



ZERO-DOSE

Analysis and Documentation of Pro-Equity Immunization

Interventions in Selected Countries of
Eastern and Southern Africa Region

Assessment Report



This assessment report was developed through MERQ Consultancy PLC (Alula Teklu, Fasil Walelign, Yibeltal Alemayehu et al) with valuable contributions from four Country Offices (Angola, Ethiopia, Mozambique, and South Africa). Antoinette Eleonore Ba, Mohamed Diaaeldin Omer and Amsalu Shiferaw provided the supervision and technical review of the report.

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Contents

List of tables	iv
List of figures	v
Acronyms	vii
Executive summary	viii
1. The zero-dose and equity agenda assessment	2
1.1. Purpose and objectives of the assessment	2
1.2. General approach, framework and principles	2
1.3. Methods used in the assessment	4
1.3.1. Data source and data collection approaches	5
1.3.2. Data management and analysis approaches	6
1.3.3. Evidence synthesis	8
2. Immunization coverage and immunization inequity status and trends	11
2.1. Extent of zero-dose and under-vaccinated children in four ESAR countries in 2022	11
2.2. Trends in numbers and rates of zero-dose and under-vaccinated children	12
2.3. The state of immunization inequity in four countries	14
2.3.1. Summary of inequity by driver	14
2.3.2. Zero-dose subnational inequities in the four countries	17
2.3.3. Zero-dose inequities by gender and residence in the four countries	17
2.3.4. Maternal education and wealth inequities	18
2.3.5. Comparison of the extent of the four equity drivers in the study countries	19
2.3.6. Under-vaccination equity gaps in the study countries	20
2.3.7. Under-vaccinated inequities by equity drivers	20
2.3.8. Impact of equity drivers on zero dose in the study countries	22
2.4. Trends in immunization inequities (equity concentration index)	25
2.4.1. Slope Index of Inequity (SII)	25
2.4.2. Equity analysis from DHS data using VERSE equity tool	26
2.5. Underlying factors/barriers to immunization inequity	26
3. Equity-focused immunization interventions in four ESAR countries	33
3.1. Service delivery and accessibility	33
3.1.1. Reach every district- quality improvement (RED-QI) strategy	33
3.1.2. The Hit- and-Run approach	33
3.1.3. Integrated child health catch-up drive/Vaccine catch-up drive/Project Jiki'izinto	33
3.1.4. Mobile vaccination teams or Integrated Mobile Brigades (IMBs)	34
3.2. Management and coordination	34
3.2.1. Mobile Health Technologies: MomConnect and Alerta Saude	34

3.2.2. Road to Health book	34
3.2.3. One Health approach	34
3.3. Commodities/Logistic system	35
3.3.1. Digital stock monitoring - Stock Visibility Solution (SVS)	35
3.4. Social norms	35
3.4.1. Engaging communities and civil organizations in communication, social mobilization, advocacy and demand generation	35
3.4.2. Model Families Initiative: Promoting male engagement	35
3.5. Legislations and policies	35
3.5.1. Equity-focused policies	35
4. UNICEF support for pro-equity immunization interventions in four ESAR countries	39
4.1.1. Zero-dose mapping and planning	39
4.1.2. Expansion of vaccination services in unreached areas	39
4.2. Supplies and logistics systems	40
4.3. Human resources	40
4.4. Demand generation, communication, advocacy and social norms	40
4.5. Evidence informed planning, inequity mapping and decision making	41
4.6. Management, budget and policy	41
5. SWOT analysis of pro-equity immunization interventions in the four ESAR countries	43
6. Conclusions and recommendations	47
Annexes: Country case studies	54
Annex 1: Angola: Zero-dose and equity agenda	56
Country context	56
Overview of immunization programme in Angola	56
Immunization coverage and immunization inequity status and trends in Angola	57
Immunization Inequity in Angola	60
Barriers and underlying factors to reaching zero-dose children in Angola	61
Pro-equity immunization strategies and interventions in Angola	62
UNICEF equity-focused immunization interventions in Angola	65
Challenges and gaps in implementation of pro-equity interventions in Angola	66
The SWOT analysis of pro-equity interventions in Angola	67
Good practices and lessons learnt	69
Recommendations for Angola	69
Annex 2: Ethiopia: Zero-dose and equity agenda	72
Country context	72
Overview of immunization programme in Ethiopia	72

Trends in numbers and rates of zero-dose and under-vaccinated children in Ethiopia	73
Immunization inequity in Ethiopia	76
Barriers and underlying factors to reaching zero-dose children in Ethiopia	77
Pro-equity immunization strategies and interventions in Ethiopia	78
UNICEF equity-focused immunization interventions in Ethiopia	83
Challenges and gaps in implementation of pro-equity interventions in Ethiopia	85
The SWOT analysis of pro-equity interventions in Ethiopia	87
Good practices and lessons learnt	91
Recommendations for Ethiopia	92
Annex 3: Mozambique: Zero-dose and equity agenda	95
Country context	95
Overview of immunization programme in Mozambique	95
Status and trends in immunization and immunization inequity	96
Immunization inequity in Mozambique	99
Zero dose and inequities in Mozambique	99
Underlying factors	100
Immunization equity-focused interventions in Mozambique	102
UNICEF equity-focused immunization interventions in Mozambique	106
SWOT analysis on equity-focused interventions in Mozambique	107
Good practices and lessons learnt	110
Recommendations for Mozambique	111
Annex 4: South Africa: Zero-dose and equity agenda	114
Country context	114
Overview of immunization programme in South Africa	114
Status and trends in immunization and immunization inequity	115
Immunization inequity in South Africa	117
Underlying factors	118
Immunization equity-focused strategies/Interventions in South Africa	119
UNICEF equity-focused immunization interventions in South Africa	123
SWOT analysis on equity-focused interventions in South Africa	124
Good practices and lessons learnt	127
Recommendations for South Africa	128
References	130

List of tables

Table 1:	Summary of data sources and data collection approaches, 2013-2022	6
Table 2:	Summary of the dimensions of the synthesis and outputs	9
Table 3:	zero-dose and under-vaccinated numbers and rates, and dtp-1 and dtp-3 coverage for the four countries, 2022	11
Table 4:	The extent of zero-dose in the four countries from survey reports 2003–2023	14
Table 5:	kruskal-wallis means rank of the study countries based on the extent of zero- dose equity driver gaps (aeg) from DHS/MICS survey reports in the last 20 years (<i>source: DHS/ MICS data</i>)	19
Table 6:	Kruskal-Wallis means rank of the study countries based on the extent of zero- dose equity driver gaps (AEG) for the most recent DHS/MICS surveys	19
Table 7:	Comparison of under-vaccinated and zero-dose AEG by equity drivers in the four countries, 2015-2016 surveys	21
Table 8:	Kruskal-Wallis means rank of the study countries based on the extent of zero- dose equity driver gaps (AEG) for the four study countries in the last 20 years (2003-2022)	22
Table 9:	Means rank of zero-dose AEG of the four equity drivers in the four study countries from the most recent surveys conducted in 2015 and 2016	23
Table 10:	Composite AEG of zero dose between the 20% of individuals with higher unfair disadvantage and those 20% with less unfair disadvantage in the four study countries	26
Table 11:	summary of underlying factors/barriers to immunization inequity in the four countries	27
Table 12:	summary of pro-equity immunization interventions in the four ESAR countries	36
Table 13:	Strength and weaknesses on pro-equity interventions for immunization in Angola, Ethiopia, Mozambique and South Africa	43
Table 14:	Opportunities and threats of pro-equity interventions for immunization in the four countries	45
Table 15:	summary of recommendations for improvement of pro-equity interventions across the four countries	49
Table 16:	Pro-equity immunization strategies and interventions in Angola	62
Table 17:	UNICEF equity-focused immunization interventions in Angola	65
Table 18:	Strengths and weaknesses of PAV programme in improving immunization equity in Angola	67
Table 19:	Opportunities and threats of PAV programme in improving immunization equity in Angola	68
Table 20:	Table 20: Pro-equity immunization interventions in Ethiopia	79
Table 21:	UNICEF equity-focused immunization interventions in Ethiopia	83
Table 22:	Strengths and weakness of EPI in improving immunization equity in Ethiopia	88
Table 23:	Opportunities and threats for EPI in improving immunization equity in Ethiopia	90
Table 24:	Pro-equity Immunization strategies/Interventions in Mozambique	103
Table 25:	UNICEF Equity-Focused Immunization Interventions in Mozambique	106
Table 26:	SWOT analysis on Zero-Dose and Immunization Equity Agenda in Mozambique	108
Table 27:	Immunization Equity-focused strategies/Interventions in South Africa	119
Table 28:	UNICEF Equity-Focused Immunization Interventions in South Africa	123
Table 29:	SWOT analysis on Zero-Dose and Immunization Equity Agenda in South Africa	125

List of figures

Figure 1:	Conceptual Framework for Action on the Social Determinants of Health (Source: WHO 2010)	3
Figure 2:	Comprehensive framework of routine immunization strategies and practices (Source: GRISP)	4
Figure 3:	The phases of the assessment approach	5
Figure 4:	Trends in numbers and rates of zero-dose children in the four countries, WHO/UNICEF WUENIC estimates, 2013–2022 (<i>Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates</i>)	12
Figure 5:	Trends in numbers and rates of under-vaccinated children in the four countries, WHO/UNICEF WUENIC estimates, 2013–2022 (<i>Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates</i>)	13
Figure 6:	DTP-3 coverage for the four countries, WHO/UNICEF WUENIC estimate 2013–2022	14
Figure 7:	The extent of Zero-dose rate in the four countries, 2015–2016 surveys	15
Figure 8:	Zero dose-inequities (AEG) trend by drivers and country	16
Figure 9:	Zero-dose AEG trends of equity drivers using two survey moving average	16
Figure 10:	Absolute equity gaps change over time by country and equity drivers	17
Figure 11:	Subnational zero-dose inequities by geographic location in the study countries	17
Figure 12:	Zero-dose inequity by gender and residence in the study countries in the last 20 years	17
Figure 13:	Zero-dose rate inequities by wealth and maternal education 2003–2022 in the study countries (source: prepared from DHS/MICS data)	18
Figure 14:	Zero-dose inequity by equity drivers from recent surveys in the study countries	19
Figure 15:	Extent of DPT3, under-vaccinated and zero-dose rates in the last 20 years in the four study countries	20
Figure 16:	Under-vaccinated AEG by equity drivers IN 2015–2016 in the four study countries	21
Figure 17:	Under-vaccinated inequities (AEG) trend by driver and country	22
Figure 18:	The extent of Absolute Equity Gap by equity driver from surveys conducted in 2015 and 2016 in the four study countries	23
Figure 19:	Study countries based on zero-dose rates and zero-dose inequities by driver	24
Figure 20:	Extent of the four equity drivers in the four study countries from surveys done in 2015 and 2016	24
Figure 21:	SII for education and wealth by country in the last 20 years	25
Figure 22:	Trend of numbers and rates of zero-dose and under-vaccinated children, Angola, 2013–2022 (Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates)	58
Figure 23:	Vaccination coverage trends in selected antigens, Angola, 2013–2022 (Data Source: WUENIC)	59
Figure 24:	Trends in DPT-1 to DPT-3 dropout rate, and comparison between DPT-3 coverage and WUENIC estimates, Angola, 2013–2022 (<i>Data Source: WUENIC</i>)	59
Figure 25:	Decomposition of zero-dose inequity in Angola (DHS 2015)	60
Figure 26:	Angola zero-dose rate and zero-dose inequity (DHS 2015) by province (<i>prepared using DHS data</i>)	61
Figure 27:	Trend of numbers and rates of zero-dose and under-vaccinated children, Ethiopia, 2013–2022 (<i>Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates</i>)	74

Figure 28:	Vaccination coverage trends in selected antigens, Ethiopia, 2013–2022 (<i>Data Source: WUENIC</i>)	75
Figure 29:	Trends in DPT-1 to DPT-3 dropout rate, and comparison between DPT-3 administrative coverage and WUENIC estimates, Ethiopia, 2013–2022 (<i>Data Source: WUENIC</i>)	75
Figure 30:	Decomposition of zero-dose inequity in Ethiopia, DHS 2016	76
Figure 31:	Ethiopia zero-dose rate and zero-dose inequity by region (<i>Source: DHS 2016</i>)	77
Figure 32:	Trend of numbers and rates of zero-dose and under-vaccinated children, Mozambique, 2013–2022 (<i>Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates</i>)	97
Figure 33:	Vaccination coverage trends in selected antigens, Mozambique, 2013–2022 (<i>Data Source: WUENIC</i>)	98
Figure 34:	Trends in DPT-1 to DPT-3 dropout rate, and comparison between DPT-3 administrative coverage and WUENIC estimates, Mozambique, 2013–2022 (<i>Data Source: WUENIC</i>)	98
Figure 35:	Decomposition of Zero-dose inequity in Mozambique, DHS 2015	99
Figure 36:	Mozambique zero-dose rate and zero-dose inequalities by region	100
Figure 37:	Trend of numbers and rates of zero-dose and under-vaccinated children, South Africa, 2013–2022 (<i>Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates</i>)	115
Figure 38:	Vaccination coverage trends in selected antigens, South Africa, 2013–2022 (<i>Data Source: WUENIC</i>)	116
Figure 39:	Trends in DPT-1 to DPT-3 dropout rate, and comparison between DPT-3 administrative coverage and WUENIC estimates, South Africa, 2013–2022 (<i>Data Source: WUENIC</i>)	117
Figure 40:	Decomposition of zero-dose inequity in South Africa, DHS 2016	117
Figure 41:	South Africa zero-dose rate and zero-dose inequity by province (<i>Source: DHS 2016</i>)	118

Acronyms

AEG	Absolute Equity Gap
ANC	Antenatal Care
APEs	<i>Agentes Polivalentes Elementares</i> (Mozambican network of community health workers)
BCG	Bacillus Calmette-Guerin
BMGF	Bill and Melinda Gates Foundation
CHAI	Clinton Health Access Initiative
CHC	Community Health Committee
CHW	Community Health Worker
CI	Concentration Index
CMAM	Centre for Pharmaceuticals and Medical Supplies
COVID-19	Coronavirus Disease 2019
CSOs	Civil Society Organizations
CSR	Corporate Social Responsibility
DHIS2	District Health Information Software-2
DHS	Demographic and Health Survey
DPT	Diphtheria, Pertussis and Tetanus
ECD	Early Childhood Development
eCHIS	electronic Community Health Information System
E-NITAG	Ethiopian National Immunization Technical Advisory Group
EPHI	Ethiopian Public Health Institute
EPI	Expanded Programme on Immunization
EPSS	Ethiopian Pharmaceutical Supply Services
ERG	Equity Reference Group
ESAR	Eastern and Southern Africa Region
EVM	Effective Vaccine Management
GIS	Geographical Information Systems
GRISP	Global Routine Immunization Strategies and Practices
HEAT	Health Equity Assessment Toolkit
HEWs	Health Extension Workers
ICC	Interagency Coordinating Committee
ICS	Institute of Social Communication
IDPs	Internally Displaced Persons
IDSR	Integrated Disease Surveillance and Response
IEC	Information, Education and Communication

IMBs	Integrated Mobile Brigades
IQR	Interquartile Range
LMICs	Low- and Middle-Income Countries
MCH	Maternal and Child Health
MCV	Measles-Containing Vaccine
MICS	Multi-Indicator Cluster Survey
MOH	Ministry of Health
NGOs	Non-Governmental Organizations
NHI	National Health Insurance
NHS	National Health System
PAV	Expanded Vaccination Program
PDSA	Plan-Do-Study-Act
PFP	Private for-Profit
PHCU	Primary Health Care Unit
PHEM	Public Health Emergency Management
PIRI	Periodic Intensification of Routine Immunization
PNFP	Private not-for-Profit
PP	Percentage points
QI	Quality improvement
RED/C	Reach every district/community
RHBs	Regional Health Bureaus
RI	Routine Immunization
SBCC	Social and Behavioral Change Communication
SD	Standard Deviation
SDD	Solar Direct Drive
SIA	Supplementary Immunization Activity
SII	Slope Index of Inequity
SMS	Short Messaging Service
SNNP	Southern Nations, Nationalities and Peoples
SVS	Stock Visibility Solution
SWOT	Strength, Weakness, Opportunities and Threats
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
VPDs	Vaccine-Preventable Diseases
WHO	World Health Organization

Executive summary

Background

In 2022, approximately 14.3 million children globally missed essential immunizations, with most residing in low- and middle-income countries (LMICs), particularly in Africa and Southeast Asia. This UNICEF Zero-Dose and Equity Agenda Assessment focuses on the Eastern and Southern Africa Region (ESAR), where the number of zero-dose children (those who have not received the first DTP vaccine) increased from 2.6 million in 2019 to 3.6 million in 2022. This rise is linked to conflicts, misinformation and disruptions from COVID-19. UNICEF aims to address vaccination gaps by supporting equity-centred interventions, analysing immunization trends, and developing advocacy tools to reach underserved communities. This assessment leverages the World Health Organization's (WHO) frameworks to identify barriers and improve vaccination access, specifically targeting four ESAR countries: Angola, Ethiopia, Mozambique and South Africa, between 2013 and 2022.

Methods

The assessment examined immunization inequities using 11 surveys in four ESAR countries (Angola, Ethiopia, Mozambique and South Africa). It identified various pro-equity interventions and associated good practices and lessons learnt from interventions implemented by government and non-government actors to address immunization inequity. The assessment used a multiple-case study approach, addressing objectives for the four countries and producing four case studies. A cross-case analysis was conducted to identify commonalities and variations in immunization inequity and its drivers and explore interventions and strategies. The assessment team also developed case studies of good practices from each country, including

those from UNICEF country offices. Pro-equity interventions implemented to improve access to and uptake of immunization services such as the Reaching Every District/Community/Municipality strategy and mobile services were highlighted. The assessment synthesized findings to generate recommendations for equitable and evidence-based immunization programming, involving stakeholders across the four countries. Data sources included reports, guidelines, databases, peer-reviewed publications, webpages and gray literature, focusing on vaccination equity.

Key findings

Extent of zero-dose and under-vaccinated children: In 2022, over 2.2 million children across four ESAR countries (Angola, Ethiopia, Mozambique and South Africa) did not receive their first dose of DPT-containing vaccine. Over three quarters of these missed children were from Angola and Ethiopia; where the latter alone contributed half of all zero-dose children. Mozambique and South Africa had showed better immunization performance with sustained DPT-3 coverage above 80 percent for years, but it substantially declined in Mozambique following the COVID-19 pandemic where DPT-3 coverage dropped from 88 percent to 61 percent; and zero-dose children increased from 97,446 to 376,639 (35 percent of eligible children in the country) between 2019 and 2022. From 2014 to 2019, the cumulative annual numbers of zero-dose children across the four countries were comparable with minimal variations, but significantly increased during the COVID-19 pandemic except in South Africa. On the other hand, the number of under-vaccinated children showed a fluctuating trend with high peaks in 2014 and 2015. No significant increase was observed during the COVID-19 pandemic. Meanwhile, none of the four countries attained the 90 percent target for DPT-3 coverage

in the last decade. With exception of South Africa, DPT-3 coverage rates remained below 65 percent in three countries, with the lowest 42 percent coverage in Angola in 2022.

Immunization inequity: Zero-dose rates have varied across the four countries in the last 20 years according to demographic and health surveys, with a median rate of 14.5 percent in Ethiopia (DHS, 2011), ranging from 4.7% in Mozambique (DHS 2011) to 24% in Ethiopia (DHS 2005). Immunization inequity trend analysis revealed a mixed progress; only Mozambique showed consistent improvement in reducing zero-dose inequities across the four equity drivers (residence, household wealth, child sex, and maternal education); and South Africa showed equity improvement by place of residence. Nonetheless, Ethiopia showed a widening inequity by all drivers in the latest 2019 DHS. Child sex is the least pronounced driver of zero-dose inequity except in South Africa while wealth and maternal education are the most pronounced inequity drivers as measured by Absolute Equity Gap (AEG). The trend of zero-dose AEG by equity drivers was not examined for Angola since the country conducted only one DHS in 2015.

The under-vaccination rate showed a similar pattern to that of zero-dose while it decreased as DPT-3 coverage increased across the four countries. Although not consistent year-to-year, the zero-dose and under-vaccination rates decreased in parallel in Ethiopia and Mozambique while DPT-3 coverage increased. Similarly, the under-vaccination rate increased as DPT-3 coverage decreased in South Africa but there was a decrease in the zero-dose rate. Household wealth was the most significant driver of under-vaccination inequity followed by maternal education and place of residence in all countries over the last 20 years, while child sex was the least driver. .

Trends in inequities: The slope index of inequality (SII) analysed using WHO Health Equity Analysis Tool revealed significant equity disparities by wealth and education. All SII values, except maternal education in 2003, showed a higher concentration of zero-dose among the poorest and uneducated. The SII trend for zero-dose

inequities by maternal education steadily declined over 20 years in Mozambique and between 2005 and 2016 in Ethiopia but increased between 2003 and 2015 in South Africa. However, the SII trends have shown a progressive increase by wealth over the 20 years.

Underlying factors: The analysis of barriers to immunization equity in Angola, Ethiopia, Mozambique and South Africa highlights a complex interplay of health system constraints and socioeconomic factors contributing to challenges in multifaceted components of immunization programmes. Deficiencies, such as inadequate infrastructure, supply, information system, budget and staffing impede effective programme implementation and delivery of vaccination services. Cultural factors affect vaccination uptake and hesitancy; while economic disparities such as geographical access to social services, livelihood styles (e.g., pastoral mobility) and income variations affect service access and utilization. Tailored strategies and interventions are vital to overcome these multifaceted barriers affecting uptake, access and utilization of immunization services regardless of socioeconomic disparities across all countries and settings. .

Pro-equity interventions: A wide range of pro-equity immunization strategies and interventions tailored to various settings and contexts were implemented in the four ESAR countries. For instance, outreach and mobile services for hard-to-reach communities and humanitarian settings, hit-and-run in conflict-affected areas, integration with community health services, leveraging mobile technologies and last-mile vaccine supply approaches can be mentioned among the innovative strategies to address immunization inequities in the four ESAR countries.

UNICEF equity-focused immunization interventions: UNICEF provides technical and financial supports to pro-equity interventions Angola, Ethiopia, Mozambique and South Africa at different levels and capacities including health system strengthening, zero-dose mapping and planning, expansion of vaccination services and delivery modes, capacity building, logistics and supply, cold chain management, demand generation, monitoring and evaluation,

data systems and evidence generation for policymaking. Key pro-equity interventions supported or implemented by UNICEF include:

1. **Reaching hard-to-reach communities:** UNICEF supported mapping of zero-dose children and the expansion of outreach, mobile and supplementary vaccination activities in remote communities of Angola, Ethiopia, Mozambique and South Africa.
2. **Integrating immunization with other services:** In all of the four ESAR countries in this assessment, UNICEF supported identification, mapping and vaccination of unreached and missed children through integration of routine immunization with essential MCH services, SIA campaign and COVID-19 vaccination, and ultimately improved health care efficiency and accessibility.
3. **Strengthening health systems:** UNICEF supports health system strengthening activities in the four ESAR countries particularly in rural and remote areas. The activities include cold chain technology, vaccine supply and logistics, fund mobilization, vaccine procurement, monitoring and evaluation, workforce capacity and information systems. For example, UNICEF mobilized over 14 million dollars in 2023 and procured 280 solar refrigerators for health facilities in hard-to-reach areas and is supporting the adaption of DHIS2 to collect data on zero-dose children aged 12-59 months in Angola.
4. **Community engagement and demand generation:** UNICEF provides financial and technical support for community engagement, social mobilization and advocacy activities to create awareness, overcome misconceptions and social barriers, create demand, identify zero-dose and mobilize for vaccination sessions using existing community structures such as women development army in Ethiopia and social mobilizers in Angola.
5. **Capacity building:** UNICEF provides

intensive training and subsequent mentoring for health care providers from health facilities in low immunization coverage areas in the four ESAR countries. The training and mentorship components include microplanning, data systems and quality, community engagement and maintenance of vaccine storage equipment, among others.

6. **Evidence generation on equity:** UNICEF supports data analysis activities to identify areas with low coverage rates and target interventions accordingly in the four ESAR countries. UNICEF supports the national health systems' monitoring and evaluation activities aimed to determine access and estimate the number of zero-dose children at different levels using multiple data sources such as routine survey and secondary sources.
7. **Advocacy and equity-focused policies:** UNICEF supports and advocates for the development and implementation of equity-focused policies and strategies to address immunization disparities in Mozambique and South Africa. This includes prioritizing vulnerable populations such as migrants, refugees, indigenous communities and those living in remote or under-served areas.

The SWOT analysis highlighted the various aspects that impact the effectiveness of pro-equity immunization interventions in Angola, Ethiopia, Mozambique and South Africa.

1. **Strengths:** The strengths of immunization programmes in the four ESAR countries in this assessment include: strong commitment to ensure immunization access to all citizens, leveraging collaborations with partners, prominent use of digital platforms and data systems for monitoring and evaluation (e.g., DHIS2) and logistic supply chains (e.g., mBrana and Dagu in Ethiopia), improved engagement of communities in immunization in demand generation, overcoming access and utilization barriers, and enhanced vaccine supply chain management systems such

as last-mile approach, among others.

2. **Weaknesses:** The challenges include inadequate financing, supply and staffing; inaccurate estimation of target population during microplanning; slow progress in RED strategies; limitations in community engagement and literacy; weak integration with MCH services; and discrepancies between survey and administrative data.
3. **Opportunities:** These include the growing attention to universal immunization and health coverage regardless of socioeconomic inequalities, expansion of digital technologies, improving multi-sectoral partnerships and community engagements, optimization of primary health care services and equity-focused policy frameworks.

Threats: Threats affecting progress towards universal immunization in ESAR countries include: health insecurities such as COVID-19 pandemics, vaccine open vial policies, donor-dependency in funding, poor infrastructure, socioeconomic inequalities (e.g., extreme poverty, food insecurity, access disparities), poor literacy and hesitancy, political instabilities and conflicts, natural disasters such as drought, and transhumance mobility of nomadic pastoralists.

Conclusions

Immunization coverage: None of the four countries achieved the global 90 percent coverage target for DTP-3 vaccination. Substantial disparities exist across the four ESAR countries. Only South Africa sustained DPT-3 coverage following the COVID-19 pandemic. Angola struggles with the lowest DPT-3 coverage and highest dropout rates.

Zero-dose rates: Zero-dose rates varied across countries, emphasizing the need for targeted interventions. Ethiopia and Angola contributed three quarters of nearly 2.3 million zero-dose children in the four ESAR countries. In 2022, the highest zero-dose rate of 46 percent was observed in Angola, followed by Mozambique (35 percent), Ethiopia (31 percent) and South Africa

(4 percent).

Immunization inequity: With the exception of Mozambique, the countries in this assessment did not show consistent improvement in reducing zero-dose inequities across the equity drivers (wealth, education, residence and sex) in 20 years.

Recommendations

To reduce and then avoid the numbers and rates of missed children from immunization services, tailored strategies and interventions specifically designed to address the unique challenges and contexts of each country should be prioritized. These include:

1. **Develop equity-focused policy and strategy frameworks**
 - a) Develop pro-equity immunization policies and strategic plans.
 - b) Standardize implementation of equity-focused interventions.
2. **Address social barriers and hesitancy**
 - a) Intensify awareness creation, demand generation, social mobilization and advocacy activities through engaging communities, civil society organizations and media outlets.
 - b) Use of technology for social mobilization such as mobile SMS for sending messages, reminders and campaigns.
 - c) Develop and disseminate social and behavioural change communication materials.
3. **Diversify and design contextualized vaccination approaches**
 - a) Strengthen mobile services in hard-to-reach, isolated and mobile communities such as pastoralists, hit-and-run in conflict and isolated areas, catch-up immunization in humanitarian (IDPs) and remote areas, and outreach and periodic intensification of

routine immunization (PIRI) in rural remote areas and urban slums.

- b)** Integrate routine immunization (RI) with other health and nutrition services in humanitarian and conflict situations.
- c)** Integrate RI with other maternal and child health (MCH) services and supplementary immunization activities (SIAs) to avoid missed opportunities.
- d)** Involve men in vaccination services particularly in hard-to-reach, and conflict affected and remote areas.
- e)** Strengthen community-based programmes, including data digitalization like the health extension programme in Ethiopia.
- f)** Engage private health facilities in immunization services particularly in urban slums.

4. Enhance supply chains and logistics management systems

- a)** Implement last-mile strategy to ensure uninterrupted supply and equitable access to vaccines.
- b)** Leverage digital tools for effective monitoring and management of supply chains to prevent stock outs and wastages.

5. Improve digital health and evidence-informed decision making

- a)** Strengthen the development and use of user-friendly digital tools for planning, monitoring and evaluation of services.
- b)** Strengthen capacity-building training on data quality, triangulation and data use for decision making at all levels.
- c)** Enhance the use of microplanning tools and approaches at lower levels.

6. Strengthen health workforce

- a)** Strengthen capacity in immunization, digital health, communication, advocacy, coordination and data use.
- b)** Design strategies to create career development opportunities, financial and other incentives, and payroll systems to keep the motivation of community health workers.
- c)** Build the capacity of community health workers to apply innovative, contextually tailored and culture-sensitive vaccination approaches.

7. Enhance immunization financing

- a)** Engage national treasury or finance ministries, private foundations, and international donors to ensure increased funding and political commitment.
- b)** Establish pooled budget mechanisms to enable harmonized, coordinated, efficient and equitable allocation of budget for implementation of equity-focused immunization interventions.



1. The zero-dose and equity agenda assessment

1.1. Purpose and objectives of the assessment

The purpose of this assessment is to contribute to a comprehensive understanding of the immunization landscape and provide evidence for programmatic recommendations concerning UNICEF support to countries on immunization, with a focus on missed communities in ESAR countries. The assessment aimed to generate evidence around immunization inequities, identify and document pro-equity immunization interventions supported by UNICEF; and synthesize the experiences of countries and UNICEF in the region. The specific objectives of the assessment for each of the countries under study and for the region are as follows:

- 1) To analyse immunization coverage and inequity status and trends in Angola, Ethiopia, Mozambique and South Africa.
- 2) To review UNICEF-specific support, at the country level, towards the implementation of equity-driven immunization interventions and identify the achievements and drivers for successes, gaps, challenges and opportunities.
- 3) To identify and review major and relevant interventions and activities that address immunization equity gaps and document countries' experiences and processes of implementation of equity-focused interventions in immunization, including lessons learnt and good practices.
- 4) To generate actionable and context-specific recommendations for better equity-focused and evidence-based Expanded Programme on Immunization (EPI) for UNICEF support.

- 5) To develop advocacy products for UNICEF to use at regional and country levels to inform and influence pro-immunization decisions and better design and implement equity-oriented immunization interventions.

The selected countries for this documentation are Angola, Ethiopia, Mozambique and South Africa.

1.2. General approach, framework and principles

The existing literature suggests that zero-dose children, under-vaccinated children and missed communities represent disadvantaged population segments. They have limited or no access to essential health services due to different barriers. Zero-dose is considered as a measure of inequity for child vaccination, health and other social services inequities. In line with this, the WHO Conceptual Framework for Action on Social Determinants of Health was adapted, which has the capacity to create a comprehensive understanding about the state of and factors contributing to inequity. The framework, thus, includes all potential dimensions of equity in the analysis.

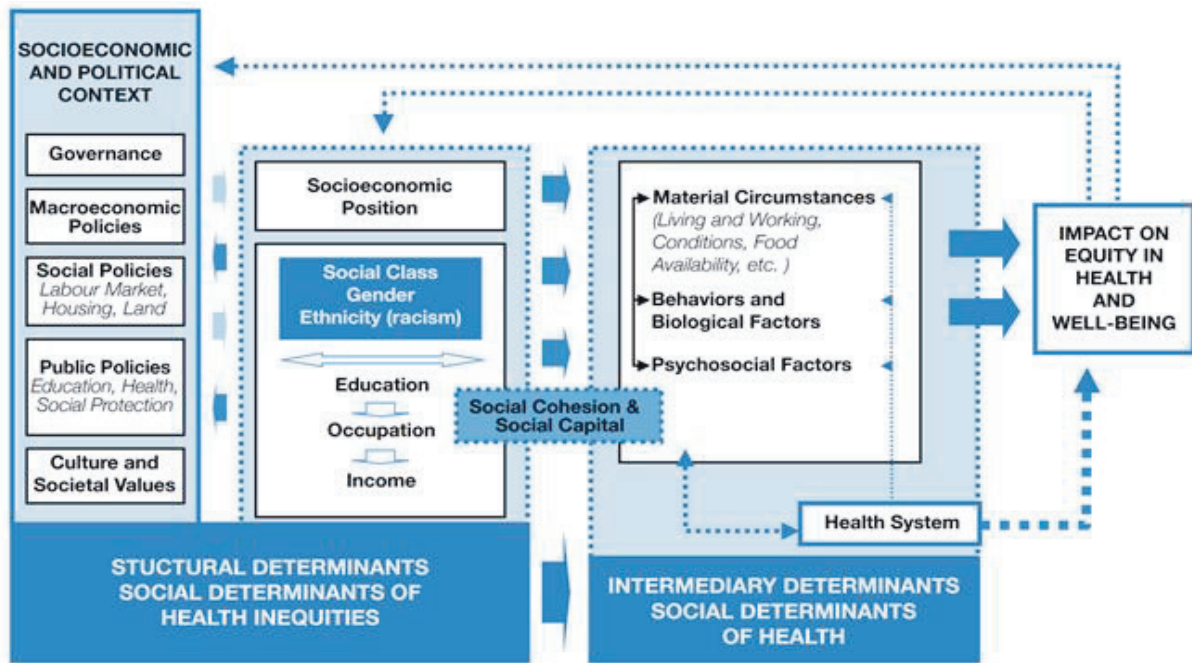


Figure 1: Conceptual Framework for Action on the Social Determinants of Health (Source: WHO 2010)

This framework was adapted by the study team to operationalize its concepts in the context of equity in child vaccination coverage. The adapted framework was used to identify and map the dimensions and causes of inequity and to characterize interventions targeting inequity in child immunization under the domains of:

- 1) Socioeconomic and political context;
- 2) Socioeconomic position; and
- 3) Intermediary determinants (material, behavioural, psychosocial factors and health system).

In the identification of pro-equity interventions, each intervention was systematically analysed for its relevance and effectiveness in addressing the main causes of inequity in the four target countries. Critical analysis was conducted on the methods or processes through which the interventions sought to bring about positive changes or improvements to extract lessons that could be transferred across geographic areas or programme components. Specific approaches to these analyses are detailed in Section 1.3 below. The key principles that were followed during the assessment are: utility (meeting the information needs of UNICEF and its stakeholders), feasibility

(prudent, realistic, and understandable), propriety (maintaining ethical principles), accuracy, collaboration and clarity.

Apart from the social determinants of the health framework, which was used to identify and map the factors that influence inequity in immunization services, the Global Routine Immunization Strategies and Practices (GRISP) framework was used to guide the efforts in identifying and thematizing the key strategies and interventions implemented by countries in ESAR to address immunization inequities. The assessment results were thematically categorized by policies, strategies and structural arrangements; service utilization; social norms; management and coordination; budget and expenditure; human resource; commodities and supplies; and gender-transformative considerations. This GRISP framework constitutes a comprehensive collection of strategies and practices packaged under four domains: maximizing reach, managing the programme, mobilizing people, and monitoring progress in strengthening routine immunization systems to improve (see Figure 2).

1.3. Methods used in the assessment

The evidence from the four targeted countries was generated focusing on the state of immunization inequities and their experience in addressing the existing inequity. As part of the evidence synthesis, the profiles of the countries pertaining to immunization, the pattern and trend of zero-dose and under-immunization between 2013 and

2022, the extent of immunization inequity and the underlying factors were described and analysed. Moreover, the good practices of the countries in addressing zero-dose and the contributing factors were also identified and documented. In documenting the good practices, the contexts or problems, solutions identified, results, replicability or scalability of the approach, and the lessons learnt were thoroughly addressed.

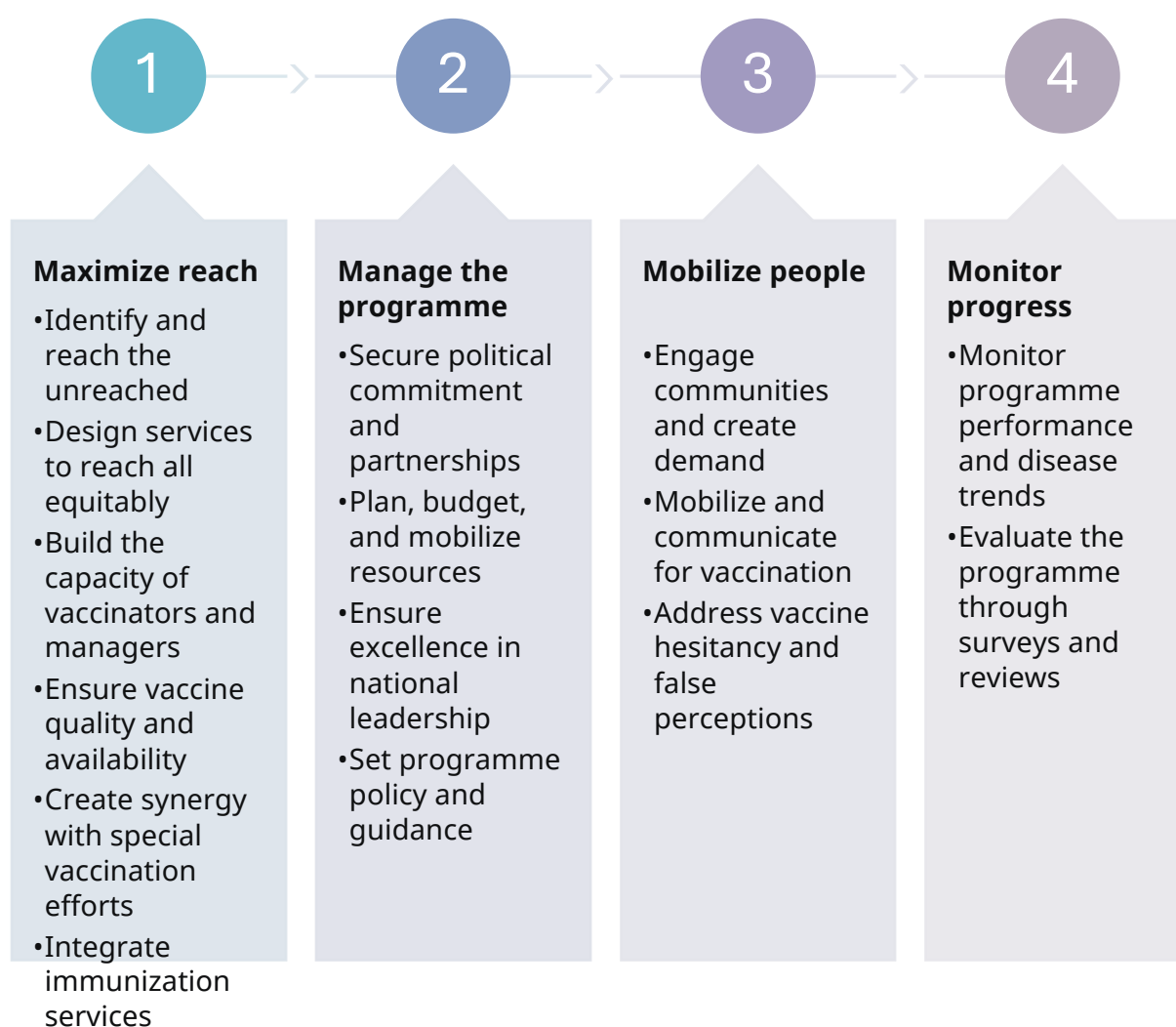


Figure 2: Comprehensive framework of routine immunization strategies and practices (Source: GRISP)

In each of the countries, the major pro-equity strategies and interventions implemented for immunization were synthesized to understand the approaches through which these countries have been addressing the identified immunization equity gaps. During this synthesis process, particular emphasis was put on identifying policies, strategic

plans, and programmes designed to address immunization inequalities and interventions implemented at national or subnational levels to address any of the population groups that are at risk of missing lifesaving vaccines. The interventions that targeted at-risk populations, which include the urban poor or slum residents,

remote rural residents and displaced communities or those affected by conflict, were included in the analysis.

The synthesis of existing evidence helped to substantiate findings from the secondary data analysis and the desk review. A phased approach was followed to allow the assessment team to have consultations and reach a consensus with the UNICEF team at critical steps during the evidence synthesis process (see Figure 3).

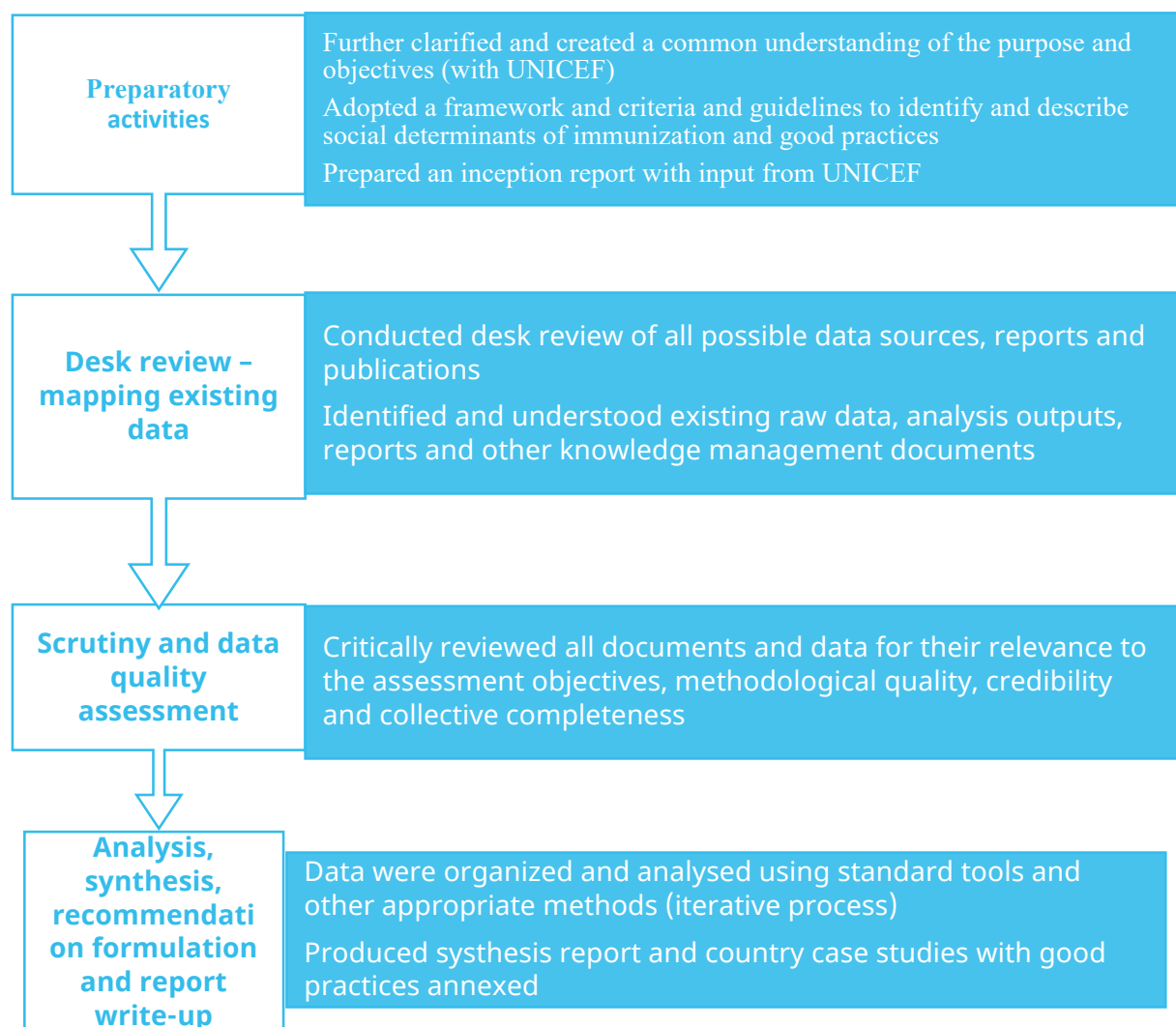


Figure 3: The phases of the assessment approach

1.3.1. Data source and data collection approaches

Data from 2013 to 2022 were collected to answer the first three objectives of the assessment. The data sources and the approaches are summarized in Table 1.

