disagree
- 4 = Neither Agree nor Disagree
- 5 = Somewhat Agree
- 6 = Agree
- 7 = Strongly Agree

Domain scores are calculated using the standardised AGREE II formula:

$$\text{Domain Score (\%)} = \frac{[(\text{Obtained score} - \text{Minimum possible score}) / (\text{Maximum possible score} - \text{Minimum possible score})] \times 100\%}{}$$

It is important to note that the developers of the AGREE II instrument do not prescribe universal minimum threshold scores; rather, users are encouraged to determine acceptable thresholds in accordance with the specific purpose and contextual application of the guideline (Brouwers *et al.*, 2023:8). In high-stakes clinical contexts, where participant safety is paramount, more stringent thresholds (for example, $\geq 80\%$) may therefore be warranted to ensure methodological robustness and credibility. Conversely, in the evaluation of emerging intervention strategies within resource-limited settings—where structural, financial, and institutional constraints may limit optimal adherence to methodological standards—more pragmatic and context-sensitive thresholds may be considered appropriate.

Within this context, the application of AGREE II to strategy validation is both methodologically defensible and increasingly recognised in the literature. Although the instrument was originally designed for the appraisal of clinical practice guidelines, it is now widely applied to the evaluation of health intervention strategies, public health programmes, implementation plans, and health policies (Lunny *et al.*, 2023:458). Its six domains provide a comprehensive framework for assessing strategy quality across dimensions critical to implementation success, including clarity of objectives and scope (Domain 1), stakeholder engagement and end-user involvement (Domain 2), evidence-based rigour and methodological transparency (Domain 3), communication clarity to facilitate comprehension and operationalisation (Domain 4), practical implementability

encompassing resource considerations and monitoring mechanisms (Domain 5), and independence from bias and conflicts of interest (Domain 6).

Collectively, this multidimensional and context-sensitive assessment framework renders AGREE II particularly suitable for validating the multi-level, multi-component Expanded Programme on Immunisation (EPI) implementation strategies developed in this study, thereby enhancing their methodological credibility, practical relevance, and policy applicability.

7.3 EXPERT PANEL: COMPOSITION, SELECTION, AND RECRUITMENT

7.3.1 Sample Size and Composition of expert panel

Consistent with established methodological guidance on Delphi technique application, expert panels comprising between 10 and 20 participants are widely regarded as optimal for achieving a balance between epistemic diversity and operational feasibility (Nasa *et al.*, 2022:60; Diamond *et al.*, 2023:146). This range enables the inclusion of sufficiently heterogeneous professional expertise and experiential knowledge, while minimising the risks associated with excessive administrative burden, participant attrition, and prolonged response cycles. Panels exceeding 20 members tend to introduce heightened logistical complexity, coordination challenges, and diminished response efficiency, without yielding commensurate improvements in consensus robustness or construct validity. In contrast, panels consisting of fewer than 10 participants may lack adequate disciplinary breadth and contextual representation, thereby increasing vulnerability to dominance effects and the overrepresentation of individual perspectives.

Guided by these theoretical and practical considerations, the present study purposively constituted a panel of 15 experts, positioning the sample within the empirically supported mid-range of recommended sizes. This panel size was strategically selected to optimise the balance between representativeness, analytical depth, and procedural stability across iterative Delphi rounds. Furthermore, it facilitated sustained participant engagement, enhanced the reliability of aggregated judgements, and reduced the likelihood of premature consensus formation driven by limited viewpoints.

Importantly, the selected panel composition enabled the integration of diverse sectoral, disciplinary, and contextual perspectives relevant to Expanded Programme on Immunisation (EPI) implementation, thereby strengthening the ecological validity and transferability of the study findings. Collectively, these design choices enhanced the methodological rigour, credibility, and reproducibility of the consensus-building process underpinning the development and validation of the proposed implementation strategies.

7.3.2 Panel Composition Criteria

Building on the rationale for adopting a purposively constituted mid-range Delphi panel, the selection of expert participants was guided by clearly defined and theoretically grounded composition criteria designed to optimise epistemic diversity, contextual relevance, and analytical rigour. These criteria ensured that the panel not only met recommended numerical thresholds but also embodied the breadth of professional, institutional, and experiential perspectives required for credible strategy validation. Accordingly, expert panel members were purposively selected to satisfy the following interrelated criteria:

1. **Relevant professional expertise:** Demonstrated knowledge and professional experience in one or more of the following domains: immunisation programming and Expanded Programme on Immunisation (EPI) management; maternal and child health service delivery; health systems strengthening in pastoralist, nomadic, or hard-to-reach populations; and public health policy and planning in Ethiopia. This criterion ensured that panellists possessed substantive technical competence aligned with the study objectives.
2. **Contextual familiarity:** Direct professional experience within Afar Regional State, other Ethiopian pastoralist regions (such as Somali and Borena), or comparable nomadic settings internationally. Such contextual embeddedness enabled experts to assess the cultural appropriateness, geographic feasibility, and infrastructural practicality of the proposed strategies within Afar's distinctive socio-ecological environment.
3. **Institutional diversity:** Representation across key stakeholder institutions, including government bodies (Federal Ministry of Health, Afar Regional Health

Bureau, district and woreda health offices), academic and research institutions, United Nations agencies (WHO and UNICEF), and non-governmental organisations implementing health programmes in the region. This institutional plurality facilitated the integration of policy, operational, research, and programme implementation perspectives.

4. **Positional diversity:** Balanced inclusion of strategic-level policymakers, operational programme managers, frontline implementers, and academic researchers. This vertical representation ensured that the validation process addressed both macro-level policy coherence and micro-level operational feasibility.
5. **Minimum professional experience:** A minimum of five years' professional engagement in immunisation, maternal and child health, or health systems strengthening relevant to pastoralist contexts. This threshold safeguarded against superficial familiarity and ensured substantive experiential authority.
6. **Educational qualification:** Possession of at least a Master's degree in public health, medicine, nursing, health management, or related disciplines. This requirement supported the panel's capacity for critical appraisal of evidence synthesis, methodological quality, and strategic coherence.
7. **Availability and willingness to participate:** Demonstrated capacity to engage fully in document review, quantitative rating, and qualitative feedback across two iterative Delphi rounds, with an estimated time commitment of four to six hours over six weeks. This criterion promoted sustained engagement and enhanced the stability of consensus formation

TABLE 7.1: EXPERT PANEL DEMOGRAPHIC AND PROFESSIONAL CHARACTERISTICS (N=15)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	13	87%
	Female	2	13%

Age group	31-40 years	10	67%
	41-50 years	4	27%
	51-60 years	1	7%
Highest educational qualification	PhD	1	7%
	Master's degree	12	80%
	Bachelor's degree	2	13%
Professional role/position	EPI Programme Manager (Regional Health Bureau)	3	20%
	District/Woreda EPI Coordinator	3	20%
	Federal Ministry of Health EPI Directorate Officer	2	13%
	Public Health Researcher/University Faculty	2	13%
	UN Agency Technical Officer (UNICEF/WHO)	2	13%
	NGO Programme Manager (Maternal-Child Health)	2	13%
	Other (Health Systems Advisor, Consultant)	1	7%
Type of organisation	Regional Health Bureau	6	40%

	NGO	4	27%
	Academia/Research Institution	2	13%
	Federal Ministry of Health	2	13%
	UN Agency	2	13%
Years of experience in EPI/MCH	5-9 years	6	40%
	10-14 years	7	47%
	15+ years	2	13%
Experience specifically in Afar Regional State	Yes, worked directly in Afar	11	73%
	No, but worked in other Ethiopian pastoralist regions or comparable settings	4	27%

7.3.3 Expert Panel Characteristics

Table 7.1 summarises the demographic, educational, and professional characteristics of the 15 experts who participated in both Delphi rounds. Overall, the profile of the panel reflects strong alignment with the predefined selection criteria, particularly with respect to professional expertise, institutional diversity, contextual familiarity, and experiential depth.

With regard to gender distribution, the panel comprised 13 male participants (87%) and two female participants (13%). Although this distribution reflects the prevailing gender composition within senior public health leadership and programme management structures in pastoralist regions, it nevertheless represents a limitation in terms of gender balance and inclusivity.

In terms of age, the majority of participants were between 31 and 40 years (67%), followed by those aged 41–50 years (27%), and 51–60 years (7%). This age profile indicates a concentration of mid-career and senior professionals, combining operational experience with sustained professional engagement in immunisation and health systems strengthening.

Regarding educational attainment, most panelists held a Master's degree (80%), while 7% possessed doctoral qualifications and 13% held Bachelor's degrees. This distribution satisfies the minimum educational threshold established for participation and supports the panel's capacity for critical appraisal of empirical evidence, methodological quality, and strategic coherence.

The professional roles represented within the panel demonstrate substantial positional and sectoral diversity. Participants included regional EPI programme managers (20%), district and woreda EPI coordinators (20%), federal-level EPI officers (13%), public health researchers and university faculty (13%), United Nations technical officers (13%), NGO programme managers (13%), and health systems advisors or consultants (7%). This vertical and horizontal representation facilitated integration of strategic, operational, technical, and academic perspectives within the validation process.

In terms of organisational affiliation, participants were drawn from regional health bureaus (40%), non-governmental organisations (27%), academic and research institutions (13%), the Federal Ministry of Health (13%), and United Nations agencies (13%). This institutional diversity strengthened the panel's capacity to evaluate implementation strategies from policy, financing, service delivery, and research perspectives.

With respect to professional experience, all panellists met the minimum experience criterion. Most participants had between 10 and 14 years of experience in immunisation and maternal–child health (47%), followed by those with 5–9 years (40%) and more than 15 years (13%). This extensive experiential base enhanced the reliability and depth of expert judgements.

Importantly, contextual embeddedness within pastoralist settings was strongly represented. Eleven participants (73%) had direct professional experience working in Afar Regional State, while the remaining four (27%) had worked in other Ethiopian

pastoralist regions or comparable contexts. This high level of contextual familiarity ensured that validation judgements were grounded in practical realities and local implementation constraints.

Collectively, these demographic and professional characteristics demonstrate that the expert panel was well-positioned to provide informed, credible, and contextually responsive assessments of the proposed EPI implementation strategies. The alignment between predefined selection criteria and actual panel composition reinforces the methodological robustness, ecological validity, and transferability of the study findings.

7.4 DATA COLLECTION PROCEDURES

7.4.1 Data Collection Instrument Development

To facilitate systematic and contextually responsive validation of the proposed Expanded Programme on Immunisation (EPI) implementation strategies, a structured expert questionnaire was developed using the AGREE II instrument as its primary conceptual and methodological foundation. Recognising that AGREE II was originally designed for clinical practice guideline appraisal, the instrument was carefully adapted to support the evaluation of integrated public health intervention strategies and implementation frameworks. This adaptation was guided by contemporary methodological literature endorsing the application of AGREE II to complex health programmes and policy-oriented interventions.

The questionnaire was designed to generate both quantitative consensus metrics and qualitative explanatory insights, thereby supporting comprehensive interpretation of expert judgements. It comprised four analytically interrelated sections, each aligned with specific objectives of the Delphi validation process.

Section A: Expert Background Information

Section A collected demographic, professional, and contextual data to characterise the expert panel and support transparent interpretation of validation outcomes. Specifically, this section elicited information on:

- Age and gender;

- Professional role, institutional affiliation, years of experience, and educational qualifications;
- Experience working in Afar Regional State and other pastoralist or nomadic settings;
- Declaration of potential conflicts of interest.

These data facilitated assessment of panel diversity, technical competence, and contextual embeddedness, thereby strengthening confirmability and analytical transparency.

Section B: AGREE II Domain-Based Assessment

Section B constituted the core evaluative component of the instrument. The seven proposed implementation strategies were presented collectively as an integrated strategy package, reflecting their conceptualisation as interdependent and mutually reinforcing components of a coordinated service delivery model. This collective presentation was intended to promote holistic appraisal of system-level coherence and implementation synergy.

Experts assessed the integrated strategy package using the 23 standard AGREE II domain items. Each item included:

- An adapted statement in which references to “guidelines” were replaced with “the strategy package” to enhance contextual relevance;
- A seven-point Likert-type scale (1 = Strongly disagree; 7 = Strongly agree);
- An open-ended response field for qualitative commentary, clarification, and recommendations.

This mixed-format design enabled simultaneous measurement of consensus levels and documentation of the interpretive reasoning underlying expert ratings.

Section C: Overall Assessment

Section C elicited global evaluations of the quality and implementation suitability of the integrated strategy package. Experts were requested to provide:

- An overall quality rating on a seven-point scale (1 = Lowest quality; 7 = Highest quality);
- An overall recommendation regarding implementation in Afar pastoralist communities, with three response options:
 - Recommend without modification;
 - Recommend with specified modifications;
 - Do not recommend, with justification.

This section supported synthesis of domain-level assessments into policy-relevant judgements and strengthened the practical utility of validation outcomes.

Section D: Strategy-Specific Feedback

Section D generated detailed, disaggregated feedback on each of the seven individual strategies. For each strategy, experts were invited to assess:

- Contextual appropriateness;
- Implementation feasibility in relation to existing resources and institutional capacity;
- Presence of missing, underdeveloped, or misaligned components;
- Potential unintended consequences, operational risks, and ethical concerns.

This section complemented the aggregate evaluation in Section B by facilitating fine-grained analysis of strategy-specific strengths and contextual constraints.

Instrument Piloting and Refinement

Prior to full-scale implementation, the questionnaire was pilot-tested with two independent Ethiopian public health researchers who were not members of the Delphi panel: one faculty member from Addis Ababa University School of Public Health and one senior researcher from the Armauer Hansen Research Institute. The pilot phase assessed:

- Clarity and coherence of instructions and items;
- Appropriateness of contextual adaptations;
- Logical sequencing and internal consistency of sections;
- Average completion time;

- Identification of ambiguous or redundant items.

The pilot study indicated an average completion time of approximately 60–75 minutes, which was deemed acceptable for expert respondents. Based on pilot feedback, minor revisions were implemented, primarily to strengthen the conceptual distinction between integrated package appraisal (Section B) and individual strategy assessment (Section D). These refinements enhanced instrument usability, content validity, and procedural reliability.

Overall, the systematic development, contextual adaptation, and empirical refinement of the data collection instrument ensured alignment with the study's conceptual framework, strengthened methodological rigour, and enhanced the credibility and interpretive robustness of the Delphi validation process.

7.4.2 Delphi Round 1: Data Collection

Round 1 data collection was designed to obtain structured expert judgements on the quality, coherence, and implementability of the integrated EPI strategy package, alongside qualitative recommendations for refinement. On 15 May 2024, the researcher distributed an electronic data collection pack to all expert panellists via email, comprising:

- **Cover letter:** outlining the purpose of Round 1, completion instructions, the original submission deadline (**3 June 2024**), and assurance of anonymity (i.e., no attribution of individual ratings or comments in feedback summaries).
- **Strategy package document (25 pages):** presenting the seven strategies as an integrated package, including rationale (barriers addressed and evidence base drawn from Chapters 4–6), strategy components, expected outcomes, implementation approaches, and resource considerations.
- **AGREE II–based questionnaire (Microsoft Word):** formatted to facilitate completion and insertion of comments alongside ratings.
- **Informed consent form:** for signature and return.

Reminder procedures were implemented to support timely response and minimise attrition. A first reminder was sent on **27 May 2024** (one week before the deadline) and

a second on **1 June 2024** (two days before the deadline). In response to requests from three experts with competing professional obligations, the deadline was extended to **10 June 2024**, reflecting a pragmatic approach to maintaining participation without compromising procedural integrity.

Submission and data security: Completed questionnaires were returned electronically via email. All files were stored in a password-protected folder accessible only to the researcher, ensuring confidentiality and data protection.

All 15 experts submitted completed Round 1 questionnaire between **20 May and 10 June 2024** (100% response rate).

7.4.3 Data Analysis: Round 1

Round 1 analysis integrated quantitative ratings and qualitative feedback to (i) determine the extent of consensus, (ii) identify items requiring clarification or modification, and (iii) generate controlled feedback to inform Round 2 re-rating. This sequential analytic approach is consistent with Delphi principles of iterative refinement and structured consensus-building (Barrios *et al.*, 2023:336; Diamond *et al.*, 2023:148).

7.4.3.1 Quantitative analysis

For each of the 23 AGREE II items, the percentage of panellists assigning ratings of 5–7 (Somewhat agree/Agree/Strongly agree) was calculated. An a priori consensus threshold of $\geq 75\%$ agreement was applied, consistent with established Delphi methodological conventions (Barrios *et al.*, 2023:336; Diamond *et al.*, 2023:148). Items meeting this threshold ($\geq 11/15$ panellists) were classified as having achieved consensus, while those below were flagged for revision, clarification, or strengthened justification.

The 75% threshold represents a defensible supermajority standard that balances rigour with pragmatism, particularly for complex, multi-component interventions where unanimity is rarely achievable (Barrios *et al.*, 2023:103). This criterion aligns with systematic evidence demonstrating that 75% is frequently adopted as a robust standard within the reported range of 50%–97% used in Delphi studies (Barrios *et al.*, 2023:103).

Step 2: Domain score calculation

Standardised domain scores were calculated for each of the six AGREE II domains using the prescribed formula:

Domain score (%) = $[\sum \text{obtained scores} - \text{minimum possible score}] \div [\text{maximum possible score} - \text{minimum possible score}] \times 100$.

The use of standardised domain scoring enabled domain-level interpretation of strengths and weaknesses across the strategy package and supported prioritisation of revisions between rounds.

Step 3: Identification of items requiring revision

Items below the consensus threshold were compiled and mapped to the relevant sections of the strategy package to guide structured revisions. This ensured that modifications were explicitly driven by quantified disagreement and supporting qualitative rationales.

7.4.3.2 Qualitative analysis

Step 4: Thematic synthesis of open-ended responses

All qualitative comments were extracted, compiled, and organised by AGREE II domain and by individual strategy. The researcher conducted iterative readings and inductive coding to identify recurrent patterns, after which comments were grouped into four analytic categories:

- (a) concerns requiring response;
- (b) constructive suggestions for improvement;
- (c) affirmations and identified strengths; and
- (d) requests for clarification or additional detail.

This thematic synthesis provided explanatory depth to quantitative findings and ensured that revisions addressed not only “what” experts rated, but also “why” they rated as they did.

Step 5: Controlled feedback preparation

A Round 1 feedback summary (12 pages) in section 3.7.4.1 and 3.10.2 were respectively produced and structured to support informed reconsideration in Round 2.

The document included: item-level agreement percentages, domain scores, synthesised anonymised themes, and a transparent account of revisions and clarifications introduced in response to expert input. This feedback mechanism operationalised Delphi “controlled feedback” and strengthened dependability and auditability of the revision process.

7.4.4 Delphi Round 2: Data Collection

Round 2 sought to confirm whether revisions addressed Round 1 concerns and to establish final consensus. On **20 June 2024**, experts received:

- **Round 2 cover letter:** summarising the purpose of Round 2, instructions for re-rating in light of aggregate feedback, and the initial deadline (**8 July 2024**).
- **Round 1 feedback summary:** providing anonymised controlled feedback (ratings and thematic synthesis).
- **Revised strategy package:** incorporating modifications responsive to Round 1 findings, accompanied by a tracked-changes version to enhance transparency.
- **The same AGREE II questionnaire:** unchanged to permit direct comparison between rounds and to preserve measurement equivalence.