Table 1: Summary of data sources and data collection approaches, 2013-2022

Objectives	Data Sources	Approaches of data collection
Objective 1: Analysis of immunization inequities	▪ Secondary data on immunization status, zero dose, and under-immunization. ▪ Reports on immunization status, zero dose, under-immunization, equity analysis, the performance of national immunization programmes and equity-focused interventions. ▪ Published articles and gray literature. ▪ Websites of government and non-governmental organizations. ▪ Google search.	The documents were exported to EndNote reference management software. Duplicates were removed, and screening was done based on predefined criteria for relevance, quality, credibility and completeness. The secondary data, linked to retrieved reports, were obtained from authors, and were extracted from the identified sources, guided by the objective, key indicators and dimensions of the analytic framework.
Objective 2: UNICEF support to equity-focused immunization interventions	▪ Country policy, strategy, and programme documents, project documents, guidelines/manuals, tools, standard operating procedures, country programme evaluations, thematic evaluations, annual reports, donor reports, assessment reports, review meeting reports, published articles, unpublished documents, newsletters, programme briefs, etc.	The documents from each country were collected from online sources. In addition, UNICEF country offices were contacted to compile the relevant documents and provide access to the study team.
Objective 3: Equity-focused immunization interventions in selected ESAR countries		These documents were identified through a systematic search of the scientific literature, a review of the websites of relevant organizations (including health ministries), and through contact with focal persons responsible for national immunization programmes in each country to obtain documents that may not be publicly available through online platforms. The assessment team developed a guide for identifying relevant documents and shared it with focal UNICEF persons in each of the study countries to identify all relevant documents for review.

1.3.2. Data management and analysis approaches

The approaches used to manage the collected data and the analysis methods are summarized hereunder, by objective.

Objective 1: Analysis of immunization inequities

Data on the distribution of zero-dose and under-vaccinated children across the different dimensions of equity were analysed with the purpose of creating a comprehensive

understanding of the status of equity or inequity in child vaccination in each of the four study countries. The study team exerted efforts to create a more representative estimate by conducting a pooled analysis and a description of recent trends by combining data from multiple time points when diverse data sources were available. Depending on the nature of the documents and data available in each of the study countries, a descriptive analysis and a narrative review of findings were made. In determining the extent of zero-dose and under-vaccinated children, the UNICEF standard definition was used.

Equity analysis from DHS data using VERSE equity tool

The Vaccine Economics Research for Sustainability and Equity (VERSE) tool was developed by the Johns Hopkins Bloomberg School of Public Health with the support of the Bill & Melinda Gates Foundation. The VERSE tool generates composite vaccination equity metrics that account for multiple factors that influence inequity in vaccination coverage. The tool produces results that measure the relative influence of socioeconomic inequality combined with measures of direct unfairness in health care access by applying regression decomposition to the concentration index (CI). A high CI suggests that individuals with a higher level of unfair disadvantage are significantly more likely to be zero dose than those with less unfair disadvantage. VERSE was used to analyse the DHS data for the four countries with DHS data available in the DHS programme. The absolute equity coverage gap (AEG) is the absolute difference between the vaccination outcome achieved by the top 20 per cent and bottom 20 per cent of the population, ranked by unfair disadvantage, and is the primary outcome recommended for interpreting and conveying the VERSE toolkit results to policymakers due to its ease of interpretation.

Objective 2: UNICEF support to equity-focused immunization interventions

A critical analysis and synthesis were performed to understand the theory behind each intervention identified and how major assumptions were aligned with the local context, the drivers of equity or inequity and the analytical framework adapted for the current assessment. Moreover, lessons from the implementation of each intervention were extracted to determine to what extent and in what ways the intervention facilitated success in addressing immunization inequity. Interventions and activities that have led to major achievements or promising results that could be implemented at a reasonable cost and have the potential to be sustained or scaled up to larger geographic areas were considered as examples of good practices.

Objective 3: Equity-focused immunization interventions in selected ESAR countries

While it is understood that this is an expanded version of Objective 2, major interventions that have been implemented by government and non-government actors were identified to address immunization inequity. The interventions were identified through literature review. Each intervention was mapped against the dimension of equity (social determinants of immunization coverage) that it is intended to address.

The experiences of countries that have led to major achievements in addressing immunization inequity based on predefined selection criteria were also identified to serve as examples of good practices. The experiences selected as good practices were explored in more depth to develop case studies of good practices to share the experiences of these countries in addressing immunization inequity. The selection of experiences for the case studies considered:

- 1) Identification of good practices from all four study countries.
- 2) Successful programmes or interventions implemented in different geographic locations (hard-to-reach areas, urban areas, urban slums, and rural areas).
- 3) Programmes implemented in various humanitarian settings, such as drought and famine, flooding and conflict-affected areas.

Case studies of good practices were reported with a format that allows clear and precise communication of what works in addressing immunization inequity in what types of contexts. Contents of case studies include: context; a brief description of the strategy, activity or experience; replicability or scalability of approach (skills needed, cost); results; challenges and lessons learnt.

Objective 4: Recommendations for better equity-focused and evidence-based EPI

To address this objective, the research team synthesized the assessment results, compiled country-specific key findings and generated

an initial set of recommendations. The initial recommendations are further refined through discussions among the team to make them actionable. This will help UNICEF and other stakeholders to better implement equity-focused and evidence-based EPI programming. Participants of the recommendation formulation engagements included the ministries of health of the respective countries, UNICEF country offices and other relevant partners. The formulations were made through a combination of online and face-to-face formats and were organized in consultation with UNICEF. This method of recommendation formulation also helps to consider the country context and makes it more likely for the recommendations to be actionable.

Objective 5: Development of advocacy products to inform and influence pro-immunization decisions and better design and implementation of equity-oriented immunization interventions

Based on the assessment findings and recommendations formulated during collective interpretation engagements, the study team developed advocacy products in consultation with UNICEF. These products include policy briefs for each country, which focus on reducing zero-dose children and promoting equity in EPI programming. Moreover, the good practices in intervention design and implementation are part of this comprehensive report.

1.3.3. Evidence synthesis

The assessment employed a multiple-case study approach to synthesize the evidence. As a first step, each of the study objectives was addressed for each of the four countries. This allowed the production of four country case studies and the identification of good practices from each of these countries. In the next step of the analysis, a cross-case analysis was conducted to identify commonalities and variations in the state and trends of immunization inequity and explore interventions and strategies that work or do not work across different contexts. In addition to country case studies, the assessment team developed case studies of good practices

identified from each of the four study countries, including those from the UNICEF country offices.

Cross-case or cross-country analysis and synthesis were conducted to identify patterns in what works and what does not work across different contexts in addressing immunization inequity in the ESAR and thus facilitate cross-country learning for pro-equity immunization programming. This allowed the study to provide evidence that can be used in the development of strategies for UNICEF's support to countries in the ESAR. To this end, the assessment team described, analysed and synthesized findings from each case study and identified relevant patterns. Since the team followed similar data sources and analysis approaches in each of the country's case studies, the cross-country analysis was focused on the key findings and implications of the documentation. Based on the results obtained from the comprehensive country-case studies, the study prepared an indicator-country matrix to summarize key findings and show differences across countries.

The key findings on the level of inequality, the reasons behind inequality, the major interventions for ensuring equity, and UNICEF support for pro-equity programming were summarized. A multiple-comparative case analysis approach was followed to provide detailed context-specific descriptions of the differences and commonalities across the four countries. Best experiences and lessons learnt from all good practice (illustrative) case studies were also summarized. The factors that inhibit and facilitate pro-equity interventions were compared in the contexts of all four study countries. This analysis also facilitated the identification and discussion of UNICEF best experiences across the ESAR. In addition, conclusions, implications, and recommendations that can be shared by all four ESAR countries were also formulated. Table 2 summarizes the dimensions addressed during the analysis and the outputs of the synthesis.

Table 2: Summary of the dimensions of the synthesis and outputs

Objective	Summary of dimensions or contents addressed in the analysis	Outputs
Objective 1: Analyse immunization inequities in the selected countries	- The status of zero dose and under-immunization across different dimensions of inequity - Trends in zero dose and under-immunization across the different dimensions of inequity - Drivers of zero dose and under-immunization among children	- Synthesis report - Country case study
Objective 2: Review UNICEF-specific country-level support for implementing equity-driven immunization interventions with the identification of achievements and drivers for successes, gaps, challenges and opportunities	- Description of support (UNICEF support in addressing immunization inequity) - Documented successes, evidence of success and drivers of success - Strengths, weaknesses, opportunities and threats (SWOT), including existing gaps and opportunities for expanding support, challenges faced and untapped opportunities - Programmatic/operational recommendations where relevant	- Synthesis report - Country case studies - Good practices (interventions initiated and/or intensively supported by UNICEF)
Objective 3: Identify and review major and relevant interventions/activities that address immunization equity gaps and document countries' experiences and processes of the implementation of equity-focused interventions in immunization, including lessons learnt/good practices.	- Structures and functions of EPI units in the health system - Structures and functions dedicated to addressing health inequity in general - Structures and functions dedicated to addressing immunization inequity in particular - Summary of major interventions/activities intended to address immunization equity gaps - Summary of SWOT (region and country level)	- Synthesis report - Country case studies - Good practices (government and/or partners' initiatives)
Objective 4: Generate actionable and context-specific recommendations for better equity-focused and evidence-based EPI programming for UNICEF support.	Recommendations categorized by social determinants of immunization coverage - Policies, strategies and structural arrangements - Service utilization - Social norms - Management and coordination - Budget and expenditure - Human resources - Commodities and supplies - Gender-transformative considerations	- Regional-level recommendations - Country-specific recommendations (specific recommendations highlighted for UNICEF)
Objective 5: Develop advocacy products for the use of UNICEF at regional and country levels to inform and influence pro-immunization decisions, design and implementation of equity-oriented immunization interventions	- Reducing zero-dose and under-vaccinated children and promoting equity in EPI programming - Good practices in intervention design and implementation (advocacy products)	Region- and country-specific infographic posters and policy briefs (advocacy products)

2. Immunization coverage and immunization inequity status and trends

2.1. Extent of zero-dose and under-vaccinated children in four ESAR countries in 2022

In 2022, there were a total of 7,395,423 surviving infants in Angola, Ethiopia, Mozambique and South Africa. Ethiopia contributed more than half (3,819,980) of these children targeted for vaccination. Over 2.2 million of these children in the four countries had not received a single dose of DPT vaccination to prevent life-threatening diseases. Out of these zero-dose children, more than three quarters (77 percent, 1,760,166) were from Angola (614,172) and Ethiopia (1,145,994). Angola had the highest rate of zero-dose with 47 percent while South Africa had the lowest rate with 13 per cent

In the same year, around 425,000 under-vaccinated children were reported in the four countries. Similarly, to zero-dose children, more than three quarters (79 per cent) of these children

lived in Ethiopia (190,999) and Angola (143,742). Angola had the highest rate of under-vaccinated children where 11 per cent of 1,306,749 target children were not fully immunized in the country. South Africa had the lowest rate of under-vaccinated children with 2 per cent among the four countries.

Meanwhile, the average proportion of eligible children who received first dose of DPT (DPT-1) vaccine in the four countries was 69.3 per cent which is below the global target of 90 per cent coverage. The coverage had huge variation between the four countries ranging from 53 per cent in Angola to 87 per cent in South Africa. Ethiopia and Mozambique had 70 per cent and 67 per cent DPT-1 coverage, respectively. Similarly, the average coverage of third dose DPT was 63.3 per cent in the four countries with the lowest of 42 per cent in Angola, 61 per cent in Mozambique, 65 per cent in Ethiopia and the highest of 85 per cent in South Africa (see *Table 3*).

Table 3: zero-dose and under-vaccinated numbers and rates, and dtp-1 and dtp-3 coverage for the four countries, 2022

Country	Zero dose		Under-vaccinated		DTP-1 coverage	DTP-3 coverage	Surviving infants
	#	%	#	%			
Angola	614,172	47.0%	143,742	11.0%	53.0%	42.0%	1,306,749
Ethiopia	1,145,994	30.0%	190,999	5.0%	70.0%	65.0%	3,819,980
Mozambique	376,639	33.0%	68,479	6.0%	67.0%	61.0%	1,141,329
South Africa	146,557	13.0%	22,548	2.0%	87.0%	85.0%	1,127,365
Total	2,283,362	30.9%	425,768	5.8%	87.0%	85.0%	7,395,423

Source: WHO UNICEF Estimate of National Immunization Coverage (WUENIC) and UNDP population estimate.

Note: Zero-dose rate was calculated by dividing zero-dose children by surviving infants, similarly under-vaccinated by surviving infants for under-vaccination percentages.

2.2. Trends in numbers and rates of zero-dose and under-vaccinated children

As shown in Figure 4 below, the number of zero-dose children increased across all countries from 2013 to 2022, except in South Africa. In 2013, the four countries had approximately 1.7 million zero-dose children, which dropped to around 1.4 million in 2014 and 2015. However, the numbers rose again from 2016 to 2022, with a slight decrease in 2019 compared to 2017. The period following the COVID-19 pandemic saw a marked increase, with 2021 and 2022 reaching the highest numbers of zero-dose children in the decade.

Country-specific trends include a sharp increase in zero-dose children in Angola from 2019 to 2022 and in Mozambique during 2020 and 2021. In Ethiopia, the number remained almost stable from 2014 to 2020, followed by a significant rise in 2021 that stabilized in 2022. South Africa showed a notable increase from 2016 to 2018, a steady decline until 2021, and an abrupt rise in 2022. Both Ethiopia and Mozambique maintained high numbers of zero-dose children in 2021 and 2022 (See Figure 4).

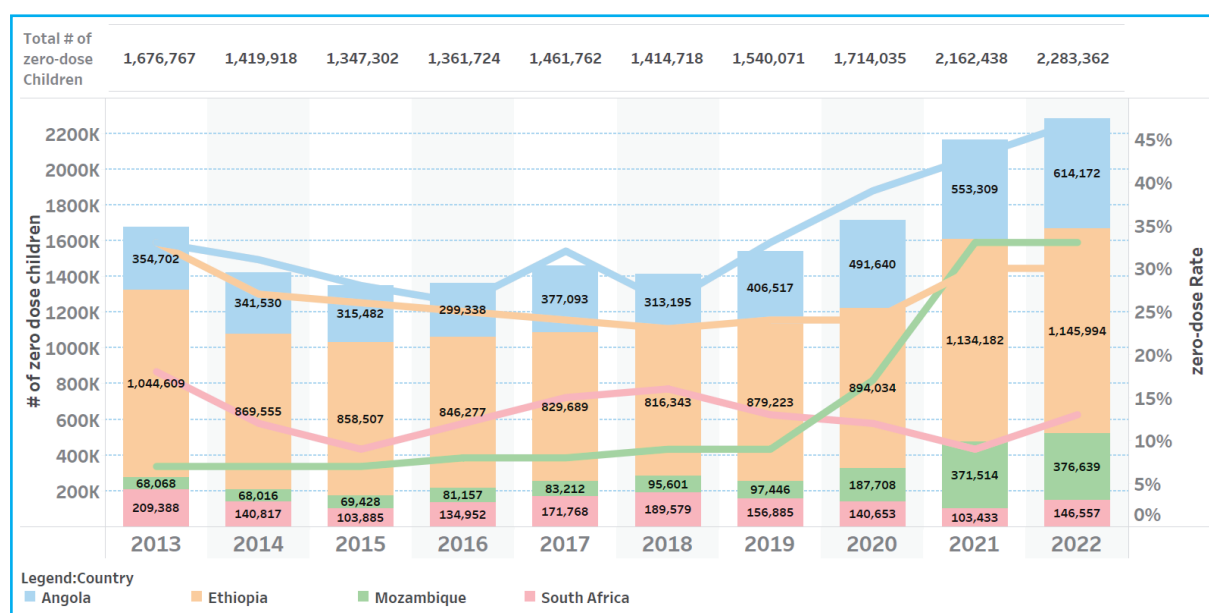


Figure 4: Trends in numbers and rates of zero-dose children in the four countries, WHO/UNICEF WUENIC estimates, 2013–2022 (Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates)

As it is shown in Figure 5 below, significant fluctuation in cumulative numbers of under-vaccinated children were recorded in the four countries in the decade (2013-2022). The highest number of under-vaccinated children were recorded in two consecutive years of 2014 (624,495 children) and 2015 (628,537 children); and then the numbers dropped during the following two years (2016 and 2017). They rose again in 2018 and significantly declined in 2019 and 2020 (first year of the pandemic). But the

number rose again in 2021 (second year of the pandemic) and dropped in 2022. The trend of the cumulative number of under-vaccinated children had a similar pattern of fluctuation in each of the countries across the years (See Figure 5).

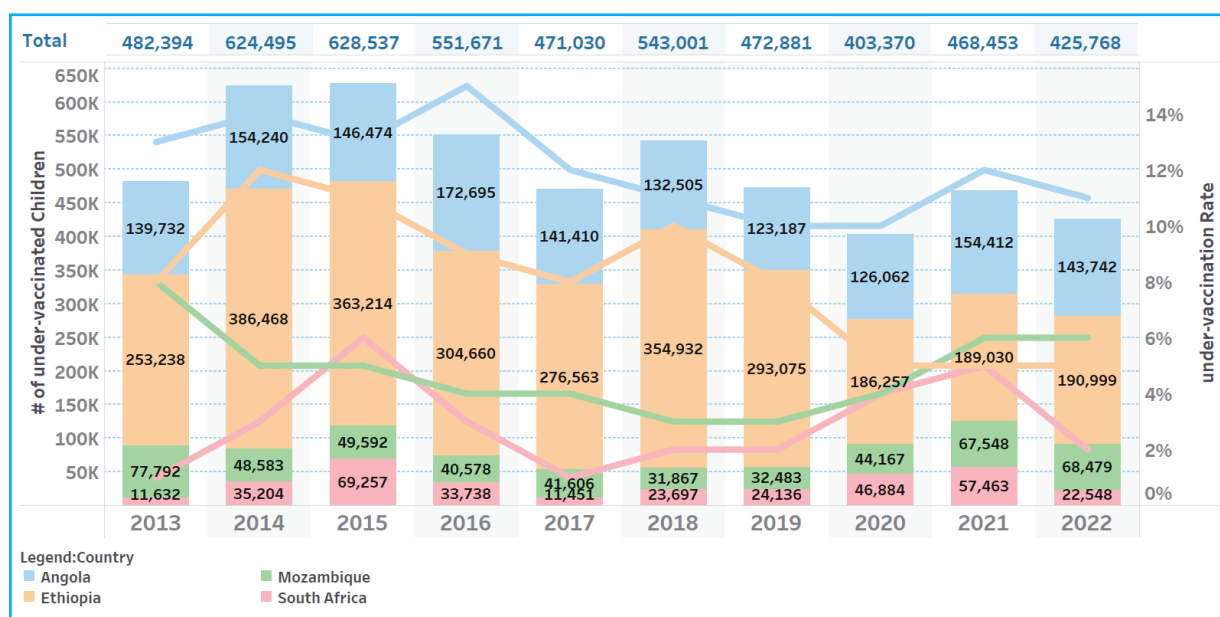


Figure 5: Trends in numbers and rates of under-vaccinated children in the four countries, WHO/UNICEF WUENIC estimates, 2013–2022 (Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates)

Regarding the immunization coverage, the study reveals that none of the four countries was able to reach 90 percent coverage for DTP-3 vaccination during the last decade. Immunization coverage had stagnant or slightly increasing trends across the four countries, but it started to decline following the COVID-19 pandemic except for South Africa. Mozambique nearly reached the coverage target with 88 percent DTP-3 coverage which was maintained for six consecutive years from 2014 to 2019 until it dropped to 79 percent in 2020 and 61 per cent in 2021 and 2022. Nonetheless, South Africa had a relatively high

DTP-3 coverage with a minimum of 81 per cent in 2013 and 86 per cent in 2021. On the other hand, a two or three percentage yearly increment in coverage was recorded in Ethiopia for the first five years from 2013 to 2017, and the maximum ever DTP-3 coverage of 71 percent was reported in 2020 which curved down to 65 percent in 2021 and 2022. Among the four countries, Angola had the lowest coverage rates over the decade. The maximum ever coverage for the country over the decade was 63 percent in 2018, which then steadily declined to 42 percent in 2022 (see Figure 6).

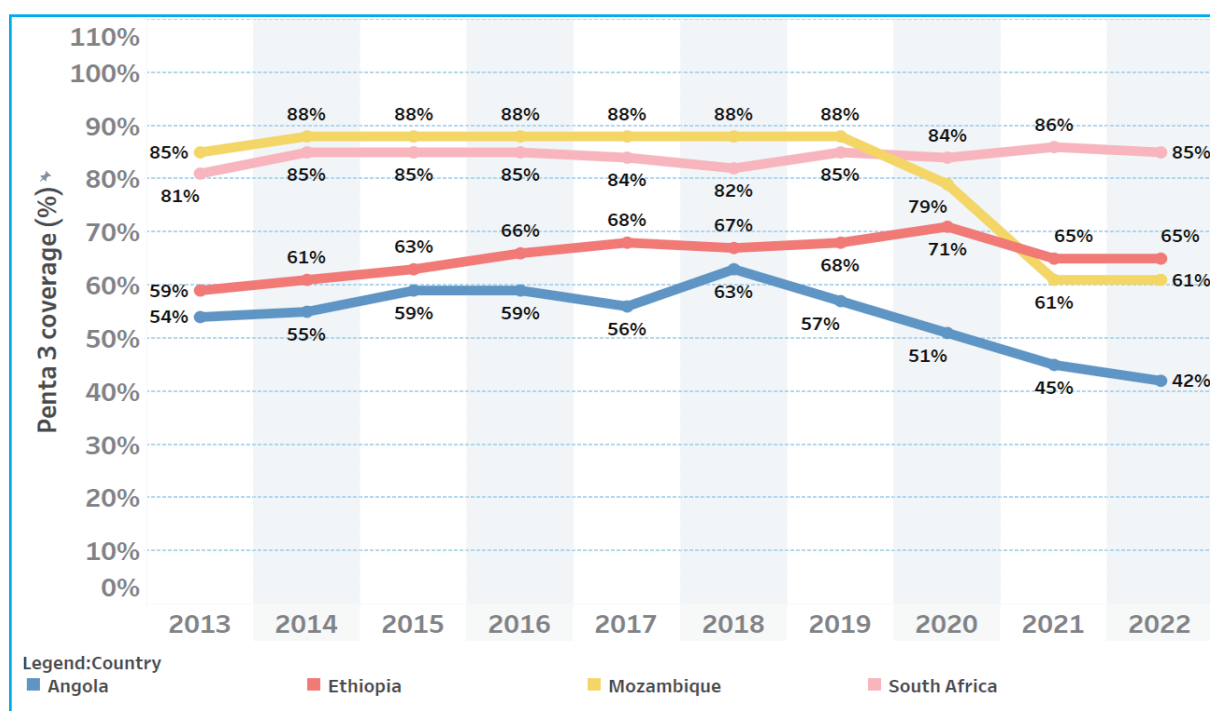


Figure 6: DTP-3 coverage for the four countries, WHO/UNICEF WUENIC estimate 2013–2022

2.3. The state of immunization inequity in four countries

2.3.1. Summary of inequity by driver

The zero-dose rate for the four study countries was assessed using data from 11 surveys conducted between 2003 and 2023: one survey in Angola, four in Ethiopia, four in Mozambique and two in South Africa. The zero-dose rates across these countries were then compared using data from surveys from 2015 to 2016 (see Table 4).

Table 4: The extent of zero-dose in the four countries from survey reports 2003–2023

Country	Abbreviation	Year	Data source	Zero-dose rate
Angola	AGO	2015	DHS	18.3%
Ethiopia	ETH	2005	DHS	24.0%
Ethiopia	ETH	2011	DHS	14.5%
Ethiopia	ETH	2016	DHS	15.9%
Ethiopia	ETH	2019	DHS	19.2%
Mozambique	MOZ	2003	DHS	8.7%
Mozambique	MOZ	2008	MICS	8.8%
Mozambique	MOZ	2011	DHS	4.7%
Mozambique	MOZ	2015	DHS	4.9%
South Africa	SAF	2003	DHS	17.0%
South Africa	SAF	2016	DHS	5.3%

The extent of zero-dose rates varied significantly among the four countries. The zero-dose rate ranged from 4.9 per cent in Mozambique (DHS, 2015) to 18.3 percent in Angola (DHS, 2015), resulting in an Absolute Equity Gap (AEG) of 13.4 percentage points (PP) (see Figure 7).

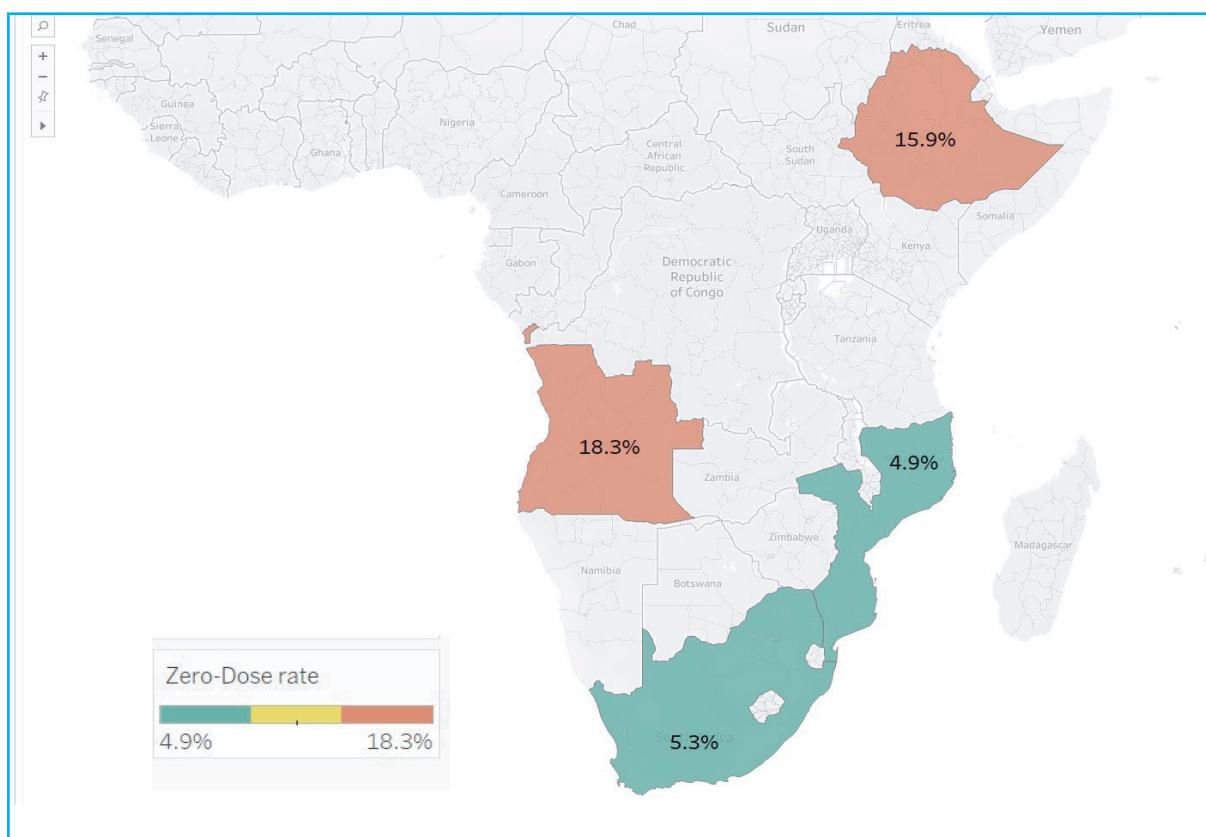


Figure 7: The extent of Zero-dose rate in the four countries, 2015-2016 surveys

(Source: mapped from data to show the rate of zero-dose using red, yellow and green colors sequentially indicating from high to low zero-dose rate)

The AEG for the four equity drivers (sex, wealth, education and residence) was compared over time for all countries except Angola which only has had one survey in the last 20 years. In South Africa, a narrowing zero-dose inequity was observed by place of residence, but the inequality widened by sex and education (see Figure 8). A two-year moving average was calculated for the four drivers in countries with more than two surveys (Ethiopia and Mozambique) by averaging the AEGs from two consecutive surveys. The two surveys moving average was used to smooth out the short-term survey-to-survey fluctuations by the four equity drivers and to determine the overall zero-dose inequity long-term trends by equity driver. Mozambique has shown consistent improvement in reducing zero-dose inequities across the four equity drivers in the last 20 years. On the contrary, Ethiopia has shown increasing trend of zero-dose inequity by all drivers in the last 20 years (see Figure 8).

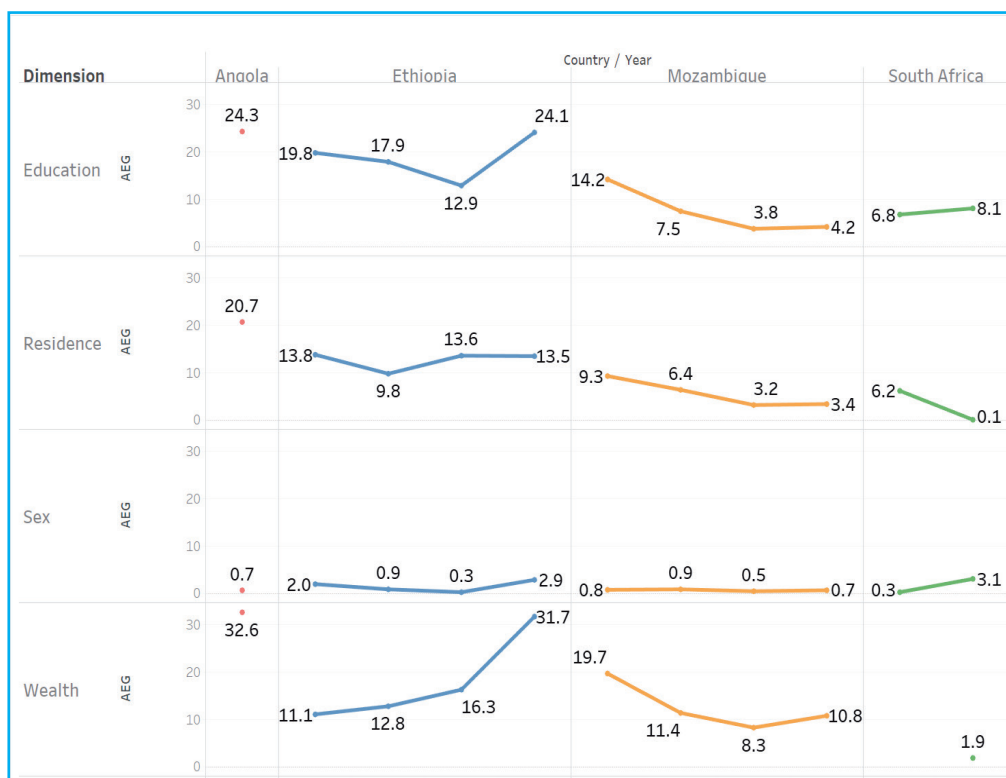


Figure 8: Zero dose-inequities (AEG) trend by drivers and country

Figure 9 shows the trend of AEG after applying two survey moving average for the four equity drivers in countries which conducted more than two surveys (Ethiopia and Mozambique).

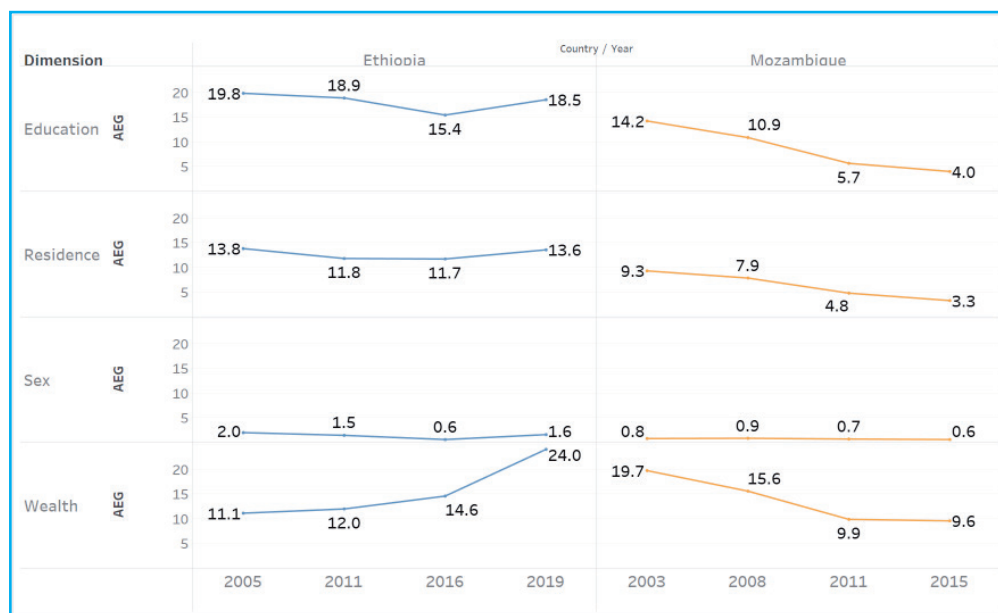


Figure 9: Zero-dose AEG trends of equity drivers using two survey moving average

Zero-dose AEG declined in Mozambique by all equity drivers, but on contrary, it increased in Ethiopia across the four drivers. In South Africa, reduction in zero-dose AEG was observed by place of residence but increased by child sex and maternal education (see Figure 10).

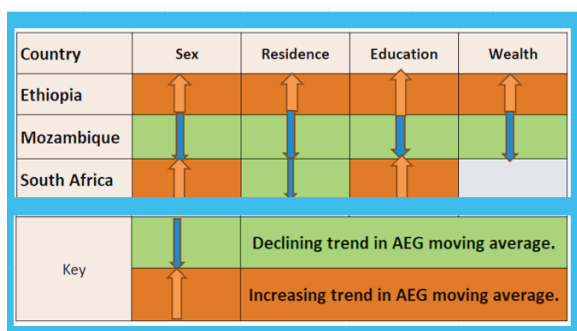


Figure 10: absolute equity gaps change over time by country and equity drivers

2.3.2. Zero-dose subnational inequities in the four countries

Subnational inequities by geographical location (subnational units where coverage survey estimates were made at state/district levels) varied by country. Countries with lower zero-dose rates (Mozambique and South Africa) had smaller zero-dose variability as measured by the small AEG, standard deviation (SD) and Interquartile Range (IQR). On the contrary, Angola and Ethiopia showed larger subnational inequalities as manifested by higher AEG, SD and IQR. The subnational AEG varies from 10.4 PP in South Africa to 42.5 PP in Angola (see Figure 11)

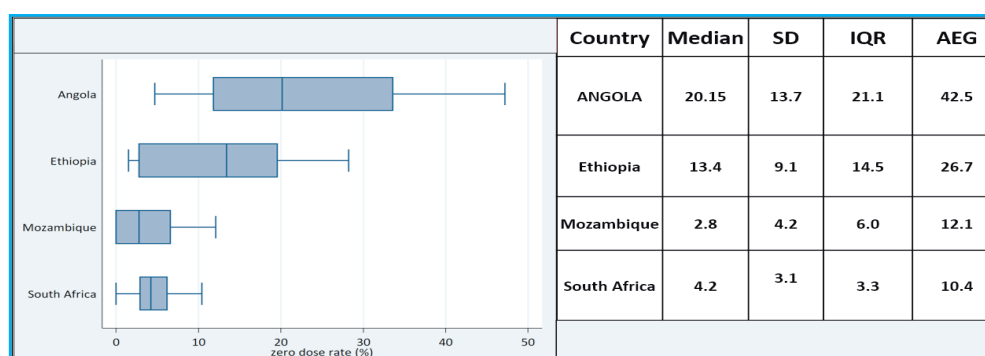


Figure 11: subnational zero-dose inequities by geographic location in the study countries

2.3.3. Zero-dose inequities by gender and residence in the four countries

The AEG of zero-dose between males and females was small ranging from 0.3 PP (Ethiopia, 2016) to 3.1 PP (South Africa, 2016) and the median and IQRs of the AEGs were 0.8 PP and 1.5 PP, respectively. Zero-dose gender inequity was very low regardless of the extent of the zero-dose rate. Countries with low zero-dose rates (South Africa and Mozambique) and high zero-dose rates

(Angola and Ethiopia) had low sex zero-dose equity gaps (see Figure 12).

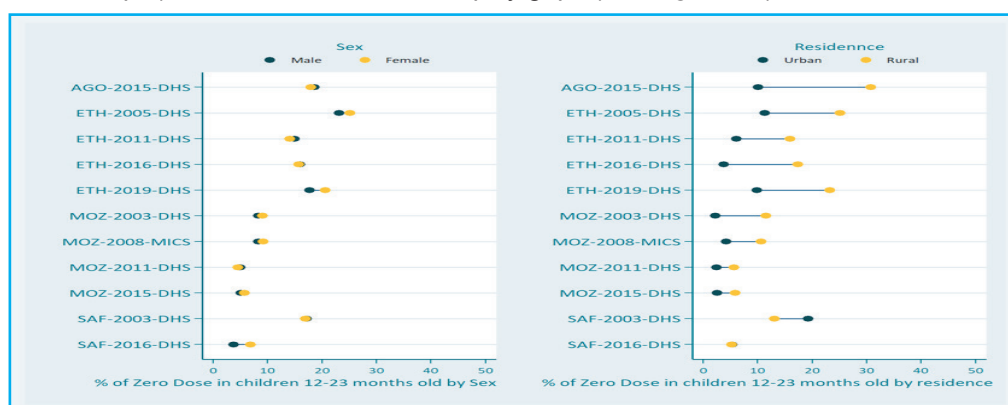


Figure 12: Zero-dose inequity by gender and residence in the study countries in the last 20 years

Despite the small gap in gender inequities, there has been no marked improvement over the past 20 years. The median (IQR) was 0.8(1.5) PP for all surveys and 0.7(2.1) PP for the most recent surveys for the four countries. Nonetheless, higher zero-dose inequities were observed by place of residence across the surveys in the study countries. The median (IQR) zero-dose AEG for place of residence for all surveys was 9.3 PP (10.2 PP), ranging from 0.1 PP in South Africa to 20.7 PP for Angola. Ethiopia had the second highest AEG by place of residence (13.6 PP). These inequities by place of residence were higher compared to the gender AEG in all the 11 surveys of the four countries except in South African DHS 2016.

2.3.4. Maternal education and wealth inequities

Maternal education zero-dose inequities, as measured by the AEG between those with no education and those with secondary or higher education, were bigger than sex and residence inequities in all the surveys conducted in the four countries over the last 20 years except Ethiopia DHS 2016 when the AEG for place of residence was slightly higher than maternal education AEG. The IQR zero-dose AEG for maternal education for all surveys was 12.9 (13.0) PP, ranging from 3.8 PP in Mozambique to 24.3PP in Angola. The zero-dose maternal education AEG increased in the most recent survey compared to the preceding one in countries with multiple surveys (Ethiopia, Mozambique and South Africa) (see Figure 13).

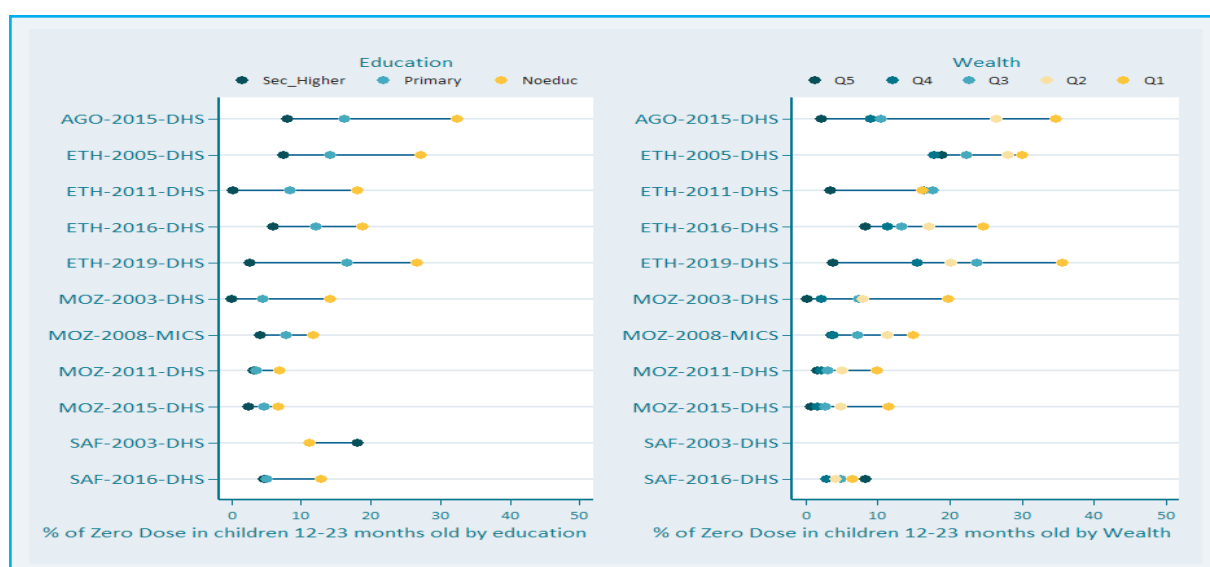


Figure 13: Zero-dose rate inequities by wealth and maternal education 2003–2022 in the study countries (source: prepared from DHS/MICS data)

The extent of zero-dose rate was highest in the poorest (first quintile) compared to the richest (fifth quintile) households. Overall, wealth-related zero-dose inequities were the highest compared to the other drivers of zero-dose inequities in most study countries and survey years. Household wealth was assessed in 10 of the 11 surveys, and it was the highest AEG in 7 of the 10 surveys (70 per cent). However, maternal education AEG was highest in Ethiopia DHS 2005 and 2016 and South Africa DHS 2016. The median (IQR)

wealth AEG (as compared between the poorest, and richest quintile households was 12.1 PP (12.5PP), ranging from AEG of 1.9 PP in South Africa (DHS 2016) to 32.6PP in Angola (DHS 2015) (see Figure 13).

2.3.5. Comparison of the extent of the four equity drivers in the study countries

The extent of zero-dose inequity varied by equity drivers and by country. Figure 14 below shows the inequity of zero-dose by equity drivers in the four countries using surveys in 2015 and 2016.