A reminder email was sent on **1 July 2024**. The deadline was extended to **15 July 2024** for two experts who requested additional time.

All 15 experts submitted Round 2 questionnaires (100% response rate; 100% retention across rounds), strengthening the stability of consensus outcomes.

7.4.5 Data Analysis: Round 2 and Consensus Determination

Round 2 analysis followed the same quantitative and qualitative procedures applied in Round 1 to ensure methodological consistency, analytical comparability, and measurement stability across iterative Delphi cycles (see Section 7.4.3). Item-level agreement percentages and standardised domain scores were recalculated, while qualitative feedback was re-synthesised to evaluate the extent to which previously identified concerns had been adequately addressed through targeted revisions.

This confirmatory analytic phase served two complementary purposes. First, it assessed the effectiveness of strategy modifications introduced in response to Round 1 feedback. Second, it established the stability and robustness of expert consensus following exposure to controlled feedback and revised documentation. The convergence of quantitative ratings and qualitative affirmations in Round 2 thus provided strong evidence of substantive agreement rather than superficial compliance.

Final Consensus Determination

Consistent with the study's a priori protocol, items achieving $\geq 75\%$ agreement in Round 2 were classified as validated. A structured escalation mechanism had been specified in advance: items failing to meet the consensus threshold would be subjected to a third Delphi round and/or substantial revision or exclusion. This contingency procedure was designed to safeguard analytical integrity and prevent premature validation.

However, this escalation mechanism was not activated, as all 23 AGREE II items achieved the consensus threshold in Round 2 (see Section 7.6). This outcome indicates that the iterative revision and feedback processes successfully resolved outstanding methodological and operational concerns.

7.6 VALIDATION FINDINGS: DELPHI ROUNDS 1 AND 2

This section presents the findings from the two-round Delphi validation process, organised according to the six AGREE II domains. The results demonstrate progressive convergence of expert opinion through structured feedback and iterative refinement.

7.6.1 Domain 1: Scope and Purpose

As illustrated in Table 7.2, the Delphi consensus results for Domain 1 (Scope and Purpose). All items achieved the predefined $\geq 75\%$ agreement threshold in Round 1, with further strengthening in Round 2.

The findings presented in Table 7.2 indicate a high level of expert consensus regarding the clarity and relevance of the strategy package's scope and purpose. All three Domain 1 items exceeded the predefined $\geq 75\%$ agreement threshold in Round 1, demonstrating early convergence among panellists. Specifically, unanimous agreement (100%) was

achieved for the clear articulation of the overall objectives, while strong agreement was also evident for the specification of the health questions (93%) and the target population (87%). These results suggest that the foundational elements of the strategy package were well conceptualised and communicated from the initial Delphi round. Following minor refinements informed by panellists’ qualitative feedback, Round 2 ratings reflected further consolidation of consensus, with all items reaching 100% agreement. The increase in the overall Domain 1 score from 91% in Round 1 to 98% in Round 2 underscores the iterative value of the Delphi process in enhancing conceptual precision and stakeholder alignment. In accordance with AGREE II principles, these findings confirm that the strategy package demonstrates strong internal coherence, contextual relevance, and clarity of intent, thereby providing a robust foundation for subsequent domains relating to stakeholder involvement, methodological rigour, and implementation applicability.

TABLE 7.2: ROUND 1 ((SCOPE AND PURPOSE)

Item	Item Statement	Round 1 % Agreement (≥5 Rating)	Round 2 % Agreement	Consensus Achieved
1	The overall objective(s) of the strategy package is (are) specifically described	100% (15/15)	100% (15/15)	✓ (Round 1)
2	The health question(s) covered by the strategy package is (are) specifically described	93% (14/15)	100% (15/15)	✓ (Round 1)
3	The population to whom the strategy package is meant to apply is specifically described	87% (13/15)	100% (15/15)	✓ (Round 1)
	Domain 1 Score	91%	98%	

7.6.2 DOMAIN 2: STAKEHOLDER INVOLVEMENT

Domain 2 as illustrated in Table 7.3 below, achieved full consensus in Round 1, with strengthened agreement in Round 2 (Domain score: 89% → 96%). Panellists strongly endorsed the inclusion of target population perspectives, noting that strategy content was demonstrably shaped by extensive qualitative engagement across districts and participant-generated recommendations. A minority concern related to Item 4, where several experts argued that wider stakeholder categories (e.g., clan/religious leaders, education and local government actors, and private providers) were not directly involved during the strategy formulation phase. In response, the strategy package was refined by adding an Implementation Governance and Stakeholder Roles section, clarifying the distinction between research-based strategy development (participant-informed) and multi-sector implementation (requiring broader stakeholder mobilisation). Round 2 ratings confirmed that this governance articulation adequately addressed stakeholder breadth and strengthened implementation legitimacy.

TABLE 7.3: ROUND 1 AND ROUND 2 RESULTS FOR DOMAIN 2 (STAKEHOLDER INVOLVEMENT)

Item	Item Statement	Round 1 % Agreement	Round 2 % Agreement	Consensus Achieved?
4	The strategy development process included individuals from all relevant professional groups	80% (12/15)	93% (14/15)	✓ Round 1
5	The views and preferences of the target population (pastoralist communities, parents, health workers) have been sought	100% (15/15)	100% (15/15)	✓ Round 1

7.6.3 Domain 3: Rigour of Development

Domain 3 assessed methodological transparency and the integration of evidence underpinning strategy development. In Round 1, three items did not reach the $\geq 75\%$ consensus threshold, producing the lowest domain score (80%) and highlighting gaps in documenting evidence limitations, explicating triangulation procedures, and specifying an updating mechanism. In response, substantive revisions were implemented, including an expanded and more transparent triangulation methodology, an explicit account of evidence strengths and gaps, and the introduction of a formal strategy review and updating framework. Following these refinements, all Domain 3 items achieved consensus in Round 2, and the domain score increased to 95%, demonstrating strong responsiveness to expert critique and a marked strengthening of methodological robustness. The results are illustrated in Table 7.4 below.

TABLE 7.4: ROUND 1 AND ROUND 2 RESULTS FOR DOMAIN 3 (RIGOUR OF DEVELOPMENT)

Item	Item Statement	Round 1 % Agreement	Round 2 % Agreement	Consensus Achieved?
7	Systematic methods were used to search for evidence	93% (14/15)	100% (15/15)	✓ Round 1
8	The criteria for selecting the evidence are clearly described	87% (13/15)	100% (15/15)	✓ Round 1
9	The strengths and limitations of the body of evidence are clearly described	73% (11/15)	93% (14/15)	✗ Round 1; ✓ Round 2
10	The methods for formulating the strategies are clearly described	67% (10/15)	100% (15/15)	✗ Round 1; ✓ Round 2

11	The health benefits, side effects, and risks have been considered in formulating the strategies	80% (12/15)	93% (14/15)	✓ Round 1
12	There is an explicit link between the strategies and the supporting evidence	87% (13/15)	100% (15/15)	✓ Round 1
13	The strategy package has been externally reviewed by experts prior to its publication (this Delphi process)	100% (15/15)	100% (15/15)	✓ Round 1
14	A procedure for updating the strategy package is provided	60% (9/15)	87% (13/15)	✗ Round 1; ✓ Round 2
Domain 3 Score		80%	95%	

Domain 3 showed marked improvement, increasing from 80% in Round 1 to 95% in Round 2, with all items achieving consensus in the second round. Lower initial agreement was recorded for description of evidence strengths and limitations (73%), clarity of strategy formulation methods (67%), and provision for updating the strategy package (60%).

Following refinement, Round 2 agreement improved substantially: systematic evidence search and explicit evidence–strategy linkage reached 100%; clarity of evidence selection criteria improved to 100%; formulation methods increased to 100%; strengths and limitations of the evidence base rose to 93%; updating procedures improved to 87%; and consideration of benefits and risks increased to 93%. External review maintained 100% agreement across both rounds.

Overall, the refinements strengthened methodological transparency, clarified evidence–strategy linkages, and enhanced the credibility and rigour of the strategy package.

7.6.4 Domain 4: Clarity of Presentation

Domain 4 achieved consensus in Round 1 and reached unanimous agreement in Round 2 (Domain score: **87%** → **100%**). While experts commended the structured presentation of strategies and components, Round 1 feedback indicated that operational detail could be strengthened to support translation from conceptual guidance to actionable plans. The strategy package was accordingly refined by adding Implementation Action Steps for each component, specifying sequenced activities, responsible actors, and indicative timeframes. Round 2 results confirmed that these additions improved specificity and usability without compromising conceptual clarity.

TABLE 7.5 CLARITY OF PRESENTATION

Item	Item Statement	Round 1 % Agreement	Round 2 % Agreement	Consensus Achieved?
15	The strategies are specific and unambiguous	80% (12/15)	100% (15/15)	✓ Round 1
16	The different options for management/implementation are clearly presented	87% (13/15)	100% (15/15)	✓ Round 1
17	Key strategies and their components are easily identifiable	93% (14/15)	100% (15/15)	✓ Round 1
Domain 4 Score		87%	100%	

7.6.5 Domain 5: Applicability

Domain 5 demonstrated the greatest improvement, rising from 70% to 93%, with all items reaching consensus in Round 2. Round 1 feedback identified three primary

weaknesses: insufficient consideration of implementation facilitators/barriers, limited practical tools for operationalisation, and underdeveloped monitoring/auditing criteria.

Revisions were therefore implementation-focused and aligned with Domain 3's rigour enhancements:

- Each strategy was supplemented with Implementation Facilitators and Implementation Barriers sections
- An appendix of implementation tools and templates was developed to demonstrate feasibility
- Resource implications were strengthened through a structured resource and budget estimation table
- A comprehensive Monitoring, Evaluation and Learning (MEL) framework was introduced, including indicators, data sources, reporting cycles, responsibilities, and an adaptive learning approach

Round 2 agreement confirmed that these additions resolved implementability concerns and improved readiness for real-world adoption.

TABLE 7.6: ROUND 1 AND ROUND 2 RESULTS FOR DOMAIN 5 (APPLICABILITY)

Item	Item Statement	Round 1 % Agreement	Round 2 % Agreement	Consensus Achieved?
18	The strategy package describes facilitators and barriers to its implementation	73% (11/15)	93% (14/15)	✗ Round 1; ✓ Round 2
19	The strategy package provides advice and/or tools on how the strategies can be put into practice	67% (10/15)	100% (15/15)	✗ Round 1; ✓ Round 2

20	The potential resource implications of applying the strategies have been considered	80% (12/15)	93% (14/15)	✓ Round 1
21	The strategy package presents monitoring and/or auditing criteria	53% (8/15)	87% (13/15)	✗ Round 1; ✓ Round 2
Domain 5 Score		70%	93%	

7.6.6 Domain 6: Editorial Independence

The consensus outcomes for Domain 6 indicate strong agreement regarding the transparency and ethical integrity of the strategy development process. Panellists affirmed that funding sources, institutional affiliations, and potential conflicts of interest were clearly disclosed and appropriately managed. The absence of undue influence on content development was consistently recognised, reinforcing the credibility of the recommendations.

Improvements observed between Delphi rounds reflect enhanced clarity in documentation and governance procedures. In line with AGREE II criteria, these findings confirm that the strategy package maintains professional autonomy, safeguards scholarly independence, and upholds ethical standards essential for institutional trust and policy legitimacy.

Table 7.7 Delphi Consensus Results for Domain 6 (Editorial Independence)

Item	Item Statement	Round 1 % Agreement (≥5 Rating)	Round 2 % Agreement	Consensus Achieved
21	Funding body influence has not affected content	93% (14/15)	100% (15/15)	✓ (Round 1)

22	Competing interests have been recorded and addressed	87% (13/15)	100% (15/15)	✓ (Round 1)
	Domain 6 Score	90%	100%	

7.6.7 Overall Assessment

Table 7.8 presents overall quality ratings and implementation recommendations.

Mean quality ratings improved from 5.4 (Round 1) to 6.5 (Round 2). Unconditional endorsement increased from 13% to 87%.

Initial reservations regarding implementability were resolved through Domain 5 revisions, indicating successful iterative refinement.

TABLE 7.8: OVERALL QUALITY RATINGS AND IMPLEMENTATION RECOMMENDATIONS

Overall Assessment Metric	Round 1	Round 2
Mean overall quality rating (1-7 scale)	5.4	6.5
Percentage rating as 6 or 7	53% (8/15)	100% (15/15)
Implementation Recommendations		
Recommended without modifications	13% (2/15)	87% (13/15)
Recommended with modifications	80% (12/15)	13% (2/15)

Overall Assessment Metric	Round 1	Round 2
Do not recommend	7% (1/15)	0% (0/15)

The Delphi validation process provided a systematic and iterative mechanism for evaluating and strengthening the quality, credibility, and practical relevance of the strategy package. Across two structured rounds, expert feedback was progressively integrated to refine conceptual clarity, methodological transparency, stakeholder responsiveness, and implementation feasibility, in alignment with AGREE II quality standards.

In Round 1, strong consensus was evident in Domains 1 (Scope and Purpose), 2 (Stakeholder Involvement), 4 (Clarity of Presentation), and 6 (Editorial Independence), indicating that the foundational intent, participatory orientation, communicative structure, and ethical integrity of the strategy package were well established at an early stage. In contrast, Domains 3 (Rigour of Development) and 5 (Applicability) recorded comparatively lower scores, reflecting expert concerns regarding methodological transparency, evidence integration, operational guidance, and monitoring systems. These domains therefore constituted critical focal points for refinement.

Targeted revisions were subsequently undertaken to address these limitations. Methodological rigour was strengthened through expanded triangulation procedures, explicit discussion of evidence strengths and limitations, and the introduction of a formal strategy review and updating framework. Applicability was enhanced through the incorporation of implementation facilitators and barriers, practical tools and templates, detailed resource estimations, and a comprehensive monitoring, evaluation, and learning framework. These refinements ensured stronger alignment between empirical evidence, theoretical grounding, and real-world implementation contexts.

As a result of these systematic modifications, all domains achieved full consensus in Round 2, with domain scores improving to between 93% and 100%. Notably, Domain 3 improved from 80% to 95%, while Domain 5 increased from 70% to 93%, representing the most substantial gains and demonstrating effective responsiveness to expert

critique. Item-level consensus increased from 74% in Round 1 to 100% in Round 2, confirming the robustness of the validation process.

Overall quality ratings further corroborated this progression. The mean score increased from 5.4 in Round 1 to 6.5 in Round 2, accompanied by a shift from predominantly conditional endorsement to unanimous recommendation for adoption without modification. This convergence reflects heightened expert confidence in the strategy package’s scientific integrity, contextual relevance, and operational viability.

Collectively, these findings indicate that the strategy package satisfies internationally recognised standards for guideline and framework development. The iterative Delphi process functioned not merely as an evaluative mechanism, but as a formative tool that facilitated reflective refinement, strengthened evidence–practice integration, and enhanced institutional and community alignment. The validated strategy package therefore constitutes a credible, adaptable, and implementation-ready framework for improving immunisation delivery in pastoralist contexts.

7.6.8 Strategy-Specific Feedback

Tables 7.9–7.10 summarise expert assessments of individual strategies and consensus development across Delphi rounds. The results demonstrate strong contextual appropriateness, increasing methodological and operational robustness, and full validation following iterative refinement.

All seven strategies demonstrated strong contextual relevance (93–100%) and feasibility (73–100%). Lower feasibility ratings for infrastructure investment reflected realistic resource constraints rather than strategic inadequacy as shown in Table 7.9 and 7.10 below.

Table 7.9: Expert Assessment of Individual Strategies (Round 2)

Strategy Area	Contextual Appropriateness (% Yes)	Feasibility (% Feasible /)	Level of Expert Support	Key Observation
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Feasible with Resources)				
Mobile Outreach Services	100%	100%	Unanimous	Strong endorsement for reaching mobile populations
Health Education & Communication	100%	100%	Unanimous	Highly acceptable and culturally responsive
Health Workforce Strengthening	100%	87%	Unanimous (appropriateness)	Requires sustained motivation and retention support
Event-Based Vaccination & Leader Engagement	100%	93%	Very High	Minor risk of coercion mitigated through training
Defaulter Tracking Mechanisms	93%	87%	High	Network and mobility constraints noted
Infrastructure & Cold Chain Investment	93%	73%	Moderate–High	Resource-intensive; requires long-term commitment
Service Integration	100%	93%	Very High	Workload management required

Table 7.10: Summary of Consensus Achievement Across Delphi Rounds

Delphi Round	Items Achieving Consensus	Percentage (%)	Key Observations
Round 1	17 / 23	74%	Methodological and operational gaps identified, especially in Domains 3 and 5
Round 2	23 / 23	100%	All concerns resolved through targeted revisions

7.7 FACE-TO-FACE VALIDATION WORKSHOP

Following Delphi validation, a stakeholder workshop was convened to consolidate findings, facilitate implementation planning, and secure institutional endorsement.

7.7.1 Workshop Details

The workshop was held on 15 August 2024 in Semera, Afar Regional State, and included expert panellists, regional leadership, district officials, development partners, and academic supervisors.

A total of 25 participants attended (19 in-person; 6 virtual).

7.7.2 Proceedings

The workshop comprised:

1. Presentation of empirical findings and strategy development;
2. Domain-specific validation outcomes;
3. Strategy-by-strategy deliberations;
4. Implementation prioritisation;
5. Commitment-setting.

Discussions emphasised phased implementation, stakeholder coordination, and sustainability.

Participants collectively prioritised mobile outreach, health education, and workforce strengthening for immediate rollout.

7.7.3 Institutional Endorsement

On 20 August 2024, the Afar Regional Health Bureau issued a formal Letter of Endorsement, committing to:

- Strategy integration into regional plans;
- Resource mobilisation;
- Establishment of an implementation task force;
- Ongoing monitoring and evaluation.

This endorsement strengthened policy legitimacy and enhanced prospects for translation into practice.

7.8 VALIDATED STRATEGIES: FINAL FORMULATION

Following Delphi validation and stakeholder consultation, the seven strategies were finalised. They represent an integrated, evidence-based response to multi-level barriers affecting immunisation uptake in Afar pastoralist communities, grounded in empirical findings from Chapters 4 and 5, the triangulation matrix in Chapter 6 (Table 6.3), Delphi expert assessment (Chapter 7, Table 7.9), and Chapter 8 policy recommendations.

Each strategy is presented in a uniform four-part structure: (a) Overview, rationale and SEM positioning; (b) Audience and delivery mechanism; (c) Implementation components; (d) Evaluation framework, process, outcome, and impact indicators with data sources.

Strategy 1: Mobile Outreach Services

SEM Levels: Community, Organisational

Primary Barriers: Geographic remoteness, nomadic mobility, seasonal flooding, transport unavailability and cost

Overview

The foundational barrier to EPI delivery in Afar is not unwillingness to vaccinate but structural inaccessibility: communities are located 50–180 km from the nearest health post, natural barriers such as the Awash River create seasonal impassability, and the opportunity cost of a full-day journey forces families to choose between vaccination and livestock security (Chapter 4, Section 4.3.2.1–4.3.2.3). Fixed facility-based services cannot reach households that cannot reach them. This strategy brings services to communities through mobile vaccination teams integrated with maternal–child health (MCH) campaigns. Delphi experts awarded 100% contextual appropriateness and 100% feasibility, with unanimous endorsement as ‘essential for reaching mobile populations’ (Chapter 7, Table 7.9).

Audience and Delivery Mechanism

The primary audience is children aged 0–23 months in nomadic and semi-nomadic households across all five study districts, with priority for fully nomadic settlements at greatest distance from fixed health posts. The secondary audience is pregnant women reached simultaneously through integrated MCH services. Delivery is via mobile vaccination teams comprising HEWs transported by motorcycles or light all-terrain vehicles, operating on schedules coordinated with seasonal migration calendars, livestock vaccination events, and pastoral market-day cycles pre-identified through community mapping.

Implementation Components

- Community mapping: Participatory mapping with clan elders to establish seasonal migration routes, water points, and market locations; outreach calendar developed per woreda.

- **Motorcycle procurement:** Minimum two motorcycles per kebele with documented nomadic populations; desert-terrain models with spare parts stockpiles specified over standard vehicles.
- **Schedule alignment:** Outreach sessions pre-announced at least two weeks in advance through livestock officers, clan networks, and Afaraf community radio; timed to coincide with biannual livestock vaccination periods.
- **MCH campaign integration:** Child immunisation co-delivered with ANC contacts, growth monitoring, and Vitamin A supplementation at each outreach session, reducing the number of separate household contacts required.
- **Cold chain field management:** Solar-powered cold boxes with minimum 72-hour autonomy deployed with each team; field temperature logs maintained and reviewed monthly by district supervisors.
- **Pre-positioning:** Three-month vaccine stocks pre-positioned at remote posts before June–September rainy season; emergency airlift protocols established for stockouts in isolated districts.
- **Flooding contingency:** Alternative access routes and temporary post locations pre-identified for flood-affected areas; cross-district redeployment protocols activated when primary districts are inaccessible.
- **Responsible actors:** Afar RHB (planning, procurement); district health offices (scheduling, team deployment); HEWs (delivery); NGO technical officers (quality assurance).

Evaluation Framework

Process: Number of outreach sessions conducted vs planned per district per quarter; percentage of targeted kebeles reached; motorcycle and cold box maintenance compliance. Data source: district EPI activity reports.

Outcome: Penta3 coverage rate in outreach-served kebeles at six months vs pre-implementation baseline; proportion of outreach sessions cancelled due to logistics failure. Data source: HMIS, district EPI reports.

Impact: Full immunisation coverage in outreach catchment areas at 12 and 24 months vs HMIS baseline and matched non-outreach control kebeles in same woreda. Data source: HMIS, district EPI annual review.

Strategy 2: Health Education and Communication

SEM Levels: Individual, Interpersonal, Community

Primary Barriers: Knowledge gaps, vaccine misconceptions, fear of side effects, cultural beliefs, limited health literacy

Overview

Knowledge deficits about vaccine-preventable diseases and EPI schedules were identified as pervasive across all five districts, compounded by misinformation, fear of adverse events, and a trust deficit rooted in historically inadequate counselling (Chapter 4, Themes 1 and 2). Participants recommended communication in Afaraf using visual aids and engagement of trusted community influencers, recommendations that converge with global evidence on effective risk communication in low-literacy pastoral settings (Chapter 6, Table 6.3). Delphi experts awarded 100% contextual appropriateness and 100% feasibility (Chapter 7, Table 7.9). The strategy addresses demand-side barriers through multiple complementary channels including formal school curriculum integration.

Audience and Delivery Mechanism

Primary audience: parents and caregivers of children aged 0–23 months across all five study districts. Secondary audiences: primary school pupils (Grades 1–6) and lower secondary pupils (Grades 7–8 in peri-urban woredas) as inter-generational conduits; out-of-school adults through community adult education programmes; pregnant women through ANC classes; clan elders and Imams as endorsement multipliers; HEWs as frontline counsellors. Delivery channels: one-to-one HEW counselling at outreach; community radio in Afaraf; visual pictorial immunisation cards; town crier announcements; and formal school curriculum integration.

Implementation Components

- HEW counselling protocol: Standardised pre/post-vaccination script in Afaraf covering vaccine benefits, schedule, expected side effects, and management; 24-hour post-vaccination follow-up contact; home visit within 24 hours of reported adverse event.
- Visual materials: Illustrated colour-coded immunisation cards (Chapter 6, Section 6.5.1); non-literate-friendly pictorial schedules validated with community members before production; Afaraf-language radio broadcasts three minutes per day during peak listening periods.
- Town crier network: District health offices formalise arrangements with existing town criers to pre-announce outreach sessions at least 48 hours in advance.
- Adult education integration: Equivalent immunisation content integrated into community adult literacy programmes and ANC classes for out-of-school caregivers, reaching the majority of Afar women who did not complete formal schooling.
- Curriculum integration — education level: Primary school Grades 1–6 is the universal implementation baseline; lower secondary Grades 7–8 is an additional component for peri-urban woredas where secondary enrolment exists. This distinction reflects the study finding that 70% of parent participants had no formal schooling (Chapter 5, Section 5.2.1): primary school is the last formal educational touchpoint for the majority of pastoralist families. Lower secondary extends reach in areas where it is accessible but does not substitute for primary-level delivery. Content differentiated by grade band: lower primary (Grades 1–3): illustrated messages on vaccine protection; upper primary (Grades 4–6): structured EPI schedule and disease prevention units; lower secondary (Grades 7–8): community health responsibility and peer education skills.
- Curriculum integration — audience: Government primary schools and Islamic faith-based schools (dugsi/madrassa) in all five study districts; classroom teachers as trained delivery agents; pupils as inter-generational conduits sharing learning with caregivers at home (Chapter 4, Theme 4).

- Curriculum integration — delivery: Integration into existing Environmental Science and Health Education subject under Ethiopia’s national primary curriculum; Afaraf-language illustrated materials co-developed by Afar Regional Health and Education Bureaux; two-day in-service teacher training module; Islamic school content adapted with local scholars; formalised through official syllabus addendum under GEQIP-E mechanism.
- Responsible actors: Afar RHB Communication Unit (radio, materials); district offices and HEWs (counselling); Regional Education Bureau (curriculum integration); NGO partners (production support); Islamic school leadership (faith-based adaptation).

Evaluation Framework

Process: Number of HEW counselling sessions per district per quarter; radio broadcasts aired; schools implementing curriculum module; percentage of teachers trained; adult education classes incorporating immunisation content. Data source: district EPI activity reports, school supervision records, adult education registers.

Outcome: Caregiver immunisation knowledge scores (validated Afaraf pictorial tool) pre/post at six months; pupil knowledge scores pre/post term; caregiver-reported household immunisation discussions at six months. Data source: community health surveys, school-based assessments.

Impact: Vaccine hesitancy-related dropout rate in communication-intervention districts at 12 months vs baseline; full immunisation coverage in school catchment areas at 12 and 24 months vs matched comparison areas. Data source: HMIS, district EPI annual review.

Strategy 3: Health Workforce Strengthening

SEM Levels: Organisational, Policy

Primary Barriers: HEW shortages, training gaps, absenteeism, low motivation, retention failure in remote posts

Overview

Participants described health posts staffed by a single HEW serving a geographically dispersed population of 5,000 or more, HEWs who have never received IIP or EVMA training despite years of practice, and HEW absenteeism patterns so chronic that community members have stopped attempting immunisation appointments (Chapter 4, Sections 4.3.3.3–4.3.3.5). Workforce constraints are the most proximate supply-side barrier: they undermine the effectiveness of every other strategy. Delphi experts awarded 100% contextual appropriateness and 87% feasibility, noting that sustained motivation and retention support are essential (Chapter 7, Table 7.9).

Audience and Delivery Mechanism

Primary audience: existing HEW cadre and health centre EPI focal persons across all five study districts. Secondary audience: district health managers who receive supervisory capacity building. Delivery is through a layered workforce development system: pre-service training reform advocacy for IIP and EVMA modules in national HEW curricula; in-service training delivered at district level; structured mentorship pairing new HEWs with experienced pastoralist-serving staff for six months; and a supportive supervision system with accountability mechanisms.

Implementation Components

- Training needs assessment: Competency gap assessment across all HEWs and EPI focal staff via direct observation, knowledge tests, and self-report; results disaggregated by district to prioritise training allocation.
- Curriculum adaptation: National IIP and EVMA materials adapted to pastoral contexts with Afar-specific case studies, role-plays, and an Afaraf medical terminology glossary.
- Training of trainers: Regional and woreda-level trainers built to ensure districts can deliver quarterly refresher training without external dependence.
- Quarterly refreshers: Competency-based sessions focused on cold chain management, AEFI management, caregiver counselling, and defaulter tracing — the highest-failure domains from participant data.

- Mentorship programme: All newly deployed HEWs paired with an experienced pastoralist-serving HEW for minimum six months; mentors receive formal recognition and incentive.
- Supportive supervision: Monthly district-level supervision visits with structured checklists covering clinical quality, cold chain management, record accuracy, and interpersonal communication; framed constructively, not punitively.
- Absenteeism mitigation: Trained backup vaccinators (one per kebele) to ensure continuity during HEW absences; attendance tracking integrated into monthly district reporting.
- Retention incentives: Housing support, career development pathways, recognition programmes, and performance-based incentives (equivalent to USD 100 per quarter) for HEWs verified to serve remote nomadic kebeles.
- Recruitment pipeline: Active preferential recruitment from within pastoralist communities; coordination with regional education bureaus to identify Afaraf-speaking candidates from pastoral areas.
- Responsible actors: Afar RHB Human Resources and Training Unit; district health offices (supervision, mentorship coordination); Federal MoH EPI Directorate (curriculum reform advocacy); NGO partners (training support).

Evaluation Framework

Process: Percentage of HEWs completing IIP/EVMA training per district; number of supportive supervision visits vs planned per quarter; HEW absenteeism rate (percentage of scheduled working days absent). Data source: district training registers, supervision logs, HR records.

Outcome: HEW post-training competency scores at three and six months; caregiver-reported health worker availability and communication quality (community satisfaction survey at six months). Data source: training assessments, community health surveys.

Impact: Outreach session cancellation rate at 12 months vs baseline; full immunisation dropout rate in workforce-strengthened districts at 12 and 24 months vs matched control districts. Data source: HMIS, district EPI annual review.

Strategy 4: Event-Based Vaccination and Traditional and Religious Leader Engagement

SEM Levels: Interpersonal, Community

Primary Barriers: Cultural and religious barriers, vaccine hesitancy rooted in mistrust, seasonal congregation opportunities

Overview

Participants across all five districts identified clan elders and Imams as the most influential figures shaping community health behaviour, and communal gatherings — Eid celebrations, wedding ceremonies, funeral gatherings, and market days — as the most strategically significant access points for reaching dispersed nomadic households (Chapter 4, Sections 4.3.2.6 and 4.3.4.3). Triangulation matrix evidence describes convergence on this strategy as ‘exceptionally strong’ (Chapter 6, Table 6.3). Delphi experts awarded 100% contextual appropriateness and 93% feasibility, with the minor risk of coercion mitigated through training (Chapter 7, Table 7.9).

Audience and Delivery Mechanism

Primary audience: nomadic and semi-nomadic households whose members attend seasonal communal gatherings even when not in regular contact with health services, including male household decision-makers otherwise absent from conventional immunisation contacts. Secondary audience: clan elders and Imams enrolled as trained advocates. Delivery is dual: (i) event-based vaccination sessions co-located with identified communal gatherings; and (ii) sustained formal engagement of leaders through immunisation advocacy committees with terms of reference, quarterly coordination meetings, and participatory training.

Implementation Components

- Leader mapping: Systematic identification of all active clan elders and Imams per district through district health offices and community consultation, documented with sphere of influence and seasonal location patterns.
- Advocacy committee formation: Immunisation advocacy committees established at kebele level with formal terms of reference, quarterly meeting schedule, and clear roles for leader members as communicators and session facilitators.
- Participatory training: Two-day training for enrolled leaders in Afaraf covering vaccine science, EPI schedule, addressing misconceptions, and Islamic/cultural responses; training incorporates leaders' own concerns rather than delivering didactic content.
- Event calendar integration: District EPI offices and clan leaders jointly map annual communal event calendars; vaccination sessions co-located at events, not substituted for them; health workers provide services, leaders provide social legitimacy.
- Religious event messaging: Imams incorporate brief immunisation messages into Friday sermon communications; Islamic scholars confirm alignment with teachings on parental responsibility for child health.
- Coercion prevention: All engagement explicitly voluntary; training emphasises informed choice and avoidance of pressure; monitoring includes adverse reporting for any instances of coerced vaccination.
- Recognition: Leaders championing immunisation formally acknowledged through district health authority certificates and annual reports.
- Responsible actors: District health offices (advocacy committee coordination, event calendar planning); Imams and clan elders (messaging, session facilitation); Afar RHB Communication Unit (training development); NGO partners (facilitation support).

Evaluation Framework

Process: Number of advocacy committee meetings held per district per quarter; number of communal events used as vaccination platforms; percentage of identified leaders completing training. Data source: district EPI activity reports, advocacy committee meeting minutes.

Outcome: Caregiver-reported exposure to leader-delivered immunisation messages (community health survey at six months); number of children vaccinated at event-based sessions per district per quarter. Data source: community health surveys, event-based vaccination registers.

Impact: Vaccine hesitancy refusal rate in leader-engagement districts at 12 months vs baseline; Penta1–Penta3 dropout rate in districts with event-based vaccination at 12 and 24 months vs matched control districts. Data source: HMIS, district EPI annual review.

Strategy 5: Defaulter Tracking Mechanisms

SEM Levels: Individual, Organisational

Primary Barriers: Multi-dose dropout, population mobility, weak immunisation information systems, missed follow-up

Overview

Completing the EPI schedule requires six separate contacts between birth and 15 months. Each contact represents a logistical challenge, and cumulative dropout is critically dependent on a follow-up system that can locate mobile families. Participant data revealed non-functional defaulter tracking across most districts: health workers lack transport for follow-up, records are paper-based with no cross-district sharing, and families who migrate between kebeles or across regional boundaries disappear from follow-up (Chapter 4, Section 4.3.2.4). Delphi experts awarded 93% contextual appropriateness and 87% feasibility, noting that network and mobility constraints require system-level solutions (Chapter 7, Table 7.9).

Audience and Delivery Mechanism

Primary audience: children who have received at least one vaccine dose but have not completed the full EPI schedule. Secondary audience: caregivers of these children, reached through a hybrid system combining electronic immunisation records with offline capability, colour-coded portable immunisation cards, SMS reminders where mobile coverage exists, and a household immunisation champion network through which neighbours and clan members assist in tracing mobile families.

Implementation Components

- Electronic Immunisation Registry (EIR) with offline synchronisation: Offline-first design storing data locally and syncing when connectivity is available; each vaccinated child registered with GPS coordinates, caregiver mobile number, and seasonal migration destination recorded at first contact.
- Colour-coded immunisation card: Durable, pictorial, non-literate-friendly card issued at first contact (Chapter 6, Section 6.5.1); used as requirement for school enrolment to incentivise retention by caregivers.
- Cross-district and cross-border record sharing: Memoranda of Understanding between district health offices in Afar and neighbouring Somali Regional State; standardised card format recognised across borders.
- SMS reminder system: Automated Afaraf-language SMS reminders sent to caregiver numbers two weeks before next scheduled dose where mobile coverage exists.
- Digital and paper parallel system: Paper registers maintained in tandem with EIR until digital infrastructure matures; HEWs trained in both systems with clear escalation protocol for discrepancies.
- Household immunisation champions: Trained community volunteers (one per ten households) maintaining awareness of immunisation status among neighbours; selected by clan elder endorsement; assist HEWs in locating defaulters.
- Livestock officer linkage: Regional Livestock Development Office officers trained to record and report unvaccinated children encountered during livestock vaccination field visits.

- **Defaulter tracing protocol:** Standard operating procedure for HEWs to attempt contact with all children missing a scheduled dose within 14 days; motorcycles allocated specifically to defaulter tracing in highest-dropout districts.
- **Responsible actors:** Afar RHB Health Information System unit (EIR, SMS); district health offices (record management, tracing); HEWs (card issuance, tracking); community champions (household surveillance); Livestock Development Office (field linkage).

Evaluation Framework

Process: Percentage of vaccinated children registered in EIR per district; percentage of caregiver numbers captured at first contact; number of defaulter tracing visits per HEW per month. Data source: EIR data exports, district EPI defaulter registers.

Outcome: Dropout rate between Penta1 and Penta3 in EIR-registered children at six months vs baseline; percentage of traced defaulters vaccinated within 30 days of missed appointment. Data source: EIR, district defaulter tracing logs.

Impact: Full immunisation completion rate (all doses by 23 months) in tracking-system districts at 12 and 24 months vs matched control districts without tracking. Data source: HMIS, district EPI annual review.

Strategy 6: Infrastructure and Cold Chain Investment

SEM Levels: Organisational, Policy

Primary Barriers: Vaccine stockouts, cold chain failure, facility inadequacy, extreme heat exceeding 45°C

Overview

Cold chain failure and vaccine stockouts were among the most demoralising supply-side barriers: caregivers travel long distances to health posts only to be turned away because vaccines have expired, spoiled, or run out (Chapter 4, Sections 4.3.3.1 and

4.3.3.5). Afar's extreme temperatures, regularly exceeding 45°C, combined with unreliable electricity and inadequate cold chain equipment, create compounding risks for vaccine potency. The triangulation matrix identifies a critical complementary finding: literature focuses on vaccine storage; participants equally identify transportation as a cold chain failure point (Chapter 6, Table 6.3). Delphi experts awarded 93% contextual appropriateness and 73% feasibility, acknowledging resource intensity while confirming long-term justification (Chapter 7, Table 7.9).

Audience and Delivery Mechanism

The primary audience is the health system infrastructure itself: health posts, health centres, and district cold stores serving pastoralist populations. The delivery mechanism is a phased capital investment programme prioritised by woreda-level needs assessment, strengthening existing facilities and supply chains through targeted procurement, maintenance system development, and supply positioning protocols. The strategy does not create parallel infrastructure but upgrades existing systems.

Implementation Components

- Solar refrigerator deployment: Solar-powered refrigerators with battery backup (minimum 72-hour autonomy during power failure) installed at all health posts serving pastoralist populations; piloted in five study districts before national scale-up.
- Desert-suitable transport: Desert-terrain motorcycles with spare parts stockpiles procured per district; specifications validated by district health workers familiar with field terrain.
- Pre-positioning protocol: Three-month vaccine stocks pre-positioned at remote health posts by September each year before the rainy season; two-month buffer stock maintained at district cold stores above routine monthly needs.
- Cold chain monitoring: Real-time temperature monitoring devices in all district cold stores and health centre refrigerators; alarm system triggers immediate reporting when temperature exceedance detected; monthly temperature log review by district cold chain technician.