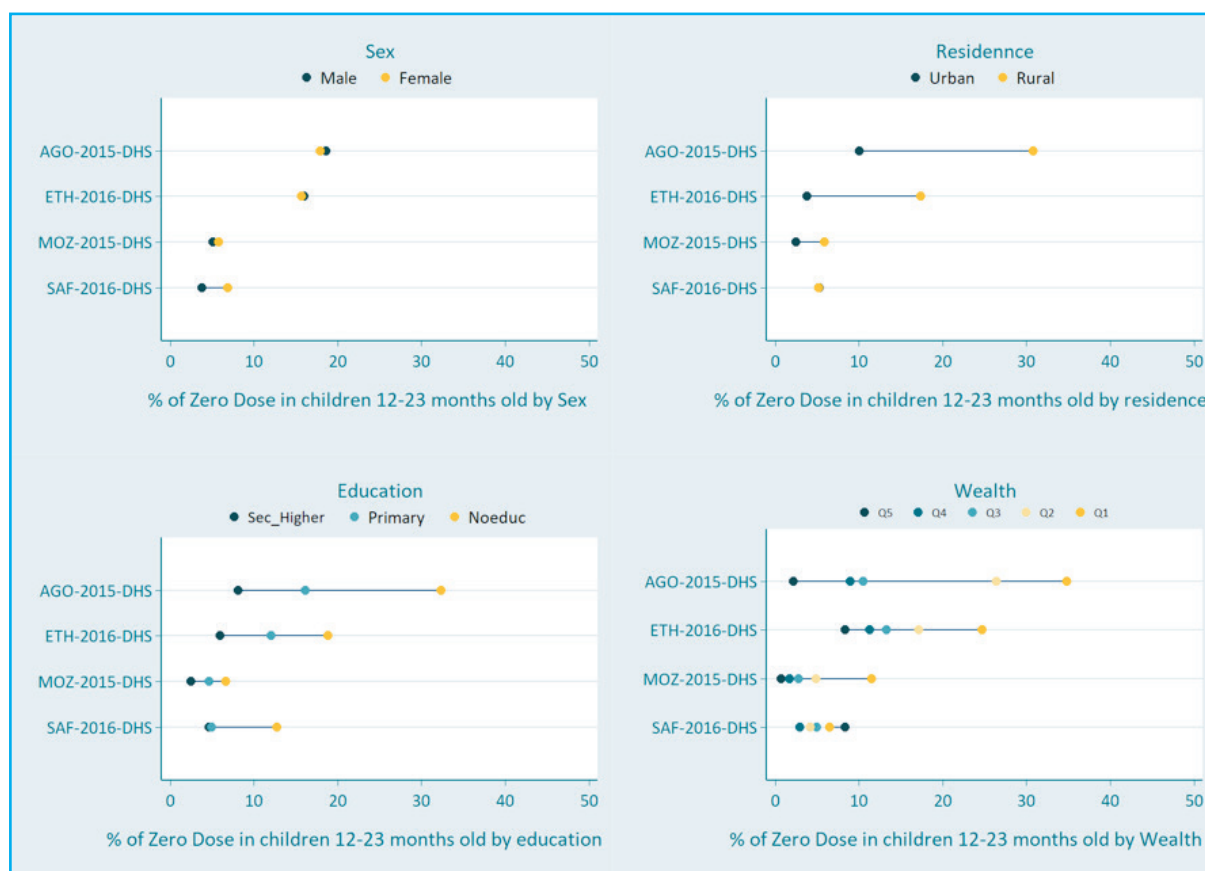


Figure 14: Zero-dose inequity by equity drivers from recent surveys in the study countries

Based on the absolute equity gaps of zero-dose by equity drivers over the last 20 years, Angola ranked first with the highest AEG means rank score (32.1), followed by Ethiopia and Mozambique. South Africa had the lowest equity gap for all equity drivers (see Table 5).

Table 5: kruskal-wallis means rank of the study countries based on the extent of zero- dose equity driver gaps (aeg) from DHS/MICS survey reports in the last 20 years (source: DHS/MICS data)

Country	N	Mean rank	Rank
Angola	4	32.1	1 st
Ethiopia	16	27.0	2 nd
Mozambique	16	18.7	3 rd
South Africa	7	12.4	4 th
Total	43		

The ranking of the four counties remains the same in the most recent surveys (see Table 6).

Table 6: Kruskal-Wallis means rank of the study countries based on the extent of zero- dose equity driver gaps (AEG) for the most recent DHS/MICS surveys

Country	N	Mean rank	Rank
Angola	4	12.13	1 st
Ethiopia	4	9.50	2 nd
Mozambique	4	7.13	3 rd
South Africa	4	5.25	4 th
Total	16		

2.3.6. Under-vaccination equity gaps in the study countries

The extent of under-vaccinated children showed a similar pattern to that of Zero-dose. The coverage surveys from the four countries indicated a general trend of decreasing under-vaccination rates as DPT3 coverage increased in most countries. In Mozambique, DPT3 coverage steadily increased from 71.6 percent in 2003 to 80.6 percent in 2015 while the rate of under-vaccinated children decreased from 19.7 per cent to 13.5 per cent during the same period. Similarly, in Ethiopia, DPT3 coverage increased progressively from 31.9 percent in 2005 to 61.1 percent in 2019, with the under-vaccination rate

declining from 44.1 percent to 19.7 percent. Although the overall trend suggested an inverse relationship between DPT3 coverage and under-vaccination rates, this pattern did not hold true in 2011 for Mozambique and Ethiopia. In that year, both countries experienced a slight increase in under-vaccination rates despite a rise in DPT3 coverage. Despite year-to-year inconsistencies, the zero-dose rate generally decreased alongside the under-vaccination rate in Ethiopia and Mozambique, while DPT3 coverage increased (see Figure 15). In South Africa, there was a slight decline in DPT3 coverage in 2016 compared to 2003 and an increase in under-vaccination rate in the same period while there was decrease in the zero-dose rate.

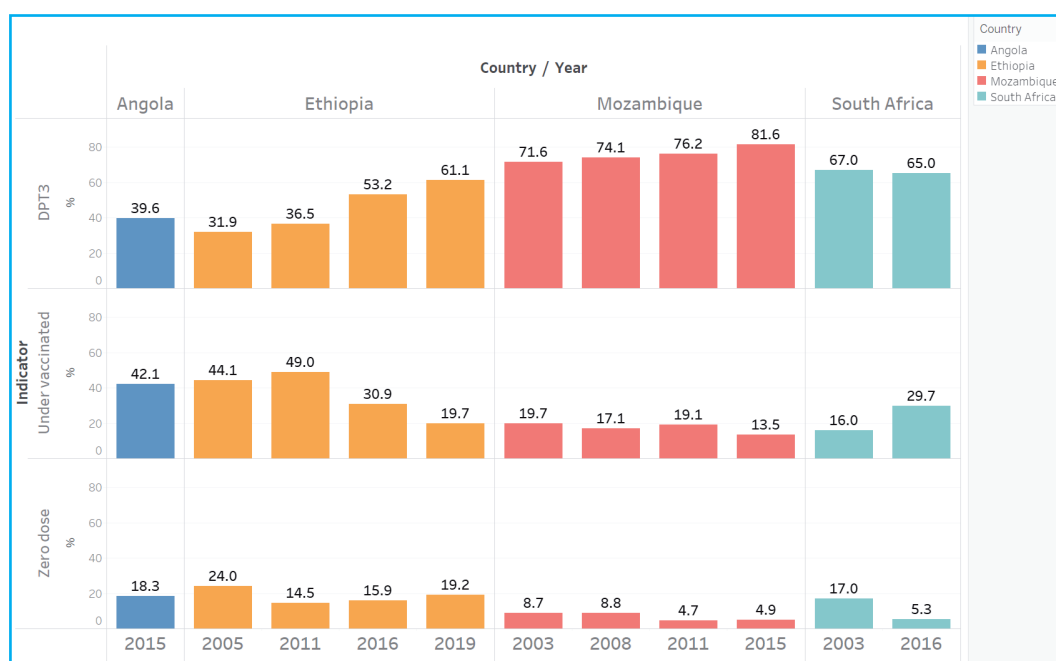


Figure 15: Extent of DPT3, under-vaccinated and zero-dose rates in the last 20 years in the four study countries

2.3.7. Under-vaccinated inequities by equity drivers

The gender under-vaccinated inequities were small regardless of under-vaccinated rates in all countries over the last 20 years. The median (IQR) under-vaccinated AEG was 0.9 PP (1.5 PP) which is consistent with the zero-dose gender inequities. The under-vaccinated inequities by place of residence were bigger than the gender inequities with median (IQR) AEG of 9.9 (10.4) PP.

The under-vaccinated inequities by maternal education was bigger than that of place of residence with median (IQR) AEG of 14.5 (11.3) PP and also wealth with median (IQR) AEG of 13.9 (12.5) PP. Overall, the smallest under-vaccinated inequities were shown by child sex regardless of under-vaccinated rates in all countries over the last 20 years followed by place of residence, wealth and maternal education (see Figure 16).

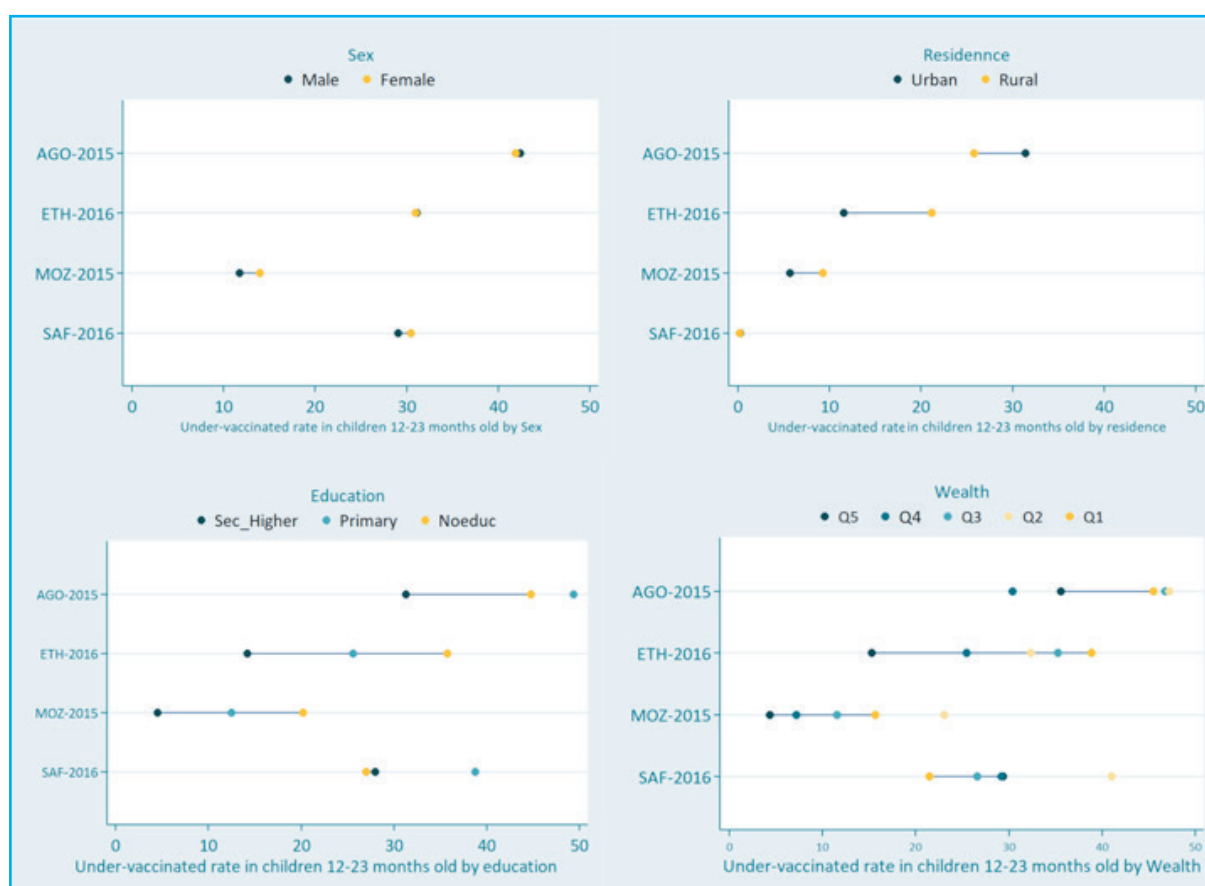


Figure 16: under-vaccinated AEG by equity drivers IN 2015-2016 in the four study countries

The gender under-vaccinated AEG ranged from the lowest of 0.1 PP in Ethiopia to highest of 2.2 PP in Mozambique according to the 2015-2016 surveys. For similar period, under-vaccinated inequities by place of residence ranged from the lowest AEG of 5.4 PP in South Africa to 16.2 PP

in Ethiopia. Similarly, under-vaccinated inequities by maternal education ranged from 12.3 PP in South Africa to 21.6 PP in Ethiopia and household wealth AEG ranged from 7.9 PP in South Africa to 23.6 PP in Ethiopia (see Table 7).

Table 7: Comparison of under-vaccinated and zero-dose

AEG by equity drivers in the four countries, 2015-2016 surveys

Country	Under-vaccinated				Zero dose			
	Education	Residence	Sex	Wealth	Education	Residence	Sex	Wealth
Angola, 2015	13.5	5.8	0.5	9.9	24.3	20.7	0.7	32.6
Ethiopia, 2016	21.6	16.2	0.1	23.6	12.9	13.6	0.3	16.3
Mozambique, 2015	15.7	7.4	2.2	11.3	4.2	3.4	0.7	10.8
South Africa, 2016	12.3	5.4	1.4	7.9	5.2	0.1	3.1	1.9

There was no consistent pattern in the trend of equity drivers of under-vaccinated rate in the study countries over the last 20 years. In South Africa, there was an increase in the rate. In Mozambique, there was a decline in the inequity of under-vaccinated rate over the last 20 year. In Ethiopia, there was decline in the trend of under-vaccinated inequity by place of residence in the last 20 years (see Figure 17).

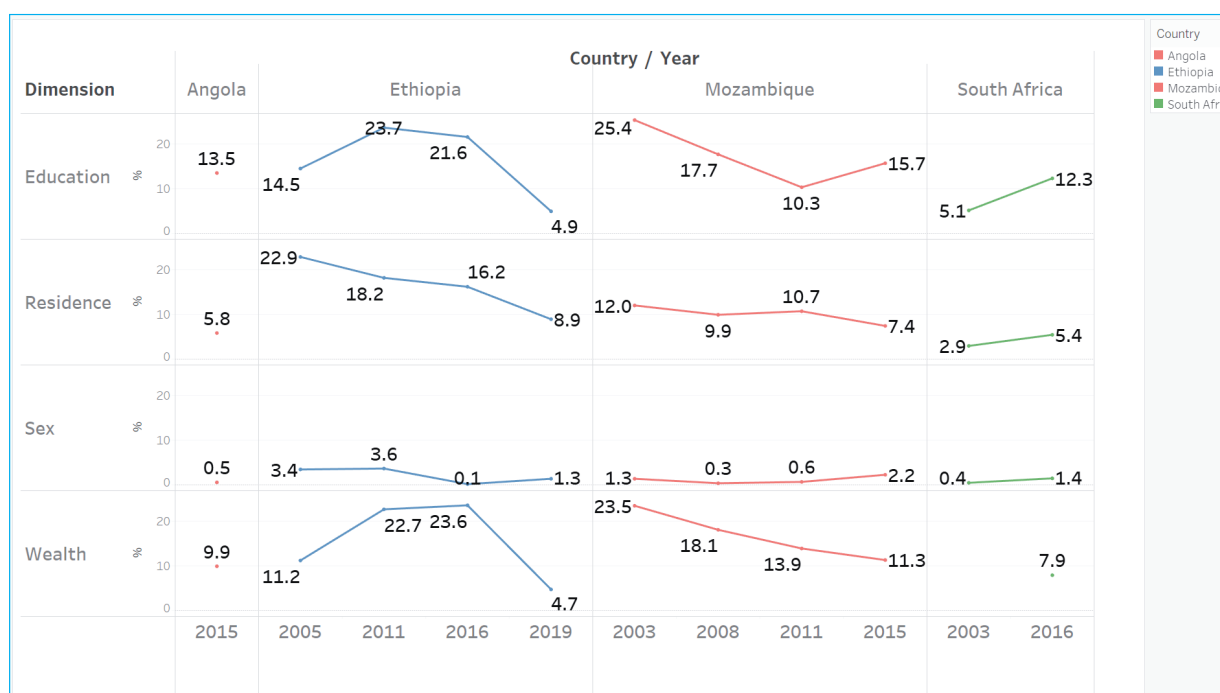


Figure 17: Under-vaccinated inequities (AEG) trend by driver and country

2.3.8. Impact of equity drivers on zero dose in the study countries

In 7 out of the 10 surveys conducted with household wealth assessment, over the past two decades across the four study countries, the predominant inequities were identified within household wealth quintiles. Additionally, maternal education took precedence in 3 of the 10 surveys. However, in the surveys conducted in 2015 and 2016, zero-dose household wealth quintile inequities were more pronounced in Ethiopia and South Africa, while maternal education emerged as the main factor in Angola and Mozambique. Based on the AEG from the survey reports in the last 20 years, household wealth quintile had the highest gaps and was ranked as the first zero-dose inequity driver (see Table 8). The minimum zero-dose inequity as measured by the AEG was observed by child sex.

Table 8: Kruskal-Wallis means rank of the study countries based on the extent of zero-dose equity driver gaps (AEG) for the four study countries in the last 20 years (2003-2022)

Equity driver	N	Mean rank	Rank
Wealth	10	30	1 st
Education	11	28.64	2 nd
Residence	11	22.82	3 rd
Sex	11	7.27	4 th
Total	43		

Similarly, the same pattern was observed in the most recent surveys (2015 and 2016) conducted in the four countries in which wealth zero-dose inequities (AEG) was the highest followed by maternal education, residence and child sex (see Table 9).

Table 9: Means rank of zero-dose AEG of the four equity drivers in the four study countries from the most recent surveys conducted in 2015 and 2016

Equity driver	N	Mean rank	Rank
Wealth	4	11.0	1 st
Education	4	10.8	2 nd
Residence	4	8.5	3 rd
Sex	4	3.8	4 th
Total	16		

Household wealth inequity was highest in all countries except South Africa where maternal education was the highest. Nonetheless, gender-related zero-dose AEG was very low in all the study countries (see *Figure 18*).

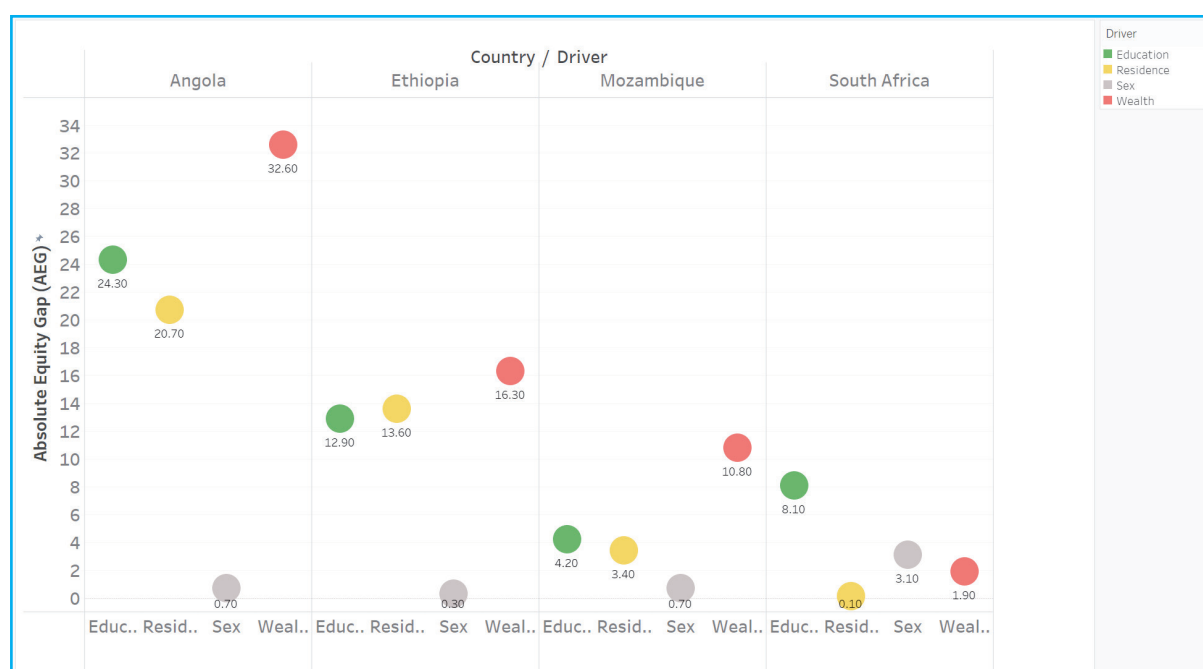


Figure 18: The extent of Absolute Equity Gap by equity driver from surveys conducted in 2015 and 2016 in the four study countries

Figure 19 shows two groups of countries based on the extent of the zero dose and zero-dose inequalities according to data from 2015 and 2016 surveys conducted in the study countries. In the first group (South Africa and Mozambique), the extent of zero dose was less than 10 per cent and the inequities across the four equity drivers were small. For the other group, Angola and Ethiopia had more than 10 per cent zero-dose rate and higher inequities by equity driver. The inequities by the four drivers as measured by the AEG were all less than 10 PP in South Africa and Mozambique except maternal education (10.8 PP). Countries far on the right side (Angola and Ethiopia) had higher zero-dose inequities by maternal education compared to those on the left

side. The extent of inequities by wealth and place of residence are represented by the size and colour of the circle. South Africa with the smallest circle size (low wealth AEG) at the bottom and green colour (low AEG by place of residence) had the best performance in terms of zero-dose extent and inequities. On the contrary, Angola at the right top of the figure (right-upper) with big red circle had poor performance in terms of zero-dose extent and inequities.



Key: The Y-axis represents the extent of zero-dose. Countries at the top had higher zero-dose rate while those at the bottom had lower zero-dose rate. The X-axis represents zero-dose maternal education inequity.

Figure 19: Study countries based on zero-dose rates and zero-dose inequities by driver

The extent of the four equity drivers is shown in Figure 20. Education is in the X-axis; wealth is in the Y-axis; and residence and sex are represented by size and colour of the circles, respectively. Angola with highest inequities in maternal education, household wealth and place of residence is at the right top (upper quadrants) shown in red colour

(the highest AEG in residence). On the contrary, South Africa with the lowest wealth and residence inequities is placed on the left lower quadrant. And the biggest size of the circle for South Africa represents the biggest zero-dose AEG by place of residence.

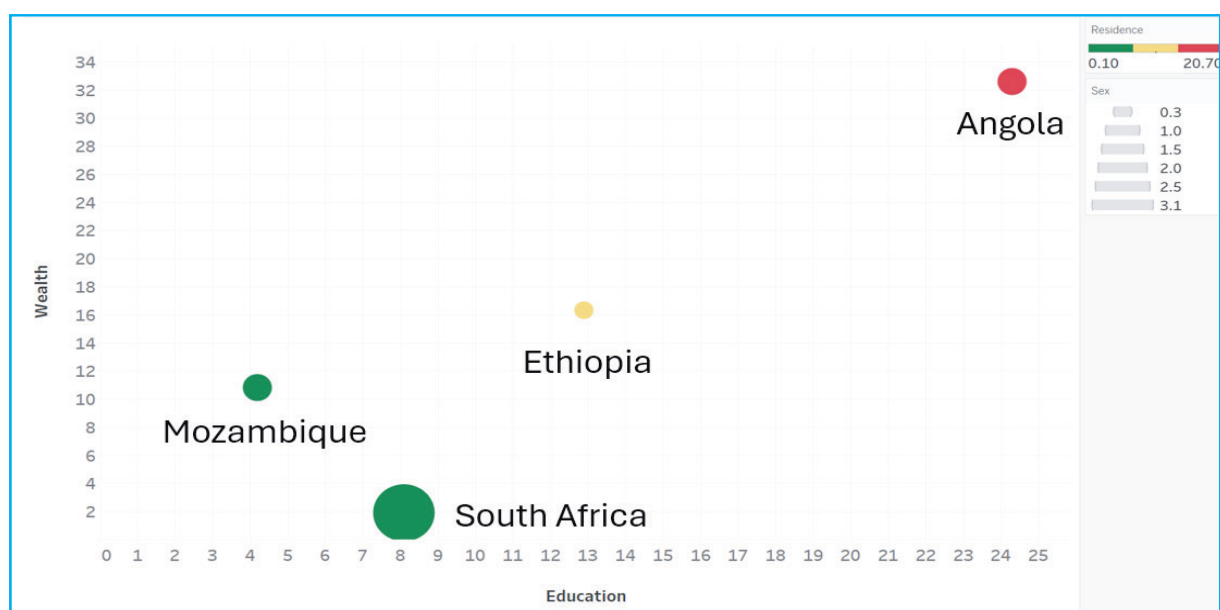


Figure 20: Extent of the four equity drivers in the four study countries from surveys done in 2015 and 2016

2.4. Trends in immunization inequities (equity concentration index)

2.4.1. Slope Index of Inequity (SII)

The Slope Index of Inequity (SII) for the AEG of zero dose by maternal education and household wealth quintile was generated using the WHO Health Equity Assessment Toolkit (HEAT) ¹. The SII is a complex, weighted measure of

inequality that indicates the absolute difference in estimated values of an indicator between the most advantaged and most disadvantaged, while taking into consideration all the other subgroups, using an appropriate regression model. The SII was used for equity drivers which have ordered subgroups (ordinal data). The WHO Health Equity Assessment Toolkit was used to generate zero-dose household wealth and maternal education SII for the four countries in the last 20 years (see *Figure 21*).

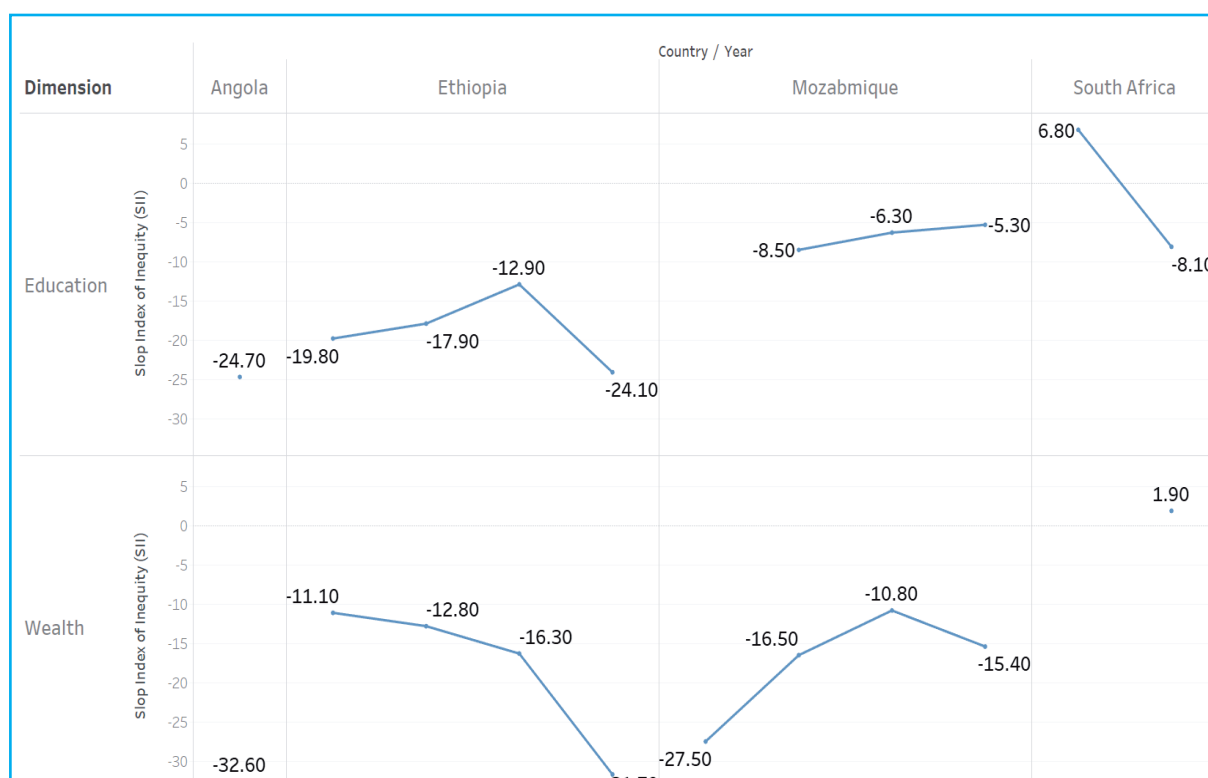


Figure 21: SII for education and wealth by country in the last 20 years

All the SII values were negative except maternal education in 2003, indicating a higher concentration of zero dose among the most disadvantaged people (the poorest and not formally educated). A negative slope indicates that as education or wealth increases, the zero-dose rate decreases. In Mozambique, the SII trend for maternal education zero-dose inequities steadily decreased in the last 20 years and household wealth inequities decreased from 2003 to 2011. In Ethiopia, zero-dose inequity for maternal education declined between 2005 and 2016 but increased by 2019, while the household

wealth inequity progressively increased over the 20 years. In South Africa, the zero-dose inequity by maternal education increased from 2003 to 2015. However, there is no SII trend for Angola because there is only one survey available in 20 years and trend inequity by household wealth for South Africa due to lack of household wealth data in the 2003 DHS.

2.4.2. Equity analysis from DHS data using VERSE equity tool

Vaccine Economics Research for Sustainability and Equity (VERSE) tool was used to generate composite vaccination equity metric which account for multiple factors influencing inequity in vaccination coverage. The tool produces results that measure the relative influence of socioeconomic inequality combined with measures of direct unfairness in health care access by applying regression decomposition to the Concentration Index (CI)². High CI suggests that individuals with higher unfair disadvantage are significantly more likely to be zero dose than those with less unfair disadvantage. The AEG is the absolute difference between the vaccination outcome achieved by the top 20 percent and the bottom 20 percent of the population, ranked by unfair disadvantage¹.

An equity analysis using VERSE tool showed that Angola had the highest (30.4 PP) AEG in zero-dose rates between the 20 percent of individuals with higher unfair disadvantage and those 20 percent with less unfair disadvantage, followed by Ethiopia (22.7 PP), Mozambique (10.6 PP) and South Africa (8.8 PP). The individuals with unfair higher disadvantage had higher zero-dose rates. The zero-dose inequity from the VERSE tool was consistent with the ranking of the countries in Table 6 (Kruskal-Wallis means rank based on the extent of zero- dose equity driver gaps). The VERSE analysis showed that vertical inequity was the major type of inequity, accounting for 40 percent to 60 percent of the zero-dose inequities in three of the study countries (Angola, Ethiopia and Mozambique). In addition, in Ethiopia, the contribution of horizontal inequity was significant (more than 25 percent) (see Table 10).

Table 10: Composite AEG of zero dose between the 20% of individuals with higher unfair disadvantage and those 20% with less unfair disadvantage in the four study countries

Country	Survey year	Zero-dose composite AEG (VERSE) in PP
Angola	2015	30.4
Ethiopia	2016	22.7
Mozambique	2015	10.6
South Africa	2016	8.8

2.5. Underlying factors/barriers to immunization inequity

The analysis of barriers in achieving immunization equity in Angola, South Africa, Mozambique and Ethiopia highlights a complex interplay of factors across the different components of immunization programmes. Systemic deficiencies within health systems, deepened by socioeconomic disparities and accessibility limitations, contribute to multiple challenges hindering the universal access to immunization services. Deficiencies such as inadequate resources and staffing impede effective programme implementation. Broader societal issues, such as economic gaps, geographic obstacles, and gender-related concerns, have also contributed to disparities in vaccination access and utilization across demographic and socioeconomic settings of the countries. Table 11 below describes several supplier- or user-side barriers and underlying factors that hinder the efforts to reach and vaccinate zero-dose children in the four countries as extracted from official reports, country level documents and websites.

Table 11: summary of underlying factors/barriers to immunization inequity in the four countries

Underlying factors / barriers to immunization	Description of the barriers/underlying factors
Cultural and religious barriers	▪ Low immunization literacy: Common demand-side barriers to vaccination include vaccine hesitancy influenced by misinformation, lack of trust, and fear of side effects. Additionally, factors such as forgetfulness, lack of awareness about the importance of immunization, dissatisfaction with health services, and socioeconomic disparities play a role in hindering vaccination uptake. ▪ Culture and religion: In some contexts, cultural and religious beliefs directly affect uptake, with caregivers either preferring traditional healing practices over modern medicine or expressing concerns based on religious grounds. In Ethiopia, cultural and religious beliefs, as well as limited health care-seeking behaviour due to adverse climatic conditions and high fertility contribute to barriers. ▪ In South Africa, wealth-based inequities are the main barrier to immunization uptake. ▪ In Mozambique, power dynamics in health facilities and distrust due to vaccine stock outs impact caregivers' decisions to take up immunization services. ▪ In Angola, low vaccine literacy and cultural barriers affect the immunization uptake; and low vaccine literacy among caregivers contributes to scepticism and reluctance to use vaccination services.
Supply barriers	▪ Supply-side barriers to vaccination vary across the four countries, with common challenges including logistic issues, causing interruptions in vaccine supply chains, infrastructure problems affecting storage and handling as well as stock outs and disrupted vaccine supplies. ▪ In Ethiopia, accessibility issues persist in many districts and health facilities, alongside frequent refrigerator failures and shortages of spare parts and skilled technicians. ▪ South Africa faces a high rate of vaccine stock outs, and inadequate vaccine availability in primary health care facilities due to systemic inefficiencies. ▪ Mozambique struggles with delays in vaccine shipments, limited storage capacities and obstacles in delivering vaccines to remote areas, leading to recurrent supply stock outs and inadequate coverage. ▪ Angola experiences a lack of vaccine supply and distribution, resulting in the absence of vaccines at static sites and a deficiency in functional cold chain equipment essential for vaccine availability.
Health system and health workforce-related barriers	Common health system and workforce-side barriers include: ▪ Data management challenges: Poor data quality, limited disaggregated data and lack of data use culture hinder effective decision-making in vaccination programmes. ▪ Staffing issues: Shortages of health workers, high turnover rates and skill gaps, especially in remote and conflict-affected areas, affect the delivery of services. ▪ Resource constraints: Inadequate facility infrastructure, budget limitations and inadequate resources pose significant barriers to the efficient functioning of vaccination programmes. ▪ Engagement and awareness: Low engagement of private facilities, insufficient community engagement and lack of sustainability of initiatives following phase out of projects inhibit successful immunization campaigns.

	Main health system and workforce-side barriers in each country: In Angola: ▪ Absence of vaccination services in remote communities leads to limited access to immunization. ▪ Irregularities of outreach vaccination and poor-quality service during vaccination sessions contribute to lower coverage rates. ▪ Poor integration of immunization with other clinical services leads to missed opportunities for vaccinations. In Ethiopia: ▪ Poor use of micro-planning results in unreliable population data for effective programme planning. ▪ Weak supportive supervision and irregular service interruptions hamper consistent vaccine delivery. ▪ Limited resources and overcrowding in health facilities lead to dissatisfaction among service users. In South Africa: ▪ Disruptions to routine immunization services due to the COVID-19 pandemic have impacted vaccination uptake. ▪ Challenges in vaccine stock management, inadequate training and difficulties in data affect service quality. ▪ Limited EPI implementation in rural clinics contribute to coverage gaps. In Mozambique: ▪ Insufficient health care infrastructure, staffing shortages and limited resources challenge effective BCG vaccination coverage. ▪ Missed vaccination opportunities due to gaps in health care worker training and service delivery hinder consistent coverage. ▪ Inadequate data management capacity and poor budget planning impede equitable access to vaccination services.
Leadership, management and coordination; governance and policy-side barriers	Common leadership, management, coordination, governance, and policy-side barriers: ▪ Operational costs heavily rely on external partners, leading to funding uncertainties. ▪ Human resource shortages at all levels impact the quality and quantity of immunization services. ▪ Shifting priorities towards donor-supported agendas leads to neglecting specific programme needs. ▪ Political instability affects government commitment to health programmes and leadership turnover. ▪ Challenges in resources such as budgets, transportation and vaccine supply affect programme implementation across countries.

	Specific barriers peculiar to each country: In Angola: ■ Implementation issues due to governance challenges and administrative instability. ■ Lack of specific policies for immunization and health care integration. ■ In Ethiopia: ■ Budget constraints pose a significant barrier to effective programme implementation. ■ Decreasing government commitment to health programmes amidst political instability. ■ Challenges in human resource availability and quality impact the EPI structure. In Mozambique: ■ Weaknesses in leadership and management affect planning and implementation of vaccination activities. ■ Sub-optimal health worker motivation leads to missed vaccination opportunities and poor clinical quality of care. ■ Insufficient implementation of national policies due to governance and financial constraints.
Socioeconomic barriers	Common socioeconomic-side barriers across the four countries: ■ Socioeconomic determinants, such as poverty, unemployment and inadequate access to education act as formidable barriers to health care access and use, impacting vaccination coverage and equity. Specific socioeconomic-side barriers peculiar to each country: In Ethiopia: ■ Budget constraints and limited resources exacerbate socioeconomic disparities, hindering vaccination uptake among disadvantaged populations. In South Africa: ■ Socioeconomic factors, such as low household income and educational levels have been associated with lower rates of immunization uptake, showcasing the impact of poverty and education on vaccination disparities. ■ Income disparity and inadequate housing conditions serve as strong predictors of incomplete vaccination coverage, particularly affecting the most economically vulnerable populations. In Mozambique: ■ Poverty, limited health care access and competing socioeconomic needs contribute to decreased vaccination uptake among children, as families prioritize other necessities over health care services. ■ Overcrowded facilities and income loss due to attending vaccination appointments pose dilemmas for families, highlighting the trade-offs between earning wages and accessing health care services

Geographical accessibility-side challenges or barrier	Common geographical accessibility barriers across countries: - Geographic isolation and inadequate transportation infrastructure in rural and remote areas pose challenges for accessing immunization services, impacting vaccination coverage. Specific geographical accessibility-side barriers in each country: In Angola: - Topographic challenges, such as rugged terrains, impede outreach efforts to remote communities, restricting immunization coverage and access. In Mozambique: - Geographical isolation and long distances to health facilities in rural areas hinder the accessibility of immunization services, resulting in challenges in reaching populations for vaccination efforts. - Inadequate infrastructure and transportation networks further exacerbate barriers to immunization coverage, particularly in remote regions due to geographical inaccessibility.
Immunization education, communication and advocacy challenge	Common communication and advocacy-side barriers: - Poor implementation of social and behavioural change communication strategies hampers community mobilization efforts and demand generation for immunization services. - Limited engagement of civil society organizations and communities to address vaccine hesitancy and enhance demand. Challenges peculiar to each country: In Ethiopia: - Needy underserved communities with a higher proportion of zero-dose children face challenges in implementing tailored communication and advocacy interventions, hindering demand generation efforts. - Limited use of health structures and community forums further impacts communication strategies for immunization. - Insufficient availability of audiovisual aids for communication efforts and under-utilization of tools such as family folders for target identification and tracking defaulters. In Mozambique: - Communication and advocacy barriers include limited community engagement, gaps in social and behavioural change communication activities, and under-utilization of family folders for monitoring and targeting vaccine beneficiaries.

Gender-related barriers:

Common gender-related barriers across the four countries:

- Educational disparities, maternal health risks, early marriage practices and gender-based violence place women at a disadvantage, impacting their ability to access health care services.
- Social norms and expectations often burden mothers with the responsibility of vaccination, leading to challenges in accessing vaccination services and completing immunization schedules.

Specific gender-related challenges in each country:

In Ethiopia and Mozambique

- Gender-related challenges in Ethiopia contribute to inequalities in childhood immunization, influenced by cultural norms and gender roles that affect decision-making power regarding health care.
- Gender disparities in Mozambique are pronounced, with barriers, such as limited family support, long distances to health facilities and societal expectations, placing a disproportionate burden on mothers for vaccination responsibilities.
- Early marriage practices, lack of educational opportunities, and gender norms contribute to challenges in completing vaccination schedules and accessing health care services for women and children in Mozambique.

3. Equity-focused immunization interventions in four ESAR countries

Addressing immunization inequity requires the implementation of major interventions to improve access and use, and ultimately coverage across populations regardless of demographic and socioeconomic inequalities. A variety of strategies have been identified to tackle the disparities in immunization coverage in the Eastern and Southern African countries of Angola, Ethiopia, Mozambique and South Africa. The broad spectra of pro-equity interventions have been put in place in these countries to enhance immunization outcomes and ensure equitable delivery of vaccination services, as elaborated in the sections below.

3.1. Service delivery and accessibility

3.1.1. Reach every district- quality improvement (RED-QI) strategy

In Ethiopia, the Reach Every District-Quality Improvement (RED-QI) strategy was developed to enhance immunization coverage by addressing challenges faced during the implementation of the RED approach, such as vaccines stock outs, inadequate supervision and limited community involvement. The strategy combined the key components of the RED approach with Quality Improvement (QI) tools. The key processes included microplanning at facility level, community engagement for mapping populations, resource mobilization for outreach sessions, root cause analyses to solve problems, and periodic reviews to ensure continuous improvement in service quality and data utilization.

The RED, also known as Reach Every Community (REC) or Reaching Every Municipality, strategy has also been prioritized in Angola, South Africa and Mozambique. This strategy is designed to address deficiencies in immunization services

in districts and areas with low immunization coverage. The RED/REC strategy enhances capacities at facility and district levels to ensure complete immunization of all children. It tackles common obstacles by supporting health facility staff in identifying underserved communities, developing micro-plans, improving resource use and implementing various vaccination modalities, including outreach and mobile sessions. In Angola, the strategy was revised to target zero-dose and missed communities based on equity parameters, such as poverty, urban-rural divide and service availability.

3.1.2. The Hit- and-Run approach

In Ethiopia, the Hit-and-Run approach is a strategy to deliver integrated immunization services alongside other health and humanitarian assistance in conflict-affected areas. This approach involves swift and efficient operations, taking advantage of brief windows of opportunity, such as humanitarian truces and negotiated access to specific regions. The primary objective is to conduct vaccination activities within a short time frame in volatile settings. It has been included in immunization plans for conflict affected areas of Afar, Amhara, Oromia, Benishangul-Gumuz and Tigray.

3.1.3. Integrated child health catch-up drive/Vaccine catch-up drive/Project Jiki'izinto

The Integrated child health catch-up drive, also known as the Vaccine catch-up drive or Project Jiki'izinto, was launched by the South African government to address the immunization backlog worsened by COVID-19. The main goal of the initiative was to restore RI services, provide catch-up doses to children and offer additional basic child health services. It covered all 52

districts, with a focus on 12 priority districts with a high number of under-vaccinated children.

3.1.4. Mobile vaccination teams or Integrated Mobile Brigades (IMBs)

An intervention named Integrated Mobile Brigades (IMBs) or mobile vaccination teams was implemented to enhance access to essential services, including immunization in South Africa. These brigades, operating quarterly, were designed to reach communities situated over eight kilometers away from health facilities with the aim of improving access to immunization services for rural populations. The mobile brigades successfully reached approximately 65 percent of the rural population in the country, playing a crucial role in reducing disparities in vaccine access and enhancing coverage rates nationwide. Mobile vaccination is also one of the key vaccination delivery strategies in Ethiopia particularly in mobile pastoral communities where the highest proportions of zero-dose children exist. Mobile vaccination services are provided by mobile health teams in pastoral communities of Afar, Somali, Oromia and Gambela regions. Furthermore, there were also attempts to expand mobile services in remote and conflict-affected agrarian areas of the country. Likewise, mobile approaches are also implemented in Mozambique and Angola to provide vaccination services in communities located at a distance of 5 kilometers to 10 kilometers from the health facilities.