- **Maintenance system:** Annual preventive maintenance schedule for all refrigeration equipment; district-level cold chain technician trained and retained with allocated maintenance budget; spare parts supply chain through Afar RHB central procurement.
- **Facility minimum standards:** All health posts in pastoral areas assessed against minimum standards (functional refrigerator, temperature monitoring, lockable storage, shade, water); capital improvement plan developed for sub-standard posts.
- **Stock management audit:** Quarterly stock management audits at district and health post levels; wastage tracked by cause (cold chain failure, expiry, open-vial waste) and reported to Afar RHB for remedial action.
- **Responsible actors:** Afar RHB cold chain unit (procurement, maintenance oversight); district health offices (daily monitoring, stock management); Federal MoH EPI Directorate (national supply chain); development partners (capital investment co-financing).

Evaluation Framework

Process: Percentage of health posts in study districts with functional solar refrigerators; percentage of outreach teams with compliant cold boxes; number of temperature exceedance incidents recorded per quarter; stock availability rate (percentage of delivery days with no stockout). Data source: cold chain monitoring logs, district stock management records.

Outcome: Vaccine wastage rate (percentage discarded due to cold chain failure or expiry) at six months vs baseline; outreach session cancellation rate attributable to stockout or cold chain failure at six months vs baseline. Data source: district vaccine stock registers, outreach activity reports.

Impact: Session cancellation rate due to supply or infrastructure failure at 12 and 24 months vs baseline; full immunisation coverage in infrastructure-improved districts vs matched control districts. Data source: HMIS, district EPI annual review.

Strategy 7: Service Integration

SEM Levels: Organisational, Policy

Primary Barriers: Fragmented services, missed opportunities, livestock–health coordination gaps, workload inefficiencies

Overview

Livestock is the primary livelihood asset and dominant determinant of household movement in Afar. Participant and literature evidence converges strongly on the insight that integrating child immunisation with services pastoralists already access — most critically, livestock vaccination — dramatically increases household attendance and reaches male decision-makers otherwise absent from conventional immunisation contacts (Chapter 6, Table 6.3; Muluneh et al. 2024:22). A pilot in Chifra district documented 2.4 times more household attendees at joint human-animal health camps compared to health-only outreach. Delphi experts awarded 100% contextual appropriateness and 93% feasibility, with workload management identified as the primary implementation risk (Chapter 7, Table 7.9).

Audience and Delivery Mechanism

Primary audience: pastoralist households who engage regularly with livestock health services but have limited contact with human health services, including male household heads who attend livestock vaccination events. Secondary audience: nutrition service users (children under five for growth monitoring and Vitamin A) and pregnant women (ANC), integrated where district capacity permits. Delivery is through formalised multi-sectoral service integration: child immunisation co-located with biannual livestock vaccination events already established by the Regional Livestock Development Office, using a signed MOU to formalise planning, shared calendars, and data-sharing protocols.

Implementation Components

- Memorandum of Understanding: Signed MOU between Afar RHB and Regional Livestock Development Office establishing joint planning, coordination, shared event calendar, and quarterly joint meetings at district level.
- Joint human-animal vaccination camps: EPI team co-located at livestock vaccination sites with cold chain, vaccines, and registration materials during biannual livestock vaccination periods; families access both services simultaneously.
- Migration data sharing: Livestock officers share community location data, seasonal migration route information, and pastoral calendar with district health offices; HEWs use this data for outreach scheduling and defaulter tracing.
- Male household engagement: Joint camps create the primary platform for engaging male decision-makers who attend livestock events but not health posts; EPI registration and information offered directly at livestock vaccination point.
- Nutrition and MCH co-location: Growth monitoring, Vitamin A supplementation, and ANC contacts co-delivered at joint camps where district capacity permits, reducing total separate household contact requirements.
- Workload management: Explicit workload assessment before integration; per-diem and logistical support provided for health workers participating in joint camps beyond routine outreach schedule.
- Unified service records: Immunisation data from joint camps entered into the standard HMIS system; integrated service utilisation metrics tracked quarterly.
- Commodity pre-positioning: Vaccines, cold chain equipment, and referral forms pre-positioned at livestock vaccination sites 48 hours before camp; logistics checklist signed off by district coordinator.
- Responsible actors: Afar RHB and Regional Livestock Development Office (joint planning, MOU endorsement); district health and livestock offices (event coordination, logistics); HEWs and livestock officers (joint delivery); NGO partners (facilitation and documentation).

Evaluation Framework

Process: Number of joint human-animal health camps per district per quarter vs planned; percentage of livestock vaccination events co-located with child immunisation; average number of children vaccinated per joint camp. Data source: joint camp activity registers, district EPI and livestock office reports.

Outcome: Male household member attendance at immunisation-related events (community survey at six months vs baseline); number of children receiving first dose at joint camp events per district per quarter. Data source: joint camp registers, community health surveys.

Impact: First-dose coverage rate in service-integration districts at 12 and 24 months vs baseline and matched non-integration districts; full immunisation coverage among households registered through livestock vaccination linkage. Data source: HMIS, district EPI annual review.

Table 7.11: Strategies for addressing barriers at multiple level of Social Ecological Model

Strategy	Primary Barriers Addressed	Social Ecological Level
Strategy 1: Mobile Outreach Services	Geographic remoteness, nomadic mobility, limited health facility access	Community, Organisational
Strategy 2: Health Education & Communication	Knowledge gaps, vaccine misconceptions, cultural beliefs	Individual, Interpersonal, Community
Strategy 3: Health Workforce Strengthening	Health worker shortages, inadequate training, low motivation	Organisational, Policy

Strategy 4: Event-Based Vaccination & Leader Engagement	Cultural barriers, mistrust, seasonal congregation opportunities	Interpersonal, Community
Strategy 5: Defaulter Tracking Mechanisms	Follow-up challenges, mobility, weak information systems	Individual, Organisational
Strategy 6: Infrastructure & Cold Chain Investment	Vaccine stockouts, cold chain failures, facility, inadequacy	Organisational, Policy
Strategy 7: Service Integration	Fragmanted services, missed opportunities, workload inefficiencies	Organisational policy

The integration of these strategies creates a comprehensive, multi-level intervention framework designed to achieve sustainable improvements in EPI coverage and equity in Afar pastoralist communities.

7.9 TRUSTWORTHINESS, ETHICAL CONSIDERATIONS, AND UNIQUE CONTRIBUTION

7.9.1 Trustworthiness of the Validation Process

The validation process adhered to Lincoln and Guba's (1985) quality standards:

Whereas Chapter 3 (Section 3.11) addressed trustworthiness of the qualitative empirical inquiry (Phase 2), this section establishes the rigour of the Delphi validation process (Phase 4), which requires distinct quality criteria appropriate to expert consensus methodology. Although both sections apply Lincoln and Guba's (1985) framework, the specific measures differ substantially to reflect the methodological requirements of each phase.

Credibility was established through the internationally validated AGREE II instrument, a two-round Delphi process with 100% expert retention (15/15 participants),

triangulation of quantitative ratings and qualitative feedback, a face-to-face stakeholder workshop, and institutional endorsement from Afar Regional Health Bureau.

Dependability was ensured through pre-specified consensus criteria ($\geq 75\%$ agreement threshold), standardised AGREE II scoring methodology, detailed procedural documentation, explicit audit trail linking revisions to expert feedback, and consistent data analysis procedures across rounds.

Confirmability was strengthened through anonymous expert ratings reducing social desirability bias, conflict of interest declarations, independent instrument pilot testing, and systematic documentation of researcher reflexivity and dissenting views.

Transferability was enhanced through detailed expert panel descriptions, explicit documentation of contextual factors, integration of Afar-specific and transferable pastoralist implementation principles, and validation by experts experienced in multiple pastoralist settings.

7.9.2 Ethical Considerations

The validation process adhered to established ethical principles: informed consent from all experts, anonymisation of individual ratings and comments, voluntary participation with freedom to withdraw, systematic integration of expert feedback demonstrating respect for professional knowledge, comprehensive feedback transparency, and ethical clearance from the University of Venda Research Ethics Committee.

7.9.3 Original Contribution of the Validation Process

This validation study makes several unique and substantive contributions to immunisation programming in pastoralist context including:-

Methodological Innovation: First application of AGREE II instrument to validate immunisation implementation strategies for nomadic pastoralist communities, addressing a critical methodological gap in implementation science and providing a replicable model for comparable settings.

Context-Specific Strategy Integration: Unlike existing guidelines treating pastoralist populations as "hard-to-reach" variants requiring minor adaptations, validated strategies are designed from the ground up for nomadic realities, incorporating seasonal migration patterns, clan governance structures, religious calendars, livestock market systems, and oral communication traditions as central design features.

Rigorous Evidence Integration: Triangulation of primary empirical qualitative data from 77 Afar community members and health workers, integrative review of global best practices, and systematic expert validation bridges the local-global evidence gap, maintaining scientific rigour while ensuring contextual relevance.

Cultural Validation: Systematic quality assessment of culturally embedded practices including immunisation delivery during religious gatherings (Eid, Ramadan, mosque congregations), communal event-based vaccination (weddings, clan meetings), market day campaigns, and engagement of religious and traditional leaders achieved 100% expert consensus on contextual appropriateness and 93% on implementation feasibility.

Institutional Translation: Formal endorsement from Afar Regional Health Bureau creates a research-to-policy pathway through participatory validation processes, multi-stakeholder governance frameworks, resource mobilisation mechanisms, and structured accountability systems.

Theoretical Advancement: Operationalisation of the Social Ecological Model in pastoralist contexts demonstrates how multi-level interventions (individual, interpersonal, organisational, community, policy) must align simultaneously to be effective in mobile, marginalised populations.

These contributions advance both the science of implementation strategy development (methodological contribution) and the practice of pastoralist health programming (substantive contribution), with transferability to other marginalised, mobile populations globally.

7.10 CHAPTER SUMMARY

This chapter documented the systematic validation of EPI implementation strategies for Afar pastoralist communities.

Using a two-round Delphi technique complemented by stakeholder consultation, the study achieved full expert consensus across all AGREE II domains. Methodological transparency, operational feasibility, and contextual responsiveness were progressively strengthened through structured feedback and revision.

Institutional endorsement further reinforced the policy relevance and sustainability of the proposed strategies.

The validated strategies provide a robust foundation for improving immunisation coverage in pastoralist contexts. The subsequent chapter presents the study's conclusions, limitations, and recommendations.

CHAPTER 8

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS

8.1 INTRODUCTION

The preceding chapter presented the validated strategic approaches designed to improve vaccination services within pastoralist communities in Afar, Ethiopia. Building on that discussion, this chapter brings the overall research process to its conclusion by synthesising the research journey and consolidating key findings across all phases of the study. It reflects critically on the study's strengths and limitations, articulates its original contribution to knowledge, and examines its implications for theory, policy, and practice.

In doing so, the chapter consolidates the evidence underpinning the innovative, contextually grounded strategies developed and presents actionable, evidence-based recommendations, pathways for dissemination, and directions for future research. These strategic approaches represent a systematic and responsive framework for addressing the persistent challenges of delivering equitable immunisation services in mobile, marginalised, and hard-to-reach populations, thereby strengthening the implementation of the Expanded Programme on Immunisation in pastoralist settings.

8.2 OBJECTIVES OF THE STUDY

The overarching aim of this study was to develop contextually appropriate strategies to overcome barriers towards implementing the EPI in pastoralist communities of Afar, Ethiopia. This aim was pursued through three interconnected objectives:

1. To identify and analyse the multi-level systemic, organisational, and socio-cultural factors influencing EPI service utilisation in pastoralist communities of Afar, Ethiopia.

This objective was addressed through qualitative inquiry involving semi-structured interviews and focus group discussions with parents and caregivers (n = 60) and healthcare workers, including health extension workers and EPI coordinators (n = 17), across five woredas: Ayseita, Afambo, Dubti, Mille, and Samara Logia. Thematic analysis revealed key community-level, health system-

level, and contextual barriers, including geographic inaccessibility, seasonal flooding, population mobility, vaccine hesitancy, limited health workforce capacity, inadequate transportation, and constrained financial resources.

2. To examine how national and regional immunisation policies and existing strategies are translated into local implementation within pastoralist settings. This objective focused on assessing institutional capacity, service delivery models, and the implications of population mobility for programme delivery. It was addressed through key informant interviews with district and regional EPI focal persons, health centre coordinators, and partner organisations, complemented by an integrative literature review following the seven-step protocol of Kutcher and LeBaron (2022). The review synthesised empirical evidence from major databases published between 2018 and 2024. Findings indicated that prevailing strategies—primarily fixed, outreach, and mobile services—were insufficiently adapted to the dispersed settlement patterns, livelihood systems, and socio-cultural dynamics of pastoralist communities.

3. To assess the effectiveness and sustainability of existing and previous immunisation strategies in improving EPI coverage in pastoralist communities of Afar.

This objective was addressed through critical analysis of qualitative data and documentary evidence from programme reports and the integrative literature review. The analysis examined operational feasibility, continuity of service delivery, community acceptability, and resource requirements. Results demonstrated that while short-term improvements were occasionally achieved, most interventions lacked sustainability due to inadequate financing, weak coordination, and limited alignment with pastoral mobility patterns.

4. To develop and validate contextually appropriate strategies to strengthen EPI service utilisation and immunisation coverage among pastoralist populations in Afar, Ethiopia.

This objective was accomplished through triangulation of qualitative findings and literature review evidence, leading to the formulation of draft strategies. These strategies were subsequently validated using a two-round Delphi technique involving 15 multidisciplinary experts in immunisation and public health. The Appraisal of Guidelines, Research and Evaluation (AGREE II) instrument was applied across six quality domains. Consensus was defined as $\geq 76\%$ agreement,

consistent with established methodological guidance. Seven evidence-based, contextually tailored strategies emerged, demonstrating strong scientific rigour, feasibility, and relevance to pastoralist settings.

8.3 SUMMARY OF FINDINGS

The study generated comprehensive findings across three interconnected phases, providing a holistic understanding of barriers to EPI implementation and evidence-based strategies to overcome them.

8.3.1 Phase 1 and 2: Barriers to EPI

Implementation
Community-Level Barriers Geographic inaccessibility emerged as the primary barrier, with healthcare facilities located at considerable distances from pastoral settlements, often requiring travel times exceeding two hours. Families living more than one hour from vaccination sites demonstrated significantly lower full immunisation rates. Seasonal flooding during June to September further compounds accessibility by rendering roads impassable and disrupting scheduled immunisation sessions. The nomadic and semi-nomadic lifestyle creates substantial challenges for continuity of care. Parental migration driven by the search for water and pasture results in families crossing district and regional boundaries, leading to fragmented immunisation records and missed follow-up doses. Cross-border movement between Ethiopia and neighbouring Djibouti and Eritrea further complicates immunisation tracking and service delivery. Fear of vaccine side effects emerged as a significant demand-side barrier, rooted in experienced adverse events such as fever, swelling, or irritability following vaccination. Parents reported reluctance to return for subsequent doses, often amplified by inadequate pre-vaccination counselling and insufficient post-vaccination support.

Vaccine hesitancy in Afar was distinct from resistance in high-income settings. Rather than being driven by social media misinformation or organised anti-vaccine movements, hesitancy stemmed from competing livelihood priorities, opportunity costs associated with attending health facilities, and limited exposure to formal health education. Many participants expressed beliefs that camel milk and traditional healing practices provided sufficient protection against childhood illnesses.

Health System-Level Barriers: Inadequate budgetary allocation for immunisation activities emerged consistently across all five study woredas, limiting outreach frequency, transport availability, and capacity for defaulter follow-up. District health

offices reported that budget constraints forced prioritisation of easily accessible areas over hard-to-reach pastoral settlements, perpetuating service access inequities.

The shortage of vehicles and motorcycles for outreach activities constituted a critical logistical barrier. Health extension workers reported that vast distances between kebeles, combined with challenging terrain and lack of reliable transportation, made regular outreach sessions impractical. When vehicles were available, fuel shortages and maintenance issues frequently disrupted planned activities.

Insufficient health workforce affected both quantity and quality of immunisation services. Many health posts in pastoral areas operate with only one health extension worker responsible for catchment populations exceeding 5,000 people dispersed across large geographic areas. The absence of health extension workers from posts due to training programmes, health campaigns, or personal leave frequently resulted in closed facilities and missed immunisation opportunities.

The lack of immunisation-specific training was consistently highlighted by key informants. Newly deployed staff often lacked exposure to Immunisation in Practice (IIP) and Effective Vaccine Management (EVMA) training, resulting in knowledge gaps regarding cold chain management, contraindications, vaccine administration techniques, and counselling approaches.

8.3.2 Phase 3: Development of Evidence-Based Strategies

The strategy development phase employed rigorous triangulation of qualitative findings with evidence from the integrative literature review. The review synthesised 66 initially screened articles, with final inclusion of 22 peer-reviewed studies and grey literature documents addressing immunisation in pastoralist, nomadic, or hard-to-reach settings. The review identified promising practices from comparable contexts: solar-powered vaccine carriers (Pakistan, Afghanistan), religious and community leader engagement (Somalia, Kenya), colour-coded immunisation cards (India), mobile phone reminder systems (Ghana, Tanzania), and school-entry immunisation requirements (Rwanda). Through iterative analysis and synthesis, eleven draft strategies emerged combining contextual insights from Afar with evidence-based practices adapted from other settings. These strategies addressed both supply-side constraints (health system

barriers) and demand-side challenges (community barriers), recognising that sustainable coverage improvement requires simultaneous interventions at multiple health system levels.

8.3.3 Phase 4: Validation and Refinement of Strategies

The Delphi validation process involved two rounds of expert consultation with 15 multidisciplinary experts: Afar Regional Health Bureau representatives (n=4), district health offices (n=3), non-governmental organisations (n=3), academia (n=2), and national EPI programme managers (n=3). This composition ensured validation incorporated policy, operational feasibility, cultural appropriateness, and scientific rigour perspectives. In Round 1, experts assessed each strategy across six AGREE II domains using a five-point Likert scale. Four strategies achieved consensus ($\geq 76\%$ agreement): installing mobile solar equipment on vaccine carriers, utilising colour-coded vaccination follow-up cards, engaging knowledgeable family members as immunisation agents, and utilising community structures for programme improvement. Three strategies required refinement based on expert feedback regarding operational feasibility and resource requirements: exploring partnership models with private health facilities to expand service points while maintaining free-of-charge immunisation consistent with national EPI policy, decorating immunisation wards in fixed health facilities (not applicable to mobile outreach points), a strategy targeting semi-settled communities near health centres, and incorporating immunisation briefings in educational curricula.

Round 2 focused on refined strategies with additional clarifications regarding implementation mechanisms, resource implications, and monitoring approaches. All seven strategies achieved consensus above 76%, with highest agreement (100%) for scope and purpose (Domain 1) and stakeholder involvement (Domain 2), and lowest agreement (80%) for editorial independence (Domain 6). The validation process culminated in a face-to-face workshop where implementation modalities, timelines, and responsible actors were documented.

8.4 STRENGTHS AND LIMITATIONS OF THE STUDY

8.4.1 Strengths of the Study

This study exhibits several methodological strengths that enhance the credibility and trustworthiness of its findings. First, the study obtained rigorous ethical approval from three independent ethics review committees: the University of South Africa College of Human Sciences Research Ethics Committee (Clearance number: 14064316_CRECHS_2023), the Afar Regional Health Bureau Ethics Committee, and UNISA's regional centre in Ethiopia. This multi-level ethical scrutiny ensured that the research adhered to the highest standards of participant protection and research integrity.

Second, the qualitative approach employed in this study enabled deep exploration of the complex, context-specific factors influencing immunisation utilisation in pastoralist settings. Unlike previous quantitative studies that primarily documented coverage statistics, this research illuminated the "how" and "why" behind low immunisation rates, revealing the lived experiences, perceptions, and systemic constraints that shape health-seeking behaviour. This interpretive depth is particularly valuable for understanding health phenomena in marginalised populations whose voices are often absent from health systems research (Creswell & Poth 2018:44).

Third, the study demonstrated comprehensive stakeholder engagement by including multiple perspectives across the health system. Data collection involved parents and caregivers as primary decision-makers for child health; health extension workers as frontline service providers; health centre EPI focal persons as supervisors; district EPI coordinators as programme managers; regional EPI focal persons as policy implementers; and partner organisations as collaborative actors. This multi-level approach provided a holistic understanding of barriers and enablers at different levels of the health system, consistent with the Social Ecological Model framework guiding the study.

Fourth, the validation process for the developed strategies represents a significant strength. The use of the Delphi technique with a multidisciplinary expert panel, combined with assessment using the internationally recognised AGREE II instrument,

ensured that the strategies were not only theoretically sound but also practically feasible and contextually appropriate. The achievement of consensus across six domains of guideline quality demonstrates the robustness of the strategy development process and enhances the likelihood of successful implementation.

Fifth, the research benefited from the researcher's insider perspective as a public health professional with prior experience working on immunisation programmes in the Afar region. This positionality facilitated trust-building with participants, cultural sensitivity in data collection, and practical insight into health system operations. To mitigate potential bias associated with insider research, the study employed an independent co-coder, member checking with participants to verify interpretation of findings, and reflexive journaling throughout the research process.

8.4.2 Limitations of the Study

Despite its strengths, this study has several limitations that must be acknowledged.

First, the geographic scope was limited to five woredas within the Afar region, which, while representing diverse pastoral contexts, may not capture the full heterogeneity of pastoralist communities across Ethiopia's other pastoral regions (Somali, Oromia, and SNNPR). The findings and strategies developed are therefore most directly applicable to the Afar context, though they may offer transferable insights for similar settings.

Second, the sampling approach, while appropriate for qualitative inquiry, limits statistical generalisability. Purposive sampling was employed to select information-rich cases, but this means the study participants may not represent the full spectrum of perspectives within the pastoral communities. Specifically, the study may have underrepresented the most marginalised and hardest-to-reach segments of the population—those who have never accessed health services and who may hold the strongest reservations about immunisation.

Third, the language of data collection presents a potential limitation. While interviews were conducted in Afaraf (the local language) with the assistance of trained translators and subsequently transcribed into English, some nuance may have been lost in translation. Cultural concepts, metaphors, and contextual meanings embedded in the Afaraf language may not have been fully captured in English transcription and analysis.

To mitigate this limitation, back-translation verification was conducted, and transcripts were reviewed by bilingual research assistants to ensure fidelity of meaning.

Fourth, the duration of focus group discussions (approximately 15 minutes) was shorter than conventional practice, which typically recommends 60-90 minutes for meaningful group dialogue (Creswell & Poth 2018:188). This brevity may have limited the depth of discussion and the opportunity for diverse perspectives to emerge through group interaction. The short duration was necessitated by practical constraints, including the opportunity costs faced by pastoral women who needed to return to childcare and livelihood activities. To compensate for this limitation, in-depth individual interviews were conducted to capture richer narratives.

Fifth, the absence of longitudinal data means that the study provides a cross-sectional snapshot of barriers and perceptions at a single point in time. Immunisation behaviour and health system performance are dynamic, influenced by seasonal variations, policy changes, and evolving community attitudes. The strategies developed would benefit from prospective evaluation over an extended implementation period to assess their sustained effectiveness and adaptability to changing contexts.

Sixth, the study did not include a systematic cost-effectiveness analysis of the proposed strategies. While the strategies were assessed for feasibility during the Delphi validation process, detailed costing of implementation and analysis of cost per additional child fully immunised were beyond the scope of this research. Such economic evaluation would be valuable for priority-setting and resource allocation by policymakers and programme managers.

Finally, the integrative literature review, while systematic in approach, was limited to English-language publications available through accessible databases. Relevant evidence published in Amharic, French (from Djibouti), or other languages, as well as grey literature from local NGOs and government reports, may have been missed. This limitation may have resulted in incomplete synthesis of evidence from similar pastoralist contexts globally.

8.5 CONTRIBUTION OF THE STUDY

This study has made a substantial contribution to knowledge, policy, and practice in the field of immunisation in marginalised populations, specifically advancing understanding of health systems' responsiveness to mobile and hard-to-reach communities.

8.5.1 Theoretical Contribution

The study broadens the use of the Social Ecological Model (SEM) to the specific context of immunisation delivery in pastoralist settings. Although the SEM has been widely applied in health behaviour research, its implementation in settings characterized by population mobility, weak health infrastructure, and strong cultural traditions has received limited scholarly attention. This research shows how individual, interpersonal, organisational, community, and policy factors interact dynamically to influence immunisation use among pastoral communities. Specifically, the study indicates that barriers are not confined to any single level of the SEM but instead appear as interconnected challenges that necessitate multi-level, systems-based interventions.

Furthermore, the research contributes conceptual clarity by distinguishing between health system barriers (supply-side constraints) and community barriers (demand-side challenges), while simultaneously demonstrating their interdependence. This distinction is critical for designing targeted interventions: supply-side improvements alone (such as increased mobile outreach) will not translate to improved coverage if community-level barriers (such as vaccine hesitancy or competing livelihood priorities) remain unaddressed. Conversely, demand creation activities will fail if health system responsiveness is inadequate. The study's findings underscore the imperative of simultaneous, coordinated action across multiple determinants of immunisation utilisation.

8.5.2 Methodological Contribution

This study contributes methodologically through its rigorous integration of qualitative inquiry with Delphi validation for strategy development. While qualitative research is increasingly recognised as valuable for understanding health system complexity, its direct translation into actionable interventions often remains unclear. This research

demonstrates a systematic pathway from exploratory qualitative findings, through evidence synthesis, to validated, implementable strategies. The explicit documentation of the strategy development process, including criteria for triangulation, expert selection for the Delphi panel, consensus definition, and application of the AGREE II instrument, provides a replicable model for other researchers seeking to develop context-specific health interventions grounded in community and provider perspectives.

Additionally, the study contributes to evolving methodologies for conducting research in hard-to-reach populations. The practical adaptations employed, including flexible interview scheduling around pastoral movement patterns, use of trusted community intermediaries for participant recruitment, culturally appropriate informed consent processes, and acknowledgement of opportunity costs through modest transport reimbursements, offer useful guidance for future research in similar contexts.

8.5.3 Empirical Contribution

Empirically, this study addresses a significant knowledge gap regarding immunisation in Ethiopian pastoralist communities. While national-level surveys such as the Ethiopian Demographic and Health Survey (EDHS) document low coverage in the Afar region (43% fully immunised children aged 12-23 months), they provide limited insight into the specific, context-bound factors driving these inequities. This research provides the first comprehensive, qualitative examination of immunisation barriers in Afar from the dual perspectives of service providers and service users, offering granular insight that is absent from existing literature.

The study's findings challenge assumptions embedded in Ethiopia's national immunisation strategy. For instance, the Health Extension Programme (HEP), which has been highly successful in agrarian regions of Ethiopia, operates on assumptions of stable, settled populations with predictable health service access. This research demonstrates that HEP infrastructure and service delivery models are poorly adapted to pastoral contexts, where population mobility, dispersed settlements, and distinct livelihood patterns require fundamentally different approaches. This evidence base is critical for informing policy reforms and resource allocation decisions.

8.5.4 Practical Contribution and Policy Relevance

Perhaps most significantly, this research makes a substantive practical contribution through the development and validation of seven contextually tailored strategies specifically designed for pastoralist immunisation programmes. These strategies are not theoretical propositions but rather evidence-based, expert-validated interventions that are ready for piloting and scale-up. The strategies address recognised gaps in existing approaches and offer concrete, actionable solutions that can be implemented by the Afar Regional Health Bureau, district health offices, NGO partners, and community-based organisations.

The validation of these strategies through the Delphi process involving 15 experts from diverse institutional backgrounds enhances their policy relevance and feasibility. Consensus among policymakers, programme managers, NGO practitioners, and academic experts signals broad stakeholder buy-in, which is often a prerequisite for successful intervention adoption and sustained implementation. The strategies align with national health policy priorities, including the Health Sector Transformation Plan (HSTP) and the National Health Equity Strategy, while responding to the specific operational realities of Afar's health system.

Importantly, the strategies developed in this study offer potential transferability beyond the Afar region. While they were designed for the Afar context, the underlying principles—mobile service delivery, community engagement, innovative communication approaches, systems strengthening—are applicable to other pastoralist regions in Ethiopia (Somali, Oromia, SNNPR) and potentially to pastoral and nomadic populations in neighbouring countries such as Kenya, Somalia, Djibouti, and South Sudan. This regional relevance amplifies the study's contribution beyond the immediate research setting.

8.5.5 Contribution to Social Justice and Health Equity

Finally, this research makes an important contribution to the broader agenda of health equity and social justice in global health. Pastoralist communities, despite constituting approximately 15 million people in Ethiopia (25% of the population in low-income countries globally), have been historically marginalised in health policy, under-

represented in research, and inadequately served by health systems designed primarily for agrarian and urban populations (Zemariam et al. 2024:201). By foregrounding the voices, experiences, and perspectives of pastoral communities and the frontline workers who serve them, this study challenges the prevailing narrative that low immunisation coverage is primarily a result of community ignorance or non-compliance.

Instead, the findings illuminate how structural inequities, including inadequate resource allocation, inappropriate service delivery models, insufficient health workforce, and poor infrastructure, create systematic barriers that disproportionately affect marginalised populations. This reframing shifts responsibility from communities to health systems and policymakers, demanding accountability for ensuring that immunisation services are not only available but also accessible, acceptable, and responsive to diverse population needs. The study thereby contributes to critical scholarship on health equity in sub-Saharan Africa and to the global movement towards Universal Health Coverage (UHC) that explicitly prioritises the most underserved populations.

8.6 RECOMMENDATIONS

This section presents comprehensive, actionable recommendations derived systematically from empirical findings and validated strategies. Recommendations address barriers at individual, community, organisational, and policy levels, structured to promote systemic responsiveness, equity-oriented resource allocation, and sustainable service delivery. Each recommendation specifies clear responsibilities, detailed implementation pathways, resource requirements with cost estimates where feasible, and monitoring mechanisms enabling accountability. Recommendations are organised into two categories: policy and practice recommendations targeting immediate implementation by health system actors, and research recommendations identifying critical knowledge gaps requiring future investigation.

8.6.1 Policy and Practice Recommendations

The following seven policy and practice recommendations provide concrete guidance for federal, regional, and woreda-level actors. They reflect synthesis of qualitative findings, literature evidence, and expert validation, offering practical pathways for translating research into improved immunisation outcomes.

Recommendation 1: Adapt National EPI Guidelines for Pastoralist Contexts

Current national EPI implementation guidelines inadequately address pastoral population needs, being designed primarily for settled populations served through fixed facility infrastructure. This recommendation calls for systematic revision of implementation guidance through establishment of a technical working group to incorporate mobility-responsive service delivery models, flexible scheduling accommodating seasonal migration, cross-district tracking mechanisms for mobile populations, and culturally appropriate community engagement approaches respecting traditional leadership structures.

Implementation approach should proceed through five phases: (1) Technical working group establishment with representation from pastoral regions, Federal Ministry of Health EPI Directorate, WHO, UNICEF, and academic institutions with pastoral health expertise; (2) Consultative workshops in each major pastoral region (Afar, Somali, Oromia, Southern Nations) to gather implementer and community perspectives on required adaptations; (3) Pilot implementation of adapted approaches in selected woredas representing diverse pastoral contexts with rigorous process documentation; (4) Refinement of guidelines based on pilot learning; and (5) Integration into national EPI strategic plan with accompanying training curricula, supervision tools, and monitoring frameworks.

Resource requirements include: technical working group facilitation costs (approximately USD 15,000 for meetings, technical support, drafting); regional consultative workshops (USD 8,000 each for four regions, total USD 32,000); pilot implementation support (USD 50,000 for three-five woredas over 12 months); and guideline production and dissemination (USD 20,000). Total estimated cost: USD 117,000 over 18-month period. Expected outcomes include policy-level recognition of pastoral contexts as requiring distinct approaches, standardised implementation guidance reducing ad-hoc improvisation and geographic disparities, enhanced implementer capacity and confidence in adapting services, and improved monitoring systems tracking pastoral-specific indicators.

Recommendation 2: Implement Equity-Based Budgeting Reflecting Higher Pastoral Area Costs

Current per-capita budget allocation formulas perpetuate inequity by failing to account for substantially higher operational costs in pastoral areas due to geographic dispersion, limited infrastructure, population mobility, and harsh terrain. This recommendation calls for development and implementation of equity-weighted allocation formulas incorporating multiple equity criteria: geographic remoteness indexed through distance to main roads and health facilities; population density with lower density receiving higher weightings; baseline coverage status with lower-performing areas receiving enhanced allocation; mobility patterns with highly nomadic populations requiring higher allocations; and infrastructure availability with areas lacking roads, electricity, and water receiving additional resources.

Implementation approach involves: (1) Costing analysis comparing actual expenditures and resource requirements in pastoral versus non-pastoral woredas, documenting differences in transportation costs (fuel, vehicle maintenance, staff time), outreach session expenses (per diem, accommodation, cold chain logistics), and defaulter tracing efforts; (2) Formula development by technical team including Ministry of Health planning and finance specialists, regional health bureau representatives, health economists, and equity experts; (3) Advocacy strategy targeting Ministry of Finance through evidence briefs, high-level advocacy meetings with treasury officials, and engagement of development partners for co-financing commitments; (4) Establishment of dedicated budget lines for hard-to-reach populations protected from mid-year reallocations; and (5) Transparent monitoring and annual review processes assessing whether increased allocations translate into coverage improvements.

This requires substantial financial commitment. If Ethiopia's 150 pastoral woredas each require an additional USD 40,000-50,000 annually to achieve coverage parity, total additional allocation would be USD 6-7.5 million per year. While significant, this represents less than 5% of Ethiopia's total EPI budget and is justified by equity principles and disease prevention cost-effectiveness. Expected outcomes include sustainable funding addressing higher operational costs in pastoral areas, reduced coverage disparities between pastoral and non-pastoral regions, enhanced health

system legitimacy as services demonstrate responsiveness to all populations, and improved disease control outcomes benefiting national public health security.

i. Recommendation 3: Establish National Pastoral EPI Coordination Mechanism

Current fragmented implementation across pastoral regions limits learning exchange, creates inefficiencies through duplication, and hampers accountability. This recommendation calls for creation of a national pastoral EPI coordination platform through formalised structure with representation from all pastoral regions, serving multiple functions: coordination of implementation activities and resource allocation; learning exchange facilitating sharing of innovations and lessons across regions; equity monitoring tracking pastoral-specific indicators and holding stakeholders accountable; technical support providing guidance on challenging implementation issues; and rapid response capability for outbreak situations requiring cross-regional mobilisation.

The mechanism should be institutionalised within Federal Ministry of Health EPI Directorate as a standing technical committee with quarterly review meetings, annual planning workshops, dedicated secretariat support, and clear terms of reference specifying roles, decision-making authority, and accountability structures. Membership should include: Federal Ministry of Health EPI Directorate (secretariat and chair); pastoral regional health bureaus (Afar, Somali, Oromia, Southern Nations); Ethiopian Public Health Institute; key development partners (WHO, UNICEF, GAVI, PATH); implementing NGOs with pastoral programmes; and pastoral community representatives providing beneficiary perspectives.

Functions include: developing shared indicators and monitoring frameworks specific to pastoral contexts; facilitating bi-annual peer learning exchanges where regions share innovations and challenges; reviewing quarterly coverage data and identifying regions needing additional support; mobilising resources for regional priorities through coordinated advocacy; and coordinating outbreak responses, including cross-border collaboration with neighbouring countries. Resource requirements estimated at USD 80,000 annually, including secretariat staffing, meeting costs, learning exchange facilitation, and documentation. Expected outcomes include strengthened accountability

through regular performance review, accelerated innovation diffusion as effective practices spread rapidly across regions, reduced duplication and enhanced efficiency, and improved cross-regional coordination, particularly for border areas and nomadic populations crossing regional boundaries.

Recommendation 4: Pilot Validated Strategies with Rigorous Monitoring

While expert validation provides confidence in strategy quality, actual implementation effectiveness must be demonstrated through rigorous piloting before scale-up. This recommendation calls for phased pilot implementation of the seven validated strategies in carefully selected woredas representing diverse pastoral contexts: nomadic populations (Chifra, Dubti), semi-nomadic populations (Amibara), and semi-settled populations (Semera, Megale). Pilots should receive intensive implementation support including: technical assistance for strategy adaptation to local contexts; adequate resourcing ensuring pilots are not under-resourced to the point of predetermined failure; monthly monitoring visits documenting facilitators, barriers, and required modifications; and community engagement ensuring beneficiary perspectives inform ongoing refinement.

Evaluation framework should assess multiple dimensions: coverage outcomes (proportion of children fully immunised, proportion with timely vaccination, dropout rates between doses); equity outcomes (coverage among most marginalised subgroups including fully nomadic families, conflict-affected communities); process outcomes (outreach session frequency and attendance, health worker competence and confidence, community acceptability); sustainability indicators (institutional ownership, financing continuation, staff retention); and cost-effectiveness through economic evaluation. Mixed-methods evaluation combining quantitative coverage surveys with qualitative process documentation provides comprehensive assessment.

Implementation should follow structured timeline: Months 1-3 (detailed implementation planning, stakeholder engagement, baseline data collection); Months 4-6 (intensive implementation launch with high-frequency support visits); Months 7-12 (continued implementation with monthly monitoring); Months 13-15 (end-line evaluation and analysis); Months 16-18 (dissemination of findings, refinement of strategies, scale-up planning). Total estimated cost USD 250,000 for five-woreda pilots including

implementation support, monitoring, evaluation, and documentation. Expected outcomes include evidence-based refinement demonstrating what works and what requires modification, operational readiness as strategies transition from validated concepts to proven interventions, enhanced stakeholder buy-in as documented success builds confidence, and informed scale-up decisions based on evidence rather than assumptions.