3.2. Management and coordination

3.2.1. Mobile Health Technologies: MomConnect and Alerta Saude

The Mobile Health Technologies approach, exemplified by MomConnect, involves the use of mobile applications to deliver targeted health information to parents and caregivers regarding immunization, maternal and child health. These technologies leverage mobile devices to provide convenient access to accurate and timely health information, empowering individuals to make informed health care decisions for themselves and their families. Through personalized reminders,

educational resources and support services, Mobile Health Technologies have shown promise in improving immunization, maternal and child health outcomes in South Africa. Similarly, a smart register platform called Alerta Saude was used for zero-dose and under-vaccinated mapping and demand generation in Angola. This platform sends SMS for vaccine alerts to reduce dropouts and create demand. Another tool, RapidPro, was also used in Angola to enhance monitoring and analysis through managing contacts, analysing data and connecting to communication channels.

3.2.2. Road to Health book

The Road to Health book initiative in South Africa provides a comprehensive guide for caregivers and health care workers. Its goal is to improve child health outcomes, including timely vaccinations. Features include recording growth milestones, vaccination schedules and digital access. The booklet contains detailed information on vaccination schedules, informing caregivers about required vaccines and the recommended timeline for immunizations. The booklet is accessible through a dedicated digital app, providing caregivers with a digital record of their child's health information for easy tracking.

3.2.3. One Health approach

In Ethiopia, the One Health approach was introduced in two districts of Afar in 2018, merging human and animal health services. This initiative involved the establishment of the Woreda One Health Committee, inclusive of clan leaders, and training community mobilizers to enhance their involvement in coordination and micro-planning of immunization activities. During the initial year, the project effectively boosted immunization coverage by 13 percent and 62 percent in the two districts.

3.3. Commodities/Logistic system

3.3.1. Digital stock monitoring - Stock Visibility Solution (SVS)

To enhance the availability of medicines, including vaccines in primary health care facilities, the South African Department of Health introduced SVS, a mobile application for tracking and monitoring of essential medicine stock levels through mobile phones. Through enabling proactive measures to address low stock levels, SVS helps reduce instances of stock outs, preventing disruptions in vaccine supply and ensuring timely immunizations for children. Pilot studies have shown positive results, underscoring the SVS potential to mitigate stock outs and enhance vaccine availability in primary health care centres. SVS has the capacity for scalability to bolster immunization coverage throughout South Africa.

3.4. Social norms

3.4.1. Engaging communities and civil organizations in communication, social mobilization, advocacy and demand generation

Across all the four countries, the EPI programmes highlight community engagement, communication, advocacy and demand generation to build trust in immunization services, especially in areas with high numbers of zero-dose and under-vaccinated children. Engaging development armies, women, community leaders, civil organizations and administrations is integral to designing and implementing demand creation activities. Diverse strategies, such as SBCC, community mobilization, dialogues and various communication channels are used to promote immunization and foster informed demand within communities. In Angola, communities and civil society organizations are also involved in participatory microplanning, mapping zero-dose children, conducting outreach immunization sessions and data collection activities. This initiative resulted in the identification and immunization of thousands of zero-dose children.

3.4.2. Model Families Initiative: Promoting male engagement

In Mozambique, the Model Families Initiative promotes male engagement in integrated health practices. Emphasizing gender equity, the initiative encourages male involvement in household responsibilities to challenge traditional gender norms, establish more equitable task distribution, and promote joint decision-making. Family support for mothers has been identified as a key factor in overcoming vaccination barriers.

3.5. Legislations and policies

3.5.1. Equity-focused policies

In South Africa, advocacy efforts led by civil society groups and health care professionals have been instrumental in raising awareness about vaccine access disparities and urging policy makers to act. As a result, initiatives, such as mobile vaccination clinics and outreach programmes have been implemented to improve vaccine coverage among marginalized communities, demonstrating the impact of advocacy in shaping immunization policies for equity. Furthermore, immunization data are leveraged to guide policymakers to implement focused outreach, communication campaigns and community engagement strategies to overcome challenges in low vaccine coverage and vulnerable populations (see Table 12).

Table 12: summary of pro-equity immunization interventions in the four ESAR countries

Strategies and interventions implemented to serve unreached or hard-to-reach communities	Determinants of effective coverage	Equity reference group (ERG) priority areas or populations addressed by the intervention	Countries where the strategy or intervention were implemented
Reach every district-quality improvement (RED-QI) strategy	Service delivery/use and accessibility	All priority areas	Ethiopia, South Africa, Mozambique and Angola
Pro-equity evaluation	Service delivery/use and accessibility	All priority areas	Ethiopia
Expansion of static vaccination services	Service delivery/use and accessibility	All priority areas	Ethiopia and Angola
Outreach vaccination/ Targeted outreach	Service delivery/ service use and accessibility	Remote rural, conflict affected areas	South Africa, Ethiopia, Mozambique and Angola
Mobile vaccination	Service delivery/use and accessibility	Remote rural, conflict affected areas	South Africa and Ethiopia
Catch-up vaccination	Service delivery/use, accessibility, logistic system, social norms	All priority areas	South Africa, Ethiopia, Mozambique and Angola
Periodic intensification of routine immunization (PIRI):	Service delivery/use and accessibility	Remote rural areas	Ethiopia
African vaccination week	Service delivery/use and accessibility	All priority areas	Ethiopia
The Hit-and-Run approach	Service delivery/use and accessibility	Conflict-affected areas	Ethiopia
Supplemental Immunization Activity (SIA)	Service delivery/use and accessibility, social norms, management and coordination, logistic system	All priority areas	South Africa, Ethiopia, Mozambique and Angola
Integration with other health services	Service delivery/use and accessibility, social norms, management and coordination, logistic system	All priority areas	Ethiopia, Mozambique, South Africa and Angola
VPDs surveillance	Service delivery/use and accessibility, management and coordination, logistic system	All priority areas	Ethiopia, Mozambique, South Africa and Angola
Mobile Health Technologies: MomConnect	Service delivery/use and accessibility, management and coordination	All priority areas	South Africa
Road to Health book	Service delivery/use and accessibility, management and coordination	All priority areas	South Africa
Integrated child health catch-up drive/Vaccine catch-up drive/Project Jiki'izinto	Service delivery/ use and accessibility, management and coordination	All priority areas	South Africa

Strategies and interventions implemented to serve unreached or hard-to-reach communities	Determinants of effective coverage	Equity reference group (ERG) priority areas or populations addressed by the intervention	Countries where the strategy or intervention were implemented
Deploying mobile vaccination team or Integrated Mobile Brigades (IMBs)	Service delivery/use and accessibility, management and coordination	All priority areas	South Africa, Angola, Ethiopia and Mozambique
Reaching every municipality	Service delivery/use and accessibility, management and coordination	Urban poor and rural	Angola
Technology use for mapping and demand generation	Service delivery/use and accessibility, management and coordination	All priority areas	Angola
Engaging communities and civil society organizations in communication, social mobilization, advocacy and demand generation	Social norms, coordination, budget, policy	All priority areas	South Africa, Ethiopia, Angola and Mozambique
Model Families Initiative approach: Promoting male engagement for integrated health practices	Social norms	All priority areas	Mozambique
The last-mile logistic supply strategy	Commodities/logistic system	All priority areas	South Africa, Ethiopia, Angola and Mozambique
Equitable distribution of vaccine and supplies	Commodities/logistic system	All priority areas	South Africa and Mozambique
Supply chain management, commodities and logistic System strengthening	Commodities/logistic system	All priority areas	South Africa, Ethiopia, Angola and Mozambique
Digital stock monitoring-Stock Visibility Solution (SVS)	Commodities/logistic system Management and coordination	All priority areas	South Africa
Capacity building for community health workers	Human resource development	All priority areas	South Africa and Mozambique
Training and retention of health workers	Human resource development	All priority areas	South Africa, Ethiopia, Angola and Mozambique
Financial support for immunization equity	Budget and expenditure for immunization programme	All priority areas	South Africa, Ethiopia, Angola and Mozambique
One Health approach	Management and coordination	All priority areas	Ethiopia
Advocacy for equity-focused policies	Legislations and policy	All priority areas	South Africa
Data-driven policy	Legislations and policy	All priority areas	South Africa



4. UNICEF support for pro-equity immunization interventions in four ESAR countries

UNICEF has been supporting the immunization programmes and equity initiative at different levels and capacities in Angola, Ethiopia, Mozambique and South Africa. It provides technical and financial supports to strengthen health systems, build the health workforce capacity, procure equipment, vaccines and related supplies, strengthen the vaccine cold chain and logistic systems, demand generation activities (advocacy and social mobilization), support microplanning, monitoring and evaluation, data quality and evidence generation activities and support the development of immunization policy frameworks. Contributions from UNICEF in addressing immunization equity disparities have been bold across the four countries. The engagement in pro-equity activities has increasingly been diversifying in recent years across the four countries particularly since 2018 in Ethiopia and following COVID-19 pandemic in Angola, Mozambique and South Africa. The pro-equity immunization strategies and interventions implemented or supported by UNICEF in the four countries are summarized as follows:

4.1. Service delivery (access and usage)

4.1.1. Zero-dose mapping and planning

UNICEF supports zero-dose mapping and planning efforts in the four countries at national or subnational levels. In Angola, UNICEF actively contributes to the preparation of the zero-dose planning in major provinces and their respective municipalities with high prevalence of zero-dose children. For example, UNICEF supported the preparation of zero-dose planning in 22 municipalities which comprise 60 percent of zero-dose children in Angola in 2023 alone. In collaboration with Angolan MOH, UNICEF also co-designed an innovative tailored approach to identify and map zero-dose children during

polio campaigns using social mobilizers. The social mobilizers are provided with training to undergo home-to-home visits to identify and map zero-dose children, and collect data during the campaigns. The strategy supports targeted vaccination planning and vaccine delivery in affected households and communities. In Ethiopia, UNICEF provides direct financial and technical support for zero-dose children mapping and vaccination planning in four major regions (Amhara, Oromia, Sidama and SNNP- divided into two regions recently) of the country. UNICEF directly participates in zero-dose identification, mapping and micro-planning activities at zonal, district and health facility levels. In general, UNICEF supported equity micro-planning development in 14 supported zones, 266 districts, 1,119 health centres and 5,196 health posts with continuous expansion between 2018 and 2022. Even though it is not zero-dose specific, UNICEF also provides support for overall health system planning and immunization recovery plan in Mozambique. This helps the MOH increase coverage of immunization services.

4.1.2. Expansion of vaccination services in unreached areas

UNICEF has remarkably contributed to the development and implementation of vaccination strategies across the four countries. The support includes adaption of RED/C strategies, intensification of RI approaches, restoration of interrupted immunization services, planning and implementation of SIA campaigns and integration of RI with other emergency immunization and community health services. UNICEF supports the expansion of static, outreach and mobile immunization services in remote, hard-to-reach and conflict-affected areas of Angola, Ethiopia and Mozambique. For example, UNICEF helped the start of static vaccination services in around

70 delivery points (hospitals, health centres and health posts), opening of nearly 1,500 outreach sites in 14 zones, integration of outreach services with other MCH services in hard-to-reach and conflict-affected areas and the development of different pro-equity strategies and guidelines, such as catch-up guideline in Ethiopia. In 2022, UNICEF supported the vaccination of 44,638 zero-dose children through integration of RI with SIA campaigns. Similarly, UNICEF plays a pivotal role in supporting outreach campaigns across all provinces in Angola. For example, UNICEF supported the vaccination of over 84,000 zero-dose children through the integration of RI with COVID-19 vaccine campaigns until the end of 2023. On the other hand, UNICEF supported massive vaccination campaigns in response to outbreaks such as measles and polio in Angola, Ethiopia, Mozambique and South Africa.

4.2. Supplies and logistics systems

UNICEF is the main partner and engages in immunization cold chain system in many ways across the four countries included in this review. It provides financial and technical support and engages in the procurement, supply, installation, maintenance, inventory and standardization of immunization cold chain systems. The interventions have certain variations across the four countries. For example, UNICEF provides financial support, technical assistants and deploys biomedical technicians to do refrigerator installation, maintenance and inventory to expand and resume of interrupted cold chain systems in health facilities located in hard-to-reach and remote areas with high immunization equity gaps. Similarly, UNICEF supported the installation more than a thousand new refrigerators in health facilities nationwide in Mozambique. In Angola, UNICEF mobilizes resources for procurement and distribution of solar refrigerators, cold boxes, vaccine carriers and ice packs to support over one third of health facilities in the country with no cold chain facilities. To specifically mention, UNICEF mobilized around two million dollars for the procurement and distribution of 280 SDD refrigerators in hard-to-reach areas of Angola in 2023. On the other hand, UNICEF supported

procurement of cold chain equipment and the development of cold chain manual and guidelines for effective and equitable vaccine distribution and management in South Africa.

4.3. Human resources

UNICEF supports health workforce capacity building activities in Angola, Ethiopia, Mozambique and South Africa. The capacity-building activities include trainings, on-job support and mentorship for frontline healthcare workers in various immunization-related activities including micro-planning, cold chain management, vaccination strategies, data tools, quality and use for decision making, community engagement and cold chain systems and equipment maintenance. UNICEF prioritizes capacity building as one of the key activities in the efforts to improve immunization equity particularly in high zero-dose, rural and hard-to-reach areas of Angola, Ethiopia, Mozambique and South Africa. The training and mentorship activities incorporate micro-planning, data tools, quality and use, community engagement, and cold chain systems, including maintenance for health care providers. Moreover, UNICEF also supports the training of social mobilizers at community level in Angola. Similarly, UNICEF collaborates with South African government in training and retention of health workers in many districts to help the development of strong health workforce in communities.

4.4. Demand generation, communication, advocacy and social norms

UNICEF has strong engagement in immunization demand generation and advocacy activities at community and across all levels of the health structures including regional, provincial, municipal, zonal, district and lower administrative levels depending on the administrative organization of the respective countries. The support includes provision of financial and technical support, engaging in planning and implementation of social mobilization and advocacy activities, awareness creation and SBCC and immunization promotion activities aiming at overcoming socio-

behavioural barriers and increasing immunization uptake in communities mainly in rural, hard-to-reach, remote, humanitarian, conflict affected and low immunization coverage settings of the countries. UNICEF also supports the capacity-building activities to engage community social mobilizers in planning and implementation of equity-focused immunization services. For example, UNICEF collaborated with the Angolan MOH to train social mobilizers to identify, map and register zero-dose children, support planning and facilitate the vaccination of identified zero-dose and under-vaccinated children. Likewise, UNICEF finances and provides technical support to activities that leverage the existing social structures such as women development armies—the main social mobilization agents during SIAs and campaigns in Ethiopia. In Mozambique and South Africa, community engagement is mainly leveraged to raise awareness and enhance acceptability and uptake of immunization services through addressing local beliefs, misconceptions, perceived barriers and promoting positive health behaviours.

4.5. Evidence informed planning, inequity mapping and decision making

UNICEF plays a pivotal role in data systems, data quality, data analysis and evidence generation activities to enable data-driven zero-dose planning, monitoring and evaluation of vaccination interventions to reach zero-dose children in different capacities and contributions across the four countries. In Angola, UNICEF takes the key role in adaptation, revision, production and deployment /or distribution immunization monitoring tools in the effort to accurately capture the vaccination of zero-dose children. For example, UNICEF has been supporting the adaption of DHIS2 to collect data on zero-dose children beyond its current use for data collection on immunization coverage in recent years. UNICEF actively engages in data analysis and evidence generation on zero-dose children by conducting periodic desk reviews, rapid household surveys following pro-equity immunization initiatives, and analysing DHIS2 data. These efforts help estimate immunization

coverage and identify the number of zero-dose children across all levels of the health system, including zonal, district and health facility levels.

UNICEF also engages in data triangulation activities to ensure the use of the most appropriate data sources for decision making at all levels. Similarly, UNICEF supported data analysis activities in South Africa, including estimation of zero-dose children, mapping of hotspot areas, identification of underlying factors for zero-dose children and vaccines stockouts, and then helped the development of strategies to overcome barriers, reach zero-dose children and enhance immunization coverage and equity. On the other hand, UNICEF supported national surveillance systems strengthening activities to map immunization inequities and target interventions effectively.

4.6. Management, budget and policy

UNICEF engages in high-level advocacy and development of pro-equity immunization policy frameworks, strategies and guidelines through participation in immunization technical working groups, government advocacy sessions, and programme design initiatives. There are good examples worth mentioning, namely UNICEF influence in immunization policy landscape. UNICEF is represented at the immunization technical working group of the MOH in Ethiopia. Most importantly, it collaborated with key partners such as WHO, BMGF and Gavi to advocate domestic financing of immunization services in Angola. This collaborative effort produced the Luanda Declaration on Immunization, a commitment signed in 2022 by the ministries of health, finance, territory administration and provincial governments to increase government funding for to improve access and use of immunization services and primary health care in general. Likewise, UNICEF contributed to the development of inclusive and equity-focused immunization policies and strategies in Mozambique and South Africa.



5. SWOT analysis of pro-equity immunization interventions in the four ESAR countries

The SWOT analysis of immunization programmes in Angola, Ethiopia, South Africa and Mozambique underscores their capabilities and potential, including strengths in technology use, vaccine access, community engagement and policy support. However, weaknesses in vaccine

supply, funding, workforce, infrastructure and governance are noted, alongside threats from logistical, socioeconomic and political challenges. The detailed results of this analysis, which further elaborate on these factors, are presented in tables 13 and 14.

Table 13: Strength and weaknesses on pro-equity interventions for immunization in Angola, Ethiopia, Mozambique and South Africa

Strengths	Weaknesses
- All four countries demonstrate a strong commitment to primary health care, with a focus on making essential health services, including immunization, accessible to all citizens. - All countries leverage collaborations with UNICEF, WHO and Gavi, the Vaccine Alliance, to bolster their immunization programmes. These partnerships provide crucial technical assistance, funding and resources, facilitating vaccine procurement, distribution and overall programme strengthening. - There's a prominent use of technology platforms and data systems (such as DHIS2 and RapidPro) across these countries to enhance supply chain management, monitor immunization service coverage and support decision-making processes. - Each country actively engages community leaders, health care workers and local organizations to promote vaccination and address barriers to vaccine access. These community-based efforts are critical in raising awareness and fostering trust within communities. - Development of a national cold chain update plan to facilitate the introduction of new vaccines (Mozambique). - Progress in enhancing vaccine supply chain management systems to ensure nationwide vaccine availability (Mozambique). - Successful network of community health workers (APEs) that aids in delivering immunization services to remote and underserved communities (Mozambique) - Implementation of integrated national and state funds for routine immunization in Angola.	- Health care provider shortages and capacity: All four countries face significant shortages in health care providers in terms of availability and training. High turnover and migration of trained staff further worsen the situation, affecting the delivery and sustainability of immunization services. - Inadequate funding and resource allocation: Financial constraints are a common issue, impacting the adequate provision of vaccines, maintenance of the cold chain, and implementation of outreach and mobilization activities. Insufficient or sporadic funding leads to disruptions in vaccine supplies and delays in operational activities. - Challenges in supply chain and cold chain management: Inadequate logistic support, including poor vaccine stock management and delivery, insufficient cold chain capacity and transport issues are recurrent across the four countries. Such challenges lead to vaccine shortages, high wastage rates and the inability to maintain the potency of vaccines. - Data management and use concerns: Issues with data quality, timeliness, and use for decision making are prevalent. The countries struggle with over- and under-reporting of immunization coverage, incomplete or inaccurate reporting and inadequate data analysis and action. - Community engagement and health literacy: Limited community knowledge about the importance of vaccination, inadequate engagement strategies, and the absence of focused technical supervision and communication strategies targeting vulnerable groups. These weaknesses underscore the need for more robust and culturally sensitive community mobilization efforts.

Strengths	Weaknesses
▪ Use of outreach strategies, such as home-to-home vaccination sessions, to reach zero-dose children in remote areas (Angola). ▪ Deployment of technology platforms, such as IOTA for optimized vaccine supply chain management (Angola). ▪ All countries put much emphasis on systems strengthening and expansion of cold chain equipment. ▪ Training of Healthcare Extension Workers on Routine Immunization and SBCC strategies (Ethiopia). ▪ Engagement of male HEWs in challenging regions to enhance vaccine coverage (Ethiopia). ▪ Implementation of various vaccination service delivery modalities to reach diverse populations (Ethiopia). ▪ Adoption of digital supply management technologies such as mBrana (vaccine logistics and supply management software at district and health facility levels) and Fridge Tag system (temperature monitoring and recording of vaccine storages) in Ethiopia. ▪ All countries are strongly working on integration of immunization programmes into the primary health care system for enhanced accessibility. ▪ In South Africa, there is strong political commitment leading to prioritization and resource allocation for immunization. ▪ Utilization of evidence-based strategies and a research and innovation ecosystem for effective interventions (South Africa).	▪ Non-optimal attitudes of health workers towards immunization (Angola). ▪ Lack of strategies to ensure sustainability of partner-initiated activities (Angola). ▪ Inaccessibility of services in remote locations due to decentralized mobile teams' limited capacity (Angola). ▪ Demotivation and skill gaps among Health Care Extension Workers (HEWs) (Ethiopia). ▪ High staff turnover without effective retention mechanisms (Ethiopia). ▪ Weak integration of vaccination with other MCH and nutrition services (Ethiopia). ▪ Inadequate health care infrastructure contributing to logistical challenges in vaccine delivery (South Africa). ▪ Vaccine hesitancy and misinformation, highlighting the need for more effective, culturally sensitive communication strategies (South Africa). ▪ Equity gaps, with disparities in access and coverage among marginalized populations (South Africa). ▪ Slow implementation of the RED strategy due to poor micro-planning and outreach/mobile brigade activities (Mozambique). ▪ No staff dedicated to social mobilization at central and provincial levels (Mozambique). ▪ Over- and under-reporting of immunization coverage, hinting at a broader issue of unreliable programme data management (Mozambique).

Table 14: Opportunities and threats of pro-equity interventions for immunization in the four countries

Opportunities	Threats
▪ Increasing attention to immunization and vaccine equity: All four countries are focusing more on immunization and striving for vaccine equity. This collective shift towards acknowledging the importance of equitable vaccine distribution presents an opportunity to address disparities in access and coverage, ensuring that all segments of the population, including the most vulnerable, receive necessary vaccinations. ▪ South Africa's National Health Insurance system, as an opportunity to strengthen health care delivery, indicates a broader opportunity across these countries to leverage policy support and existing health infrastructure for immunization benefits. Strengthening health care systems, policies and structures can provide a more robust foundation for delivering immunization services and ensuring wider and more equitable access ▪ Each country acknowledges the significance of partnerships and community engagement in bolstering immunization programmes. ▪ Expansion and optimization of digital technologies: There is an emphasis on expanding and optimizing digital technologies across these countries; leveraging mHealth technologies for improved vaccine delivery, data collection and patient follow-up. ▪ The development of effective communication strategies to bridge gaps for communities with low health service use (Mozambique). ▪ Multi-sectoral partnerships that can mobilize expertise, funding and resources to address challenges in vaccine coverage and service delivery. Engaging with a broad range of stakeholders ensures interventions are responsive to community needs. ▪ The optimization of its health extension programme and increasing involvement of partners across various aspects of immunization (Ethiopia). ▪ The expansion of digital tools such as eCHIS for improved micro-planning, monitoring and defaulter tracing (Ethiopia).	▪ Limited resilience during emergencies: The COVID-19 pandemic has exemplified how global health emergencies can severely disrupt immunization services. Future pandemics or outbreaks of infectious diseases remain a latent threat to the continuity and effectiveness of immunization programmes. ▪ Donor dependence for immunization financing: A high reliance on donor funding for immunization activities makes these programmes vulnerable to changes in donor priorities and financial landscapes, potentially leading to funding shortfalls. ▪ Infrastructure and access issues: Inadequate transportation networks and challenges in accessing remote areas can limit the delivery of immunization services. ▪ Vaccine misinformation and hesitancy: The spread of misinformation and resulting hesitancy undermines public trust in vaccines, decreasing uptake and coverage rates. This issue is worsened by the pervasive influence of social media. ▪ Health inequities: Socioeconomic factors, including poverty, food insecurity and inadequate access to health care create disparities that limit immunization access and use, particularly among vulnerable populations. Unique threats by country: ▪ Policies regarding the use of open vials for vaccines such as BCG or measles may lead to service dissatisfaction, contributing to vaccine hesitancy (Angola). ▪ Ethiopia's unique struggles include ongoing armed conflicts, political instability, the disintegration of social networks and frequent droughts, which displace communities and hinder logistics systems. ▪ South Africa is particularly vulnerable to vaccine supply chain disruptions, which can be caused by global health emergencies, geopolitical tensions and logistical challenges. Special considerations: ▪ Mozambique and Angola face specific challenges related to their topographic and transportation access in remote areas. This geographic isolation complicates the delivery of immunization services to these regions. ▪ Mozambique is highlighted for its vulnerability to natural disasters and the impacts of climate change, which can disrupt health care delivery and impair health disparities among affected communities. ▪ Transhumance mobility: In Ethiopia, the mobility of pastoralist communities poses a challenge for consistent vaccine delivery, requiring tailored strategies for outreach and immunization.



6. Conclusions and recommendations

Reducing immunization equity gaps is essential for achieving universal immunization coverage and realizing Universal Health Coverage (UHC). Despite efforts, none of the four countries in this study achieved the global target of 90 percent coverage for the DTP-3 vaccination, underscoring the significant challenges that remain. South Africa was the only country able to maintain over 80 percent DTP-3 coverage over the past decade, even amid the challenges of COVID-19, whereas the other three countries struggled to reach 65 percent, with Angola reaching as low as 42 percent in 2022. The pandemic had a particularly pronounced impact in Mozambique, where coverage dropped from 88 percent to 61 percent.

In 2022, these countries collectively accounted for nearly 2.3 million zero-dose and 426,000 under-vaccinated children, with Ethiopia and Angola comprising over three quarters of this group. The number of zero-dose children remained relatively stable from 2014 to 2018 but rose sharply from 2019 onwards, highlighting the pandemic's disruptive effect. Ethiopia alone contributed half of all zero-dose children in the study, and Angola reported the highest zero-dose rate at 46 percent, followed by Mozambique and Ethiopia. Fluctuations in the number of under-vaccinated children were observed across the decade, yet no significant reduction was seen in 2022 compared to 2013, indicating persistent gaps in vaccine coverage and access.

Addressing these disparities is critical for improving immunization outcomes and supporting the health and resilience of populations in these countries. Without targeted interventions, such inequities will continue to hinder progress towards global immunization goals and broader health objectives.

The absolute equity gap (AEG) analysis (comparison of zero-dose rates as reported by 2015/2016 coverage surveys in respective

countries) showed a significant variation across the four countries with AEG of 13.4 PP difference between the lowest zero-dose rate of 4.9 percent in Mozambique and the highest rate of 18.3 percent in Angola. The subnational level analysis within countries showed that countries with lower zero-dose rates (Mozambique and South Africa) had smaller zero-dose variability while high zero-dose rate countries (Angola and Ethiopia) showed larger subnational inequalities, ranging from the subnational AEG of 10.4 PP in South Africa to 42.5 PP in Angola.

The analysis of zero-dose AEG across the four equity drivers (wealth, education, residence and gender), measured as the PP difference between each driver categories within the respective countries, showed that Ethiopia and South Africa have not shown consistent improvement in all equity drivers in 20 years; while Mozambique has shown consistent improvement in reducing zero-dose inequities across the four equity drivers in 20 years. Angola was excluded from the analysis as only one DHS had been conducted between 2003 and 2023. A narrowing zero-dose inequity was only observed by place of residence (from zero-dose rate difference of 6.2 PP in 2003 to 0.1 PP in 2016) in South Africa, but the inequality widened by child sex and maternal education. In Ethiopia, a narrowing inequity was observed in 2016 by maternal education (AEG of zero-dose between none-educated and educated dropped from 19.8 PP in 2005 to 12.9 PP in 2016) and child sex (AEG of zero-dose between males and females from 2.0 PP in 2005 to 0.3 PP in 2016) but the inequity was shown widening by all drivers in 2019. After applying the two surveys moving average smoothing technique for Ethiopia and Mozambique which had more than two surveys, the trend of AEG has shown a consistent decline in zero-dose inequity by all drivers in Mozambique. On the contrary, the zero-dose inequity increased by all drivers with the highest 24.0 PPAEG of zero-dose between poorest and wealthiest households in Ethiopia in 2019. In general, the magnitude of

zero-dose inequity varied by equity drivers and by country. Based on the absolute equity gaps of zero-dose by equity drivers over the last 20 years, Angola ranked first with the highest AEG means rank score (32.1 percent) of the four drivers, followed by Ethiopia (27.0 percent), Mozambique (18.7 percent) and South Africa (12.4 percent).

On the other hand, the analysis of under-vaccinated inequities trends by equity drivers showed no consistent pattern in the trend of under-vaccinated rates by equity drivers in the study countries over the last 20 years. The inequity by under-vaccinated rate showed increasing trend in South Africa, a declining trend in Mozambique and a declining under-vaccinated inequity by place of residence in Ethiopia. The highest under-vaccinated inequities were observed by maternal education with median AEG of 14.5 PP followed by wealth with median AEG of 13.9 PP and place of residence with AEG of 9.9 PP. The least under-vaccinated inequity was shown by sex with median AEG of 0.9 PP.

Regarding the impact of equity drivers on zero-dose, the predominant inequities were observed between household wealth quintiles in 7 of 10 surveys conducted in the last 20 years across the four countries with more pronounced inequities in Ethiopia and South Africa in 2015 and 2016 DHSs. Maternal education which showed highest inequity in 3 of the 10 surveys, next to wealth, was observed as the main inequity factor in Angola and Mozambique. In general, household wealth quintile was ranked as the first zero-dose inequity driver and child sex as the least inequity driver as measured by the zero-dose AEG. Moreover, the trend of immunization inequities, measure by slope index of inequity for the AEG of zero-dose (the absolute difference in estimated values of education and wealth between the most advantaged and most disadvantaged categories), indicated a higher concentration of zero-dose among the most disadvantaged people (the poorest and uneducated) except in 2003.

The immunization inequities across the countries and equity drivers are a result of a complex interplay of various socioeconomic and health system factors that hinder access and use of immunization services. These underlying factors

that cause challenges in the immunization programme and result in immunization disparities consists of demand-side barriers, such as illiteracy, gender inequality, poverty, geographical barriers, and cultural and religious beliefs affecting vaccine acceptance and uptake; and supply-side barriers due to deficiencies and constraints in vaccine logistics systems, infrastructure, staffing, information systems, financing, leadership, management and governance, policy frameworks and health education and communication gaps.

Tailored and properly designed pro-equity immunization strategies and interventions are vital to reaching millions of zero-dose and under-vaccinated children in the study countries. The findings from this zero-dose documentation reveal a wide range of pro-equity strategies that have been implemented in different countries, settings and contexts which can be adapted in other countries with similar situations, settings and challenges. This evidence synthesis shows significant investment by countries and innovation in addressing the children who missed lifesaving vaccines. The countries included in this review have improved immunization equity. This evidence synthesis can serve as an important step to showcase the importance of investing in mapping impactful pro-equity immunization interventions and strategies while placing reasonable emphasis on the good practices to facilitate learning about and across countries.

Table 15 presents recommendations and actionable items that have been drawn up based on the findings from desk reviews and secondary data analysis on the magnitude of zero-dose and under-vaccinated children, equity gaps analysis, underlying factors, pro-equity interventions and SWOT analysis. Key recommendations that may be applicable to all the ESAR countries are pointed out with the assumption that the recommendations will be further refined and contextualized through recommendation formulation workshops at regional and country levels. Detailed country-specific recommendations are also included in each country case study reports annexed at the end of this report. The areas in which UNICEF may act in accordance with its strategic positioning and interest to enhance its support and efforts to address immunization inequity are highlighted.

Table 15: summary of recommendations for improvement of pro-equity interventions across the four countries

Determinants of immunization coverage (weaknesses intended to address)	Recommended actions	Areas of engagement for UNICEF	Country suggested for implementation
Lack of pro-equity policy and strategic frameworks and implementation guidelines that results in financing gaps, variability in strategies, unsustainability of innovative strategies	Develop immunization equity policies, strategic plans and standardized implementation guidelines.	Advocacy, financial and technical support in partnership with other stakeholders including countries' ministry of health and partners.	Comprehensive immunization policy frameworks and implementation guidelines are required to streamline pro-equity immunization interventions and increase political commitment towards universal immunization coverage mainly in Angola, Ethiopia and Mozambique.
Social norms and hesitancy affecting acceptance and uptake of immunization services	- Awareness creation, demand generation, social mobilization and advocacy through engaging community, private and civil society organizations. - More engagement of religious and community leaders in immunization promotion activities. - Use of technology for social mobilization such as use of mobile SMS for sending messages, immunization reminders and campaigns.	- Supporting the design, testing, production, and dissemination of SBCC products to increase immunization literacy, generate demand and optimize uptake. - Strengthening social mobilization activities through engagement of community leaders and structures.	Angola has a good experience in using social mobilizers to identify, map and register zero-dose children in their communities and Ethiopia is using women health development agents for community mobilization. These examples can be adapted in other countries.

Determinants of immunization coverage (weaknesses intended to address)	Recommended actions	Areas of engagement for UNICEF	Country suggested for implementation
Deficiency in the appropriateness of service delivery modalities in marginalized communities	Strengthening tailored immunization services such as mobile for hard-to-reach, isolated and mobile communities such as pastoralists, hit-and-run in conflict and isolated areas, catch-up immunization in humanitarian (IDPs) and remote areas, and PIRI and outreach services in rural remote areas and urban slums.	- Resource mobilization, technical support in micro-planning, implementation, monitoring and evaluation of tailored interventions. - Procurement and distribution of cold chain equipment such as iceboxes and solar refrigerators to support in remote health posts.	- The variety of RED/C strategies should be diversified and tailored to the contexts of each country. - In Ethiopia, dire situations due to conflict, IDPs, refugees and significant pastoralist communities require the implementation of all those strategies. - PIRI, mobile and outreach services , integration with SIAs in rural communities of Mozambique, Angola and South Africa
	Integration of RI with other health and nutrition services in humanitarian situations such as IDPs and conflict-affected areas.	- Capacity building on planning and implementation. - Collaborate with health sector on development of manuals and standardization of approaches.	
	Strengthening mobile health teams.	As UNICEF leads implementation of nutrition intervention in humanitarian settings, it can facilitate the integration of RI services with other services such as nutrition screening, therapeutic and supplementary feeding, psychosocial support, and alike in humanitarian settings.	
	Integration of RIs with other MCH services and SIAs to avoid missed opportunities.		
	Involving men in vaccination services particularly in hard-to-reach, conflict-affected and remote areas.		
Constraints in supply chains and logistics	- Last-mile strategy is crucial to ensure uninterrupted supply of vaccines. - Digital tools for monitoring and management of supply chains to prevent stockouts and wastages.	- Resource mobilization for refrigerator procurement, installation and maintenance in rural settings. - Vehicle support. - Development and deployment of digital tools for management and monitoring supplies.	Ethiopia and South Africa have been implementing the last-mile strategy and digital tools for management of supply chains. This can also be adapted in Angola and Mozambique to ensure sustainable supply chains.

Determinants of immunization coverage (weaknesses intended to address)	Recommended actions	Areas of engagement for UNICEF	Country suggested for implementation
▪ Revisiting existing planning and promoting the use of micro-planning exercise at all levels. ▪ Use of digital tools for planning of immunization services and accurate target population estimation. ▪ Applying innovative, contextually tailored and culture-sensitive vaccination approaches. Inadequate use of micro-planning		▪ Technical and financial support micro-planning exercises. ▪ Resource mobilization for expansion of digital tools. ▪ Supporting the design, planning, implementation and financing of innovative and locally designed vaccination approaches.	▪ Ethiopia applies an electronic community health information system called eCHIS to digitalize family folders. This tool helps to effectively identify zero-dose and under-vaccinated children and accurate target population count in rural areas including remote and hard-to-reach areas. Other countries can also adapt this platform. ▪ Innovative vaccination approaches in complex situations such as conflict-affected areas, during disasters, humanitarian settings, populations with unique features such as pastoralists.
	▪ Strengthening community health programmes and including immunization as priority package of services. ▪ Design strategies to create career development opportunities, financial and other incentives, payroll systems to keep the motivation of community health workers. ▪ Digitalization of community health services for better data quality and use Weakness in and poor integration of immunization in community health programmes	▪ Capacity building. ▪ Incentivization. ▪ Digitalization activities including procurement of devices such as tablets and phones.	▪ Rural and urban slum settings of all countries.

Determinants of immunization coverage (weaknesses intended to address)	Recommended actions	Areas of engagement for UNICEF	Country suggested for implementation
Weak data systems and inadequate practice of data use for decision-making	- Strengthening the development and use of user-friendly digital tools for planning, implementation, monitoring and evaluation of immunization interventions and services. - Building capacity on data quality, triangulation and data use for decision making at all levels.	- Support the development and use of data quality assurance and triangulation, monitoring, analytic and visualization activities through development and adaptation of digital tools. - Procurement and distribution of digital devices such as smart phones and tablets. - Capacity building on data analysis and use at all levels of the health system. - Support and fund research and evaluation of equity interventions to reach zero-dose children and missed communities. - Advocate data quality and use culture at all levels	- Research capacity at national and regional/provincial levels. - Data quality, analysis and use at all levels of the health system.
Deficiencies in leadership and governance capacity	Strategies to build capacity on leadership, resource mobilization and political engagement to tackle the persistent challenges such as high staff attrition, funding shortfalls and weak accountability.	- Capacity building of leadership and health workforce. - Resource mobilization for capacity-building activities.	At regional, provincial, district and lower administrative levels of the health system.
Inadequate budget and funding	- Engaging national treasury or finance ministries, private foundations and international donors to ensure increased funding and political commitment. - Establishing pooled budget mechanisms: pooling all budget sources for harmonized, coordinated, efficient and equitable allocation of budget for implementation of immunization services.	- Mobilization of resources with donors. - Creating and organizing advocacy sessions and forums. - Advocate intersectorality of immunization programme.	At regional, provincial, district and lower administrative levels of the health system.

Determinants of immunization coverage (weaknesses intended to address)	Recommended actions	Areas of engagement for UNICEF	Country suggested for implementation
Weak public-private partnerships	▪ Strengthening public-private partnership with private health sector and technology companies. ▪ Engaging the private sector in service delivery, technology development and deployment.	▪ Advocating and supporting the engagement of the private sector in vaccination services and digital technologies. ▪ Supporting cold chains systems in private health facilities.	▪ Private health sector can be leveraged to increase service access in both rural and urban settings particularly urban slums. Angola has a demonstrated experience in engaging private technology companies in developing innovative and contextual solutions assisting zero-dose mapping, community mobilization, data collection and analysis for decision making. This should be considered and adapted in other countries.

ANNEXES: COUNTRY CASE STUDIES



ANNEXES: 1
COUNTRY CASE STUDIES

ANGOLA

Zero-Dose and Equity Agenda



Annex 1: Angola: Zero-dose and equity agenda

Country context

Angola, the seventh largest in size and the second largest oil producer country in Africa, has a long coastline and a central plateau in southern Africa. It has diverse landscapes, ranging from tropical rainforests to savanna deserts. Angola borders with Namibia, Botswana, Zambia and the Democratic Republic of the Congo. The estimated population of Angola is about 34 million people in 2022. Children and adolescents (0-19 years old) account for over 20 million (>58 per cent) of the entire Angolan population. Angola is a relatively urbanized country where over 67 per cent of the population live in urban areas compared to an average of 42 per cent in sub-Saharan countries. The country has one of the highest fertility rates which underpins the high proportions and rapid growing number of children in Angola ³.

The Angolan health system incorporates both public and private health sectors, with public health sector being the major provider of basic health care services to the Angolan population. The public health system is structured in three tiers: primary health care (district hospitals, health centres, health posts and health clinics), secondary (general) hospitals and tertiary hospitals.

Overview of immunization programme in Angola

Immunization is one of the key primary health care interventions in Angola. The Expanded Vaccination Program (PAV) was launched in 1979 with six antigens (DPT, polio, measles and BCG) for children under one year of age and tetanus vaccine for women in the reproductive age group. The immunization programme has expanded its vaccines since then by adding new antigens, including yellow fever in 1980, pentavalent vaccine

(Hepatitis B and Hib added to DPT) in 2006, PCV in 2013, Rotavirus in 2014, Hepatitis B at birth in 2015, IPV in 2017 and combined measles/rubella vaccine in 2018. The PAV programme aims to ensure universal, equitable and sustainable access and utilization of immunization services, and ultimately to reduce morbidity, mortality and catastrophic health expenditure associated with vaccine-preventable diseases (VPDs). Multiple partners engage in PAV to optimize support for immunization programme in Angola, including WHO, UNDP, USAID, World Bank and GAVI ⁴.

Despite a quarter of a century history of the PAV programme, the coverage and use of immunization services and reduction of VPDs is far behind the expected targets and goals. Progress has never been equitable across settings and social segments in the country. The substantial progress in immunization coverage over two decades in the new millennium faced a shock decline in recent years following the COVID-19 pandemic. In 2021, Angola was the second highest contributor, next to Ethiopia, of zero-dose children in the Eastern and Southern African region with over half a million zero-dose and about two hundred thousand under-vaccinated children. This makes the country one of the top countries globally with the highest proportion of zero-dose children.

Immunization coverage in Angola significantly varies across socio-demographic, socio-economic and geographical settings due to variations in access, service use (e.g., high dropouts and zero-dose in uneducated and poor), years of armed conflicts and civil war and the overriding challenge by COVID-19 pandemic which affected the delivery of basic health care services in the country. These multifaceted challenges have resulted in substantial equity disparities in immunization services across settings and social segments of the country. For instance, DPT-1&3 coverage is significantly higher in urban,

educated mothers and wealthy households as compared to their counterparts of rural areas, illiterate mothers and poor households, respectively. The urban-rural divide in terms of immunization access and use coverage has been the main source of immunization inequities in the country. The majority (nearly two thirds) of zero-dose and under-vaccinated children are concentrated in five provinces of the country and their respective rural municipalities, namely Luanda, Bié, Huambo, Cunene and Cuanza Sul provinces which comprise over 40 per cent of the total under-1-year-old population of the country ⁴.

The national PAV is part of the primary health care system in the country. The coordination and management structure of PAV programme is aligned with the country's administrative system which consists of national, provincial and municipal structures.

At the national level, the Department of Hygiene and Surveillance within the National Directorate of Public Health is responsible for overseeing the PAV. Its key responsibilities include developing policies, strategies and projects for PAV; managing the acquisition and distribution of vaccines and vaccination materials to provinces; providing guidance, supervision and capacity building; managing the information system; coordinating with provincial and municipal levels on the surveillance of VPDs and epidemic control; and implementing complementary response measures. Additionally, the department monitors and evaluates the performance of the PAV programme to ensure its effectiveness.

At the provincial level, the PAV unit is responsible for directing and organizing vaccination and epidemiological surveillance activities in their respective regions. These include adapting policies, plans and programmes provided at the central level, ensuring compliance with national standards for PAV and epidemiological surveillance, managing the information system, providing capacity building and supportive supervision to the municipalities, managing resources, designing and promoting information, education and communication campaigns, monitoring and controlling the quality of vaccination services, coordinating the implementation of

routine vaccination campaigns, depending on vaccination coverage and epidemiological situation ⁴.