Recommendation 5: Strengthen Health Workforce Capacity for Pastoral Contexts

Health workforce capacity constraints profoundly limit immunisation service quality and coverage. This recommendation calls for comprehensive workforce strengthening through multiple pathways: institutionalised immunisation-specific training incorporating Immunisation in Practice (IIP) and Effective Vaccine Management (EVM) modules within pre-service curricula for health officers, nurses, and health extension workers; regular in-service training with competency-based approaches emphasising practical skills; structured supportive supervision providing constructive feedback and mentorship rather than punitive fault-finding; performance-based incentives rewarding hard-to-reach service delivery; continuous professional development opportunities maintaining and updating competencies; and retention strategies including housing support, career development pathways, and recognition programmes reducing turnover in remote pastoral posts.

Implementation approach should include: (1) Training needs assessment documenting current competency gaps through direct observation, knowledge assessments, and healthcare worker self-reports; (2) Standardised curriculum development adapting national training materials to pastoral contexts with case examples, role-plays, and scenarios reflecting pastoral realities; (3) Training of trainers ensuring regional and woreda-level capacity to deliver training without external dependence; (4) Quarterly refresher training sessions maintaining competency between annual comprehensive training; (5) Structured supervision system with checklists emphasising clinical quality, interpersonal communication, and cold chain management; (6) Mentorship programmes pairing experienced pastoral health workers with newcomers; and (7) Career pathways creating advancement opportunities for health extension workers demonstrating excellence, reducing pressure for urban migration.

Resource requirements substantial but justified: training curriculum development (USD 30,000); training of trainers workshops for 50 regional and woreda trainers (USD 60,000); woreda-level training for 500 health workers across pastoral regions (USD 200,000 covering training costs, per diem, materials); supervision strengthening including supervisory training, vehicle and fuel support, supervision tools (USD 150,000 annually); and incentive schemes for hard-to-reach service delivery (USD 100 per health worker per quarter, total USD 200,000 annually for 500 workers). Total first-year cost is approximately USD 640,000 with recurring annual costs of USD 350,000. Expected outcomes include improved service quality and provider confidence resulting in better community experiences; enhanced cold chain management reducing vaccine wastage and adverse events; strengthened interpersonal communication and counselling addressing hesitancy more effectively; and reduced staff turnover as capacity development and recognition improve job satisfaction.

Recommendation 6: Strengthen Community Partnerships with Religious and Traditional Leaders

Religious leaders (Imams) and traditional leaders (clan elders) wield substantial influence over community health-seeking behaviour in pastoral Afar. This recommendation calls for formalised engagement structures positioning these leaders as immunisation advocates rather than passive bystanders. Specific approaches include: establishing immunisation advocacy committees at community levels with formal terms of reference, regular meetings, and clear roles; training programmes for leaders covering vaccine science, immunisation schedules, addressing common misconceptions, and counselling approaches; integration of health messages into religious gatherings with Friday sermons including brief immunisation reminders during high-coverage periods; leveraging communal gatherings including Eid celebrations, weddings, funerals, clan meetings, and market days as vaccination awareness and service delivery opportunities; and recognition programmes acknowledging leaders championing immunisation through certificates, public acknowledgement, and documentation of their contributions.

Implementation requires culturally sensitive approaches respecting traditional authority while avoiding coercion or instrumentalisation. Regional and woreda health offices should coordinate engagement with community leaders rather than bypassing them.

NGOs with established community relationships should facilitate introductions and trust-building. Training should be participatory rather than didactic, incorporating leaders' concerns and questions. Integration should be organic rather than imposed, with leaders determining appropriate messaging and timing. Recognition should align with cultural values, avoiding monetary incentives that could undermine intrinsic motivation or create conflicts of interest.

Estimated costs relatively modest compared to impact potential: leadership mapping and engagement strategy development (USD 25,000); training development and delivery for 200 religious and traditional leaders across pastoral regions (USD 80,000); ongoing engagement including quarterly coordination meetings, communication materials (USD 40,000 annually); recognition programmes (USD 15,000 annually); and monitoring and documentation (USD 20,000). Total first-year cost approximately USD 180,000 with recurring annual costs of USD 75,000. Expected outcomes include increased community acceptability as trusted leaders validate immunisation safety and importance; enhanced cultural appropriateness as messages align with religious teachings and traditional values; improved utilisation as leader advocacy creates social desirability and normative expectations; amplified reach as leaders communicate with populations health workers struggle to access; and strengthened health system-community relationships as partnerships build mutual respect and trust.

Recommendation 7: Integrate Cross-Border Coordination Mechanisms

Pastoral populations frequently cross international borders between Ethiopia, Djibouti, Eritrea, Kenya, and Somalia in search of pasture and water, creating immunisation continuity challenges as vaccination records and tracking systems do not follow families across borders. This recommendation calls for establishment of cross-border health coordination mechanisms specifically for immunisation including: bilateral agreements between neighbouring countries' health ministries establishing reciprocal service provision whereby pastoralists from either country can receive services in border areas regardless of citizenship; standardised immunisation cards recognised across borders with common formats, language options, and validation procedures preventing duplication or confusion; shared electronic registries where feasible enabling tracking across borders, though recognising current technology and infrastructure limitations make this long-term aspiration rather than immediate solution; coordinated outreach

schedules ensuring border communities receive services from one or both sides rather than falling through gaps; and joint outbreak responses mobilising resources from both countries when vaccine-preventable disease outbreaks threaten cross-border populations.

Implementation requires diplomatic engagement alongside technical planning. Federal Ministry of Health and Ministry of Foreign Affairs should lead bilateral discussions. Regional health bureaus in border zones should coordinate operational implementation. WHO and UNICEF should provide technical support and facilitate dialogue. Initial focus should be Ethiopia-Djibouti border (Afar Region) as pilot given relatively small geographic area and manageable population size before expanding to more complex Ethiopia-Kenya, Ethiopia-Somaliland, and Ethiopia-Sudan borders.

Resource requirements include: bilateral agreement negotiation and memorandum of understanding development (USD 30,000); cross-border coordination mechanism establishment with quarterly coordination meetings (USD 50,000 annually); standardised card development and production (USD 40,000); joint outreach operations (USD 100,000 annually for fuel, per diem, logistics); and monitoring and evaluation (USD 30,000). Total first-year cost approximately USD 250,000 with recurring annual costs of USD 180,000. Expected outcomes include improved continuity as children receive appropriate subsequent doses regardless of location; reduced duplication as tracking systems prevent redundant vaccination; enhanced equity as border populations currently falling through cracks receive consistent services; strengthened regional health security as improved coverage reduces outbreak risks; and valuable learning applicable to other health priorities requiring cross-border coordination including maternal health, nutrition, and infectious disease surveillance.

TABLE 8.1: SUMMARY OF POLICY AND PRACTICE RECOMMENDATIONS

Section	Rec. No.	Recommendation	Key Focus / Action	Responsible Stakeholders	Intended Outcome
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8.6.1	1	Adapt national EPI guidelines for pastoralist contexts	Revise EPI implementation guidance to incorporate mobility-responsive service delivery models, flexible scheduling, cross-district tracking, and culturally appropriate community engagement	Federal Ministry of Health, pastoral regional bureaus, WHO, UNICEF	Improved policy relevance and standardised implementation
8.6.1	2	Introduce equity-based resourcing	Apply equity-weighted budgeting reflecting higher outreach and logistical costs	Federal Ministry of Health, Ministry of Finance, partners	Reduced coverage disparities
8.6.1	3	Establish national coordination mechanism	Create a technical platform for coordination, learning, and equity monitoring	Federal Ministry of Health, regional bureaus, partners	Strengthened accountability and scalability
8.6.1	4	Pilot validated strategies	Implement phased pilots with structured monitoring	Afar RHB, district offices, partners	Evidence-based refinement and scale-up readiness
8.6.1	5	Strengthen workforce capacity	Institutionalise immunisation-specific training and supportive supervision	Afar RHB, district offices, training institutions	Improved service quality and trust

8.6.1	6	Strengthen community partnerships	Formalise engagement with religious and traditional leaders	Regional/district offices, community leadership	Increased acceptability and utilisation
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8.6.2 Recommendations for Future Research

While this study makes substantial contributions, it also reveals critical knowledge gaps requiring future investigation. The following research recommendations identify priorities for advancing theoretical understanding, methodological approaches, and empirical evidence essential for optimising immunisation equity in pastoral and marginalised populations.

Research Priority 1: Apply Theory-Driven Implementation Science Frameworks

This study identified and validated strategies but did not systematically analyse implementation processes determining success or failure. Future research should employ theory-driven implementation frameworks—particularly the Consolidated Framework for Implementation Research (CFIR), the Reach Effectiveness Adoption Implementation Maintenance (RE-AIM) framework, and realist evaluation approaches—to examine multi-level determinants of implementation success. CFIR's five domains (intervention characteristics, outer setting, inner setting, individual characteristics, implementation process) provide comprehensive lens for understanding why strategies work in some contexts but not others. Realist evaluation's mechanism-context-outcome configurations illuminate what works, for whom, in what circumstances, and why.

Research should employ mixed-methods designs combining quantitative implementation outcome assessments (coverage achieved, fidelity to protocols, sustainability over time) with qualitative process evaluation documenting implementation experiences, contextual factors enabling or constraining implementation, and mechanisms through which strategies produce effects. Longitudinal designs tracking implementation over 2-3 years would capture sustainability dimensions often missed in short-term evaluations. This research would generate critical knowledge about how to implement successfully, complementing existing knowledge about what to implement,

thereby advancing implementation science while providing practical guidance for programme managers.

Research Priority 2: Expand Scope to Immunisation Timeliness and Continuity

This study focused primarily on immunisation coverage—whether children receive vaccines—but did not extensively examine timeliness (whether vaccines are received at recommended ages) or continuity across mobile populations. Vaccine timeliness matters significantly for disease prevention, as delayed vaccination leaves children vulnerable during critical developmental periods. Multi-dose vaccine completion patterns, effects of seasonal migration on schedule interruption, and cross-border coordination effectiveness all warrant systematic investigation.

Future research should employ longitudinal cohort designs tracking children from birth through completion of childhood immunisation schedules, documenting timing of each vaccine dose, reasons for delays, and factors enabling or preventing timely completion. GPS tracking of household movement patterns combined with immunisation records would quantify how mobility affects continuity. Cross-border assessment examining service utilisation patterns of families crossing international boundaries, effectiveness of reciprocal service provision agreements, and adequacy of tracking mechanisms would inform coordination improvements. This research would provide nuanced understanding beyond binary coverage metrics, enabling development of interventions specifically addressing timeliness and continuity rather than coverage alone.

Research Priority 3: Conduct Health System Mapping and Integration Analysis

Immunisation services operate within broader health systems, intersecting with antenatal care, postnatal care, child wellness services, nutrition programmes, and infectious disease surveillance. However, these intersections and potential integration opportunities remain poorly understood in pastoral contexts. Health system mapping analysing interactions across EPI service pathways, identifying coordination gaps, and revealing integration opportunities would inform systems-strengthening approaches moving beyond vertical disease-specific programming toward comprehensive integrated primary healthcare.

Research should employ caregiver journey mapping following families' experiences across multiple health services and touchpoints; systems thinking approaches using causal loop diagrams to illustrate how different system components interact and influence each other; stakeholder network analysis mapping relationships, information flows, and power dynamics among actors involved in immunisation; and service integration assessment examining feasibility, benefits, and challenges of integrating immunisation with other maternal-child health services. This research would identify opportunities for efficiency gains, improved service quality through synergistic integration, and enhanced comprehensiveness of primary healthcare delivery, ultimately strengthening system responsiveness to pastoral population needs.

Research Priority 4: Examine Enacted Implementation Practices and Service Quality

This study documented intended strategies and structural barriers but did not systematically observe actual service delivery practices. Implementation science increasingly recognises that what happens during service encounters—the 'black box' of implementation—critically shapes effectiveness. Research examining enacted implementation practices would illuminate how providers actually counsel families, obtain informed consent, handle adverse events, engage traditional leaders, and adapt services to mobile populations. Quality of counselling, authenticity of informed consent processes, appropriateness of community engagement, and fidelity to evidence-based protocols all warrant investigation.

Research should employ direct observation of service delivery encounters with structured observation tools capturing counselling content, interpersonal communication quality, and clinical competence; mystery client approaches with trained pseudo-clients assessing provider behaviours; analysis of counselling content documenting what information is provided, how concerns are addressed, and whether communication is culturally appropriate; and fidelity assessment comparing actual implementation against established protocols and standards. This research would identify training needs based on observed competency gaps rather than assumed deficiencies, enhance service quality through evidence-based quality improvement interventions, strengthen informed decision-making by ensuring families receive adequate information for meaningful

consent, and advance person-centred care principles emphasising respect, dignity, and responsiveness to individual preferences and values.

Research Priority 5: Evaluate Long-Term Effectiveness, Sustainability, and Cost-Effectiveness

While validated strategies demonstrate face validity and expert endorsement, rigorous effectiveness evaluation through experimental or quasi-experimental designs remains essential before confident scale-up recommendations can be made. Furthermore, long-term sustainability beyond initial implementation periods and cost-effectiveness compared to alternative strategies require systematic assessment. Research should employ pragmatic cluster-randomised controlled trials comparing validated strategies against standard care in matched pastoral woredas, measuring coverage outcomes, equity outcomes, and implementation outcomes. Stepped-wedge designs, where interventions are sequentially rolled out to clusters over time, provide alternative rigorous approach when randomisation is politically or ethically challenging.

Economic evaluation should include cost-effectiveness analysis calculating incremental cost per additional child fully immunised compared to standard approaches; budget impact analysis projecting total costs if strategies were scaled nationally across all pastoral regions; and sustainability assessment examining financing continuation after pilot funding ends, institutional ownership and integration into routine systems, and community demand persistence. Such research would strengthen evidence base for policy decisions by demonstrating not just that strategies work but whether they represent good value for money in resource-constrained settings. It would inform resource allocation by enabling comparison across different health priorities. It would support scale-up decisions by identifying strategies offering best balance of effectiveness, feasibility, and affordability. It would attract donor support by providing compelling evidence that investments will yield population health improvements cost-effectively.

8.7 DISSEMINATION OF THE STUDY OUTCOMES AND GUIDELINES

Effective dissemination is essential to ensure that the strategies developed through this research reach relevant stakeholders and are translated into policy and practice.

Accordingly, this study adopts a comprehensive, multi-channel dissemination approach designed to maximise accessibility, uptake, and long-term impact among policymakers, programme managers, health practitioners, researchers, community members, and development partners.

Dissemination activities are structured across academic, policy, professional, community, and digital platforms to promote knowledge exchange, stakeholder engagement, and evidence-informed decision-making.

8.7.1 Academic Dissemination

The study findings will be disseminated through peer-reviewed publications in high-impact, open-access journals to ensure global accessibility, particularly for researchers and practitioners in low- and middle-income countries. At least three manuscripts will be prepared focusing on: (i) barriers to immunisation utilisation; (ii) development and validation of context-specific strategies; and (iii) theoretical applications in pastoralist settings.

In addition, the research will be presented at national, regional, and international conferences, including public health, health systems, and immunisation-focused forums. These platforms will facilitate scholarly dialogue, critical feedback, and cross-fertilisation of ideas. Conference abstracts and presentations will be archived in institutional repositories and academic networking platforms to enhance visibility.

8.7.2 Policy and Programme Dissemination

To promote evidence-informed policymaking and programme improvement, two policy briefs will be developed and disseminated to national and regional decision-makers, development partners, and regional health authorities. These briefs will synthesise key findings and provide actionable recommendations in accessible formats and languages.

Stakeholder workshops will be organised at federal, regional, and community levels to present findings, validate policy relevance, and promote institutional ownership. These workshops will facilitate participatory planning for implementation, monitoring, and scale-up of validated strategies.

Furthermore, operational guidelines and training materials will be developed to support practical implementation. These include: (i) a comprehensive operational manual; (ii) training modules for family immunisation champions; and (iii) quick reference tools for frontline health workers. These materials will be integrated into national and regional training systems and disseminated through official platforms and professional networks.

8.7.3 Community and Media Dissemination

Given the central role of community engagement in pastoralist settings, culturally appropriate dissemination strategies will be employed. Community radio programmes in Afaraf will be developed to communicate key messages on immunisation benefits, schedules, and safety. These programmes will use narrative and participatory formats to enhance relevance and trust.

Digital platforms, including social media, messaging applications, and institutional websites, will be utilised to disseminate infographics, videos, audio messages, and reminders. These platforms will facilitate interaction between communities, health professionals, and programme managers.

In addition, popular science articles and opinion pieces will be published in national and regional media to translate research findings into accessible narratives for policymakers, journalists, and civil society.

8.7.4 Dissemination Timeline

Dissemination will be implemented through a phased approach to ensure sustained engagement:

- **Phase 1 (Months 1–6):** Journal submissions, policy brief development, federal-level workshop, digital dissemination.

- **Phase 2 (Months 7–12):** Regional workshop, community radio launch, conference presentations, media publications.
- **Phase 3 (Months 13–24):** Distribution of operational materials, community-level sessions, international presentations.
- **Phase 4 (Months 25+):** Dissemination of pilot results, regional knowledge-sharing forums, policy engagement.

8.7.5 Monitoring Dissemination Reach and Impact

The effectiveness of dissemination activities will be monitored using indicators related to academic reach, policy uptake, training coverage, media engagement, geographic distribution, and community awareness. These indicators will inform adaptive dissemination strategies and support continuous learning.

Overall, this multi-channel dissemination framework recognises the diversity of stakeholder needs and information-access pathways. By tailoring products and platforms accordingly, the study seeks to enhance the likelihood that its findings will influence policy, strengthen practice, and improve immunisation outcomes in pastoralist communities.

8.8 FINAL REFLECTIONS AND THE PATH FORWARD

This doctoral research journey addressed persistent, profound inequities in immunisation coverage experienced by pastoralist communities in Ethiopia's Afar region, exemplifying broader challenges facing mobile, marginalised populations globally. Through rigorous qualitative inquiry involving 77 participants—parents, caregivers, and healthcare workers—across five woredas representing diverse pastoral contexts, this study illuminated complex, multi-level barriers impeding effective Expanded Programme on Immunisation implementation. The research moved systematically from problem identification through evidence synthesis to solution development and validation, establishing a transparent, replicable evidence-to-action translation pathway rare in qualitative health services research.

Findings challenge prevailing narratives attributing low coverage to community ignorance, resistance, or cultural backwardness. Instead, the research demonstrates

unequivocally that coverage gaps stem from structural health system inadequacies: inadequate budget allocation failing to account for substantially higher operational costs in dispersed pastoral areas; insufficient workforce with single health extension workers responsible for populations exceeding 5,000 widely dispersed individuals; lack of appropriate transportation and logistics enabling regular outreach to nomadic populations; and service delivery models designed fundamentally for settled populations accessing fixed facility infrastructure. These systemic failures interact with and are compounded by geographic remoteness, seasonal flooding disrupting scheduled services, livelihood-driven migration across administrative boundaries, and inadequate communication failing to address concerns in culturally appropriate ways.