At the municipal and/or local level, the immunization team responsible for PAV operations translates the programme's technical and administrative standards into practice. This team prepares annual programme plans, monitors the implementation of activities and assesses population risks related to vaccine-preventable diseases through epidemiological investigations. They also train health care providers, manage the information system across all health facilities offering vaccination services, whether public or private, for-profit or non-profit, and coordinate with communities, local organizations and authorities to encourage active community participation in the immunization strategy and schedules. Additionally, the team designs and promotes information, education and communication campaigns and implements local vaccination campaigns ⁴.

The health facilities implement various strategies designed in accordance with the communities' socio-economic characteristics, participation, geographic barriers, coverage rates, health system capacity and availability of resources necessary to carry out immunization activities in the context of primary health care. Hence, combined strategies are implemented, including: fixed, outreach, mobile, supplementary campaigns and house-to-house vaccination approaches.

Immunization coverage and immunization inequity status and trends in Angola

As shown in Figure 22, the number of under-vaccinated children fluctuated significantly over the first four years from 2013 to 2016, experiencing notable rises and falls. In the subsequent period from 2017 to 2019, this number steadily declined, reaching 123,187 children in 2019, marking a reduction of 49,500 children. However, the trend reversed as the number rose to 126,062 in 2020 and further increased to 154,412 in 2021, reflecting a growth of over 31,200 children compared to 2019. By 2022, the figure declined

again to 143,742, a decrease of more than 10,600 children from 2021. Overall, the peak number of under-vaccinated children was observed in 2016 at 172,695, followed by a substantial drop to 123,187 in 2019.

On the other hand, the number of zero-dose children progressively decreased during the first four consecutive years from 354,702 (33 per cent) in 2013 to 299,338 (26 per cent) in 2016 with a

significant drop of more than 55,300 children, and back again it significantly increased to 377,093 (32 per cent) children in 2017 with 6 PP variation compared to 2016. Nonetheless, a compelling increment was seen from 313,195 (26 children) in 2018 to 614,172 (47 per cent) in 2022 with a difference of 21 PP compared to 2018. Thus, the maximum number of zero-dose children (over 614,000) was seen in 2022 within the 10 years.

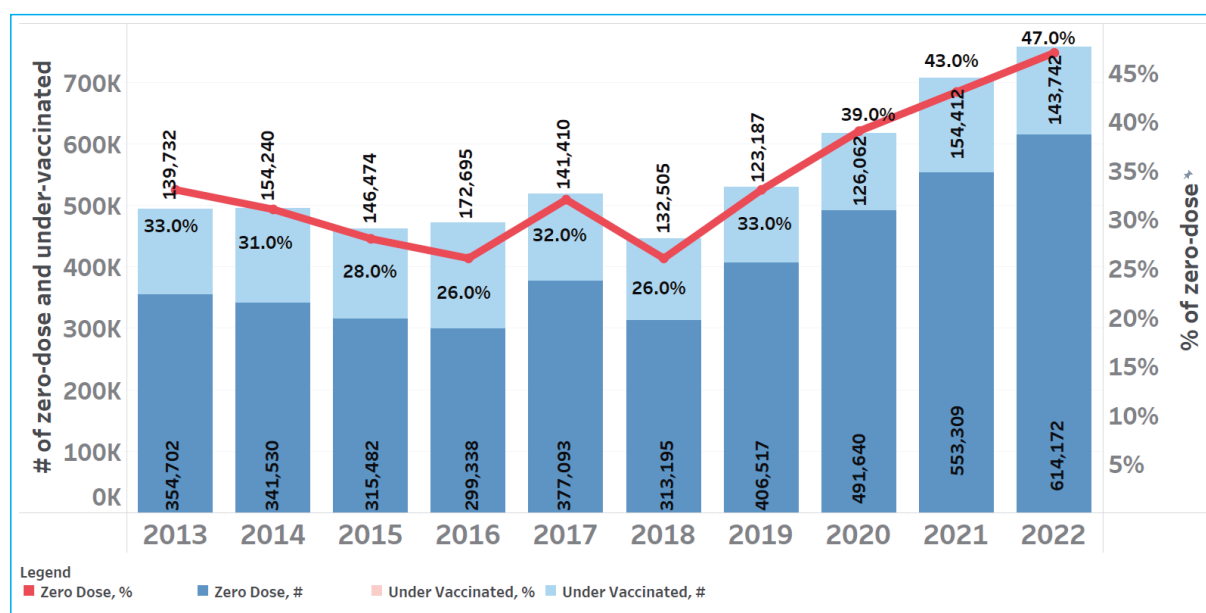


Figure 22: Trend of numbers and rates of zero-dose and under-vaccinated children, Angola, 2013–2022 (Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates)

The average coverage of BCG (2013–2022) was 63.1 per cent with the highest coverage of BCG (72 per cent) observed in 2014 and 2018. Since 2014, the coverage significantly dropped to the lowest coverage (40 per cent) level reported in 2016 with 32 PP difference. In 2017, the rate increased to a peak of 69 per cent with 29 PP difference which went up to 72 per cent in 2018. Then, it progressively declined, specifically, during the last two years (2020 and 2021) of COVID-19 period to the level of 56 per cent in 2021. There was a slight increment of four PP in 2022.

Nonetheless, the average coverage of Penta-1 was 66.2 per cent over the 10 years (2013–2022). The availability and accessibility of the immunization services were not good as the coverage reported was below the standard of 90

per cent throughout the decade. The maximum peak of 72 per cent coverage was seen in 2016 and 2018. During the first six consecutive years (2013–2018), there were no significant variations. However, the coverage considerably dropped during the COVID-19 period which continued to the level of 53 per cent rate (the lowest coverage in the decade) reported in 2022 with a negative difference of 21 PP from 2018.

Correspondingly, the Penta-3 coverage progressively increased from 54 per cent in 2013 to 59 per cent in 2015 and 2016; and then it fell to 56 per cent in 2017. It increased back to 63 per cent (the peak in the decade) in 2018 with seven PP difference. Since then, the rate steadily declined during the three consecutive years of COVID-19 pandemic period and reached to the

lowest coverage of 42 per cent in 2022, with 21 PP difference, which was the lowest ever reported coverage. In general, the Penta-3 average coverage was 54.1 per cent over the 10 years (2013–2022). On the contrary, after the peak of 59 per cent MCV-1 coverage reported in 2013, the

rate significantly declined to 42 per cent in 2017 with 17 PP negative difference. Then, it increased to 50 per cent in 2018 and 51 per cent in 2019. In the last three years (2020–2022), the coverage progressively dropped.

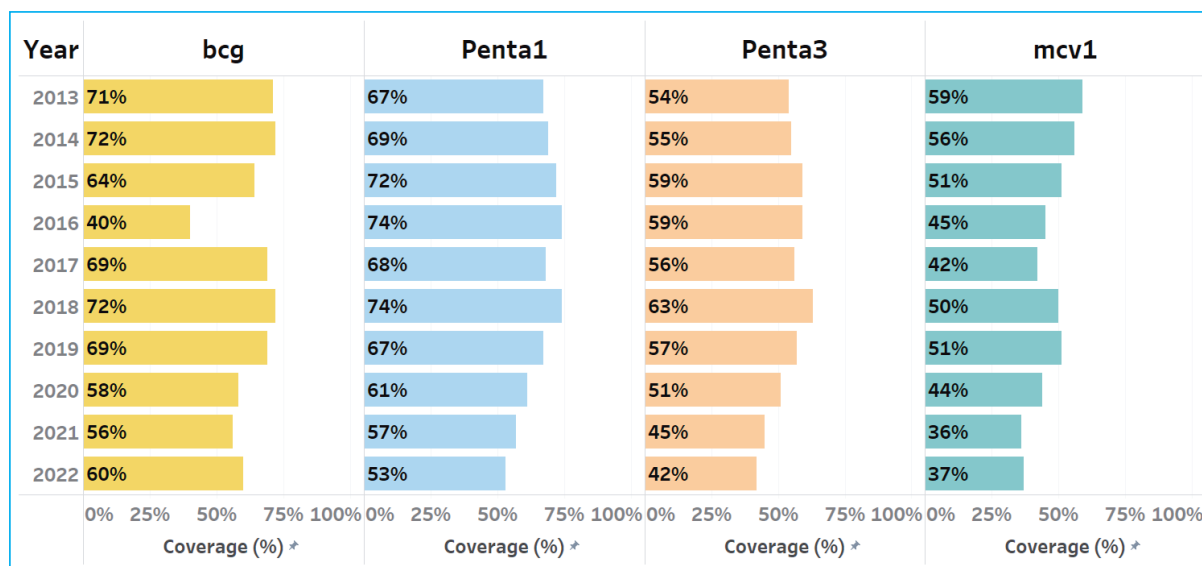


Figure 23: Vaccination coverage trends in selected antigens, Angola, 2013–2022 (Data Source: WUENIC)

Throughout the 10 years, the Penta-3 coverage was higher than the WUENIC estimate. In 2013, the wider variation was observed with 39 PP difference; and narrowed to 25 PP difference in 2014. For eight consecutive years starting from 2015 to 2022, the difference remained at 21 PP.

Throughout the 10-year period, the DTP-1 to DTP-3 dropout rate was above the 10 per cent target, which reached the highest rate of 21 per cent in 2021 and 2022 and the lowest level of 15 per cent in 2018 and 2019.

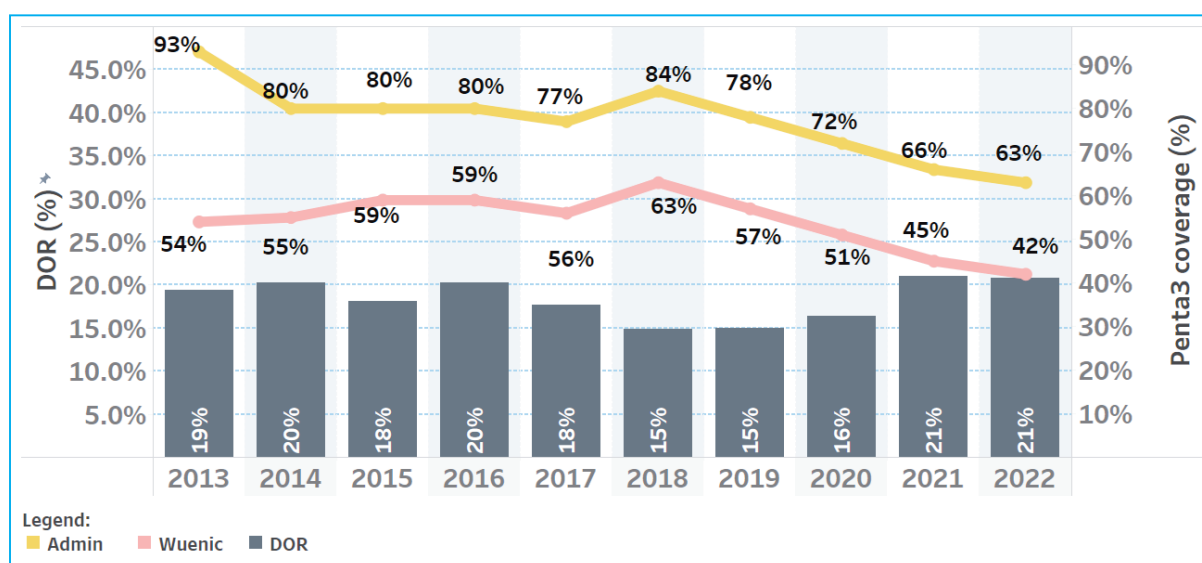


Figure 24: Trends in DPT-1 to DPT-3 dropout rate, and comparison between DPT-3 coverage and WUENIC estimates, Angola, 2013–2022 (Data Source: WUENIC)

Immunization Inequity in Angola

The overall concentration index for the multivariate equity measure was 0.463 with an AEG of 0.304 for zero-dose status, indicating that those with higher levels of unfair advantage more likely to be vaccinated than those with lower levels of unfair advantage. Zero-dose prevalence among the most disadvantaged 20 per cent of the population would need to decrease by approximately 30.4 PP to reach levels of the most advantaged 20 per cent. The big (0.304) AEG indicates that there is gross inequity in zero-dose distribution among the most privileged and those most disadvantaged groups.

Household wealth and maternal education were the leading reasons for zero-dose inequities,

contributing for 41.2 per cent and 19.5 per cent of zero-dose inequity in Angola, DHS 2015. Urban/rural residence accounted for 13.3 per cent, and differences between districts accounted for 3.4 per cent of zero-dose inequity. Similarly, underage (being underage for zero-dose consideration by definition or too young to receive the first dose of DTP, OPV/IPV, or MCV vaccines at the time of the survey, according to the national immunization schedule) accounted for 7.4 per cent the variation in zero-dose inequity. Sex of child, on the other hand, accounted for the 0 per cent of the variation in zero-dose inequity. Overall, vertical inequity, the combined contribution of household wealth and maternal education accounted for 60.7 per cent of the zero-dose inequity in Angola DHS 2015 (see Figure 25).

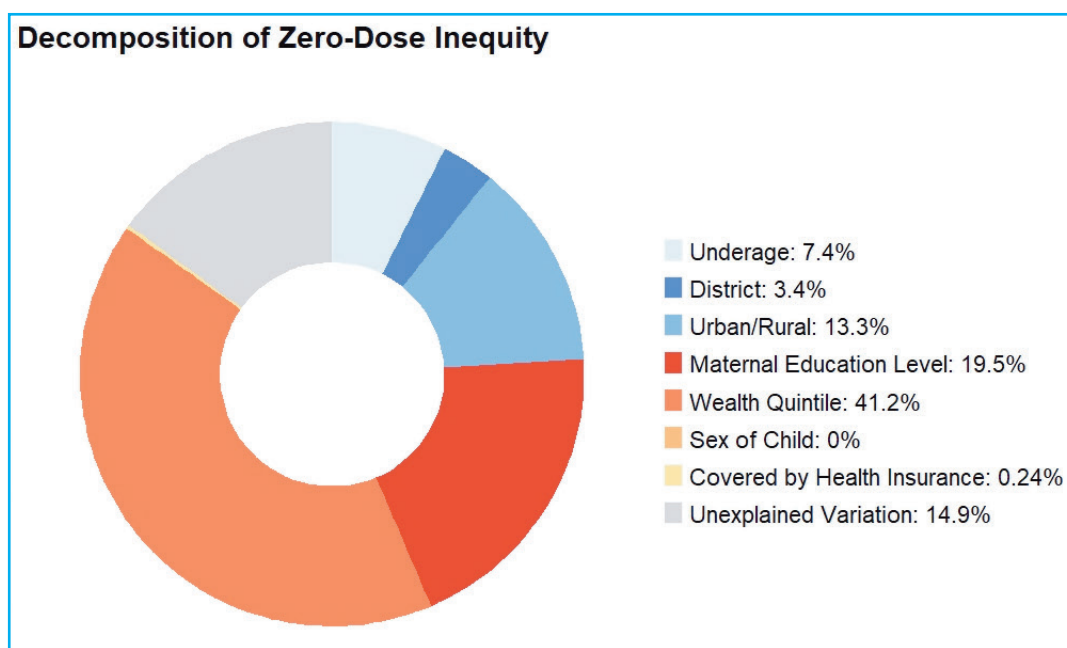


Figure 25: Decomposition of zero-dose inequity in Angola (DHS 2015)

In Figure 26, the zero-dose rate map, zero-dose inequity heat map and zero-dose inequity plane are used to visualize the provinces by zero-dose rate and zero-dose inequities. Cuando Cubango Province had the highest zero-dose rate. Cabinda Province, on the other hand, had low zero dose rate and high zero-dose inequity. Zaire had the lowest zero-dose inequity.

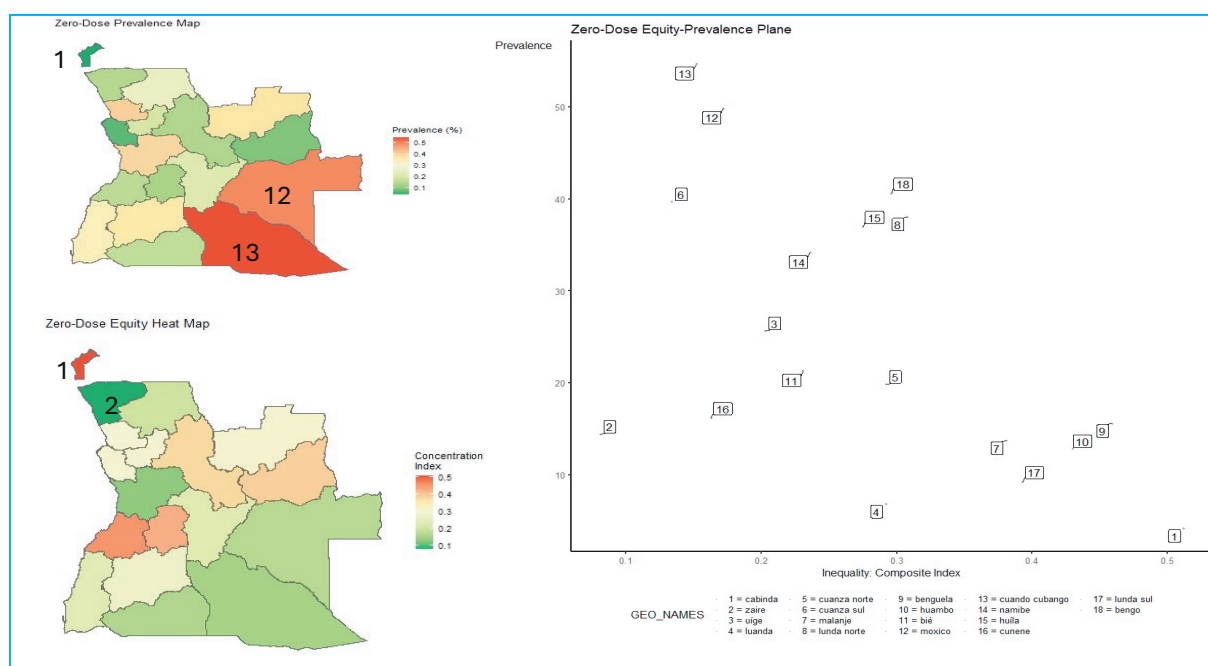


Figure 26: Angola zero-dose rate and zero-dose inequity (DHS 2015) by province (prepared using DHS data)

Barriers and underlying factors to reaching zero-dose children in Angola

There are several supplier- or user-side barriers that hinder the efforts to reach and vaccinate zero-dose children in Angola⁵⁻⁷. The main barriers hindering the implementation of zero-dose-targeted interventions include:

- 1) **Provider-side barriers:** The main barriers that hinder the provision of vaccination services are:
 - a) Absence of vaccination service in remote communities or where health facilities in hard-to-reach areas do not provide outreach vaccination services.
 - b) Failure of health workers to visit the village during outreach sessions.
 - c) Poor quality of care during vaccination and long waiting time during vaccination sessions often because more children need to be gathered to open a vial, restart of the vaccination schedule, when the interval between doses exceeds the indicated interval, delay from the beginning of vaccination sessions.

- d) Poor integration of immunization with other clinical services, for example, hospitalized children who on the day of discharge are not linked to vaccination services.
- e) Absence of vaccine in static sites due to deficiency in supply and distribution of vaccines and inputs and unavailability of functional cold chain equipment.
- f) Existence of vaccination days and periods with limited hours and establishment of specific days for some types of vaccines.
- g) Poor health service coverage or limited access to primary health care services.
- h) Topographic barriers to reach remote communities through outreach sessions.
- 2) **Demand-side barriers:**
 - a) Forgetfulness of the vaccination card: caregivers do not carry vaccination cards and they do not remember the vaccines the child has already received; they do not know the number of doses of vaccines needed and the interval between them, etc.
 - b) Vaccine hesitancy: caregivers do not allow children to be vaccinated when the children have illnesses such as a cough, fever,

diarrhoea or vomiting, and due to barriers related to cultural or religious norms.

- c) Vaccine literacy: caregivers are unaware of or do not consider vaccination as an important health care intervention.

Pro-equity immunization strategies and interventions in Angola

The MOH prioritizes immunization as a basic health care service. The PAV programme designs and implements various strategies, interventions and activities to address zero-dose children,

and ultimately achieve the strategic objectives of universal, equitable and sustainable access and utilization of quality immunization services regardless of socio-economic and geopolitical inequalities in the country. The efforts also include special strategies and interventions aimed to reach communities in underserved rural and disadvantaged socio-demographic and socio-economic population groups in the country ^{4 8-12}. The pro-equity immunization strategies and intervention implemented by the MOH along with other immunization partners are summarized in Table 16.

Table 16: Pro-equity immunization strategies and interventions in Angola

Strategies and interventions	Implementation experience of the strategies and interventions (rationale, context, description and successes)
Reaching every municipality	Angola faces an urban-rural divide in terms of immunization coverage as well as inequities in terms of geographical access. To address these inequity disparities between urban and rural municipalities, Angola has been implementing ' <i>reaching every municipality</i> ' strategy over the last decade. This strategy is adapted from WHO's Reach Every District/Community strategy and the key components of the strategy include participatory micro-planning at the municipality level, improving service coverage through mobile teams, strengthening community linkages, capacity building and feedback mechanisms. Due to challenges in achieving the required immunization coverage, the strategy was revised in accordance with Gavi's new strategy focused on reaching zero-dose and missed communities. This revised equity-focused strategy is being implemented in targeted municipalities selected based on equity parameters such as poverty index, urban-rural divide, migration, availability of health services, accessibility, presence of implementing partners and local NGOs. From 2022 to 2023, this strategy was implemented in 22 municipalities in 5 provinces - Luanda, Bié, Huambo, Cunene and Cuanza Sul. These municipalities possess around 60 per cent of zero-dose children and 41 per cent of the total under-one-year-old population in the country.
Engaging communities and civil society organizations	The PAV programme applies participatory micro-planning approach at the subnational levels and involves communities in planning, communication, advocacy and demand generation activities of routine immunization. The objective was to develop a community participatory model and plan for intensifying routine immunization in the country. This approach is assumed to make the planning more participatory, effective and efficient as well as to understand the demand-side barriers in vaccine uptake. This approach was first used to map the zero-dose children and conduct outreach immunization activities in Viana Municipality of Angola in 2022, with technical and financial support from UNICEF. The implementation of this approach involves coordinating with the local authorities and stakeholders as well as strengthening their capacities in mapping the zero-dose children to provide equitable immunization services. This participatory microplanning activity involves:

	▪ Coordinating meetings with the local CSOs, representatives from district administration, experts from the municipal directorate of health, and zonal and neighbourhood coordinators. Discussions are made with the participants on perceived barriers to vaccination, immunization advocacy to raise awareness, community participation to improve coverage and communication practices. ▪ Capacity building activities: Training is provided for the community mobilizers on mapping the zero-dose and under-vaccinated children, and use of data collection tools such as KoBoCollect tool to collect data related to knowledge, attitude and practices of routine immunization in the community. In the first implementation in Viana Municipality, the community mobilizers created community groups for identifying and mapping the zero-dose and under-vaccinated children through door-to-door visits. They used the KoBoCollect tool to register and enrol the children for immunization. A total of 1,519 zero-dose children were identified and registered by 23 community groups of women leaders; and vaccinations were provided through mobile teams. In general, a total of 3,905 children were reached for vaccination services through this activity until May 2023. The women community groups were also trained to monitor and register zero-dose and under-vaccinated children and conduct social and behavioural change communication (SBCC) activities.
Extended static approach	In addition to hospitals, maternity wards, health centres and health posts, fixed vaccination service is provided daily throughout the MOH health service network, churches and private health facilities by duly trained providers. This strategy is cost-effective as it does not require additional resources and supervision is easier.
Outreach and mobile immunization strategy	Locations located at a distance of 5 kilometres to 10 kilometres from the health facilities are covered by outreach teams consisting of health care providers from the nearby health facilities. The team provides the outreach service according to a pre-established schedule into villages or neighbourhoods at least once a quarter by integrating vaccination with other health interventions. Locations that are more than 10 kilometres away from a health facility are covered through mobile teams. These teams are organized by the municipality health directorate and travel to villages and neighbourhoods according to a pre-established schedule at least once a quarter by integrating vaccination with other health interventions. The mobile immunization teams at municipality directorate of health provide mobile immunization services to zero-dose children who are identified and registered by community mobilizers. Continuous capacity-building (training of PAV manager and providers) activities have been done over the last decade to intensify routine immunization through outreach and mobile teams in municipalities with high numbers of zero-dose children. It includes the application of intensive support and monitoring, improvement of micro-planning, supportive supervision, strengthening the engagement of the community in outreach and mobile immunization services.
Catch-up vaccination	Catch-up vaccination sessions were provided for missed children during the COVID-19 pandemic. The routine immunization services were vaccination campaigns.

House-to-house vaccination	It is the provision of vaccination services in users' homes through home-to-home visits by health care providers. This strategy is generally used in the event of lockdowns, when the aim is to increase vaccination coverage in a short period of time and when the population is very dispersed, as intensified strategy in combination with other health services by multipurpose mobile teams. It is not an easy strategy to implement as it requires sufficient human resources and sustainable budgets. Supervision is difficult; it requires qualified personnel; and it also requires tailored cold chain management systems.
Technology use for mapping and demand generation	The immunization programme in Angola, in collaboration with UNICEF and technology companies, has developed and tested different technological solutions and tools to generate demand, and identify and map zero-dose and under-vaccinated children. One of them is a short messaging system (SMS) based vaccine alerts to send reminder messages for vaccination which was designed to reduce dropouts and generate demand for vaccines. This solution was initially rolled out in Cacuaco and Viana municipalities of Luanda Province between April 2021 and February 2022. This solution is an open-source smart register platform (OpenSRP) application called Alerta Saude. It was developed to register children and their caregivers for tracking their immunization. It incorporates a system to send SMS vaccine reminder, collect client satisfaction information, and rate service quality. This system sends SMS alerts and reminders to caregivers prior to vaccination days, track immunization status, send behavioural change and child protection messages, and conduct satisfaction surveys. It sends messages in line with vaccination schedules at the second, fourth, sixth and ninth months of child age. The other solution is mobile software named RapidPro designed to strengthen monitoring and analysis. RapidPro manages contacts, graphically analyses data, connects to multiple communication channels, sends messages in multiple languages and can integrate with other external systems. Moreover, an interactive PowerBI dashboard is used to visualize the registration data of the zero-dose and under-vaccinated children for monitoring and evaluation of micro-planning interventions in a municipality. This dashboard is used to visualize the mapping of zero-dose and under-vaccinated children for targeted, efficient and effective resource allocation and informed decision making.
Communication and social mobilization	This incorporates advocacy to maintain the engagement and active participation of the national, provincial, municipal and community authorities as well as communication to and social mobilization of families, communities and CSOs to increase demand for and uptake of vaccination and other health services.
Integration with vaccination campaigns	As Angola has struggled to reach every child with lifesaving vaccines, the MOH in partnership UNICEF and other partners conducts regular nationwide vaccination campaigns to reach zero-dose children. The immunization campaigns incorporate routine vaccines with measles and polio vaccination. In 2023, a total of 45,092 zero-dose children aged 12 to 59 months from nine provinces were successfully mapped through the polio campaign. This exercise also raised the importance of zero-dose children at the provincial and municipal levels, and it was used to generate data on zero-dose through engaging health authorities and community leaders.

Surveillance of VPDs	The PAV programme implements epidemiological surveillance of VPDs to monitor the immunization programme performance, plan, design and implement response interventions and strengthen supportive supervision to surveillance staff and focal points at health facilities and community level. Active surveillance activities are incorporated in the health units and community activities through improving transport logistics and communication systems. Rapid assessment of surveillance system is established in high-risk municipalities to determine the causes of low performance in the detection, reporting, investigation and referral of samples of polio, measles, neonatal tetanus and yellow fever suspected cases/outbreaks. The lessons learnt in high-risk municipalities are then taken into consideration for applications in other municipalities. The VPD surveillance system is established to achieve faster referral of samples in cold boxes to the central level and referral laboratory.
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UNICEF equity-focused immunization interventions in Angola

UNICEF provides multifaceted support to the government's effort to improve the immunization programme and equity-focused immunization activities. UNICEF provides technical, financial,

medical supply and human resource support during planning, implementation, monitoring and evaluation of routine, supplementary and emergency vaccination services and the immunization programme at large ^{10 13}. The UNICEF equity-focused immunization interventions in Angola are summarized in Table 17.

Table 17: UNICEF equity-focused immunization interventions in Angola

Pro-equity support / intervention areas	Implementation experience of pro-equity supports or interventions (description, context and successes)
High level advocacy for immunization funding and social mobilization	In collaboration with key partners such as WHO, BMGF and Gavi, UNICEF engages in advocacy sessions with the Angolan Government. This collaborative effort led to the Luanda Declaration on Immunization, which is a high-level commitment signed by the ministries of health, finance, territory administration and provincial governments in 2022, with a commitment to increase government funding for immunization and primary health care, and to improve access and the use of immunization services. Moreover, UNICEF along with the MOH, focuses on involving local community leaders and beneficiaries in the planning and implementation of the services to reach zero-dose children.
Zero-dose plan development	UNICEF actively contributes to the preparation of the zero-dose plan. For example, UNICEF Angola, with financial support from GAVI, supported zero-dose planning in 22 municipalities in five provinces (Luanda, Bié, Huambo, Cunene and Cuanza Sul) in 2023. These municipalities covered 60% of zero-dose children and 41% of children under 1-year-old (457,122 children) in the country. UNICEF also supports planning activities in municipalities which are not covered by GAVI funding. The interventions are decentralized at the municipality level and UNICEF provides support to strengthen the local capacities in mapping the zero-dose children and community outreach.
Resource mobilization	UNICEF supports the Angolan MOH in mobilizing funds to support PAV programme. For example, UNICEF secured a funding of \$1.2 million from the Government of Korea to support zero-dose activities in a strategically selected priority province in 2023. The same year, UNICEF also achieved a significant milestone by mobilizing \$11.2 million for vaccine procurement for the acceleration of catch-up vaccination in the country.

Integration of catch-up activities in COVID-19 vaccination	UNICEF plays a pivotal role in supporting the MOH at the provincial level to conduct extensive outreach campaigns across all provinces. Until the end of 2023, it was reported that UNICEF supported the vaccination of over 84,000 zero-dose children through integration of routine immunization with COVID-19 vaccine campaigns.
Zero-dose mapping during polio campaigns	UNICEF and the MOH of Angola initiated the implementation of an innovative approach to identify and map zero-dose children during polio campaigns in 2023. UNICEF designed tailored forms to be used by social mobilizers to facilitate the successful identification, recording and consolidation of Zero-dose children mapping. UNICEF also provides training for the mobilizers; a home-to-home approach is implemented to identify and map zero-dose children during the campaigns. This helps collect and compile zero-dose data at the lowest administrative levels. This approach enables targeted vaccination efforts in households and communities. UNICEF is also planning to digitalize this approach using mobile phones by social mobilizers.
Adaptation of routine immunization monitoring tools	UNICEF takes the key role in adapting routine immunization monitoring tools in the effort to accurately capture the vaccination of zero-dose children in Angola. UNICEF facilitates the revision, production, deployment and/or distribution of tools. Currently, UNICEF Angola supports the adaption of DHIS2 to collect data on zero-dose children aged 12-59 months, to capture immunization data beyond the current focus on Penta-2 and Penta-3.
Procurement and distribution of solar direct drive (SDD) refrigerators	As of 2023, only 61% of health facilities had functional cold chain equipment in Angola. This critical challenge severely impacts access to immunization services and reaching zero-dose children. To address this gap, UNICEF mobilizes resources for procurement and distribution of solar refrigerators. For example, UNICEF mobilized around 2 million dollars from USAID Global Vax project for procurement and deployment of 280 SDD refrigerators in hard-to-reach areas of the country in 2023. In addition, to the refrigerators, UNICEF procures cold boxes, vaccine carriers and ice packs to assist the delivery of outreach services in hard-to-reach and remote areas.

Challenges and gaps in implementation of pro-equity interventions in Angola

- 1) **Budget and logistics:** Low investment in immunization, disruption of vaccine supplies due to different reasons.
- 2) **Poor vaccination integration:** The low integration of immunization with other basic health care services results in missed opportunities to vaccinate children due to lack of training/information for health workers, poor awareness of families about vaccination importance and services and lack of service integration with other maternal and child health services.
- 3) **Specified vaccination dates:** Certain vaccines such as those for measles and BCG are administered on specific days due to open vial policy to prevent vaccine wastage. This might affect client satisfaction

and caregivers might miss the established day as well as a prolonged waiting times in health facilities.

- 4) **Irregularity of mobile and outreach vaccination sessions:** Outreach and mobile vaccination teams do not visit remote villages or communities according to regular visits, making it impossible for children or women to complete their vaccination schedule in a timely manner.
- 5) **High defaulter rates:** This includes children who receive one or more vaccine doses but do not return for the remaining doses needed to complete their immunization. This dropout is often due to caregivers' lack of awareness, fear of side effects or other factors such as myths and cultural beliefs.
- 5) **Irregular provision of vaccination services:** This happens due to restricted

service hours, insufficient application of the open vial policy and consequent failure to open vaccine vials whenever it is mistakenly considered that the number of children to be vaccinated does not justify opening a small one.

- 6) **Unreached communities:** This includes communities who are not covered by vaccination services due to socio-economic, cultural, religious or geographical barriers in accessing immunization services. Certain geographical areas are difficult to access through static or outreach vaccination services; and insufficient awareness of communities on vaccination importance and existence of myths related to misinformation hinder the use of vaccination services in some communities.
- 7) **Cold chain system:** Most health facilities in Angola do not have functional cold chain

equipment. This critical challenge severely impacts access to immunization services and reaching zero-dose children in most rural municipalities.

- 8) **Service availability:** All health facilities in the country do not provide vaccination services. This prevents guaranteeing a universal delivery of routine vaccination services at national level.
- 9) **Limited funding and resource mobilization:** This was one of the key challenges hindering the implementation of planned immunization activities.

The SWOT analysis of pro-equity interventions in Angola

The strengths, weakness, opportunities and threats (SWOT) of the PAV programme in Angola are summarized in tables 18 and 19 below.

Table 18: Strengths and weaknesses of PAV programme in improving immunization equity in Angola

Component	Strengths	Weakness
Human resource	Training of staff at all levels including for social mobilizers.	- Shortages of health care providers both in terms of availability and capacity. - Increased mobility and shifting of the trained staff. - Non-optimal attitudes of the health workers towards immunization.
Program financing	- Government funding has increased although not optimal. - Partners such as UNICEF, WHO and GAVI support the mobilization of resources for implementation of immunization planning and implementation. - Integration of national and state funds for routine immunization.	- The funding is not adequate. - Weak or no clear strategies to ensure sustainability of partner-initiated activities and funding.
Immunization service delivery	- Outreach, mobile and home-to-home, vaccination sessions to reach zero-dose children in remote areas. - Integration of routine immunization and zero-dose mapping with immunization campaigns such as polio, measles and COVID-19. - Pro-equity interventions are decentralized at municipality level. - Implementation of EVM system.	- Failure to comply with vaccination schedules due to non-availability of vaccines or vaccinators on the vaccination day. - Lack of knowledge on importance of vaccination in the community. - Inaccessibility of services in remote locations and other contextual factors that affect vaccine uptake. - Mobile teams are not decentralized to reach all remote places in need.

Communication, social mobilization and advocacy	- Engagement of social mobilizers, CSOs and representatives from administrative structures at all levels. - Multi-sectoral government offices and authorities at all levels of the government structure are targeted in advocacy activities for improved support to immunization programme.	- Local media use is not indicated. - Limited in major areas with the highest burden of zero-dose and under-vaccinated children.
Vaccine supply and cold chain management	- Use of technology platforms such as IOTA for vaccine supply chain. - Focus on systems strengthening and cold chain equipment expansion such as SDD refrigerators. - Pooling of funds for routine immunization from non-state and state sources.	- Limited availability of the cold chain equipment. - Interruption of vaccine supplies. - Lack of transportation services for vaccines.
Monitoring and evaluation	- Implementation of DHIS2 platform for immunization data. - Use of micro-planning. - Local community leaders and beneficiaries are engaged in the planning and implementation of the services to reach zero-dose children.	- Data quality (timeliness and completeness) is not optimal. - Capacity shortfalls to use data for decision-making at lower level.
Information and communication technology	- Use of comprehensive IT solutions. - RapidPro that are designed to register and track children, send SMS reminder, send BCC messages to collect client information and rate service quality. - PowerBI for visualization to monitor immunization services coverage.	- Delays in procuring devices and deploying solutions. - Delays in launching the use of IT solutions after training made users forgot on the operation skills. - Challenges in network issues and data synchronization between platforms.

Opportunities and threats

Table 19: Opportunities and threats of PAV programme in improving immunization equity in Angola

Opportunities	Threats
- Increasing attention to immunization and vaccine equity. - Multiple partners in a wide range of immunization activities including financial and technical support, vaccine logistic system, capacity building and technologies. - No major community-level resistance to routine vaccines. - Expansion of IT, for example, SMS reminder systems to reduce vaccine dropouts and RapidPro for zero-dose mapping and data collection, and PowerBI for visualization to track progress in immunization programme.	- Limited resilience to sustain essential health services including immunization during emergencies, for example, immunization services were interrupted following the COVID-19 pandemic. - Highly donor-dependent immunization financing. - Limited technical and financial capacity may impede the expansion and implementation of digital technologies and pro-equity interventions. - Topographic and transport access challenges in remote areas. - Open vial policy for BCG or measles may affect service dissatisfaction.

Good practices and lessons learnt

- 1) Advocacy and community mobilization strategies and activities were effective in increasing acceptance of pro-equity immunization interventions and for ensuring support from government and local community. Government and community leaders were involved in the implementation of pro-equity interventions.
- 2) Situational analysis was conducted for identification and prioritization of high zero-dose burden provinces and respective municipalities for implementation of pro-equity immunization interventions.
- 3) Use of data collection, analytics and visualization tools, such as RapidPro and PowerBI for mapping zero-dose children, community mobilization, identifying areas with high zero dose, guiding targeted pro-equity interventions and monitoring immunization services coverage. This creates the platform for evidence-based decision making at higher and lower levels of immunization programme and it increases visibility of immunization services to government authorities and policymakers.
- 4) Public-private partnerships with the technology companies to develop and deploy IT solutions for immunization implementation and monitoring.
- 5) Engagement of community leaders, including women leaders and caregivers in identifying and mapping zero-dose children, micro-planning and implementation of vaccination sessions were a useful approach in the efforts to reach zero-dose and under-vaccinated children.
- 6) Subsequent capacity-building activities, using innovative approaches, will enhance the ability of staff and community mobilizers to implement pro-equity interventions effectively. UNICEF and the MOH are committed to providing regular training sessions for local experts and community mobilizers to ensure ongoing

skill development and impactful community engagement.

- 7) Resource mobilization activities from both donors and the Government for implementing pro-equity interventions were successful and remarkable, so that funds to implement planned activities were ensured.

Recommendations for Angola

- 1) Continuous advocacy for pro-equity interventions is essential for mobilizing resources and scaling up efforts, particularly in high zero-dose burden provinces and extending to high-burden municipalities in lower-burden provinces. Engaging the Government, partners, stakeholders and local communities will strengthen these efforts. Expanding partnerships beyond UNICEF will enhance financial and technical capacities, streamline advocacy and support community mobilization at all levels. This collaborative approach will also build the capacity to implement context-specific, innovative solutions that reach zero-dose children in underserved communities, while raising community awareness about the critical importance of immunization services.
- 2) **Strengthening support supervision activities:** Failure to deliver vaccinations sessions and poor quality of care are among the major challenges in the country. Hence, uninterrupted supportive supervision to health care workers will be useful to ensure continuity of immunization services and prevent client dissatisfaction.
- 3) **Continuous capacity building at all levels:** it is useful to continue the capacity-building activities at all levels to support the health system's capacities in planning, implementing, monitoring and evaluating pro-equity interventions and the progress towards reaching zero-dose children. The capacity-building activities should also include community mobilizers who are instrumental in identifying and mapping

zero-dose children as well as planning and implementing pro-equity interventions.

- 4) **Cold chain systems:** Most of health facilities in Angola do not have functional cold chain equipment. Hence, the Government and partners should create synergy to increase the procurement and distribution of cold chain equipment, including SDD refrigerators in rural and remote health facilities.
- 5) **Integrating immunization with other basic health services:** The integration of immunization services into maternal and pediatric care units will help to identify and vaccinate children visiting health facilities for other health care services and this will help to reduce missed opportunities.
- 6) **Strengthening community health programmes and services:** As community health is a fundamental pillar of primary health care in Angola, the inclusion of immunization in the national community health services should be strengthened as it helps to reach a significant number of zero-dose and under-vaccinated children during community health activities.
- 7) **Strengthening public-private partnerships:** Private companies demonstrated capacity in developing innovative solutions assisting zero-dose mapping, community mobilization, data collection and analysis for better implementation of equity interventions and evidence-based decision making. This strategic partnership between the health system and private technology companies should be sustained and scaled up. UNICEF can play a pivotal role in strengthening the partnership for leveraging digital health tools for better implementation, monitoring and evaluation of pro-equity interventions.
- 8) **Improving funding for immunization programmes:** Limited funding is one of the key challenges affecting the implementation of pro-equity interventions across all provinces and municipalities. The mobilization of funding by UNICEF

and government funding should be strengthened to enable the expansion of pro-equity interventions across all missed communities and settings.

ANNEXES: 2
COUNTRY CASE STUDIES

ETHIOPIA

Zero-Dose and Equity Agenda



Annex 2: Ethiopia: Zero-dose and equity agenda

Country context

Ethiopia is a landlocked country in East Africa, bordering with Eritrea, Djibouti, Somalia, Kenya, South Sudan and Sudan. It is Africa's second most populous country after Nigeria with more than 120 million inhabitants, residing in 12 regional states and two chartered cities. These are sequentially subdivided into zones, *woreda* (district) and *kebele* (lowest administrative unit). Over 80 per cent of the total population lives in rural areas and relies on agrarian/pastoral ways of subsistence. The population is characterized by a rapid growth (2.6 per cent), high total fertility rate of 4.6 births per woman (2.3 urban and 5.2 rural) and a corresponding crude birth rate of 32 per 1000 according to the DHS 2016. Ethiopia remains one of the poorest countries, with a per capita gross national income of USD 1,020. The country aims to reach lower-middle-income status by 2025.

Ethiopia has a three-tier health system structure, with primary, secondary and tertiary levels of care. The per capita government expenditures on health were only USD 34 in 2017.¹⁴¹⁴¹⁴¹⁴¹⁴¹⁴¹⁴ The primary health care units (PHCUs) that include primary hospitals, health centres and satellite health posts are responsible for the provision of basic health care services for the rural areas.

Overview of immunization programme in Ethiopia

Immunization is one of the key primary health care priorities in Ethiopia. The national Expanded Program on Immunization (EPI) was launched in 1980 with six antigens (DPT, polio, measles and BCG). A total of 12 antigens are currently incorporated into the routine immunization (RI) programme of the country following the expanded progress over the years, with the introduction of

Hep-B and Hib in 2007, PCV in 2011, Rotavirus in 2013, IPV in 2015, HPV in 2018 and MCV2 in 2019. The national EPI has also emphasized the introduction of new and underused vaccines, such as Hepatitis B birth dose, yellow fever, and Meningitis A in its 2021-2025 multi-year plan. The EPI aims to ensure universal, equitable and sustainable access and use of immunization services, and ultimately to reduce morbidity, mortality and catastrophic health expenditure from vaccine-preventable diseases (VPDs) to achieve the universal goals, targeting the elimination and eradication of VPDs. The EPI designs and implements various strategies and activities to achieve these strategic objectives of improving access and use of quality immunization services, including special strategies and interventions to reach hard-to-reach, resource constraint and disaster-affected communities¹⁵.

Despite the long history of EPI, various efforts to ensure universal access and remarkable progress in immunization coverage and VPDs reduction over the last two decades, immunization coverage has neither been optimal nor equitable in Ethiopia. The 2019 min-EDHS shows that 39 per cent of children are not fully immunized and another 23 per cent of children aged 12-23 months were never vaccinated for a single dose of DPT-1 in 2019.¹⁶ Zero-dose and under-vaccinated children are disproportionately high in hard-to-reach pastoral regions, remote areas of major regions, urban slums, conflict-affected and internally displaced communities. More than half of children have been shown to be zero-dose in pastoral and developing regions. Ethiopia is the fifth highest contributor of zero-dose immunization globally. The immunization programme has been facing multiple challenges due to variations in access (e.g., geographical and social inequality), service use (e.g., high dropouts and zero dose in underprivileged settings), and the recurrent natural and man-made disasters (e.g., COVID-19

and armed conflicts). The high incidence of VPDs (e.g. measles) in recent years can be taken as a reliable indicator of drawbacks in immunization programme. ¹⁷⁻²⁰

To enable a seamless delivery of immunization programme and services, the EPI in Ethiopia is structured in line with the administrative structure of the country. The Maternal and Child Health (MCH) directorate at Federal Ministry of Health (FMOH) is the overall coordinating body of EPI activities at national level via EPI task force led by the case team manager. It leads the development, standardization and revision of implementation guidelines, training manuals and job aids; and ensures the distribution of related supplies. It also provides technical and financial support to the regions. Similarly, Regional Health Bureaus (RHBs) provide this support to the lower administration levels particularly zonal health departments, woreda health offices and health facilities to implement planned activities. Woreda health offices are mandated to support primary health care units which are the main vaccination and other basic primary health care services delivery points in Ethiopia. Ethiopian Pharmaceutical Supply Services (EPSS) has been mandated with the distribution of vaccines in woredas and health facilities (hospitals and health centres) which are then responsible for distributing vaccines to satellite health posts ^{15 21}.

The national immunization programme also possesses scientific, advocacy, resource mobilization and technical working groups and committees that support its efforts of achieving national immunization goals and targets, including the Ethiopian National Immunization Technical Advisory Group (E-NITAG), EPI inter-agency coordinating committee (ICC), and technical working groups engaging immunization partners that support immunization planning, monitoring and evaluation; communication and advocacy; and logistics and supply. ¹⁵

Trends in numbers and rates of zero-dose and under-vaccinated children in Ethiopia

The number of under-vaccinated children was not stable throughout the 10 years period. In 2014, the highest number (over 386,000) of under-vaccinated children was reported with more than 133,000 children variation compared with 2013. The number progressively declined from 2015 to 2017 for three consecutive years, and again escalated to 354,932 in 2018 with a difference of 78,000 children in 2017. The number dropped to the lowest level in the 10 years to 186,257 in 2020, and then increased to 190,999 in 2022.

In contrast, there were over 1 million (33 percent of infants) zero-dose children in 2013; and the number progressively declined for the five consecutive years and reached 816,343 (23 percent of infants) in 2018 which had a significant drop of more than 228,000 (10% percentage point) children compared to the 2013 rate. The number slightly increased to 879,223 (24 percent) in 2019 with 1 PP difference compared to 2018. Even though there was no change in percentage, there was an increment in the number in 2020. In 2021, a remarkable change was observed as the number of children increased by over 240,000 (6 percent) compared to 2020. This upward trend continued in 2022, reaching a total of 1,145,994 children.

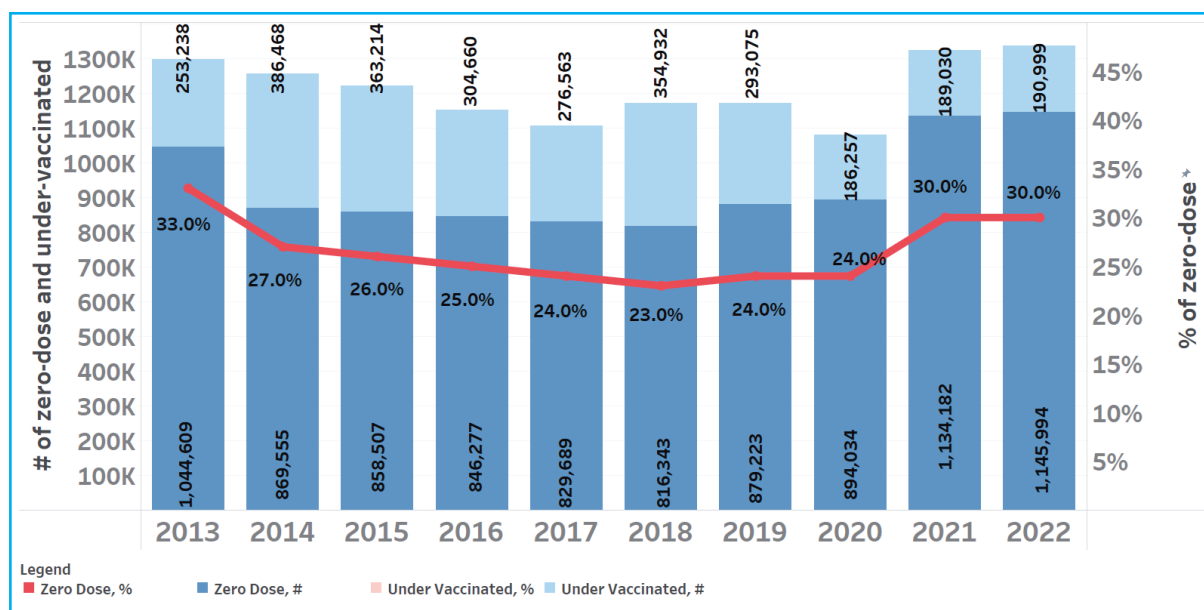


Figure 27: Trend of numbers and rates of zero-dose and under-vaccinated children, Ethiopia, 2013–2022 (Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates)

Throughout the 10 years (2013–2022), there were no significant variations observed in BCG coverage. The average coverage was 69.8 per cent with the highest pick of 73 per cent reported in 2017 and the lowest rate of 68 per cent reported in 2013, 2021 and 2022. Likewise, the lowest Penta-1 coverage of 67 per cent was reported in 2013, and then it increased to 73 per cent in 2014 with 6 PP increment. Since 2015, a staggered 1 per cent increase was observed in each year for four consecutive years until 2018 which reached 77 per cent. In 2019, it dropped by 1 PP to 76 per cent which remained stable until 2020. In 2021 and 2022, the rate declined to 70 per cent with 6 PP difference compared to 2020.

On the contrary, the lowest Penta-3 coverage was reported in 2013; and then the rate progressively escalated by almost 2 PP for four consecutive

years (2014–2017) and reached to 68 per cent in 2017, which had a difference of 9 PP from the 2013 coverage. In 2018, the rate fell to 67 per cent and again rose to 68 per cent and 71 per cent in 2019 and 2020, respectively. In 2021 and 2022, the coverage dropped to 65 per cent with 6 PP difference from the maximum reported rate in 2020.

However, the coverage of the first dose of MCV had a lot of fluctuations during the 10-year period. From 2014 to 2017, the coverage saw a slight, steady increase, rising from 54 per cent in 2014 to 59 per cent in 2017, a change of 5 PP. However, in other years, coverage fluctuated significantly. Overall, the ten-year period (2013–2022) average coverage for Penta-1, Penta-3 and MCV-1 was 73.4 per cent, 65.3 per cent and 56.4 per cent, respectively.

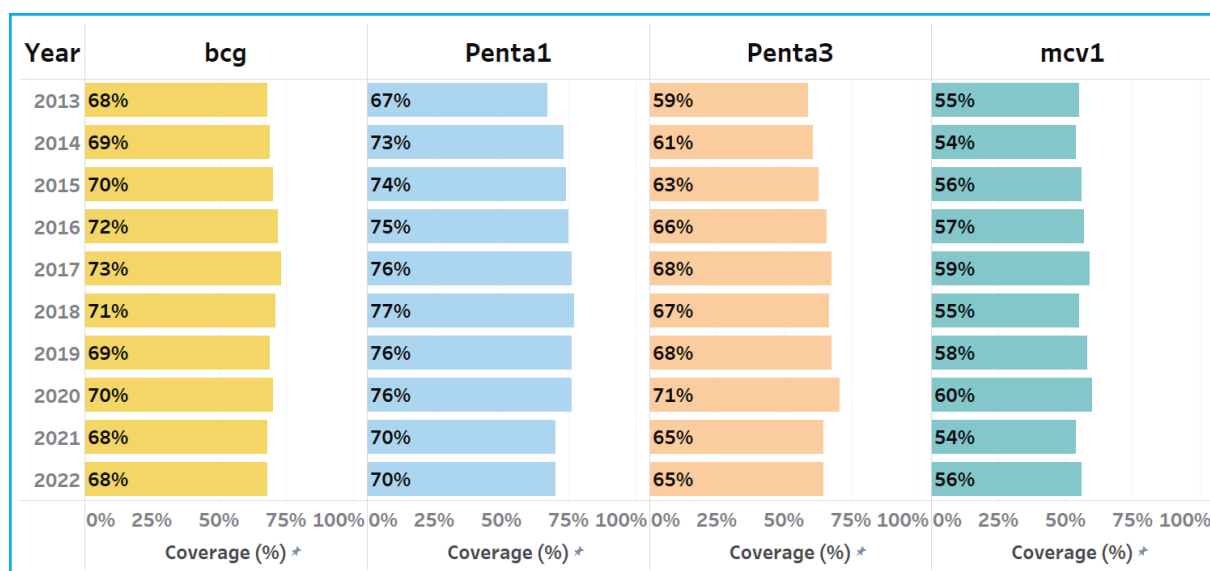


Figure 28: Vaccination coverage trends in selected antigens, Ethiopia, 2013–2022 (Data Source: WUENIC)

Throughout the 10 years, the discrepancy between the administrative and WUENIC Penta-3 coverage was big with the maximum interval of 33 percentage-point in 2015 and a minimum interval of 23 percentage-point in 2013.

In the first consecutive seven years from 2013 to 2019, the DTP-1 to DTP-3 dropout rate was above the standard rate of 10 per cent. However, the rate decreased and reached to 7 per cent for three consecutive years (2020 to 2022). The highest peak of 16 per cent was in 2014.

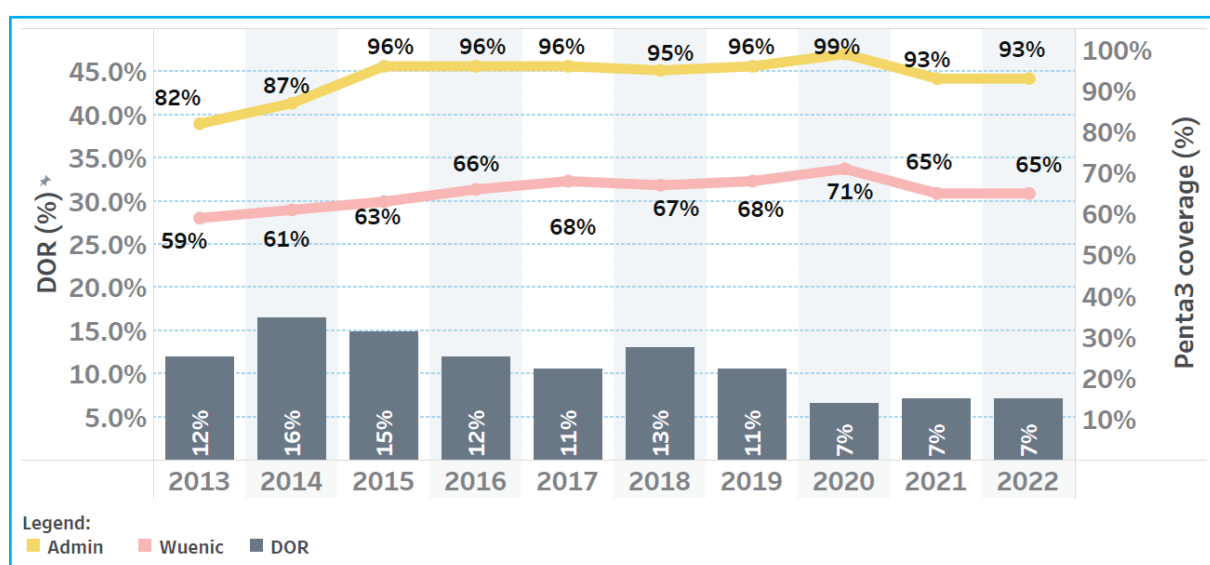


Figure 29: Trends in DPT-1 to DPT-3 dropout rate, and comparison between DPT-3 administrative coverage and WUENIC estimates, Ethiopia, 2013–2022 (Data Source: WUENIC)

Immunization inequity in Ethiopia

Using DHS 2016, the overall concentration index for the multivariate equity measure was 0.359 with an AEG of 0.227 for zero-dose status. The zero-dose rate among the most disadvantaged 20 per cent of the population would need to decrease by approximately 22.7 PP to reach levels of the most advantaged 20 per cent.

Household wealth was the most important equity driver that explained the 30.2 per cent of the variation in zero-dose inequity in Ethiopia (DHS 2016) followed by urban/rural residence (25.4 per

cent), and maternal education (13.7 per cent). Vertical inequity accounts for over 43.9 per cent of the zero-dose inequity. In addition, horizontal inequity (urban/rural residence and regional differences) explains the 28.4 per cent variation in zero-dose inequity. The contribution of child sex to zero-dose inequity was almost nil (0 per cent) (see Figure 30).

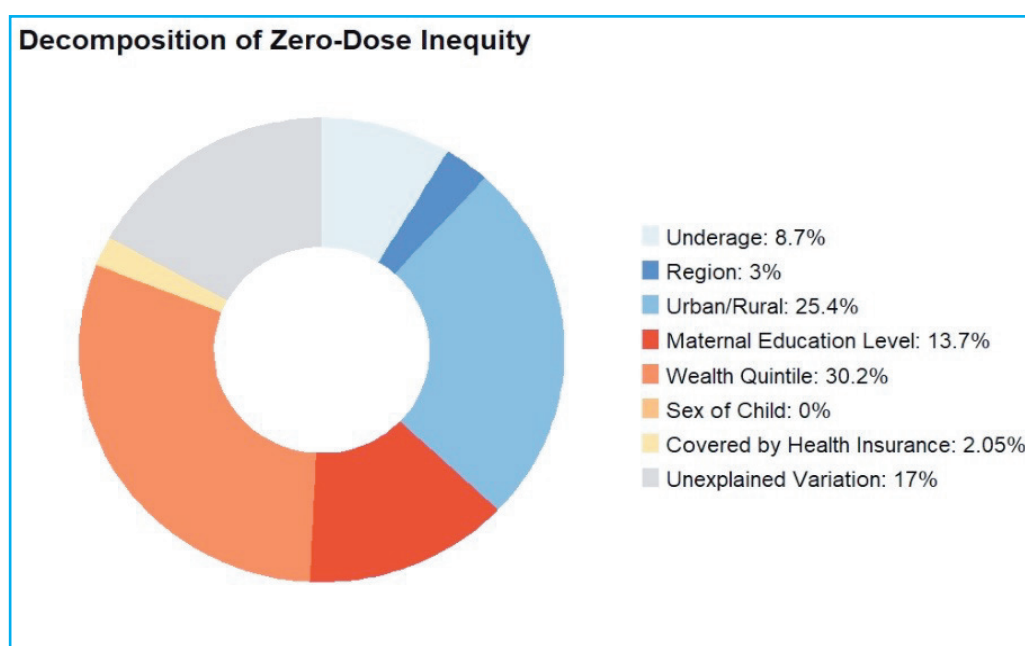


Figure 30: Decomposition of zero-dose inequity in Ethiopia, DHS 2016

At regional/subnational level, Addis Ababa city administration and Tigray Region had low zero-dose rate, while Afar Region had the highest zero-dose rate in Ethiopia (see DHS 2016). With respect to zero-dose inequity, Dire Dawa City had the highest zero-dose inequity. On the country, Harari and Somali regions had the lowest zero-dose inequity (see Figure 31).

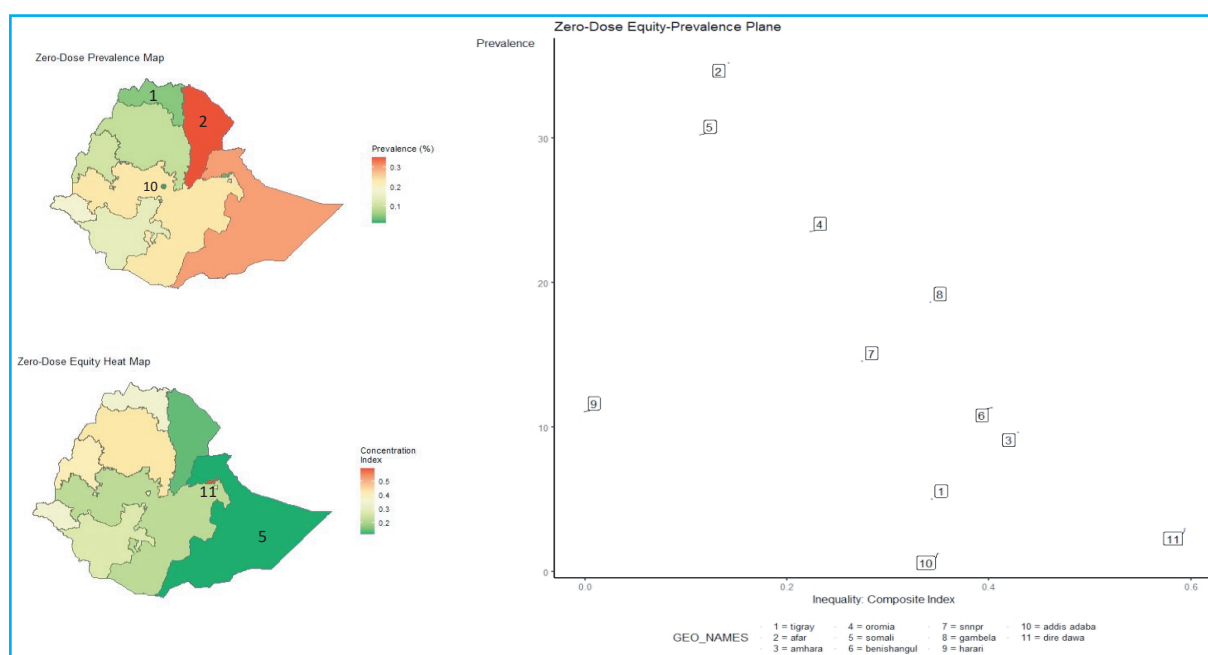


Figure 31: Ethiopia zero-dose rate and zero-dose inequity by region (Source: DHS 2016)

Barriers and underlying factors to reaching zero-dose children in Ethiopia

There are several supplier- or user-side barriers that hinder the efforts to reach and vaccinate zero-dose children in Ethiopia^{17 22-24}. The leading barriers hindering the implementation of zero-dose-targeted interventions are summarized as follows:

- 1) **Provider-side barriers:** The main barriers that hinder the provision of vaccination services in remote areas of Ethiopia are:
 - a) Absence of vaccination service in remote communities: A national study¹⁷ shows that 10 per cent of the health facilities in remote and hard-to-reach areas did not provide outreach vaccination service and 21 percent who conduct outreach do not provide regularly on monthly basis.
 - b) Failure of health workers to visit villages during outreach sessions due to scattered settlement and distances.
 - c) Closure of vaccination site due to absence of health workers during vaccination sessions for other competing priority activities.

- d) Absence of vaccine in static sites due to setbacks in vaccine supply and cold chain system.
 - e) Poor functionality of health posts due to absence of HEWs or cold chain system.
 - f) Poor health service coverage or limited access to primary health care services.
 - g) Topographic barriers to reach remote communities and large catchment population or area size.
 - h) Female HEWs usually refuse travelling to hard-to-reach and topographically challenging communities due to physical challenge and fear of sexual violence.
 - i) Unsatisfactory incentives and poor support to frontline providers results in demotivation and reluctance of frontline health workers to provide campaigns in remote areas.
 - j) No tailored service delivery strategy that takes the nomadic nature of pastoralist communities into consideration.
- 2) **Demand-side barriers:**
 - a) Vaccine hesitancy: Although resistance to routine vaccination is rare in Ethiopia, it is reported from few remote areas.

- b) Low self-initiated demand for vaccination in most settings of the country except in urban areas and major regions that might be due to poor health literacy, poor access to vaccination service, service dissatisfaction and absence of sustained SBCC interventions on benefits and side effects.
- c) Small-scale misconceptions due to religious beliefs (beliefs such as the baby should get baptized, fear of evil eye, and protected by God).
- d) Cultural norms (limited movement during postpartum period).
- e) Fear of injections and concerns about multiple injections at a time.
- f) Reluctance to accept booster doses.
- g) Domestic workload of caregivers, forgetfulness and negative influence of others family members (e.g., husbands, parents).
- h) Reduced health care seeking in general due to recurrent drought and adverse climatic conditions.
- i) High fertility and polygamy also limit the ability of parents to give optimal care to their children in certain areas.

Pro-equity immunization strategies and interventions in Ethiopia

Immunization is among the priority MCH services and essential primary health care interventions in Ethiopia. It is outlined as a key indicator to track progress towards health sector transformation plan (HSTP) and universal health coverage targets and milestones. Immunization services are stretched down to the lowest health care delivery level or health posts and integrated with community health services. The EPI is guided by strategic documents, including comprehensive strategic plans and manuals. The current comprehensive multi-year plan spanning the years 2021-2025 explicitly describes the strategies, interventions and suggests the design of new strategies targeting socially/geographically hard-to-reach communities by using people-centred approach to achieve equitable access to and use of immunization services regardless of socio-economic and geographical inequalities in the country. The pro-equity interventions include vaccination delivery approaches, logistic and supply mechanisms, communication and advocacy, planning, monitoring and evaluation, leadership and governance and information management systems. The key pro-equity strategies and interventions are summarized in Table 20 below ^{15 21 25-29}.

Table 20: Pro-equity immunization interventions in Ethiopia

Strategies and interventions	Implementation experience of the strategies and interventions (rationale, context, description and successes)
Reach every district- quality improvement (RED-QI) strategy	Ethiopia adopted the RED approach in 2004 in districts with poor immunization coverage and high dropout rates. However, its implementation faced challenges such as vaccine stockouts, limited cold chain systems, inadequate mentorship and supervision, limited data use for action, sub-optimal community involvement and inadequate guidelines to implement the RED strategy fully and sustainably. Hence, John Snow Inc. (JSI) in collaboration with MOH designed the RED-QI strategy and implemented it from 2012 to 2021. This strategy operationalized the full RED strategy and its components and adds-up QI tools and practices to build implementation capacity, explore obstacles in RED implementation, solve problems and sustain the gains. The key QI processes and tools include developing facility-level EPI micro-plans, engaging community and civil administration in mapping catchment populations, mobilizing resources and implementing outreach/mobile sessions, facility-level root cause analyses to identify causes of problems, using Plan-Do-Study-Act (PDSA) cycles to test solutions developed by health workers and community members, building provider capacity on problem-solving and data use (quality assessment, analysis and use for action) and supporting quarterly review meetings. Started in three pilot woredas in 2012, the approach was eventually scaled to 103 woredas across four developing regions (17 in Afar, 25 in Somali, 16 in Benishangull-Gumuz and 8 in Gambela) and two major regions (6 Tigray and 31 SNNP). Two thirds of these woredas were hard-to-reach areas and populations such as pastoralists, with extremely limited infrastructure, low health system capacity and poor immunization coverage. This strategy demonstrated improvements in planning, reach of all eligible targets with vaccination services, immunization coverage and protection (sero-survey conducted), health provider capacity to plan, provide and manage EPI services, and improvements in data quality and use.
Engaging communities and CSOs in communication, advocacy, and demand generation	The EPI prioritizes community engagement, communication, advocacy and social mobilization as key strategy and activities in generating demand, building confidence and trust in the immunization services particularly in communities with big numbers of zero-dose and under-vaccinated children in hard-to-reach, remote, conflict affected and urban slum areas. Health/women development armies, mothers/caregivers, community leaders and CSOs and administrations are engaged in the design and implementation of demand creation activities particularly in high zero-dose and under-vaccinated settings. Communication and advocacy activities are part of immunization programme planning, monitoring and evaluation. Capacity building on communication planning and implementation is provided for immunization experts at all levels. Diversified efforts, including SBCC, community mobilization, community dialogues and the use of different channels of communication (interpersonal, mass media, print media) are used to promote immunization and create informed demands in the community.

Pro-equity evaluation	An evaluation study was conducted to ensure evidence-informed policy and practice towards reaching zero-dose and under-vaccinated children in Ethiopia ¹⁷. The study identified and mapped clusters of missed communities and zero-dose children, explored demand and supply barriers and assessed the feasibility and acceptability of interventions for reaching zero-dose and under-vaccinated children in hard-to-reach and remote areas of Ethiopia. Zero-dose and under-vaccinated target populations were mapped and numbers were estimated. It then guided the development of locally tailored and context-specific interventions and strategies to address inequalities in hard-to-reach, remote and humanitarian settings of the country.
The last-mile logistic supply strategy	The vaccine supply has been transitioned to EPSS since 2016. The agency is mandated to distribute vaccines directly to woredas; and health facilities (hospitals and health centres) and satellite health posts collect from health centres to ensure the last-mile vaccine delivery strategy. Moreover, the country designed and successfully implemented initiatives of mass distribution of solar refrigerators, refrigerator maintenance campaigns, and rollout of the Effective Vaccine Management (EVM) system including the Fridge-tag systems. Through the support of Gavi and other partners, over 10,000 Solar Direct Drive refrigerators (SDDs) have been installed at health posts located in hard-to-reach and remote areas. The supply transition and expansion of cold chain facilities into health posts have shown to substantially improve vaccine logistic system nationally.
Expansion of static vaccination services	The routine static vaccination at health facilities has been the main vaccine delivery approach for most children in the country. However, evidence coming from service provision surveys, routine health information and evaluation findings showed significant numbers of health facilities did not provide static vaccination services. Therefore, the EPI has taken the expansion of static vaccination services across public health facilities as a primary initiative to address zero doses. Moreover, the engagement of the private sector and expansion of immunization services into private facilities has been identified as one strategy in slum areas having no public health facility within the catchment area and implemented to address zero doses in urban areas particularly Addis Ababa, Dire Dawa, Harar and towns of Oromia. Other regions are also trying to engage private facilities. However, this initiative is hugely challenged by difficulties of purchasing refrigerators fulfilling the cold chain standard. The MOH, in partnership with ABH partners PLC, recently launched a national initiative of scale up private sector engagement in immunization through financial support from USAID.
Outreach vaccination	Outreach refers to is a vaccine delivery strategy in which health providers leave their health facilities and travel on foot, bicycle, or motorized vehicle to community settings to deliver immunization in surrounding communities. This has been part of the routine vaccination strategies in hard-to-reach areas, including rural remote areas, off-roads, distant from health facilities and challenging topographic features. Despite irregularities due to many factors related to transportation, operational budget and competing priorities of HEWs, the strategy is implemented in all regions of Ethiopia.

Mobile vaccination	Mobile vaccination is one of the key vaccination delivery strategies in Ethiopia particularly in mobile pastoral communities, such as Afar and Somali where the highest proportions on zero-dose children exist. The mobile vaccination approach is implemented in Afar and Somali, and pastoral areas of Oromia (Borena and Guji) and Gambela (Neur and Anuak zones) by mobile health teams. On other hand, SNNP, Southwest and Amhara regions have also tried to implement mobile health services although it has not been effective due to the shortage of resources and lack of partners. Recently, mobile services were implemented in conflict-affected areas of Amahara and Tigray.
Catch-up vaccination	It is a strategy to vaccinate children who missed vaccination doses for whatever reason (e.g. security, disaster, stockouts, access, hesitancy and service interruptions) and for which they were eligible as per the immunization schedule. Catch-up vaccination is provided through a mix of strategies, including static, outreach, periodic intensification, mobile and/or campaigns, or local innovative strategies as part of the routine immunization. Missed children are reached with specific catch-up plans. The MOH developed and endorsed a catch-up vaccination guide in 2022 to support the efforts to address zero-dose children and missed community in Ethiopia. Oromia had a catch-up vaccination guideline before the development of the national one. The MoH conducted catch-up vaccination to provide measles preventive campaign for more than 22,000 zero-dose children in conflict-affected areas in 2022.
Periodic intensification of routine immunization (PIRI):	It is a spectrum of time-limited and intermittent activities used to deliver routine immunization services and capacity building. PIRI focuses on areas with poor access to immunization services, such as mobile communities and remote areas. It is also implemented as part of a catch-up in vaccinations in hard-to-reach areas. PIRI is a component of the RED strategy and is encouraged for woredas with zero-dose cases to organize regular outreach, mobile and other modalities. A consolidated PIRI was conducted in woredas with below 50 per cent Penta1 coverage in 2019. It was shown that one PIRI implementation reduced the percentage of woredas with <50 per cent Penta1 coverage from 10 per cent to 6 per cent. As it is part of RI modalities, PIRI reporting is designed through DHIS 2 system. So, it is difficult to evaluate the actual effects of PIRI implementation.
African vaccination week	African vaccination week is a campaign celebrated every year in Ethiopia to advocate the strengthening of RI uptake, particularly in low performing areas. It is used to create demand at a community level, trace defaulters, identify zero-dose children and vaccinate by arranging additional vaccination sessions and mobilizing resources. This event is organized centrally and used to organize campaigns without compromising routine immunization services. It is also reported to be used by HEWs as a main approach to identify zero-dose children and trace defaulters in remote areas which are only accessible through campaign (e.g., Akobo in Gambela region and Surma in SW region).
The Hit-and-Run approach	It is a strategy to provide integrated immunization with other health and humanitarian services through hit-and-run approach in conflict affected areas in Ethiopia. It is quick in-and-out operations, using windows of opportunity, such as truces for humanitarian relief and negotiated access to targeted area and conduct vaccination within a short timeline. It has been included in immunization plans for conflict affected zones of Afar, Amhara, Oromia, BG and Tigray.
Supplemental immunization activity (SIA)	SIA activity is one strategy or opportunity to address zero-dose children and missed communities in Ethiopia during EPI planned campaigns such as measles, polio and recently, COVID-19. Integrating RI services during SIA is prioritized as a good opportunity to identify zero-dose or under-vaccinated children and vaccinate them during the SIAs. Hence, SIAs vaccination teams are double-tasked to identify zero-dose children and vaccinate or refer them to routine vaccination delivery points (static, outreach and mobile).

Integration with other health services	Studies in Ethiopia show that significant proportion of zero-dose children are missed opportunities. A recent study reveals that 20-25 per cent of zero-dose children were missed opportunities for immunization service in different programmes, and another study in Amhara region indicates it could be as high as 75 per cent. The EPI implementation guideline and plans emphasize the integration of immunization services with other maternal and child health services. It is a low hanging to improve and vaccinate children with simple and low cost. The major service integration areas identified to reduce missed opportunities include antenatal care, postnatal care, family planning, pediatric care, nutrition screening and supplementation, deworming, early childhood development and family health services. EPI-nutrition nexus is identified as a good platform to leverage more for both programmes. The comprehensive Multi-Year EPI Plan includes joint micro-planning development and at-service delivery point to identify immunization dropouts and zero doses during nutrition screening; and conducting nutrition screening, vitamin supplementation and deworming during immunization campaigns. Efforts of integrating immunization and micronutrient supplementation have been implemented in Afar through JSI's Universal Immunization Through Family Health Services (UIFHS). The EPI also targets the 'Seqota Declaration' platform that focuses on nutrition improvement of pregnant and lactating women and children under two which are the same target population for the EPI. The EPI aims to benefit from the multi-sectoral the already mobilized and committed inter-ministerial steering committee at federal and regional, zonal, woreda and kebele level governing structures. The programme uses this platform to reach out to zero-dose children and hence, both programmes can benefit from the integration that contributes to enhanced child development.
VPDs surveillance	In Ethiopia, VPD surveillance is implemented through the Integrated Disease Surveillance and Response (IDSR) system which has been implemented since 2009 as part of Public Health Emergency Management (PHEM). VPD surveillance has become a core component of the PHEM activities within the Ethiopian Public Health Institute (EPHI). VPDs which comprise measles, polio, cholera, meningitis, yellow fever and others are included in the 32 prioritized diseases for surveillance in Ethiopia and reported on a weekly basis by all levels of the health care delivery points, including health posts. The information generated from VPD surveillance is used for key decisions in RI, for example, in designing strategies, such as PIRI and catch-up vaccinations, campaigns and reactive vaccinations. Besides, the information is also used as input for RI improvement plans, policy and strategy designing and development.
One-Health approach	The One-Health approach integrating human and animal health was initiated in Afar in 2018. The project integrated immunization services with human/animal health services. This project entailed activities, such as formation of Woreda One Health Committee including clan leaders and training of community mobilizers to enhance their engagement, and capacity building and coordination of settlement bases, micro-planning and implemented in three woredas of Ada'ar, Dubti and Mille, selected from Zone One of Afar Region. In the first year of implementation, the project improved immunization coverage by 13 per cent and 62 per cent in Dubti and Mille woredas, respectively.

UNICEF equity-focused immunization interventions in Ethiopia

UNICEF is a key partner supporting the immunization programme at all levels and in almost all regions. It provides technical and financial support to strengthen health systems; build the health workforce capacity; procure the national vaccine supply; engage in the vaccine logistic system and demand promotion (advocacy and social mobilization); and support

micro-planning, monitoring and evaluation, data quality and evidence generation activities. UNICEF is highly engaged in immunization equity efforts and is the main financial and technical partner of the EPI in its works towards reducing vaccine inequity. It supports the efforts to increase immunization coverage to children in least privileged and underserved areas. The equity-focused immunization strategies and interventions implemented or supported by UNICEF are summarized in Table 21 below^{28 30-34}.

Table 21: UNICEF equity-focused immunization interventions in Ethiopia

Pro-equity support / intervention areas	Implementation experience of pro-equity support or interventions (description, context and successes)
Strengthening zero-dose mapping and micro-planning	UNICEF supports the immunization programme efforts to reach zero-dose children in 14 zones of Amhara, Oromia, Sidama and SNNP regions. Both technical and financial support is provided to zones, woredas and health facilities. It participates in the process of identifying zero-dose children and underserved communities and equity micro-plan development. A total of 266 woredas, 1,119 health centres, and 5,196 health posts were supported by UNICEF between 2018 and 2022.
Building the capacity of immunization service providers in underserved areas	UNICEF considers capacity building as one of the key priority areas to improve immunization service access and equity. UNICEF provides intensive training and subsequent mentoring for health care providers from health facilities with no immunization services and health workers without EPI-related on-job training in targeted areas. The training and mentorship components targeted include micro-planning, data tools and data quality, community engagement, maintenance of vaccine storage equipment, among others.
Cold chain equipment installation, maintenance and inventory	UNICEF provides financial, technical and logistical support; deploys technical assistants and mobilizes biomedical technicians to conduct refrigerator inventories and maintain installations. These efforts ensure that health facilities can begin immunization services, sustain ongoing service provision and resume any interrupted services in supported areas. Effective and equitable immunization cannot be achieved without strong cold chain systems which is crucial to ensure the availability of potent vaccines across the immunization delivery points.

Expanding static and outreach immunization services, including PIRI	UNICEF supports the start and resumption of interrupted immunization services in health facilities that do not provide immunization due to various reasons, such as security, lack of refrigerators, shortage of health workers and lack of vaccine supplies. In 2022 alone, UNICEF helped the start of immunization services in two hospitals, 39 health centres and 27 health posts in 14 zones through deployment and training of additional health workers, and maintenance of broken or installation of new refrigerators. Besides the start of static services in health facilities, about 1,439 outreach sites were opened in 14 implementation zones of Amhara, Oromia, Sidama and SNNP regions in the same year. Moreover, UNICEF supports the provision of integrated periodic outreach service as a package of services with other MCH services to ensure equity and improve performances in hard-to-reach and conflict-affected areas. For example, an integrated periodic outreach service was implemented to supplement and ensure continuity of RI services in four woredas of Amhara Region. On the other hand, UNICEF supported the development of different pro-equity strategies and guidelines, for example, the development of the catch-up guideline. The translation of equity guidelines into Oromiffa was also supported by UNICEF so that HEWs and community leaders could develop micro-planning in their language.
Community engagement, social mobilization and advocacy	UNICEF provides financial support and deploys technical assistants to support community engagement, mobilization and advocacy to communicate, overcome obstacles, create demand, mobilize for immunization services and identify zero-dose cases through existing community structures, such as women development army groups and integrating with other campaigns such as measles and COVID-19 SIAs. UNICEF also organizes advocacy meetings at regional, zonal and woreda levels and transmits vaccination key messages through mainstream channels (e.g. TV and radio), social media (e.g., Facebook and Telegram...), particularly during SIA campaigns, including polio, measles and COVID-19.
Integration of RI in SIAs	Interruption of immunization services has been common in recent years in many parts of the country due to conflicts and COVID-19 pandemic. So, the delivery of immunization sessions as per schedules remains difficult and the numbers of zero-dose children were shown to increase in affected areas. In response to this, UNICEF supports the integration of RI with other SIAs. Identification and linkage of zero-dose children was integrated with the nationwide measles SIA in 2022 when a total of 44,638 zero-dose children were identified and vaccinated in 14 zones of Amhara, Oromia, Sidama and SNNP regions.
Evidence generation for monitoring and evaluation of immunization equity	UNICEF provides support through periodic desk review, DHIS2 data analysis, for example, coverage for Penta 1, Penta 3, MCV 1, full immunization to determine access and estimate the number of zero-dose children at zonal, woreda and health facility levels. It also conducts rapid community household surveys to trace zero-dose children and enumeration of target children with HEWs and community members in some kebeles/villages to inform monitoring and evaluation efforts. UNICEF also engages in data triangulation activities to ensure the use of the most appropriate data sources for decision making at all levels.

Challenges and gaps in implementation of pro-equity interventions in Ethiopia

The progress towards immunization targets and the implementation of various strategies and interventions aiming to improve universal access, quality and use of immunization services has been hindered by multifaceted challenges. The key challenges in the immunization programme and the implementation of equity-focused interventions in Ethiopia are summarized as follows:

1) Constraints in communication and advocacy: The development and implementation of tailored communication and advocacy interventions to generate demand is limited in the needy underserved communities with higher proportion of zero-dose children. This includes:

- a) poor implementation of social behavioural change communication (SBCC) and community mobilization strategies activities;
- b) limited use of community structures for immunization communications, including health developments armies, HEWs' house-to-house visit, and community forums;
- c) lack of audiovisual aids for SBCC efforts;
- d) Under-use of family folders for target identification and defaulter tracing; and
- e) Limited engagement of CSOs in addressing vaccine hesitancy and enhancing demand for immunization.

2) Logistical system: Despite the last-mile strategy to directly deliver vaccines, many districts and health facilities remain inaccessible to EPSS. There are multiple challenges related to vaccine supply at district and health facility levels, including:

- a) Frequent refrigerator failures and lack of rapid maintenance capacities due to shortage of spare parts and skilled technicians;

- b) Limited resources to transport vaccines to health facilities and limited cold storage capacity at lower levels or health posts in hard-to-reach and remote areas;

- c) Stockouts due to interrupted requisition, vaccine wastage and interruption of vaccine supplies due to political instability that hinder mobility and transportation; and

- d) Shortage of power supply (kerosene).

3) Suboptimal monitoring and evaluation:

- a) Micro-planning is not being done in many settings due to lack of attention, workload, lack of resources and lack of reliable target population denominator for planning. In the settings with micro-planning practice, the conversion factor is used to estimate target children for the catchment areas instead of headcount.

- b) There is limited use of GPS/GIS geocoding for locating services delivery points and identifying and locating zero-dose communities.

- c) There is lack of data disaggregated by strategies (static, outreach and mobile), session interruption and quality monitoring practices.

- d) There is limited and inconsistent use of data quality tools and practices.

- e) There is weak and irregular supportive supervision and leadership for lower levels

4) Service delivery: Programme reviews and evaluation studies have identified multiple challenges related to vaccination delivery strategies. The major ones are:

- a) interruption of static sessions according to fixed schedules due to different reasons such as closure of health posts, supply and cold chain gaps, frequent campaign activities;

- b) static services not being available on daily basis as providers fear of wasting multi-dose vaccines due to low client flow;

- c) mass destruction of health facilities in

- conflict-affected areas and regions;
- d) overcrowding at health facilities leading to client dissatisfaction and poor geographical distribution of health centres in urban areas;
 - e) many hard-to-reach areas remaining unreached;
 - f) most hospitals assuming that EPI is the duty of health posts and health centres, resulting in missed opportunity to vaccinate birth-doses to newborns;
 - g) static immunization not being adequately integrated with other maternal and child health services, resulting in high missed opportunities;
 - h) low engagement of private facilities in routine immunization except few facilities in urban settings;
 - i) irregular outreach services due to operational budget shortages, lack of vehicles/fuel, overtasked and demotivated HEWs and health workers and limited use of health development army networks;
 - j) irregular mobile services in remote areas due to resource shortages, limited team capacity, irregular deployment, large catchment areas, competing priorities (e.g., nutrition, emergency response), lack of local ownership and high costs for regions and districts;
 - k) SIA campaigns being limited to polio and measles vaccinations and campaigns organized centrally on semi-annual basis or during special events such as African vaccination week; and
 - l) challenges in SIA campaigns due to low provider motivation, insufficient per diems, budget and time constraints, vehicle shortages in remote areas, caregiver unavailability in urban settings and security concerns.
- 5) Human resources:**
- a) shortage of EPI staffing at all levels, including HEWs;
 - b) lack of a system to recognize well performing health workers;
 - c) unavailability of health workers at workstation during working hours due to weak control mechanism;
 - d) high staff turnover especially in remote and conflict-affected areas;
 - e) skill gaps for mainly junior workers;
 - f) overload of HEWs with increasing service packages, repeated campaigns and other engagements;
 - g) absence of male HEWs in hard-to-reach and remote settings; and
 - h) shortage of biomedical technicians.
- 6) Immunization financing:** Immunization is largely donor-dependent with reasonable government funding which affects sustainability of activities.
- a) Operational costs during immunization activities are mostly funded by partners.
 - b) Shortage of budget is frequently reported as a major barrier of implementation of immunization services in many areas.
- 7) Information system:**
- a) limited data quality and assurance mechanisms and lack of source documents;
 - b) limited staff skills in data management;
 - c) limited data use culture and triangulation practices;
 - d) use of faulty population conversion factors instead of headcount; and
 - e) lack of ownership of certain system and platforms when projects phase out; for example, mBrana developed for supply data is currently not functional because the programme that introduced the initiative has phased out.

8) Leadership and governance:

- a) high shortage of human resources in number and quality at all levels of the EPI structure;
- b) priority focus to contemporary and highly donor-support agendas, e.g., previous priority attention given to “model-household” initiative and recently shifted to CBHI;
- c) ongoing political instability in the country, leading to declining commitment of the government to implement health programmes;
- d) low-level health officials attributing challenges, such as underachievement, to lack of partners, budget, or resources (e.g., vehicles), and blaming VPD outbreaks on vaccine inefficacy, drought, or imported cases; and

- e) administrative instability due to dissolution and formation of districts, and turnover of political leaders.