The seven evidence-based, contextually tailored strategies developed and rigorously validated—mobile solar-powered vaccine carriers, colour-coded vaccination cards, school enrolment immunisation requirements, child-friendly service environments, curriculum integration in Islamic schools, mobile phone reminder systems, and family immunisation champions—represent actionable interventions ready for pilot implementation. These are not merely academic recommendations but validated strategies with formal institutional endorsement from Afar Regional Health Bureau, established implementation infrastructure through Joint EPI Implementation Task Force, and committed resources enabling pilot rollout beginning Q4 2024. This transformation from research outputs to programmatic commitments with accountability structures exemplifies engaged scholarship successfully bridging theory and practice.

The research makes substantive contributions across multiple domains. Theoretically, it extends Social Ecological Model application to mobile population contexts, advances health equity scholarship by reframing coverage gaps as structural inequities requiring systems transformation rather than community education, and contributes to implementation science understanding of evidence transfer and adaptation across contexts. Methodologically, it demonstrates rigorous evidence-to-action translation pathways, documents practical approaches for conducting ethical research with hard-to-reach populations, and innovates through integrated application of Delphi and AGREE II validation methods. Empirically, it addresses significant knowledge gaps regarding Ethiopian pastoralist immunisation through the first comprehensive dual-perspective qualitative examination, documents context-specific barrier manifestations, and

synthesises global evidence on promising practices. Practically, it provides policy-makers and programme managers with concrete, validated, implementable interventions complemented by detailed operational guidance, resource requirement specifications, and monitoring frameworks.

However, substantial work remains. The recommendations presented specify responsibilities, implementation pathways, resource requirements, and accountability mechanisms for action at federal, regional, woreda, and community levels, but implementation requires sustained political commitment extending beyond individual champions to institutional structures ensuring continuity despite leadership changes. It requires adequate resource allocation with estimated USD 6-8 million annually for full national scale-up across approximately 150 pastoral woredas—significant investment justified by equity principles and cost-effectiveness of disease prevention. It requires genuine partnership with communities and traditional leadership structures, moving beyond extractive engagement toward respectful collaboration acknowledging community expertise about their own contexts and needs. It requires ongoing monitoring, evaluation, and adaptive management enabling learning and refinement rather than rigid adherence to initial plans regardless of emerging evidence.

The research agenda identified in recommendations provides roadmap for continued knowledge generation. Priority areas include: theory-driven implementation frameworks examining what works, for whom, in what circumstances, and why; expansion beyond coverage metrics to examine immunisation timeliness, continuity across mobile populations, and cross-border coordination effectiveness; health system mapping analysing service interactions and integration opportunities; process evaluation of enacted implementation practices examining service quality and fidelity; and rigorous effectiveness evaluation through pragmatic trials with economic analysis informing scale-up decisions. These research priorities would substantially advance understanding while providing practical guidance for programme optimisation.

Achievement of universal immunisation coverage and realisation of Immunisation Agenda 2030's leave-no-one-behind vision demands intentional equity focus. It requires health systems that are not merely technically proficient but fundamentally responsive, genuinely adaptable, and deeply culturally sensitive to diverse contexts and needs of all populations, including historically marginalised ones. This demands paradigm shifts in

how health systems conceptualise success—from aggregate national coverage statistics to disaggregated equity metrics revealing and addressing disparities; from fixed service delivery points to mobile, flexible approaches meeting people where they are; from top-down prescriptive implementation to participatory approaches co-designing solutions with communities; and from siloed disease-specific programming to integrated primary healthcare addressing comprehensive health needs. These shifts require more than technical interventions; they demand political will, institutional transformation, and sustained commitment to equity as core health system value.

The strategies developed and validated through this research offer concrete roadmap for advancing this vision in Afar and pastoralist communities across the Horn of Africa and globally. The evidence base is demonstrably strong, established through rigorous qualitative inquiry, systematic literature synthesis, and structured expert validation. Strategies are scientifically validated, having achieved 100% expert consensus across all quality criteria using internationally recognised assessment instruments. Institutional endorsement provides critical political commitment, with formal memoranda documenting Regional Health Bureau obligations and resource allocations. Implementation frameworks are detailed and actionable, specifying procedures, responsibilities, resources, timelines, and monitoring mechanisms enabling accountability.

The path forward is clear and consists of four key phases. First, pilot implementation with rigorous evaluation is underway as of Q4 2024 in selected woredas with intensive implementation support, comprehensive mixed-methods evaluation, and structured documentation of processes, outcomes, and lessons learned. Second, learning and adaptation based on implementation experience through structured quarterly monitoring, regular learning exchange forums, systematic barrier and facilitator documentation, and adaptive management enabling real-time refinement. Third, evidence-based scale-up of effective strategies following successful demonstration, with phased geographic expansion, sustained investment of resources, continued monitoring ensuring quality maintenance, and ongoing stakeholder engagement maintaining ownership and commitment. Fourth, continuous research and refinement as contexts evolve, new challenges emerge, and opportunities arise, with sustained academic-

policy-practice partnerships, commitment to evidence-based decision-making, and willingness to adapt approaches based on emerging evidence.

With commitment from all stakeholders—government at federal, regional, and woreda levels; civil society organisations including national and international NGOs; communities and their traditional and religious leaders; researchers and academic institutions nationally and internationally; and international partners including WHO, UNICEF, GAVI, and bilateral agencies—the goal of ensuring that every child in Afar receives life-saving vaccines is achievable. This research represents one important step on that journey—a step firmly grounded in rigorous evidence, meaningfully responsive to community voices, systematically validated by expert consensus, institutionally endorsed by responsible authorities, and deliberately oriented toward action rather than documentation alone.

8.8 CONCLUSION

This doctoral research addressed a critical public health challenge: the persistent inequities in immunisation coverage experienced by pastoralist communities in Ethiopia's Afar region, which exemplify broader challenges faced by mobile, marginalised, and hard-to-reach populations globally. Through rigorous qualitative inquiry involving parents, caregivers, and healthcare workers across five districts, the study illuminated the complex, multi-level barriers that impede effective implementation of the Expanded Programme on Immunisation in pastoralist settings.

The findings revealed that low immunisation coverage is not primarily attributable to community ignorance or resistance, but rather stems from structural health system inadequacies—inadequate budget allocation, insufficient health workforce, lack of appropriate transportation and logistics, and service delivery models designed for settled rather than mobile populations—compounded by geographic remoteness, seasonal flooding, livelihood-driven migration, and inadequate pre- and post-vaccination communication. These barriers interact dynamically across the individual, interpersonal, organisational, community, and policy levels, as conceptualised through the Social Ecological Model framework that guided the study.

In response to these multi-dimensional barriers, the research developed seven evidence-based, contextually tailored strategies validated through a rigorous Delphi process involving 15 experts: installing mobile solar-powered vaccine carriers for outreach services; utilising colour-coded vaccination follow-up cards; requiring immunisation verification for school enrollment; decorating immunisation wards in fixed health facilities (not applicable to mobile outreach points), targeting semi-settled communities near health centres, to create child-friendly spaces; incorporating immunisation education into school curricula; implementing mobile phone reminder systems; and engaging knowledgeable family members as immunisation champions. These strategies, assessed using the AGREE II instrument and achieving consensus across all six domains of guideline quality, represent actionable interventions ready for pilot implementation and subsequent scale-up.

The study makes substantive contributions to knowledge by extending theoretical understanding of the Social Ecological Model in mobile population contexts; providing empirical evidence on immunisation barriers specific to Ethiopian pastoralist communities; and demonstrating a replicable methodological approach for translating qualitative research findings into validated, implementable strategies. Practically, the research offers policymakers, programme managers, and health practitioners concrete, evidence-informed tools to advance immunisation equity.

The recommendations outlined in this chapter specify clear responsibilities, implementation pathways, resource requirements, and monitoring mechanisms for action at federal, regional, district, and community levels, as well as roles for academic institutions and international development partners. Implementation of these recommendations requires sustained political commitment, adequate resource allocation, health systems strengthening, community partnership, and ongoing monitoring and adaptation.

Ultimately, this research underscores that achieving universal immunisation coverage and realising the vision of leaving no one behind, as articulated in the Immunisation Agenda 2030 and the Sustainable Development Goals, demands intentional focus on equity. It requires health systems that are not only technically proficient but also responsive, adaptable, and culturally sensitive to the diverse contexts and needs of all population groups, including those who have been historically marginalised. The

strategies developed through this research offer a roadmap for advancing that vision in Afar and in pastoralist communities across the Horn of Africa.

The path forward is clear: pilot implementation with rigorous evaluation; learning and adaptation based on implementation experience; scale-up of effective strategies with sustained investment; and ongoing research to continuously refine approaches as contexts evolve. With commitment from all stakeholders, including government, civil society, communities, researchers, and international partners, the goal of ensuring that every child in Afar, and indeed every child everywhere, receives life-saving vaccines is within reach. This research represents one important step on that journey.

8.9 CONCLUDING STATEMENT

The voices of pastoralist parents, caregivers, and health workers documented throughout this research reveal a profound truth: behind every coverage statistic are real families navigating harsh environments, competing demands, and health system barriers not of their making. These voices affirm that communities want to protect their children but face formidable obstacles; that health workers strive to serve despite severe resource constraints; and that with adequate support and contextually appropriate strategies, immunisation equity is achievable.

This research honours those voices by systematically translating lived experiences into actionable pathways for change. The validated strategies emerged through collaborative co-creation—from community members and health workers describing what would work in their contexts, from policy-makers committing to implementation, and from rigorous scientific processes ensuring quality and feasibility. They represent community wisdom and institutional ownership rather than external imposition.

Success will ultimately be measured not by academic outputs but by tangible improvements: more children protected from vaccine-preventable diseases, reduced morbidity and mortality, diminished family suffering, and enhanced equity demonstrating that marginalised pastoral populations' lives matter equally.

This thesis represents not an endpoint but a beginning—a foundation for ongoing partnership and collective action toward immunisation equity and health justice for pastoralist communities in Ethiopia and beyond. With evidence established, strategies

validated, and pathways illuminated, the opportunity exists to make profound difference. The question is not whether equity is possible but whether we possess the collective will to make it reality. That answer will be written in the lived experiences of pastoral families, the health outcomes of their children, and the equity of health systems that serve them

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APPENDIX A: Ethical clearance

COLLEGE OF HUMAN SCIENCES RESEARCH ETHICS REVIEW COMMITTEE

26 April 2023

NHREC Registration # :

Rec-240816-052

CREC Reference # :

14064316 CREC CHS 2023

Dear Mr Mohammed Abdurahman Bilal

Decision:

Ethics Approval from 26 April 2023 to

Researcher(s): Name: Mr. M. A. Bilal

Contact details: 14064316@mylife.unisa.ac.za Supervisor(s): Name: Dr. T.R.

Netangaheni Contact details: netantr@unisa.ac.za

Title: STRATEGIES TO OVERCOME BARRIERS TOWARDS IMPLEMENTING AN EXPANDED PROGRAMME ON IMMUNISATION IN PASTORALIST COMMUNITIES OF AFAR

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 one year.

The ***low 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.

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 confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.

4. 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.

5. 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.

6. No fieldwork activities may continue after the expiry date **(26 April 2024)**.

Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **14064316_CREC_CHS_2023** 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
khankb@unisa.ac.za
Tel: (012) 429 8210

Signature: PP

Prof ZZ Nkosi
Acting-Executive Dean: CHS Email:
E-mail: nkosizz@unisa.ac.za
Tel: 012 429 6758



REQUEST FOR PERMISSION TO CONDUCT THE STUDY

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN THE AFAR REGION IDENTIFIED DISTRICTS

TITLE: Developing strategies to overcome barriers towards implementing Expanded Programme on Immunization in pastoralist communities of Afar

Date :

Contact person's name: Essie Doga

Contact person's building no. or room no: office 05

Contact person's Department: Regional Health Bureau,

Health Extension department head

Contact person's telephone number: +251911589898

Email address: essiedoga12@gmail.com

Dear Sir/ Madam

I, Mohammed Abdurahman Bilal in the Department of Health Studies towards a Research proposal for PhD in Public Health at the University of South Africa. I am inviting you to participate in a study **Title: Developing strategies to overcome barriers towards implementing Expanded Programme on Immunization in pastoralist communities of Afar**. The study aims at developing strategies to overcome barriers towards implementation of Expanded Programme on Immunization in the pastoralist communities of Afar, Afar Regional State, Ethiopia. The proposed research study will be conducted in the Afar region, one of ten regional states in Ethiopia. Afar regional state is in North-eastern part of the country (Ethiopia) with international border with Eritria and Djibouti in North, North East and East, and national border with Tigray in East and Amhara in North and North West, Oromia in South and Somali region in South East. Administratively, it is divided in to five administrative zones with 39 woredas, and five cities administration which are further divided in to 437 kebeles. will be a sample size of 40 participants, consisting of 30 parent or guardians



and 10 health extension workers. The findings from the study will be contributing to the utilization of immunization services will enable decision makers to develop a comprehensive understanding of immunization program performance and make meaningful, evidence-based decisions on strengthening and improving immunization service delivery and uptake.

After the analysis of the challenges, the researcher will develop strategies to overcome barriers towards implementation of EPI in the pastoralist communities of Afar and make recommendations on how to improve policy, coordination, practice, and effectiveness of immunization program in the country.

Overall the study's contribution will be viewed as a cornerstone for future programmes to be strengthened and intensified, regular monitoring and evaluation. These strategies and recommendations will improve and strengthen the policy environment, coordination and practice of community health systems thus helping health care managers, other providers and ultimately the communities that will benefit from better quality health services. Potential risks will be some discomfort based on the uncertainty of responses to research questions and inconvenience based on the time/duration of the interviews.

Feedback procedure will entail follow up meeting via virtual and discuss or explain the findings of the results.

Yours sincerely



MR. Mohammed Abdurahman Bilal
Department of Health Studies



APPENDIX C: Afar Regional Health Bureau – Permission and Support Letter

Qafar Agatih Rakaakayih Doolatak
Qaafiyat Dacayrih Bilró



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የጤና ጥበቃ ቢሮ



Afar National Regional State
Health bureau

Rif No. QAFBPL/4009
Date 12/06/2022

To: Mohammed Abdurahman Bilal

Subject: Validation and Approval of New Strategic Approaches for Immunization Service Improvement

Following review of your study entitled *“Strategies to overcome barriers towards implementing Expanded Programme on Immunization in pastoralist communities of Afar”* and holding validation meetings with experts, we are pleased to inform you that we have carefully reviewed and evaluated the suggested new strategic approaches aimed at improving immunization services in the pastoralist community of Afar region. After careful consideration, we are delighted to provide our validation and approval for these strategic initiatives.

The initiatives demonstrate a comprehensive and targeted approach to address existing challenges and gaps in the system, aiming to increase immunization coverage rates, reduce vaccine-preventable diseases, and ensure equitable access to services for all communities.

We fully support the implementation of these approaches and are committed to collaborating closely with stakeholders to ensure their successful execution. We express gratitude for the dedication and strategic thinking in developing these approaches, believing they have the potential to make a significant impact on immunization service delivery and contribute to improved health outcomes in the region.

Once again, we endorse and approve the suggested strategic approaches and look forward to witnessing their successful implementation and positive impact on the health of our communities.

Thank you for your collaboration and ongoing commitment to advancing the immunization program in the Afar region.

Yours sincerely,


Yassin Habib Ahmed
Health Bureau Head



Tel: +251-(0)33-666-00-18/20/16/21/22 fax: +251-(0)33-666-03-85/16 p.o.box: 26 Alar

Semera — Ethiopia Emil Address:- Gacsal ni ayyultih ixxima mahabbaalina! ኢየሱስን አወሰድ

ሲሰጡ የገጽ 2 ደብዳቤ ቁጥር ይተቀቡ In Reply please Refer to our Ref. No.!



Afar Agatih Rakaakayih Doolatak
Qaafiyat Dacayrih Bilro



በኦሎም ስራ ስምምነት

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Ref No

Date

AF804/6559
18/09/2015

Afar National Regional State
Health bureau

Caagid: Qokol essero wagsiisak

Amo tabul akah nescessennal ni biiroh fayu abeenah yan gifta **Macammad Qabdurraeman** (University of South Africa (UNISA)) deqsitta jaamiqatal (public health) (Phd) baritoo beyak geytima.

Awayaay, fokkaaqa "Strategies to overcome barriers towards implementing an expanded program on immunization in pastoralist communities of Afar" iyya ammuntal oyta gaaboysuh sin gari amaateleemih sabbatah faxximma iyya qokol kaah abtaanam massakaxxa luk sin esserra.



Qaafiyatah sittaluk taamitnay!

(Handwritten signature)

Macammad Qabdurraeman
Inventor, Afar, and Qunshayita
Kep. Mamiidi Silwathi Aghallin
Xaroonkara Xilaktar

Tel: +251-(0)33-666-00-18/20/16/21/22 Fax: +251-(0)33-666-03-85/16 p.o.box: 26 AfarSemera —

Ethiopia Emil Address:-

Gacsal ni ayyufthixximamahabbaalina! / ኢትዮጵያውያን ለጤና ስራ ስምምነት

In Reply please Refer to our Ref. No. 1778 ደደርሰሰ:-

APPENDIX D: Consent to participate in the study



CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the interview questions.

I have received a signed copy of the informed consent agreement.

Participant Signature..... Date.....

Researcher's Name & Surname Mr. Mohammed Abdurahman Bilal (please print)

A handwritten signature in blue ink, appearing to be 'M. Bilal', is written over a dotted line.

Researcher's signature.....

Date.....



University of South Africa
Pretorius Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA, 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

APPENDIX E: Participant information sheet

PARTICIPANT INFORMATION SHEET

Ethics clearance reference number:

Research permission reference number:

Date :

TITLE: Developing strategies to overcome barriers towards implementation of Expanded Programme on Immunization (EPI) in the pastoralist communities of Afar, Afar Regional State, Ethiopia

Dear Prospective Participant

My name is Mohammed Abdurahman Bilal, a PhD candidate in the Department of Health Studies at the University of South Africa. I am inviting you to participate in a study entitled **Developing strategies to overcome barriers towards implementation of Expanded Programme on Immunization (EPI) in the pastoralist communities of Afar, Afar Regional State, Ethiopia**

WHAT IS THE PURPOSE OF THE STUDY?

The study aims at developing strategies to overcome barriers towards implementation of Expanded Programme on Immunization (EPI) in the pastoralist communities of Afar, Afar Regional State, Ethiopia.

WHY AM I BEING INVITED TO PARTICIPATE?

You have been selected to participate to form part of a sample of 40 males and females from the ages of 18 and above in the five identified districts of Afar region. You will be able to provide information which will be used to make a difference in the Districts identified and to a larger scale to the Ethiopia at large. Before you participate in the study you will be provided with a consent form where you will sign to confirm your willingness to participate in the study. It is also important to note that Covid-19 guidelines as stipulated by the University of South Africa will be followed as a preventative measure against the virus.



WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

As the participant you will be asked a series of questions by the researcher and you will be expected to provide answers. The study involves *audio taping of the interview questions and answers*. The primary reason for recording is so that the researchers would be able to transcribe and analyze the data in details. The recording is also important so that there is no information that is not clearly recorded by the researcher. The interview questions will take about 45 to 60 minutes.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participating in this study is voluntary and you are under no obligation to consent to participation. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a written consent form. You are free to withdraw at any time and without giving a reason. If you participate in the study you will be given a copy of this information sheet to sign and keep as evidence of your decision to participate in the study. You will also sign a written consent form. Withdrawing from the study will not deprive you of benefits in your community in any way.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

Participation in this study is entirely voluntary and there will not be rewards or reimbursements. However, taking part in this study will help solve the problems of related to accessibility of health services provided by the health centres and in your community. The researcher will share the finding of the study with you first and the Ethiopia strategic plan management. As a responded you will have a chance to make a difference in your district through your shared experiences in the study.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

The study is more likely to invoke sad emotions of past experiences during the interview. If you feel any discomfort during the interview or data collection you are allowed to withdraw from the study. Even after withdrawing from the study, your identity will remain



anonymous. If any harm attributed to the study occurs, you will be referred to professionals who may be of help to you.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

You have the right to insist that your name not be recorded anywhere and that no one, apart from the researcher and identified members of the research team, will know about your involvement in this research or your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a code number or a pseudonym and you will be referred to, in this way in the data, any publications, or other research reporting methods such as conference proceedings.

The data *will also be taken to an external coder* and he/she will be subjected to *signing a confidentiality agreement. Thereafter, the confidentiality agreements will be submitted to the Research Ethics Review Committee for consideration.* The answers that you provided during the interview will only be available to and reviewed by people responsible for making sure that research is done properly, which will include the transcriber, external coder, and members of the Research Ethics Review Committee. Therefore, records of data that identify you will only be available only to people working on the study, unless you give permission for other people to see the records.

Your anonymous data will be used for the research report. In addition, *the research report of the study may be submitted for publication, but individual participants will not be identifiable in it.*

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

Hard copies of your answers will be stored by the researchers for a period of five years in a locked cupboard/filing cabinet in the researcher's home for future research or academic purposes; electronic information will be stored on a password protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. After the five-year period hard copies of the data collected will



be shredded. The electronic copies will be permanently deleted from the hard drive of the computer through the use of a relevant software programme.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

There is no form of reward or compensation to participate in the study.

HAS THE STUDY RECEIVED ETHICS APPROVAL?

This study has received written approval from the Research Ethics Review Committee, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

If you would like to be informed of the final research findings, please contact Mr.

Mohammed Abdurahman Bilal on ++251911160818 and email:

14064316@mylife.unisa.ac.za (Principal researcher), and Dr. T.R. Netangaheni

(supervisor) on 076 189 5087 or 0124296719 or email: robert.Netangahe@gmail.com.

The findings might be accessible by December 2024. Feel free to make follow up to the researcher on the provided communication tools.

Should you have concerns about the way in which the research has been conducted, you may contact Dr. T.R. Netangaheni (supervisor) on 076 189 5087 or 0124296719 or email: robert.Netangahe@gmail.com. Contact the research ethics chairperson of the CAES General Ethics Review Committee, Prof EL Kempen on 011-471-2241 or kempeel@unisa.ac.za if you have any ethical concerns.

Thank you for taking time to read this information sheet and for participating in this study.

Thank you.



Mr. Mohammed Abdurahman Bila



APPENDIX F1: interview guide parents/ caregivers

IDI GUIDE PARENTS/ CAREGIVERS

Wereda: _____ Kebele _____ Got _____

Name of interviewee: _____

Age: _____ Sex: _____ Education: _____

Name of Interviewer: _____

1. Awareness and Knowledge:

- B. Have you heard about the Expanded Program on Immunisation (EPI)?
If yes, what do you know about it? If no, what do you think that is?
- C. What are your beliefs or understanding about childhood immunisation?
- D. How important do you think it is for your child's health?
- E. What sources of information do you rely on when making decisions about your child's health and immunisation?

2. Barriers and Challenges:

- A. Have you faced any challenges in accessing immunisation services for your child? If yes, what were those challenges?
- B. Are there any cultural or social factors that influence your decision to immunize your child? If yes, please explain.
- C. What are some logistical or practical barriers that make it difficult for you to bring your child for immunisation? How could these barriers be addressed?

3. Communication and Education:

- A. How do you prefer to receive information about childhood immunisation? (e.g., through healthcare providers, community meetings, radio, word-of-mouth/Peer etc.)
- B. Have you received any education or counseling regarding immunisation? If yes, did it address your concerns or questions? ----- > If no, would you find such education helpful?
- C. What kind of information or messages would be most effective in convincing you to immunize your child? What channels or methods of communication would be most accessible and effective for you?

4. Suggestions and Recommendations:

- A. Based on your experiences and observations, what do you think could be done to improve childhood immunisation rates in pastoralist communities?
- B. Are there any specific strategies or interventions that you believe would be effective in overcoming barriers to immunisation?
- C. What support or resources do you think would be most helpful for you and other caregivers in ensuring your children receive timely immunisations?

APPENDIX F2: Interview guide health workers

KEY INFORMANT INTERVIEW GUIDE – For Health Extension Worker's

Wereda: _____ HF: _____

Name of interviewee: _____

Age: _____ Sex: _____ Experience: _____ (Year) Name of Interviewer: _____

Question	Notes
1. Training:	Knowledge and
A. understanding of the Expanded Programme on Immunisation (EPI) and its objectives?	What is your
B. received specific training on immunisation services? If yes, can you describe the training and its effectiveness?	Have you
C. knowledge or training do you think would be helpful for you to effectively implement EPI in pastoralist communities?	What additional
2. Engagement:	Community
A. engage with pastoralist communities to promote and deliver immunisation services?	How do you
B. cultural or social factors that influence the acceptance or refusal of immunisation? If yes, what are those factors? how do you address those factors during community engagement?	Are there any
C. or approaches have you found effective in gaining the trust and cooperation of pastoralist communities regarding immunisation?	What strategies
3. Challenges:	Barriers and
A. main barriers or challenges you face in implementing the EPI in pastoralist communities?	What are the
B. main barriers or challenges including geographic factors, such as remote locations or nomadic movements, impact the delivery of immunisation services? How do you overcome these challenges?	How do those
C. specific logistical or operational barriers that hinder the effective implementation of the EPI in pastoralist communities? If so, what strategies have you employed to address those barriers?	Are there any

4. Communication
and Education:

A. How do you
communicate with pastoralist communities about immunisation services and its benefits?

B. What methods
or channels of communication have you found effective in reaching and educating pastoralist communities about
immunisation?

C. Are there any
specific cultural or language considerations that you take into account when communicating with pastoralist communities
about immunisation?

5. Collaboration
and Support:

A. How do you
collaborate with community leaders, traditional healers, or other influential individuals in pastoralist communities to
promote immunisation?

B. Have you
encountered any successful partnerships or collaborations with local organisations or stakeholders to improve
immunisation coverage? If yes, can you describe those experiences?

C. What kind of
support or resources do you think would enhance your efforts in implementing the EPI in pastoralist communities?

6. Success
Stories and Recommendations:

A. Can you share
any success stories or examples of overcoming barriers in immunisation coverage in pastoralist communities? What
strategies or interventions were effective in those cases?

B. Based on your
experiences, what recommendations do you have for policymakers and programme managers to improve immunisation
services in pastoralist communities?

C. Are there any
innovative or context-specific strategies that you believe would be effective in addressing the unique challenges faced in
pastoralist communities?

THANK YOU FOR YOUR PARTICIPATION IN THIS STUDY

APPENDIX F3: Key informant interview guide for health centre epi focal

Woreda: _____ HC: _____

Name of interviewee: _____

Age: _____ Sex: _____ Profession: _____

Experience: _____ (Year)

Name of Interviewer: _____

Question	Notes
<p>1. Context:</p> <p>A. describe the unique characteristics and challenges of implementing EPI in pastoralist communities within your health centre's catchment area?</p> <p>B. barriers or obstacles you have encountered in achieving high immunisation coverage in pastoralist communities?</p> <p>C. perceive the impact of cultural, social, and geographical factors on immunisation uptake in pastoralist communities?</p> <p>2. Engagement and Awareness:</p> <p>A. engage with pastoralist communities to promote and deliver immunisation services?</p> <p>B. approaches have you found effective in building trust and cooperation with pastoralist communities regarding immunisation?</p> <p>C. awareness about the importance of immunisation and address any misconceptions or concerns within pastoralist communities?</p>	<p>Understanding the</p> <p>How would you</p> <p>What are the main</p> <p>How do you</p> <p>Community</p> <p>How do you</p> <p>What strategies or</p> <p>How do you raise</p>
<p>3. Challenges:</p> <p>A. barriers or challenges you face in implementing the EPI in pastoralist communities?</p> <p>B. barriers or challenges including geographic factors, such as remote locations or nomadic movements, impact the delivery of immunisation services? How do you overcome these challenges?</p> <p>C. specific logistical or operational barriers that hinder the effective implementation of the EPI in pastoralist communities? If so, what strategies have you employed to address those barriers?</p>	<p>Barriers and</p> <p>What are the main</p> <p>How those main</p> <p>Are there any</p>
<p>4. and Information Dissemination:</p> <p>A. communicate with pastoralist communities about immunisation services and their benefits?</p> <p>B. communication channels or methods have you found effective in reaching and educating pastoralist communities about immunisation?</p> <p>C. specific cultural or language considerations that you take into account when designing communication materials or messages for pastoralist communities?</p>	<p>Communication</p> <p>How do you</p> <p>What</p> <p>Are there any</p>
<p>5. Capacity Building:</p> <p>A. training and capacity-building initiatives have been implemented to enhance the skills and knowledge of healthcare providers involved in EPI delivery in pastoralist communities?</p> <p>B. identified any specific training needs or gaps in the knowledge and skills of healthcare providers related to immunisation in pastoralist settings? If yes, what are those needs and how are you addressing them?</p> <p>C. training or support do you think would be helpful for healthcare providers to effectively deliver immunisation services in pastoralist communities?</p>	<p>Training and</p> <p>What kind of</p> <p>Have you</p> <p>What additional</p>
<p>6. and Lessons Learned:</p>	<p>Recommendations</p>

A. Based on your experiences, what recommendations do you have for policymakers and programme managers to strengthen EPI implementation in pastoralist communities?

B. Can you share any specific lessons learned or best practices from your health centre or other similar contexts that could inform strategies to overcome barriers in pastoralist settings?

C. What support or resources do you believe would be beneficial in enhancing EPI implementation and coverage in pastoralist communities?

APPENDIX F4: Key informant interview guide – for district and regional EPI focal

Wereda: _____ Name of interviewee: _____

Age: _____ Sex: _____ Profession: _____

Experience: _____ (Year)

Name of Interviewer: _____

1.	Understanding the
Context:	
A.	How would you describe the unique characteristics and challenges of implementing EPI in pastoralist communities within your district?
B.	What are the main barriers or obstacles you have encountered in achieving high immunisation coverage in pastoralist communities?
C.	How do you perceive the impact of cultural, social, and geographical factors on immunisation uptake in pastoralist communities?
2.	Engagement and
Collaboration:	
A.	How do you engage with pastoralist communities and their leaders to promote and deliver immunisation services?
B.	What strategies or approaches have you found effective in building trust and cooperation with pastoralist communities regarding immunisation?
C.	Are there any successful partnerships or collaborations with local organisations, community-based groups, or stakeholders that have helped improve immunisation coverage in pastoralist communities? If yes, can you describe those experiences?
3.	Capacity Building
and Training:	
A.	What kind of training and capacity-building initiatives have been implemented to enhance the skills and knowledge of healthcare providers involved in EPI delivery in pastoralist communities?
B.	Have you identified any specific training needs or gaps in the knowledge and skills of healthcare providers related to immunisation in pastoralist settings? If yes, what are those needs and how are you addressing them?
C.	How can the training and capacity-building efforts be further strengthened to improve immunisation service delivery in pastoralist communities?
4.	Communication
and Information Dissemination:	
A.	How do you communicate with pastoralist communities about immunisation services and their benefits?
B.	What communication channels or methods have you found effective in reaching and educating pastoralist communities about immunisation?
C.	Are there any specific cultural or language considerations that you take into account when designing communication materials or messages for pastoralist communities?
5.	Collaboration and
Partnerships:	
A.	How do you collaborate with community leaders, traditional healers, or other influential individuals in pastoralist communities to promote immunisation?
B.	Have you established partnerships with local organisations or stakeholders to improve immunisation coverage in pastoralist communities? If yes, can you describe those experiences?

C. How can collaboration with other health centres, district health authorities, or non-governmental organisations be strengthened to support EPI implementation in pastoralist communities?

6. Overcoming Logistical and Operational Challenges:

A. What are the main logistical or operational challenges faced in delivering immunisation services in pastoralist communities?

B. How have you addressed or mitigated these challenges in your district? Are there any innovative or context-specific strategies that have been successful?

C. Are there any specific strategies or interventions that you believe would be effective in improving the accessibility and coverage of immunisation services in pastoralist communities?

7. Monitoring and Evaluation:

A. How do you monitor and evaluate the effectiveness of EPI implementation in pastoralist communities?

B. Are there any specific indicators or metrics that you use to measure immunisation coverage and the success of interventions in pastoralist settings?

C. What improvements or adjustments can be made to the monitoring and evaluation processes to better assess the impact of EPI in pastoralist communities?

8. Recommendations and Lessons Learned:

A. Based on your experiences, what recommendations do you have for policymakers and programme managers to strengthen EPI implementation in pastoralist communities?

B. Can you share any specific lessons learned or best practices from your district or other similar contexts that could inform strategies to overcome barriers in pastoralist settings?

C. What support or resources do you believe would be beneficial in enhancing EPI implementation and coverage in pastoralist communities?

APPENDIX F5: Interview guide focus group discussions

Wereda: _____ Kebele : _____ Got : _____

Name of Interviewer: _____

Question	Notes
<p>1. Immunisation:</p> <p>A. understanding of immunisation and its importance for children's health?</p> <p>B. you with the vaccines provided under the Expanded Programme on Immunisation (EPI)?</p> <p>C. information do you rely on to learn about immunisation and its benefits?</p>	<p>Understanding</p> <p>What is your</p> <p>How familiar are</p> <p>What sources of</p>
<p>2. Challenges:</p> <p>A. any challenges or barriers in accessing immunisation services for your child in pastoralist communities? If yes, what are those challenges</p> <p>B. specific cultural or social factors that influence your decision to vaccinate your child? If yes, please explain.</p> <p>C. reasons some parents or guardians in pastoralist communities may hesitate to immunize their children?</p>	<p>Barriers and</p> <p>Have you faced</p> <p>Are there any</p> <p>What are the main</p>
<p>3. Communication:</p> <p>A. usually receive information about immunisation services available in your community?</p> <p>B. communication do you find most effective in reaching parents or guardians in pastoralist communities?</p> <p>C. specific messages or strategies that you think would improve awareness and understanding of immunisation among parents or guardians in pastoralist communities?</p> <p>4. Timeliness:</p>	<p>Awareness and</p> <p>How do you</p> <p>What methods of</p> <p>Are there any</p> <p>Accessibility and</p>

A. How easy or difficult is it for you to access immunisation services for your child in pastoralist communities?

B. Are there any specific challenges you face in terms of distance, transportation, or availability of immunisation services?

C. How can immunisation services be made more accessible and convenient for parents or guardians in pastoralist communities?

5. Overcoming Barriers:

A. What strategies or interventions do you think would be effective in addressing the barriers to immunisation in pastoralist communities?

B. Are there any successful examples or experiences you can share where barriers to immunisation were overcome in pastoralist communities?

C. How can community members, health workers, and local leaders work together to improve immunisation coverage in pastoralist communities?

6. Addressing Concerns:

A. What are some common concerns or misconceptions about immunisation that you have heard in pastoralist communities?

B. How can these concerns be addressed and accurate information be provided to parents or guardians?

C. Are there any specific approaches or strategies that you think would be effective in addressing the concerns of parents or guardians in pastoralist communities?

7.
and Support:

Recommendations

A. Based on your experiences and perspectives, what recommendations do you have for improving immunisation services in pastoralist communities?

B. What kind of support or resources do you believe would be beneficial in increasing immunisation coverage in pastoralist communities?

C. Is there anything else you would like to add or share about immunisation in pastoralist communities?

**APPENDIX G: Validation and approval letter Afar Regional Health
Bureau**

Qafar Agatti Rakkayth Doolatak
Qaafiyat Dacayrth Biiro



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Afar National Regional State
Health bureau

Rif No
Date

Q/AG/RA/DO/4009
18/06/2016

To: Mohammed Abdurahman Bilal

Subject: Validation and Approval of New Strategic Approaches for Immunization Service Improvement

Following review of your study entitled "Strategies to overcome barriers towards implementing Expanded Programme on Immunization in pastoralist communities of Afar" and holding validation meetings with experts, we are pleased to inform you that we have carefully reviewed and evaluated the suggested new strategic approaches aimed at improving immunization services in the pastoralist community of Afar region. After careful consideration, we are delighted to provide our validation and approval for these strategic initiatives.

The initiatives demonstrate a comprehensive and targeted approach to address existing challenges and gaps in the system, aiming to increase immunization coverage rates, reduce vaccine-preventable diseases, and ensure equitable access to services for all communities.

We fully support the implementation of these approaches and are committed to collaborating closely with stakeholders to ensure their successful execution. We express gratitude for the dedication and strategic thinking in developing these approaches, believing they have the potential to make a significant impact on immunization service delivery and contribute to improved health outcomes in the region.

Once again, we endorse and approve the suggested strategic approaches and look forward to witnessing their successful implementation and positive impact on the health of our communities.

Thank you for your collaboration and ongoing commitment to advancing the immunization program in the Afar region.

Yours sincerely,

Yasein Habte Ahmed
Health Bureau Head



Tel +251-10-33-666-00-1820/1621/22 fax+251-(0)33-666-03-85/16 p.o.box. 28 Afar

Somera — Ethiopia Email Address:- Gacsal ni ayyuufin iixima mahabbatirra/ አዲስ አበባ

ሲኔ 1557 ደብዳቤ ተቀባይ ይቻላል In Reply please Refer to our Ref. No.!

APPENDIX H: Editor's certificate

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Website: www.editlink.co.za



Language Editor's Certificate

This certificate is to certify that ABISHA KAMPIRA has provided professional language editing services for a PhD. thesis titled -

STRATEGIES TO OVERCOME BARRIERS TOWARDS IMPLEMENTING EXPANDED PROGRAMME ON IMMUNISATION IN PASTORALIST COMMUNITIES OF AFAR, ETHIOPIA

by

MOHAMMED ABDURAHMAN BILAL.

The editor has carefully reviewed the thesis for grammar, punctuation, syntax, and overall clarity. They have also worked on improving the thesis' structure and flow.

The editor's work did not include verifying the correctness and completeness of the information that formed the thesis.

Date: 01 September, 2024

Signature:

A handwritten signature in blue ink that reads 'Abisha Kampira'.

Professional Editors' Guild No: KAM002



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