The SWOT analysis of pro-equity interventions in Ethiopia

The strengths, weakness, opportunities and threats (SWOT) of the EPI are summarized in tables 22 and 23 according to the health system building blocks and process-based EPI interventions. The domains include service delivery, human resources for health, supply chain management, SBCC and community mobilization, programme planning, monitoring and evaluation, health information system and data quality, surveillance of vaccine preventable diseases, governance and leadership, and partnerships.

Table 22: Strengths and weakness of EPI in improving immunization equity in Ethiopia

Component	Strengths	Weakness
Human resource	- Trained HEWs on RI including SBCC - Engagement of male HEWs in pastoralist and hard-to-reach areas - Increasing availability of biomedical technicians	- Shortage and demotivation of HEWs - Lack of adequate incentive mechanisms for implementing outreach, community mobilization and other routine activities - Skill gaps (fresh HEWs and health workers) - High staff turnover and lack of effective staff retention mechanism
Immunization service delivery	- Multiple vaccination service delivery modalities (static, outreach, and mobile services) - PIRI- and SIAs campaigns in hard-to-reach areas - Provision of vaccination services to refugees and IDPs through statistic, outreach and supplementary campaigns - Availability of guidelines for equity-focused service delivery strategies, e.g., catch vaccination	- Frequent campaigns compromise delivery of RI services - Weak integration of vaccination in mobile outreach health services in pastoralist settings - Inadequate support and resources for mobile and outreach sessions - Weak horizontal integration of vaccination with other MCH and nutrition services - Irregularity of static sessions and unavailability on daily basis - Irregular outreach schedules - Weak private engagement - Weak engagement of hospitals - Non-functional health facilities, including health posts in certain remote and conflict-affected areas and regions - Lack of specific strategy to disadvantaged urban communities such as homeless and slums - High burden in urban health facilities leading to long waiting and client dissatisfaction
Communication, social mobilization and advocacy	- Use of local mainstream media (TV, radio) to promote immunization in regions - Translation of SBCC materials into local languages - Engagement of community leaders and civil administration in vaccination advocacy in some regions	- Lack of well-designed and diverse SBCC interventions - Lack of budget and resources for SBCC and community mobilization activities - HEWs and health workers frequently fail to provide information on benefits and side effects of vaccination to caregivers - Low engagement of HEWs in community mobilization activities due to demotivation and workload - Declining use of HDA for community mobilization activities - Low use of community forums

Vaccine supply and cold chain management	▪ The “last mile” direct delivery to health facilities ▪ Mass distribution of solar refrigerators ▪ Implementation of EVM system ▪ Fridge Tag system for temperature monitoring ▪ Availability of digital supply management technologies such as mBran ▪ Decentralization of high vaccine storage facilities at regional EPSS hubs	▪ Many health facilities are inaccessible to EPSS ▪ Failure to timely refrigerator maintenance due to shortage of spare parts or technicians’ skill gaps ▪ Unavailability of refrigerators in many health posts (HPs) ▪ Poor vaccine demand estimation and stock management ▪ Interruption of vaccine supply at national level ▪ High vaccine wastage and lack of monitoring system ▪ Lack of refrigerated tracks for distributing vaccines ▪ Failure to sustain mBran for supply management and tracking
Monitoring and evaluation	▪ Presence of technical working groups at higher levels, performance monitoring teams and quality improvement teams at facility levels for supporting planning, monitoring and evaluation activities ▪ Community engagement in planning, identifying and mapping zero-dose in regions where RED-QI was implemented	▪ Low use of micro-planning and inadequate implementation of bottom-up planning approach ▪ Use of conversion factors instead of headcount resulting in lack of precise denominator or for planning, monitoring and evaluation ▪ Irregularity of review meetings ▪ Weak and sporadic supportive supervision and feedback
Immunization information system, data quality and use for decision making	▪ Use of the digital District Health Information System-2 (DHIS-2) for immunization programme ▪ The expansion of community health information system (i.e. eCHIS)	▪ Gaps in data quality, including false reporting problems ▪ Low value given for data and sub-optimal use for decision making mainly at lower levels ▪ Absence of disaggregated data collection and analysis by sex, immunization session ▪ Lack of data triangulation system ▪ Failure to sustain data quality initiative due to resources and lack of ownership, for example, mBran for supply side data collection and reporting
Surveillance of VPDs for monitoring immunization programme	▪ Presence of public health emergency surveillance structures at national and regional levels ▪ Availability of guidelines to monitor VPDs and guide responses action including immunization ▪ Availability of lab facilities for surveillance of VPDs	▪ Weak PHEM system in developing regions ▪ Inadequate workforce at district and health facilities levels ▪ Giving more attention to outbreak control than prevention interventions such as immunization ▪ Delayed responses due to resource constraints or coordination gaps

Leadership and governance	- High leadership commitment and attention to zero-dose cases - Improved attention to data quality issues and use	- Poor management and distribution of health workers - Competing priority of officials - Inadequate commitment to sustain programmes initiated by partners - Deflection of problems instead of seeking local innovative solutions - Priority given to current hot agendas that shift attention from regular programme
Partners' role	- High government commitment to work with partners - High engagement of partners in immunization programme through participation in taskforces or technical working groups - Increasing support of partners in service delivery and cold chain system	- Shortage of budget for operational activities and high dependency of programme activities on partners - Weak exit strategies to ensure sustainability of partner-initiated activities after project phase-outs - Inequitable distribution of partners across regions and districts- more concentrated in major regions.

Table 23: Opportunities and threats for EPI in improving immunization equity in Ethiopia

Opportunities	Threats
- Increasing attention to immunization and vaccine equity - The optimization of the health extension programme initiative - Increasing involvement of partners in a wide range of activities financial and technical support, vaccine logistic system and capacity building - Increasing availability of digital technologies (e.g., Fridge Tag system, mBrana programme) to support the vaccine logistics - No major community-level resistance to routine vaccines - No gender difference in vaccination uptake - The community gives equal vaccination access to boys and girls - Expansion of digital technologies, e.g., eCHIS will improve micro-planning and monitoring of immunization services, identifying and finding zero-dose cases and tracing defaulters	- Ongoing armed conflicts and political instability cause destruction of health facilities, interruption of basic health services including immunization, hindrance of logistic system, overwhelming IDPs - Learning from the experience of COVID-19 pandemic which distorted the health service delivery and vaccine logistic system, any potential pandemics in future remain a threat to immunization programme - High donor dependence - Disintegration of the social networks including health development army - Poor accessibility of electricity and mobile network services in remote areas may impede the implementation of digital technologies - Lack of precise denominator for micro-planning, expansion of eCHIS may solve this challenge - Frequent droughts in semi-arid areas (Afar, Somali, Oromia and others) are causing displacements that make service delivery in pastoralist areas difficult - Poor road infrastructure, topographic challenges, and scattered settlement in hard-to-reach areas - Transhumance mobility of pastoralists - Low immunization literacy in the general population particularly in rural areas

Opportunities	Threats
	▪ Low women empowerment in social and economic terms as vaccination is mainly the role of mothers ▪ Cultural norms that limit the movement of women in the postpartum period in certain regions ▪ Open vial policy for BCG or measles may affect service dissatisfaction ▪ Cross-border community movement and no integration of immunization programme across neighbouring countries ▪ High cross-border mobility of refugees and growing population in refugee camps

Good practices and lessons learnt

- 1) Improved vaccine cold chain system:** The provision of vaccine refrigerators at health posts by mass distribution of SDD refrigerators has substantially improved cold chain management system over the last few years in hard-to-reach area where health posts have no or limited access to electricity. The training and deployment of biomedical technicians has improved refrigerator maintenance activities. Moreover, the rollout of effective management system has also contributed positively to improvements in vaccine cold chain systems.
- 2) Last mile/direct delivery strategy:** This has substantially improved the vaccine logistic system in the country, including the hard-to-reach areas. This, coupled with mass distribution of SDD refrigerators, and the rollout of the effective vaccine management system have shown to be effective initiatives for improving the vaccine logistic and cold chain systems in the country. The impacts need to be more equitable since there are still many districts and health facilities that remain inaccessible to EPSS.
- 3) Digital community health information system:** eCHIS has created an opportunity to alleviate the ever-existing challenge of population denominator to implement micro-planning. Hence, the eCHIS system

should be strengthened and expanded to all districts of the country.

- 4) The use of data triangulation tools:** It is a tool to triangulate vaccine supply and vaccine service delivery data obtained through different routine health information systems (i.e., mBrana for vaccine supply and DHIS2 for service delivery data) in some regions, including SNNP and Benishangule-Gumuz regions. However, the mBrana is not currently in use due to lack of ownership after the project that introduced it phased out.
- 5) Monitoring of immunization performance:** The use of REC/D prioritization tools has helped to identify priority woredas and health facilities for targeted support in certain regions of the country.
- 6) Service integration:** The integration of catch-up immunization with COVID-19 vaccination and measles SIAs campaigns, has helped to reach out to many zero-dose and defaulter children. Moreover, the integration of outreach immunization with nutritional services, such as iron and folic acid supplementation, has also shown to improve immunization service uptake in hard-to-reach areas such as the Afar Region.
- 7) The RED-QI strategy:** It was shown to be effective in improving planning of immunization sessions, improving quality

of services and data, improving decision making at all levels and community engagement, and increasing equity of service provision through adaptive and context-based actions and activities in underserved and high zero-dose communities.

Recommendations for Ethiopia

- 1) To address vaccine inequity and improve immunization programme performance in pastoralist populations and developing regions, tailored strategies and interventions are essential. Expanding the mobile outreach strategy is critical and should involve integrating immunization services into the activities of existing mobile health and nutrition teams as well as mobile clinics in pastoralist areas. This strategy should be nationally standardized to enhance integration, planning, logistics and mobile cold chain management. Additionally, integrating routine immunization (RI) services with supplementary immunization activities (SIAs), such as measles and polio campaigns, offers a valuable opportunity to reach missed children and vaccinate zero-dose children in these regions.
- 2) Health posts in pastoralist areas should be supported to provide static and outreach vaccination services through increasing availability of SDD refrigerators and building the capacity of HEWs. Considering the climate and geographical hardships in these areas, deployment of male HEWs will be meaningful for improved EPI performance.
- 3) Catch-up vaccination and hit-and-run approaches should be strengthened in conflict-affected areas and IDPS sites.
- 4) Establishing and strengthening mobile vaccination services in conflict-affected and remote areas across major regions is crucial. Additionally, integrating immunization services with humanitarian activities, such as food aid, outbreak response, and psychosocial interventions for internally displaced persons (IDPs) and refugees, can enhance access and coverage in these vulnerable populations.
- 5) It is beneficial to engage community, private and civil society health facilities in EPI and demand generation and service delivery. Refrigerator supply to private facilities will improve the engagement of private facilities in immunization services.
- 6) Male health extension workers in geographical challenging and hard-to-reach areas will also be helpful to address immunization inequity.
- 7) Capacity building activities to district and health facilities with low immunization coverage and high zero-dose children will enable the design of context-specific innovative strategies in hard-to-reach and remote settings.
- 8) Meaningful career development opportunities, financial and other incentives should be used as a key strategy to turn down the increasing demotivation of HEWs. Hardship benefits need also be considered for HEWs in remote areas across all regions. This should also cover incentives and recognitions for health development armies. Performance-based incentives as a recognition of outstanding health development army members, including financial, training, and appraisal system should be in place to ensure continued contribution of community volunteers in EPI activities.
- 9) The engagement of hospitals in immunization services should be strengthened at least for birth-dose vaccinations and linkage to PHCU as most deliveries happen in hospitals.
- 10) eCHIS implementation should be expanded and strengthened. This will improve micro-planning implementation and effectively identify zero-dose and under-vaccinated children across all areas, including remote and hard-to-reach areas.

- 11) Strategies such as capacity building, resource mobilization and political engagement should be in place to tackle the persistent health system challenges such as high staff attrition, funding shortfalls and weak accountability at higher levels.
- 12) Data quality issues: Data quality and triangulation tools should be prioritized for improved use of data for planning, monitoring and evaluation of immunization programme at all levels of the health system.

ANNEXES: 3
COUNTRY CASE STUDIES

MOZAMBIQUE

Zero-Dose and Equity Agenda



Annex 3: Mozambique: Zero-dose and equity agenda

Country context

Mozambique is in the southeastern strip of the African continent. It covers a surface area of 786,380 km². It is thus one of the largest countries in Africa and the 36th biggest in the world. The country possesses the third longest coastline on the Indian Ocean covering a total distance of 2,470 km. It is bordered to the north by Tanzania, to the east by the Mozambique Channel, which separates it from the island of Madagascar, to the south and southwest by South Africa and Swaziland, to the west by Zimbabwe, and to the northwest by Zambia, Malawi and Lake Nyasa. The country's area is subdivided into 10 provinces ³⁵. As of 2023, Mozambique's population stood at around 34 million, of which 51.4 per cent are female. The population is also young with 45 per cent between 0-14 years, with an urbanization rate of approximately 39 per cent, and 62.4 per cent of the total population living in rural areas. About one third of the total population is in coastal cities and towns ³⁶.

The country is considered one of the poorest countries and most underdeveloped countries in the world and the 7th poorest in Africa with a GDP per capita of USD 491.8 (2021), a total GDP of USD 15.78 billion (2021), and an annual GDP growth of 2.4 per cent (2021). Approximately 70 percent of the population live below the poverty line³⁶.

The Mozambican health system operates in a decentralized manner, with the MOH or the public sector which is the National Health System (NHS), is the main provider of health services nationwide. At central level, it plays the stewardship role in defining policies, developing strategic plans, resource mobilization and allocation as well as developing cooperation relations ³⁷. The health system is composed of the public sector, the private for-profit, and the non-for-profit

private sector. The public health sector comprises four levels, namely: primary (urban and rural health centres), secondary (general, rural and district hospitals), tertiary (hospitals of the provincial capitals) and quaternary (central and specialized hospitals). The private sector comprises the private not-for-profit (PNFP) health services providers – mainly CSOs with strong ties to the public sector – and private for-profit (PFP) providers that are few and almost exclusively in urban areas. Through the decentralization policy of government, districts have become the administrative and implementation units for the provision of the public sector services, including health, in Mozambique. Service providers at the community level partially cover some basic health needs where there are no NHS facilities. Traditional healers remain the main practitioners outside the health system. The national health policy is based on the principles of primary health care (PHC), equity and provision of quality services to the population. The focus on PHC implies that services are provided at the primary level in an integrated manner ³⁷.

Overview of immunization programme in Mozambique

The national immunization programme of Mozambique operates under the guidance of the MOH and is executed through the EPI. Within the MOH, the EPI functions as a unit housed within the Department of Health Promotion, which falls under the National Directorate for Health Promotion and Disease Control. At the central level, this unit is responsible for establishing policies, setting standards and priorities, enhancing capacity, coordinating initiatives with collaborating partners, securing resources and procuring vaccines and injection safety materials in collaboration with the Centre for Pharmaceuticals and Medical Supplies (CMAM). It also undertakes monitoring activities and extends technical assistance to all provinces.

The provinces, in turn, are tasked with capacity building, monitoring, supervision, and providing technical support to the districts. The districts and their associated health facilities bear the responsibility for planning, managing and delivering EPI services. At the district level, immunization is integrated in PHC and is seamlessly woven into child survival initiatives. Various community stakeholders play a pivotal role in mobilizing community members to ensure children are brought in for immunization.

The EPI is operationalized through a network of health facilities comprising hospitals, health centres and outreach clinics, and facilitates the distribution of vaccines to communities nationwide. This network is instrumental in adhering to international standards for the storage, transportation and administration of vaccines, thereby safeguarding their efficacy and safety ³⁸. The EPI units in Mozambique are responsible for coordinating immunization activities nationwide. These units oversee vaccine procurement, distribution and delivery, as well as monitoring and evaluation of immunization coverage. They also provide training and support to health care workers involved in immunization activities, ensuring the quality and consistency of services

^{38 39}

Status and trends in immunization and immunization inequity

The highest number of under-vaccinated children, 77,792, was reported in 2013. This figure significantly dropped in 2014 to 48,583, marking a decrease of over 29,200 children. However, the number rose slightly to 49,592 in 2015 before beginning a steady decline over the next three years (2016–2018), reaching 31,867 in 2018, a reduction of 17,700 compared to 2015. In 2019, the numbers began to rise again, culminating in a sharp increase in 2020 with an additional 12,300 children compared to 2018, and a further surge in 2021, when the figure rose by 35,600 from 2018. By 2022, the total number of under-vaccinated children had grown to 68,479, reflecting a slight increase from the previous year.

In contrast, the trend for zero-dose children showed minimal variation in the first three years (2013–2015), with the lowest numbers reported during this period, remaining below 70,000. The first notable increase occurred between 2015 and 2016, with an additional 11,700 zero-dose children. The numbers then rose consistently over the next three years (2017–2019), reaching 97,446 in 2020, an increase of over 16,200 compared to 2016. A dramatic surge was recorded in 2020, with the figure leaping to 187,708, an increase of 90,200 children (8 per cent) from 2019. This upward trend continued in 2021, with a total of 371,514 zero-dose children, reflecting an increase of over 129,800 (16 per cent) compared to 2020 and 274,000 (24 percent) compared to 2019. By 2022, the number had risen slightly again to 376,639, representing an additional 5,125 children from 2021.

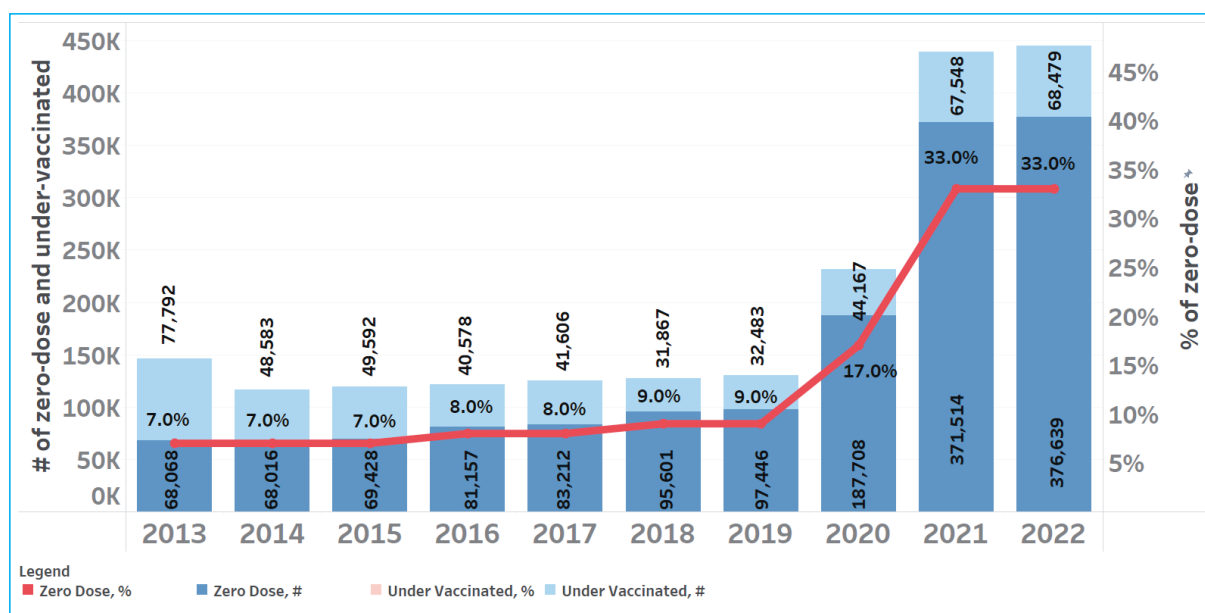


Figure 32: Trend of numbers and rates of zero-dose and under-vaccinated children, Mozambique, 2013–2022 (Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates)

For eight consecutive years (2013–2020), the country had high BCG coverage above the global target of 90 per cent coverage. In 2013, the coverage was 93 per cent, and then after 1 PP increment in 2014, it was stable until 2017 with 94 per cent coverage. Again, it dropped back to 93 per cent in 2018 and remained the same in 2019. The coverage further dropped to 91 per cent in 2020. The first dramatic drop (79 per cent) was observed in 2021 and 2022 with a negative 12 per cent variation compared with 2020.

Similarly, Penta-1 coverage exceeded the 90 per cent target during the first seven years, from 2013 to 2019. However, the overall trend showed a gradual decline, dropping from a peak of 93 per cent in 2013 to a low of 67 per cent in 2021 and 2022, a decrease of 26 PP. The coverage remained stable at 93 per cent for three consecutive years (2013–2015), and then slightly decreased to 92 per cent for two years (2016–2017), and to 91 per cent for another two years (2018–2019). A significant drop occurred in 2020, with coverage falling to 83 per cent, an 8-PP decrease from 2019. This downward trend continued, with coverage plunging further to 67 per cent in both 2021 and 2022, reflecting a sharp decline of 16 PP compared to 2019.

Likewise, the Penta-3 coverage increased from 85 per cent in 2013 to 88 per cent in 2014. For six consecutive years (2014–2019), the coverage remained the same; and then it significantly dropped to 79 per cent in 2020 with 9 PP difference compared to the 2019 rate. Again, it considerably declined to 61 per cent in 2021 and 2022 with 18 and 27 PP drops when compared to the 2020 and 2019 rates, respectively.

On the contrary, the first MCV dose coverage was 86 per cent in 2013; and increased to 87 per cent in 2014 and continued at the same rate for six consecutive years (2014–2019). The coverage dropped to 81 per cent in 2020 with a 6-PP decrease compared to 2019. Again, it rose to 84 per cent in 2021 and 2022 with 3 PP increase compared to 2020.

Overall, the 10 years mean average of BCG, Penta-1, Penta-3, and MCV-1 was 90.4 per cent, 86.2 per cent, 81.4 per cent and 85.7 per cent, respectively.

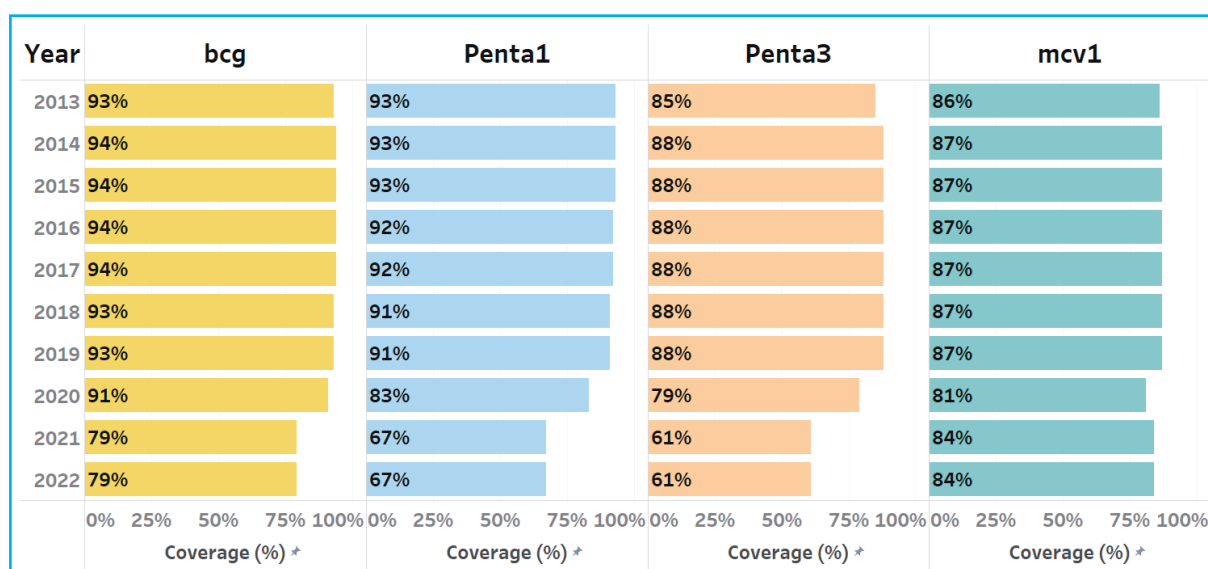


Figure 33: Vaccination coverage trends in selected antigens, Mozambique, 2013–2022 (Data Source: WUENIC)

In terms of data quality, the penta-3 coverage with wuenic data was significantly lower than what was reported with the administrative data. There was no perfect match between the two data sources. Relatively in the 10-year period, the congruence was better between 2013 and 2017, with differences of 6 to 12 per cent. From 2018 to 2022, the congruence deteriorated with a maximum range of 30 per cent difference in 2019.

The dropout rates were below 10 per cent for the whole period. The maximum dropout rates of 9 per cent were recorded in 2013, 2021 and 2022. The lowest rate of 3 per cent was recorded in 2018 and 2019.

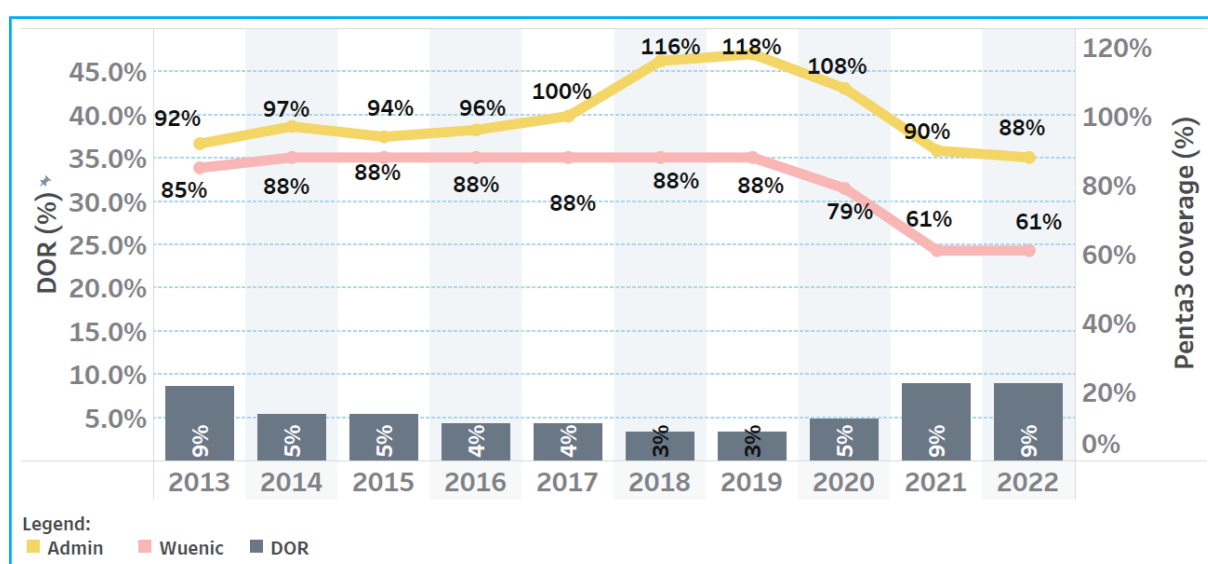


Figure 34: Trends in DPT-1 to DPT-3 dropout rate, and comparison between DPT-3 administrative coverage and WUENIC estimates, Mozambique, 2013–2022 (Data Source: WUENIC)

Immunization inequity in Mozambique

The overall concentration index for the multivariate equity measure from DHS 2015 was 0.519 with an AEG of 0.106 for zero-dose status. The zero-dose rate among the most disadvantaged 20 per cent of the population would need to decrease by approximately 10.6 PP to reach levels of the most advantaged 20 per cent.

Vertical inequity as manifested by household wealth (30.4 per cent) and maternal education (19.5 per cent) is the most important determinant for the zero-dose inequities in Mozambique. Horizontal inequity (districts 12.5 per cent and urban/rural place of residence 9.4 per cent) is also an important determinant of inequity which accounts for more than 21.9 per cent of the variation in zero-dose inequity in Mozambique. The sex of the child had no noticeable contribution for the zero-dose inequity in Mozambique (see *Figure 35*).

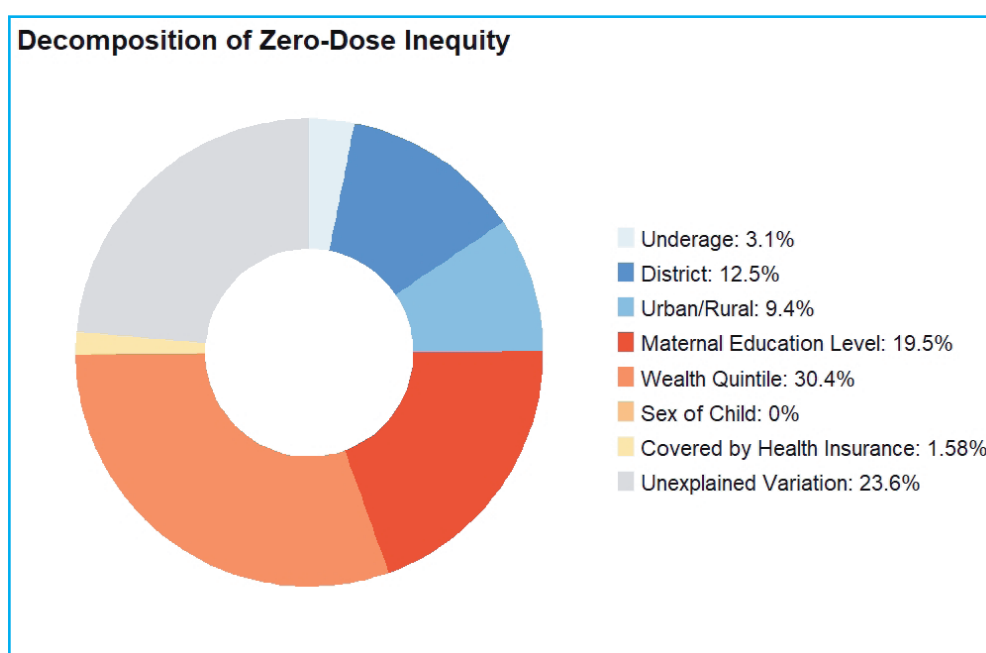


Figure 35: Decomposition of Zero-dose inequity in Mozambique, DHS 2015

Zero dose and inequities in Mozambique

Inhambane Province had the lowest zero-dose rate and lowest zero-dose inequity. On the contrary, Zambezia Province had the highest zero-dose rate while Niassa Province had the highest zero-dose inequity (see *Figure 36*).

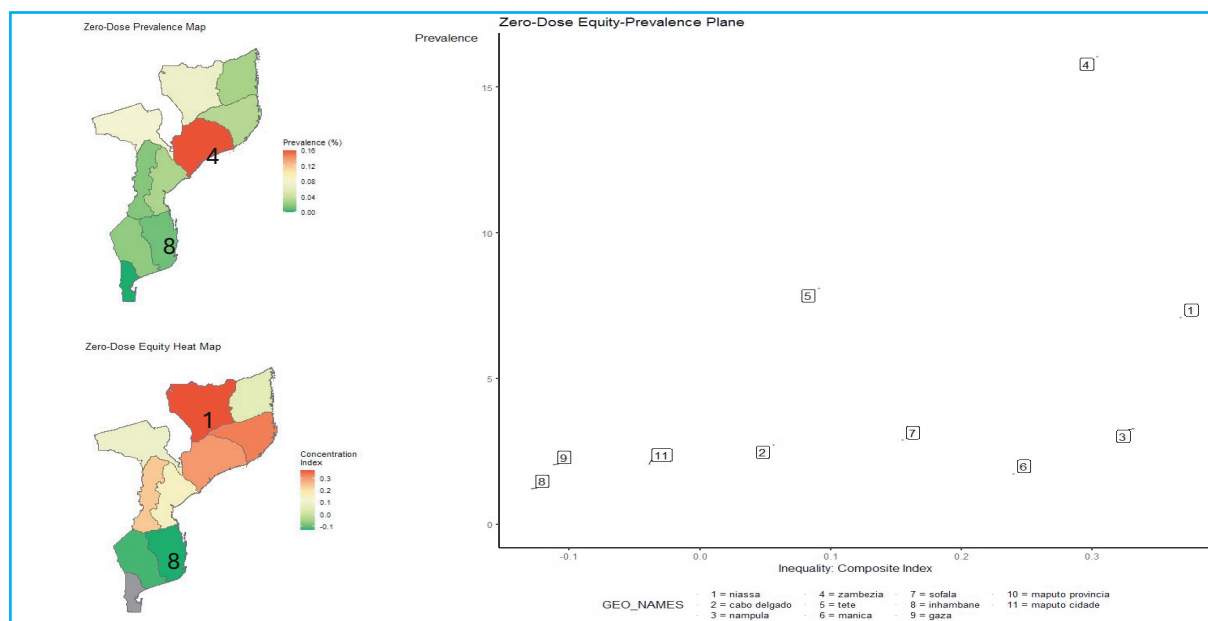


Figure 36: Mozambique zero-dose rate and zero-dose inequalities by region

Underlying factors

The findings from qualitative synthesis of peer-reviewed and gray literature are summarized as follows:

1) Demand-related barriers or challenges:

- a) Lack of education and awareness about the importance of vaccines contribute to lower demand for immunization services ⁴⁰.
- b) Concern about side effects leads to hesitancy. Some caregivers raised concern about the side effects such as swelling at the injection site or fever ⁴¹.
- c) Perceived poor quality of health services reduces caregivers' trust in the health system. Some caregivers were dissatisfied with their experiences at the service delivery point due to vaccine stockouts, long waiting times and inconsistent health facility hours.
- d) In the health facility setting, power dynamics deter caregivers from seeking and advocating for vaccination services ³⁸.
- i. Caregivers express hesitancy due to fear of reprimand from health workers, particularly if they arrive out of schedule, fail to bathe

their child before the visit, or forget to bring their vaccination card.

- ii. This fear is worsened for caregivers of low socio-economic status, who often experience disrespectful treatment from health workers and are unfairly blamed for not vaccinating their children.
- iii. These caregivers also report feelings of shame, especially if they are not appropriately dressed.
- e) Caregivers of zero-dose children feel excluded, leading to avoidance of vaccination services. Instances of blame or disrespect at the vaccination facility further discourage caregivers from returning ⁴²
- f) The literature has also highlighted that the absence of vaccines on vaccination days breeds mistrust among caregivers, impacting their perception of service quality and consequently, dampening their motivation to vaccinate their children.

2) Supply-related barriers or challenges:

- a) From the literature review, it was observed that challenges such as delays in shipments due to custom clearances, limited storage capacities, and obstacles in delivering vaccines to remote areas were prominent.

b) The immunization supply chain in Mozambique faces various challenges, including stockouts of vaccines and essential supplies, inadequate infrastructure for storage and distribution and logistical issues in transporting vaccines to remote areas ⁴³.

c) Recurrent failures to maintain vaccine stocks undermine the programme's ability to maintain adequate coverage and improve equity ⁴⁴.

d) Evaluation of the EPI in rural Mozambique highlights challenges related to vaccine coverage, cold chain management and vaccine delivery to remote areas ⁴⁵.

3) **Health system and human resource-related barriers or challenges:**

a) Inadequate health care infrastructure, staffing shortages and limited resources are barriers to effective BCG vaccination coverage in rural Mozambique ⁴⁶.

b) Missed opportunities for vaccination in Mozambique are attributed to health care worker training and service delivery gaps ⁴⁷.

c) Data quality and capacity to manage and analyse data at the more peripheral levels influence the use of results to address coverage and equity challenge.

d) Many caregivers decided not to seek vaccination services because of the long, difficult or unsafe walks to health centres, distance to health facilities, poor roads and the high cost of public transport as well as long waiting time once there. This was worse among low-income women and those who were socially isolated.

e) Insufficient or poorly planned and managed immunization and PHC budgets.

f) Lack of person-centeredness or alignment of immunization programmes with client needs, particularly for caregivers and communities facing multiple intersecting vulnerabilities.

4) **Leadership, management and coordination challenges:**

a) Weaknesses in leadership, management and coordination within Mozambique's immunization programme pose significant obstacles to the effective planning, implementation and monitoring of vaccination activities. These persistent challenges have the potential to adversely affect both vaccine coverage and equity. Issues in leadership and management often lead to delays in the disbursement of funds and allocation of vaccines and other essential materials to peripheral levels of the health care system, further worsening the situation.

b) Sub-optimal health worker motivation and performance was an important barrier to vaccination, ranging from absenteeism that led to missed opportunities for vaccination, to disrespectful care and poor clinical quality of care.¹⁸

c) In Mozambique, national policies supporting integrated health services were sub-optimally implemented due to insufficient and fragmented finances stemming from weak governance.

5) **Socio-economic barriers:**

a) Poverty and limited access to health care services contribute to lower vaccination uptake among children in Mozambique. Families facing financial constraints prioritize other basic needs over health care, leading to delayed or missed immunizations. Poverty and other socio-economic factors such as lack of education and income disparities, creates barriers to accessing immunization services.

b) Overcrowded facilities and the loss of a day's wages for attending vaccination appointments present families with the difficult choice between vaccinating their children and meeting basic needs such as food. This dilemma is exemplified by a mother from Lugela District who must choose between tending to the farm for

income or ensuring her other children have sustenance. Similarly, fathers, as primary earners, face income loss or reduced food availability when taking time off from farming or fishing ⁴⁸.

- c) Birth order or greater family size contributed to changes in immunization coverage in Mozambique although the direction of impact varied. In Mozambique, children of a higher birth order or within families of three or more children had a greater risk of incomplete vaccination ⁴⁹.

6) **Geographical accessibility-related challenges:**

- a) Geographical isolation, inadequate transportation infrastructure and long distances to health care facilities pose significant challenges to accessing immunization services in rural and remote areas of Mozambique.
- b) Challenges in rural immunization coverage in Mozambique are attributed to geographical inaccessibility, including limited infrastructure and transportation networks.

7) **Gender-related barriers:**

- a) Gender-related barriers, including cultural norms, gender roles and inequalities in decision-making power influence childhood immunization inequality in Mozambique.
- b) Low levels of education, high maternal health risks, pressure to marry at a young age, limited economic prospects, gender-based violence and accepted patriarchal norms all place women at a high disadvantage.
 - i. Few girls finish primary school (46 per cent) or secondary school (22 per cent); and 56 per cent of women are illiterate (upwards of 70 per cent in rural areas).
 - ii. Mozambique has a high rate of child marriage, with almost one in every two girls aged 20–24 married or in a union before the age of 18. Early marriage and motherhood impact girls' skills, awareness

and decision making in all spheres of life, including their health and the health of their children.

- iii. Families tend to have many children, often closely spaced, and need to make frequent visits to the health facility for both routine care and illness.
- c) Social norms and limited family support place the burden of vaccination on the mother, compounding the challenges of accessing vaccination services:
 - i. Caregivers noted that given the long distances required to travel to receive vaccinations, lack of support from other family members was a major barrier to completing the vaccination schedule.
 - ii. Limited family support was in part due to community beliefs that vaccination responsibility resides with mothers and that fathers should not be involved in the process.

8) **Other barriers:**

Humanitarian crises in Mozambique, including poverty and displacement, pose barriers to accessing immunization services.

Immunization equity-focused interventions in Mozambique

The major pro-equity immunization strategies/ Interventions are identified and summarized in Table 24 below:

Table 24: pro-equity Immunization strategies/Interventions in Mozambique

Strategies/pro-equity interventions	Major assumptions, implementation experiences (challenges, successes...) and evidence on intervention effectiveness
Health system/Service use	
Reach Every District/Reach Every Community (RED/REC) strategy to high priority districts [39]	To address gaps in immunization services, the MOH and the EPI have prioritized introducing and scaling up the RED/REC strategy in high-priority districts across Mozambique. This strategy consists of five core components aimed at building national capacity from the facility and district levels upwards to ensure all children are fully immunized. It addresses common challenges in delivering immunization services, such as inadequate district planning, low-quality and unreliable services, and inequitable access. Key interventions under the RED/REC strategy include supporting health facility staff to identify and map underserved communities, developing and regularly updating micro-plans for health areas and districts, improving resource usage, and implementing integrated outreach services that combine immunization, nutrition, and family planning. These efforts aim to increase immunization coverage, especially in underserved areas. During the period 2019–2021, the number of districts and facilities implementing RED/REC grew significantly, leading to an increase in the number of children immunized through both fixed and outreach services 50. Lesson Learnt: The EPI continues to recognize the effectiveness of the RED/REC strategy. In 2021, 59 districts were designated as focal points for implementing RED/REC, including 25 per cent that were entirely new districts spanning additional provinces. These districts were selected due to their underperformance on key immunization indicators, such as a low number of health facilities providing RI services for every 10,000 residents. This decision reflects a clear understanding that meticulous planning and expanded outreach, central to the RED/REC approach, are essential for extending health service coverage and ensuring inclusive care for underserved communities.
Deploying Integrated Mobile Brigades (IMBs), (outreach teams)	The intervention involves the establishment of mobile brigades, also known as outreach teams, to enhance accessibility to various services, including immunization. These brigades operate on a quarterly basis and are tasked with delivering services to communities located more than 8 kilometres away from health facilities. Major assumptions of the intervention: Deploying mobile vaccination brigades will effectively improve access to immunization services, particularly for rural populations residing far from health care facilities. Targeting communities beyond the 8-kilometre radius will address disparities in vaccine access and contribute to achieving equitable immunization coverage across the country. Greater utility of mobile brigades in areas with high dispersion rates will facilitate increased immunization coverage, particularly in remote and hard-to-reach regions. Implementation experiences: <i>Successes:</i> ▪ The intervention has successfully extended immunization services to communities located beyond the 8-kilometre radius of health facilities, thereby improving access for rural populations.

	▪ The deployment of IMBs has been widespread, covering various districts across the region, including Angoche, Ilha de Moçambique, Meconta, Liupo, Mogovolas, Moma, Monapo and Mossuril. Through the operation of these brigades, a significant number of children under the age of five, totalling 13,182, have benefited from essential services, including health care and immunization. ▪ Mobile brigades have contributed to reaching approximately 65 per cent of the country's rural population, addressing disparities in vaccine access and coverage. ▪ In areas with higher dispersion rates, mobile brigades have significantly contributed to vaccination efforts, accounting for approximately 15 per cent of total immunization coverage. <i>Challenges:</i> ▪ Limited availability of mobile brigades poses a significant challenge to outreach efforts, particularly in rural areas where access to health care services is already constrained. ▪ Challenges related to transportation, fuel availability and incentives for outreach activities further hinder the effective functioning of mobile brigades, especially in peri-urban and remote areas. Evidence on intervention effectiveness: ▪ According to the Coverage and Equity Analysis for Immunization Program in Mozambique conducted by UNICEF in 2019, mobile brigades have played a critical role in increasing vaccine access and coverage, particularly in rural areas. ▪ Despite challenges identified in the literature review, the effectiveness of mobile brigades in reaching underserved populations is evident from their contribution to vaccination rates, especially in areas with higher dispersion rates.
Social mobilization campaigns	Social mobilization campaigns are implemented to raise awareness about the importance of immunization, increase demand for vaccines and encourage community participation. Social mobilization campaigns have been conducted through various channels, including mass media, community events and door-to-door outreach. These campaigns helped to minimize myths and misconceptions about vaccines, address cultural barriers and promote the benefits of immunization. Despite various challenges, social mobilization campaigns have been effective in increasing community acceptance of vaccination and generating demand for immunization services.
Social Norms	
Model Families Initiative approach: Promoting male engagement for integrated health practices	Major assumptions of the Model Families Initiative: The Model Families Initiative assumes that addressing multiple aspects of well-being such as health (immunization), hygiene, sanitation, education and protection practices simultaneously will lead to improved child health outcomes. Certifying families based on the adoption of established behavioural indicators, verified by Community Health Committees (CHCs), will incentivize active engagement and accountability for adhering to recommended practices.

	The initiative's emphasis on gender equity: By forming CHCs with a majority or equal ratio of females to males and encouraging male engagement in household responsibilities, traditional gender norms can be challenged, leading to more equitable distribution of tasks and improved health outcomes. Expecting key gender-related changes: ▪ Male engagement ▪ Joint decision making ▪ Sharing of household responsibilities Implementation experience in Mozambique: ▪ Challenges: Implementation of the Model Families Initiative in Mozambique has faced challenges such as limited resources, including funding and trained personnel, which have hindered the scale-up of the programme. Cultural barriers and entrenched gender norms have also posed challenges to promoting male engagement and challenging traditional gender roles within households. ▪ Successes: Despite challenges, there have been notable successes in implementing the initiative in Mozambique. CHCs have been effectively established, providing a platform for community engagement and decision making. Moreover, there have been instances of improved health-seeking behaviours among caregivers and children, indicating positive changes resulting from the initiative's integrated approach. Evidence on intervention effectiveness in Mozambique: ▪ Emerging evidence from Mozambique suggests that the Model Families Initiative has had positive impacts on child health outcomes. Studies have shown improvements in indicators, such as child immunization rates, hygiene practices and access to education and protection services among participating families. ▪ Family support of mothers is a strong enabler to overcoming many vaccination barriers
Health care Workforce for Immunization Services	A core assumption of this intervention is that deploying community health workers (APEs) will enhance access to immunization services, particularly in remote and underserved areas. Providing APEs with formalized training and clearly defined roles will lead to more effective delivery of primary health care services, including immunization. Community-based health workers can bridge the gap between health care facilities and communities, thereby improving vaccine uptake and coverage rates. Implementation experiences: <i>Successes:</i> ▪ The intervention has successfully leveraged existing community structures, such as APEs, to strengthen immunization services and reach marginalized populations. ▪ Through formalized training and support from government and non-governmental partners, APEs have been able to effectively deliver immunization services and provide essential health information to communities. ▪ Scaling up the programme across the country demonstrates a successful effort to institutionalize and expand community-based approaches to immunization.

	Challenges: - Ensuring consistent and sustained engagement of APEs, particularly in areas with high turnover rates or limited resources. - Overcoming logistical hurdles, such as transportation and communication barriers, pose challenges to the effective deployment of APEs. - Balancing the workload of APEs with other community health priorities and responsibilities. Evidence on intervention effectiveness: - Community health workers, such as APEs, can significantly contribute to improving immunization coverage and reducing disparities in access to health care services, especially in resource-constrained settings. - APE-led interventions result in increased immunization rates, decreased vaccine-preventable diseases, and improved health outcomes for children and mothers in rural and underserved areas.
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UNICEF equity-focused immunization interventions in Mozambique

UNICEF has historically played a vital role in supporting health interventions in Mozambique with a strong focus on improving equity in immunization. The support from UNICEF to Mozambique's immunization efforts is multi-faceted. The major areas of support are presented in Table 25 below:

Table 25: UNICEF Equity-Focused Immunization Interventions in Mozambique

Strategies/pro-equity interventions	Major assumptions, implementation experiences (challenges, successes...) and evidence of intervention effectiveness
Health system strengthening	With support from partners, UNICEF works closely with the Government of Mozambique to strengthen health systems, especially at the subnational level. UNICEF prioritizes: a) Digitalization of the RED/REC strategy in selected districts. UNICEF collaborated intensively with both national and subnational stakeholders to boost their capabilities in expanding digitalization and micro-planning efforts. Workshops at the national level were hosted for priority districts and major stakeholders to evaluate the implementation of the RED/REC strategy. Training sessions were organized for technicians from the MOH (MISAU as its equivalent acronym in Portuguese for Ministério da Saúde), the EPI and the Ministry of State Administration and Public Service, involving more than 30 EPI technicians. Training for EPI managers at the district and health facility levels was provided to equip them with the skills to use digital health maps for micro-planning activities in their respective health areas. b) Health system planning, delivery capacity and supply chain reinforcement, with the objective of creating health systems that are robust and efficient, leading to increasing coverage of services, with a community focus c) Expansion of immunization and Vitamin A supplementation services, with the objective of preventing vaccine-preventable diseases and the consequences of vitamin deficiency. d) UNICEF supported the MISAU to develop and implement an immunization recovery plan and a response strategy to ensure continuity of essential health services ⁵¹.

	e) UNICEF supported expansion of the cold chain system for effective vaccine management by installing 1,267 new refrigerators in health facilities nationwide. These enhanced routine immunization services and facilitated the introduction of HPV and COVID-19 vaccines. The RED strategy resulted in 94 per cent of children below one year being fully vaccinated ⁵². f) Major accomplishments include: ▪ Responding to a measles outbreak in Zambezia by supporting a vaccination campaign that reached over 1.1 million children; and ▪ Reaching nearly 3.8 million people with key lifesaving and behaviour change messages.
Capacity building	UNICEF supported training of health care workers and improving health care infrastructure in Mozambique, particularly in rural and hard-to-reach areas.
Supply chain and logistics	UNICEF supported in enhancing the procurement and distribution of vaccines, ensuring the maintenance of the cold chain.
Advocacy and policy development	UNICEF supported the MoH to develop inclusive health policies and programmes that prioritize equity.
Community engagement and education	UNICEF supported the Government of Mozambique in strengthening community engagement to raise awareness and enhance acceptability of immunizations, which entails understanding local beliefs and barriers to vaccine uptake.
Demand generation	Demand generation efforts for immunization services have been significantly enhanced through collaboration between UNICEF and the Institute of Social Communication (ICS) in Mozambique. The ICS plays a crucial role in disseminating pertinent immunization messages to communities through community radios. These messages are broadcast weekly in local languages, allowing for broader reach and better understanding among community members. Additionally, community leaders and service providers actively participate in these radio programmes, further amplifying the impact of the messages. The ICS also uses mobile units to visit communities where they project informative videos or relay messages about immunization services using megaphones. This innovative approach ensures that even remote communities are reached with essential information about vaccination. The collaborative efforts between UNICEF and the ICS have contributed to increasing awareness and demand for immunization services among communities, ultimately leading to improved vaccination coverage and public health outcomes.
Surveillance and data analysis	UNICEF provided support in strengthening the national surveillance systems to identify gaps in immunization coverage and target interventions effectively.

SWOT analysis on equity-focused interventions in Mozambique

The zero-dose and pro-equity-focused initiatives have several strengths that have enabled it to make progress in improving immunization coverage and equity in Mozambique. Despite the progress made in recent years, the immunization programme in Mozambique still faces significant challenges in order to ensure sustainable immunization coverage and equity. The immunization programme has several opportunities to further improve immunization coverage and equity. Despite the potential opportunities to improve access to immunization services, there are several threats that could impede progress. The key strengths, weaknesses, opportunities and threats are summarized in Table 26 below:

Table 26: SWOT analysis on Zero-Dose and Immunization Equity Agenda in Mozambique

Strength:	Weakness:
Mozambique demonstrates strong commitment to PHC, with a focus on providing essential health services, including immunization, to all citizens. This commitment is reflected in policies and strategies that prioritize equity and accessibility in health care delivery, ensuring that immunization services reach even the most remote areas of the country	Health system: - Slow implementation of RED strategy, mainly due to poor micro-planning process and lack of funds and transport for outreach/mobile brigades' activities. - Weak EPI communication strategy targeting rural communities. - Minimal focused technical supervision at all levels. - Poor recording of injection safety material at central level. - Poor programme data management (reliability of produced data, lack of regular data analysis and use); delay in reporting from the provinces.⁸ - Over- and under-reporting of immunization coverage data remains a problem at all levels in Mozambique. The timeliness and completeness of reporting is still not optimal and immunization monitoring data is not systematically analysed and used for action. The coordination between the EPI and surveillance programmes of the MOH remains weak, as these are under different directorates.
Mozambique has established the National Immunization Technical Advisor Group. The group advocates for and guides the adequate implementation of the recommended EPI strategies ⁸	Human resource: - No staff dedicated to social mobilization of EPI at central and provincial levels, inadequate staffing at all levels and high turnover of EPI personnel. - Mozambique experiences shortages of trained health care professionals, including doctors, nurses and midwives, especially in rural areas.
Mozambique collaborates with international organizations, such as UNICEF, WHO and Gavi, the Vaccine Alliance, to strengthen its immunization programmes. These partnerships provide technical assistance, funding and resources to support vaccine procurement, distribution and delivery, enhancing Mozambique's capacity to reach vulnerable populations and improve vaccine coverage rates.	Communication: - Absence of Information, Education and Communication (IEC) materials on routine EPI at all levels especially at health facilities. - Limited use of mass media (TV, radio, newspapers) in routine message dissemination.
The country has developed a national cold chain update plan that includes the expansion of cold chain to accommodate new vaccines to be introduced in the national immunization.	Logistical and supply chain management: - Inadequate logistics including poor vaccine stock management. - Inadequate vaccine delivery to different subnational levels due to transport issues, insufficient cold chain capacity and poor cold chain management. - Inadequate stock management at provincial and lower levels.
Mozambique has made significant progress in strengthening its vaccine supply chain management systems, ensuring the availability and accessibility of vaccines across the country	

Mozambique has a well-established network of community health workers (<i>Agentes Polivalentes Elementares</i> - APEs) who play a crucial role in delivering immunization services to remote and underserved communities. These community-based health care providers are trusted members of their communities and help bridge the gap between formal health care systems and marginalized populations	
Opportunities:	Threats:
The MISAU has developed a health promotion strategy and already has a well-developed community involvement strategy (APEs). A Health Education Manual has been developed and is being used to guide activities at the operational level.⁸ This is a good opportunity to develop an effective communication strategy to address communication gaps for communities with low use of health services, with emphasis on immunization	Mozambique faces infrastructure challenges, including inadequate transportation networks, limited health care facilities, and lack of electricity and refrigeration in rural areas.
Strengthening community engagement: Mozambique has the opportunity to further strengthen community engagement and participation in immunization programmes. By empowering communities to take ownership of their health and actively participate in decision-making processes, Mozambique can enhance vaccine acceptance, uptake and coverage rates, especially among marginalized groups.	Socio-economic determinants of health: Socio-economic factors, such as poverty, food insecurity and inadequate access to clean water and sanitation, contribute to health inequities and impact vaccine access and use in Mozambique.
Expansion of immunization services: Mozambique has the opportunity to expand immunization services beyond traditional health care settings to reach populations with limited access to health care facilities. Mobile outreach clinics, community-based vaccination campaigns, and integration of immunization services with other health interventions, such as MCH programmes, can help extend vaccine coverage to underserved areas and marginalized populations.	Vaccine hesitancy and misinformation: Vaccine hesitancy and misinformation are growing threats to immunization efforts in Mozambique. Misleading information about vaccine safety, efficacy and side effects, spread through social media and other channels, can erode public confidence in vaccines and undermine vaccination campaigns, leading to decreased vaccine uptake and coverage rates.
Using mobile health technologies: Mozambique can leverage mobile health (mHealth) technologies to improve vaccine delivery and monitoring systems. Mobile applications, SMS reminders and electronic immunization registries can facilitate data collection, enhance communication with health care providers and caregivers and ensure timely vaccination reminders and follow-ups, thereby improving immunization coverage and tracking.	Emerging infectious diseases: Mozambique is vulnerable to emerging infectious diseases, epidemics and pandemics, such as Ebola, cholera, and COVID-19. These outbreaks can disrupt routine immunization services, strain health care resources, and undermine public trust in vaccines, posing significant challenges to immunization programmes and public health systems.
	Natural disasters and climate change: Mozambique is prone to natural disasters, including cyclones, floods and droughts, made worse by climate change. These disasters can disrupt health care delivery, damage health care infrastructure and displace communities, leading to interruptions in immunization services and increased health disparities among affected populations.

Good practices and lessons learnt

Expansion of community health worker network for immunization outreach

Mozambique has expanded its community health worker (CHW) network to serve as frontline health workers for immunization outreach. Between 2018 and 2022, the number of CHWs increased from 1,000 to 8,300, significantly enhancing the country's capacity to deliver vaccines to hard-to-reach areas. The expansion of the CHW network for immunization outreach demonstrates a scalable and replicable approach to improving vaccine equity in Mozambique. Leveraging the existing community-based infrastructure and partnerships with international organizations and donor agencies, Mozambique has successfully scaled up immunization services to reach millions of households across the country. Through the expansion of the CHW network, Mozambique has achieved community access to immunization services. The presence of trained CHWs in remote areas has led to higher vaccine uptake and reduced disparities in vaccine coverage among marginalized populations.

Integration of immunization services with nutrition interventions

Mozambique has integrated immunization services with nutrition interventions delivered through the CHW network. CHWs receive specialized training on immunization and nutrition education, enabling them to provide comprehensive health care services to communities. The integration of immunization services with nutrition interventions offers a scalable and cost-effective approach to improving vaccine equity and health outcomes in Mozambique. The integration of immunization services with nutrition interventions has led to improved vaccine coverage and nutrition outcomes among children and vulnerable populations in Mozambique. CHWs play a crucial role in delivering vaccines, promoting breastfeeding and providing nutrition education to families, thus contributing to better health outcomes and reduced health inequities.

Model Family Initiative

The Model Family Initiative emerged within Mozambique's National Health Promotion Strategy 2015–2024, a collaborative effort between the Government of Mozambique and UNICEF. The purpose of this initiative is to address multi-faceted challenges in child health by integrating various sectors, including health, hygiene, sanitation, education and protection. It sought to tackle entrenched gender norms, which often hindered access to health care services and contributed to inequities in health outcomes. At its core, the Model Family Initiative focused on empowering communities through the establishment of CHCs. These committees served as the driving force behind the initiative, implementing and monitoring the adoption of recommended health practices by families. A key criterion for families to be certified as model families was the adoption of at least 10 out of 13 recommended practices, with a strong emphasis on completing immunizations. To foster behaviour change and challenge gender norms, the initiative employed various communication channels, including community dialogue sessions, videos, community theatre, and engagement with religious leaders and collaboration with traditional healers. The initiative also promoted male engagement in childcare and household responsibilities, aiming to shift traditional gender roles and promote spousal communication and decision making. The Model Family Initiative has demonstrated potential for replication and scalability. With government endorsement and support, CHCs were established nationwide, providing a scalable platform for intervention delivery. Over the implementation period, significant progress has been achieved, with a total of 37,365 families certified across three provinces, and an additional 21,387 families certified in 2021 alone. These achievements have translated into tangible improvements in addressing gender inequalities, promoting spousal communication, and encouraging shared decision making within households. Furthermore, the initiative has contributed to enhancing vaccine coverage, particularly in provinces characterized by lower coverage and higher poverty levels.

Digitalization of the RED/REC strategy

Through the implementation of the RED/REC strategy across all provinces (except Gaza and Cabo Delgado) from 2019 to 2021, a concerted effort has been made to refine immunization services. This strategy emphasizes detailed micro-planning, incorporating data on target populations, outreach methodologies and frequency of services. A pilot project leveraging geospatial data and technologies for immunization micro-planning was executed in select districts, including Gurue and Mocuba. This initiative was accomplished in collaboration with the National Agency for Geospatial Development (ADE) and partners such as CHAI and HGL. The creation of interactive maps delineating rural and urban health facilities and focal points for immunization efforts played a pivotal role. These maps, enriched with details, such as health centre locations, communities under the EPI programme and geographical features, enabled EPI managers to easily identify unvaccinated communities and optimize vaccination campaigns, including for COVID-19, among adolescents in Mocuba District.

The success of the pilot underscores the potential for scalability and replication, particularly through the engagement of local managerial staff and the straightforward utility of GIS maps in micro-planning. The collaboration with entities experienced in geospatial data, the development of relevant training materials and the progress towards a national spatial data policy and infrastructure (IDEMOÇ) signal a robust foundation for expanding this initiative across Mozambique and potentially beyond. This initiative has demonstrated the effectiveness of using geospatial data in health service micro-planning, specifically for enhancing immunization coverage. The GIS maps facilitated targeted efforts to reach underserved communities, supported the efficient allocation of resources, and enabled a more strategic approach to managing vaccination campaigns.

Recommendations for Mozambique

General recommendations

Strengthen community engagement and ownership

- 1) Actively engage diverse stakeholders, including local economic agents, NGOs, government officials, community leaders, religious leaders, teachers and traditional healers, in promoting and supporting vaccination services. This collaborative approach enhances community ownership, participation and awareness, especially in underserved and hard-to-reach areas.
- 2) Involve men in vaccination through tailored health education sessions that emphasize their roles in child health, economic benefits of vaccination, and positive collaboration with women. Disseminate examples of successful male involvement to inspire broader participation.
- 3) Map hard-to-reach communities and involve them in planning vaccination outreach to increase access and address local barriers effectively.

Enhance access to vaccination services

- 1) Plan and implement regular, community-centred outreach vaccination sessions, particularly in remote areas. These sessions should address logistical challenges, such as unsafe or long walks to health centres, and reduce waiting time. Joint planning across health programmes and extended service hours can further improve service accessibility.
- 2) Revise immunization planning processes, including annual planning and micro-planning tools, to integrate gender considerations, community engagement and solutions to systemic barriers.

Improve quality and availability of services

- 1) Strengthen supply chains to ensure consistent availability of vaccines, supplies and well-equipped health facilities that respect privacy and confidentiality.
- 2) Build health worker capacity through training, retraining and supportive supervision, emphasizing respectful, empathetic and patient-centred communication. This includes improving messaging around vaccine availability, scheduling and common reactions, especially for off-schedule vaccines.
- 3) Address workforce challenges by ensuring health workers are adequately motivated, supported and equipped to build strong relationships with the community.

Foster data-driven decision making

- 1) Improve the coordination of data quality improvement activities, involving MISAU, UNICEF, WHO and other partners. This includes supporting provincial and district teams in data collection, analysis and use to enhance programme performance and responsiveness.
- 2) Conduct evaluations of RED/REC activities, such as micro-planning implementation, to assess their impact on reaching zero-dose and under-vaccinated children. Use findings to refine strategies for better immunization coverage and equity.

Promote collaboration and integration

- 1) Strengthen communication between central and provincial levels to improve coordination, resource allocation and response to high-need areas.
- 2) Advocate for administrative reforms to streamline procurement processes and reduce delays in acquiring vaccines and essential supplies.
- 3) Expand the REC strategy to improve service access and reduce inequities in immunization coverage across underserved regions.

Advance gender and equity considerations

- 1) Invest in building skills and fostering a culture of gender and intersectionality awareness among immunization stakeholders. This ensures that strategies and interventions address the needs of vulnerable caregivers and families effectively.

Final recommendations

- 1) Focus on delivering integrated child health services at facilities to minimize missed opportunities and improve the overall service experience.
- 2) Collaborate with community leaders to sustain and expand vaccination promotion efforts, ensuring all influential voices, including teachers and traditional leaders, are authorized and empowered to participate.

Recommendations to UNICEF

- 1) Encourage donors, such as GAVI, to prioritize investments in gender-responsive or transformative interventions, activities targeting caregivers and marginalized communities and reforms that strengthen health systems and governance. These investments should enhance the availability, quality and accessibility of people-centred PHC approaches.
- 2) Support and fund research to evaluate the effectiveness and equity impacts of current and innovative interventions aimed at reaching zero-dose children and underserved communities. This research should also explore strategies to address persistent implementation challenges.
- 3) UNICEF should continue assisting the NHS in diversifying communication strategies about vaccination opportunities. This includes improving the quality of interpersonal communication, particularly by health workers, to foster trust and awareness.
- 4) UNICEF should strengthen its capacity-building efforts for CHWs and health promotion activists, ensuring comprehensive training in immunization alongside other health priorities.

ANNEXES: 4
COUNTRY CASE STUDIES

SOUTH AFRICA

Zero-Dose and Equity Agenda



Annex 4: South Africa: Zero-dose and equity agenda

Country context

South Africa occupies the most southern tip of Africa. It shares boundaries with Namibia, Botswana, Zimbabwe, Mozambique, Lesotho and Eswatini. Its long coastline stretches more than 3,000 kilometres from the desert border with Namibia on the Atlantic coast southwards around the tip of Africa and then north to the border of sub-tropical Mozambique on the Indian Ocean. It is a country marked by diverse landscapes, including mountains, plateaus and coastal areas. The population of South Africa was more than 62 million in 2022; females constituted 51.5 per cent of the total population and 28 percent were aged younger than 15 years^{53 54}. South Africa has the most advanced economy on the continent, but it faces challenges such as high-level income inequality, high unemployment rates, and the enduring impact of historical apartheid policies. Approximately, 50 percent of the population lives in poverty, yet this issue impacts two thirds of the children, equating to about 12.7 million⁵⁵.

South Africa's health care system operates on a decentralized model, where the Department of Health is responsible for overseeing national policies. At the provincial level, health care delivery is managed and a mix of public and private sectors coexist. In this system, the Department of Health oversees public health care, while the private sector operates independently. The National Department of Health collaborates with provincial counterparts (nine provinces have their own Department of Health) to manage health care policies and public-private partnerships, as well as engagements with NGOs. South Africa's constitution ensures that every citizen has access to health services through both the public and private health sectors. Public health care is available to all citizens free of charge, without formal health insurance plans. The public

health system is organized into three tiers of health services consisting of primary health care facilities, districts hospitals and tertiary hospitals

^{56 57}.

Overview of immunization programme in South Africa

The national immunization programme was launched in 1994 in South Africa. It is managed by the National Department of Health and implemented through the EPI. There are currently 11 antigens in the vaccination schedule targeting a spectrum of preventable diseases, including polio, measles, tuberculosis, diphtheria, pertussis, tetanus, haemophilus influenzae type B, hepatitis B, rotavirus diarrhea, pneumococcal infection and cervical cancer. All are offered free of charge at all public health care facilities. The government provides 100 per cent of RI expenditures. Additional vaccines targeting influenza, rubella, mumps, varicella (chickenpox), meningococcal meningitis, hepatitis A, and genital warts (the quadrivalent HPV vaccine) are available in the private sector. This dual-sector approach ensures comprehensive coverage of vaccine-preventable diseases, further bolstering the nation's immunization efforts⁶. There are over 3,000 government facilities offering immunization in South Africa⁵⁸. The government allocates approximately 8.1 per cent of its budget to health care. Within this allocation, the EPI receives dedicated funding, focusing on achieving universal vaccine coverage.

The EPI operates at the national/central, provincial and district levels, creating a multi-tiered framework that facilitates comprehensive management of immunization programmes. The national level bears the crucial responsibility of vaccine procurement, storage, distribution, coordination and integration, and training

and education to ensure the effective and efficient implementation of the programme. The provincial coordination units are responsible for the overarching strategy and communication between the different levels of the health system, guaranteeing that immunization guidelines and protocols are standardized across the country together with the central unit. On a more grassroots level, district coordination units ensure that immunization services at health facilities are effectively delivered within their specific catchment. Moreover, international and non-governmental organizations, such as GAVI, WHO, BMGF, UNICEF, CDC and others, also provide technical support, funding, policy guidance, vaccine marketing, research, disease surveillance and laboratory support.

Status and trends in immunization and immunization inequity

Trends in numbers and rates of zero-dose and under-vaccinated children in South Africa

The trend of zero-dose rates has had multiple fluctuations. The highest number of zero-dose children (209,388) was reported in 2013. Meanwhile, the first dramatic decline was observed in 2013 and 2014 with a negative

variation of over 68,500 (6 per cent) children. The number continued dropping to 103,885 in 2015 that had a 9-PP drop compared to 2013. A progressive increment was observed for three consecutive years from 2016 to 2018 with a 7-PP increment between 2015 and 2018. However, a decline was observed during the COVID-19 period from 2019 to 2021 with a 7-PP negative difference (86,146 children) from 2018. The last significant increase was in 2022 with a 4-PP increase (more than 43,100 children) compared to 2021.

A significant increase of under-vaccinated children was observed in 2014 with a difference of over 20,000 reported in 2013, and then the increment continued in 2015 with an increase of more than 34,000 children from 2014. The highest number of under-vaccinated children (69,257) over the decade was reported in 2015. The numbers significantly dropped in 2016 with a negative variation of more than 35,500 children compared to 2015 and continued declining to the lowest level of under-vaccinated children (11,451) in 2017 over the 10- year period. On the contrary, an increment was observed again in 2018 and continued for four consecutive years and reached 57,463 in 2021. Finally, the number dropped to 22,548 in 2022 (see Figure 37).

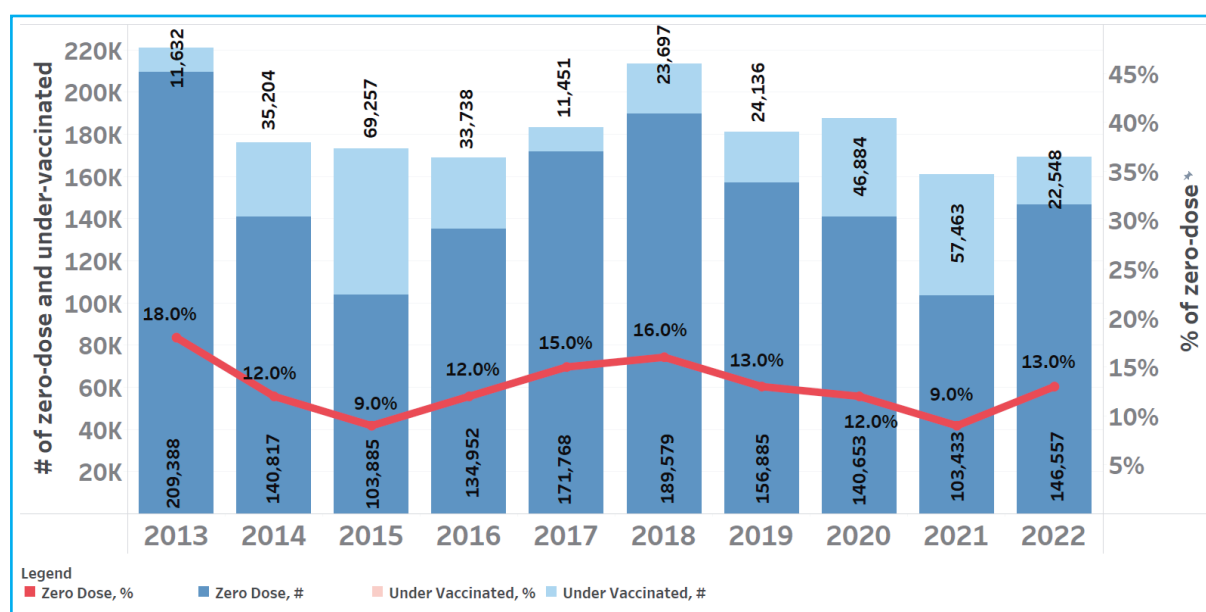


Figure 37: Trend of numbers and rates of zero-dose and under-vaccinated children, South Africa, 2013–2022 (Data source: WHO-UNICEF Estimates of National Immunization Coverage (WUENIC) and UNPD population estimates)

From 2013 to 2022, the average coverages for BCG, Penta-1, Penta-3, and MCV-1 were 82.8 per cent, 87.0 per cent, 84.2 per cent and 83.4 per cent, respectively. In 2013, the BCG coverage was 88 per cent which rose to the highest 93 per cent in 2014 during the decade, the only time the country crossed the standard cut-off rate of 90 per cent. Since 2015, the rate considerably declined for four consecutive years and reached the lowest 70 per cent coverage in 2018 over 10 years, with a 23-PP difference compared to 2014. The coverage increased again to 84 per cent in the 2019, 86 per cent in 2020 and 2021 and slightly declined to 84 per cent in 2022.

Regarding the Penta-1 coverage, the country had the lowest coverage of 81 per cent in 2013. Then, the rate increased to 88 per cent and 91 per cent for 2014 and 2015, respectively. Even though a 10-PP increment was observed from 2013 to 2015, the coverage decreased for three consecutive years (2016-2018) and reached 84

per cent in 2018 with a negative difference of 7 PP compared to 2015. During the COVID-19 pandemic, the coverage progressively increased for three consecutive years and reached 91 per cent (above the 90 per cent cut-off mark) in 2021 which dropped again to 87 per cent in 2022. On the other hand, Penta-3 coverage in 2013 (81 per cent) was the lowest in 10 years. It increased to 85 per cent in 2014 and remained the same up to 2016 before declining to 82 per cent in 2018. The coverage was not stable starting from 2019 to 2022 with many fluctuations from one year to another. Likewise, the MCV-1 coverage increased from 78 per cent in 2013 to 84 per cent in 2014, and 86 per cent in 2015. Then, it dropped for three consecutive years (2016-2018) and reached 81 per cent in 2018 with a 5-PP negative difference compared to 2015. During the COVID-19 pandemic, it slightly increased to 87 per cent in 2021 and 86 per cent in 2022 (see *Figure 38*).

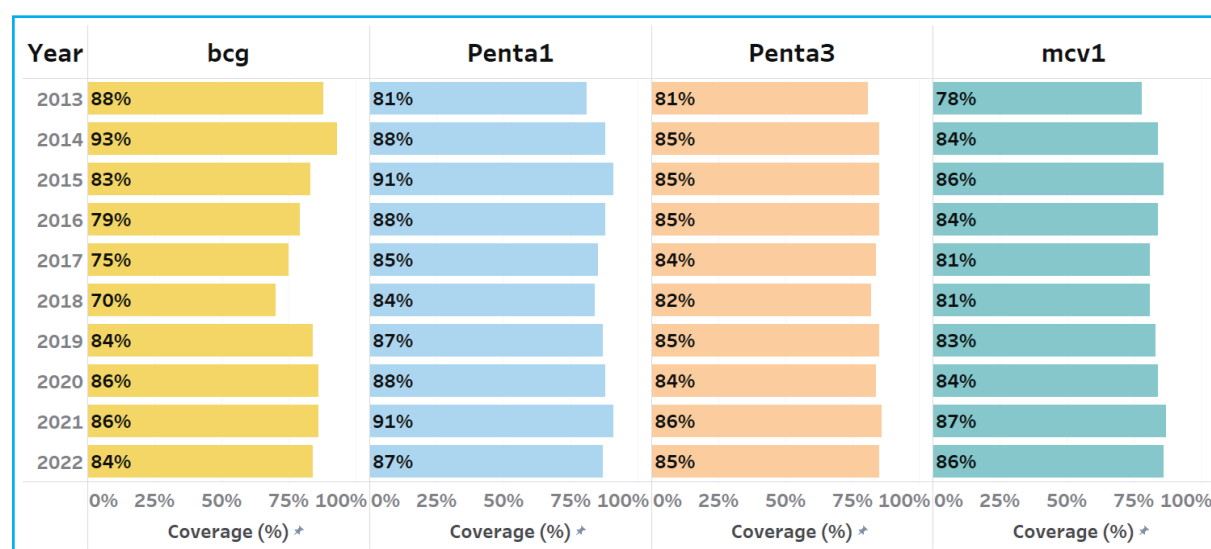


Figure 38: Vaccination coverage trends in selected antigens, South Africa, 2013–2022 (Data Source: WUENIC)

During the first three years (2013-2015), the discrepancy between administrative and WUENIC data was wide, with a 10-PP difference in 2013 and 2014 which narrowed to 8 PP variation in 2015. There was 1 PP and 2 PP slight differences in 2016 and 2018, respectively. Otherwise, the coverage was consistent in the rest of 2017

and from 2019 to 2022. The Penta-1 to Penta-3 dropout rates were below the 10 per cent target for the whole 10 years and the maximum reported rate of 7 per cent was in 2017. Otherwise, the rates were less than or equal to 5 per cent for the rest of the nine years.

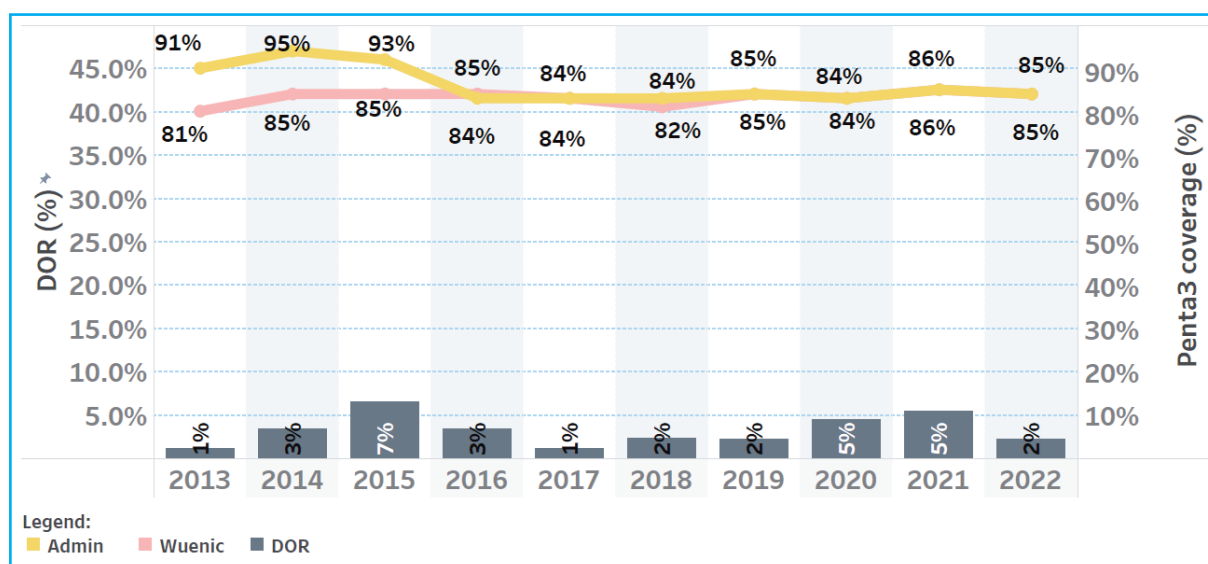


Figure 39: Trends in DPT-1 to DPT-3 dropout rate, and comparison between DPT-3 administrative coverage and WUENIC estimates, South Africa, 2013–2022 (Data Source: WUENIC)

Immunization inequity in South Africa

The overall concentration index for the multivariate equity measure from the 2016 DHS was 0.4, with an absolute equity gap (AEG) of 0.09 for zero-dose status. To match the zero-dose rate of the most advantaged 20 per cent of the population, the rate among the most disadvantaged 20 per

cent would need to decrease by approximately 8.8 PP. Child sex accounted for about 4 per cent of the observed zero-dose inequity. However, a high unexplained variation of 69.4 per cent suggests that the narrow AEG gap between the most disadvantaged and most privileged groups (8.8 PP, as shown in Figure 40) is influenced by other unmeasured factors.

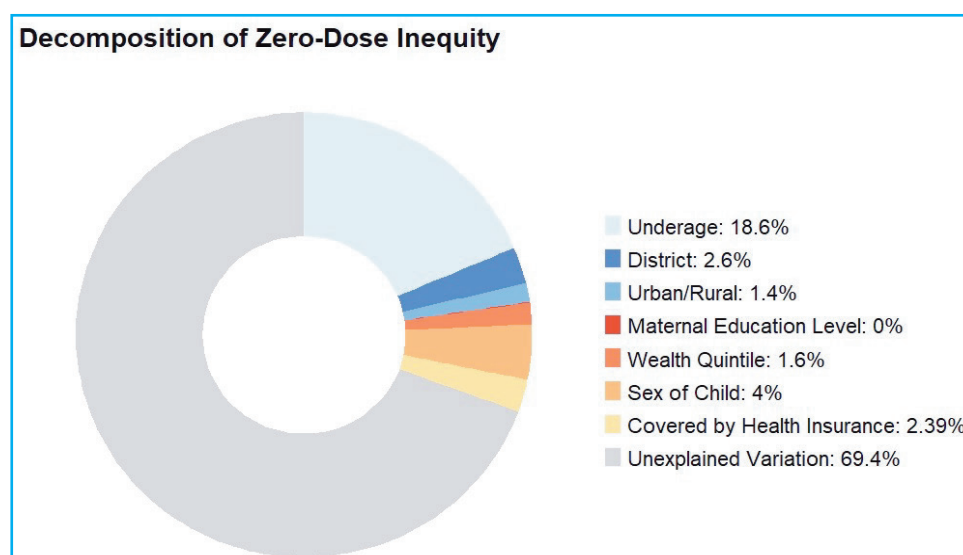


Figure 40: Decomposition of zero-dose inequity in South Africa, DHS 2016

At subnational level, the zero-dose equity plane in Figure 43 shows that Gauteng Province had the highest zero-dose rate while Northwest Province had the lowest. In terms of zero-dose inequity, Northwest Province had the lowest zero-dose inequity while Northern Cape Province had the highest zero-dose inequity.

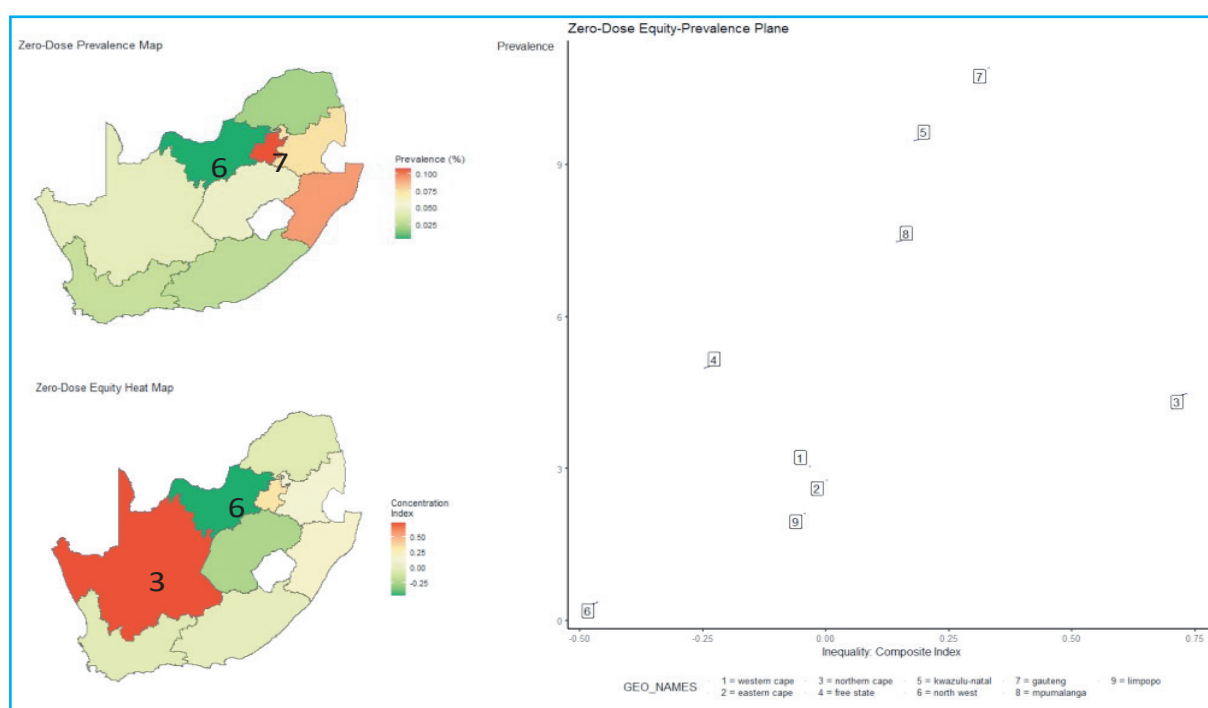


Figure 41: South Africa zero-dose rate and zero-dose inequity by province (Source: DHS 2016)

Underlying factors

1) Demand-related barriers:

- a) Vaccine hesitancy: This is due to misinformation spread through online platforms or lack of trust in vaccines and health care systems⁵⁹. Anti-vaccine sentiments are fueled by anecdotal evidence or conspiracy theories, or lack of credible information from trusted sources, influencing individual and community vaccination decisions⁶⁰.
- b) Missing vaccination: This happens due to caregiver or parental factors such as forgetting scheduled vaccination appointments or lack of awareness about the importance of immunization and lack of shared immunization decision making by both parents^{61 62}.
- c) There are socio-economic factors affecting demand, such as transportation challenges for lower-income families to reach vaccination sites, or limited resources for health care-seeking behaviours⁶³.

2) Supply-related barriers:

- a) Vaccine stockouts cause missed doses across all vaccines. Health care facilities run out of specific vaccines, leading to missed vaccination during schedules^{64 65} 18. In two communities, Pietermaritzburg and Soweto, vaccine stock shortages at clinics were 58.1 per cent⁶⁶.
- b) There may be inadequate availability of vaccines in PHC facilities due to systemic issues such as inefficient distribution systems, procurement delays, or inadequate infrastructure for vaccine storage and handling⁶⁷.
- c) There are challenges in vaccine stock management at PHC facilities including inaccurate forecasting of needs, improper storage or lack of timely reporting on stock levels and use of WHO-prequalified equipment in some places and a lack of temperature monitoring devices^{68 69}.
- d) Other social determinants, such as maternal education and unemployment, family size, household poverty and rural residence, have profound influence

on mother's health-seeking behaviour including immunization.

3) Health system and health workforce-related barriers:

- a) There were disruptions to routine immunization services caused by the COVID-19 pandemic due to closures of health care facilities, re-allocation of resources away from immunization programmes or reduced community engagement due to public health measures such as lockdowns ⁷⁰.
- b) Challenges faced by health care workers in implementing immunization programmes included high workload, shortage of facility staff number, limited training or resources for vaccine administration or difficulties in data management and reporting, difficulties in vaccine stock management and reporting affecting the quality and efficiency of immunization services ⁷¹.

c) There were challenges in implementing the EPI at rural clinics due to insufficient staffing, limited resources for outreach and vaccination campaigns or difficulties in maintaining cold chain logistics in remote areas ⁷¹.

d) Dropout of vaccination driven by transport costs and access was highlighted in South Africa despite mitigation through outreach activities ⁴⁹.

e) In Pietermaritzburg and Soweto, there was also lack of available caregivers to accompany children for immunizations ⁶⁶.

Immunization equity-focused strategies/Interventions in South Africa

Table 27 summarizes key pro-equity interventions/strategies implemented to address social determinants of immunization inequity and reduce burden of zero-dose children in South Africa.

Table 27: Immunization Equity-focused strategies/Interventions in South Africa

Strategies/pro-equity interventions	Major assumptions, implementation experiences (challenges, successes...) and evidence on intervention effectiveness
Health system/Service delivery	
Targeted outreach	The existing health care facilities may not adequately reach all populations, especially those in remote or underserved areas. Targeted and localized intervention efforts have been implemented to address geographical barriers. These efforts include mobile vaccination, SIAs and door-to-door campaigns and deployment of mobile clinics. In South Africa, the implementation of targeted outreach strategies has yielded promising results. For example, mobile vaccination clinics have been deployed to remote rural areas and informal settlements, where access to health care facilities is limited. Door-to-door campaigns have been also conducted in underprivileged urban areas to ensure that children without traditional health care access receive necessary vaccinations. As a result of these targeted outreach efforts, the country has increased vaccination rates, particularly in hard-to-reach areas. These efforts have led to measurable reductions in disparities in immunization coverage between population groups.

Community health programmes	Community health programmes involve extensive training and deployment of individuals within communities to promote immunization and essential health care services. It is believed that trusted individuals within the community can effectively promote immunization and address health care barriers specific to the community's cultural context. In South Africa, the community health programme has been instrumental in promoting immunization and essential health care services, particularly in rural and underserved areas. The country has been able to address vaccine hesitancy and barriers specific to different communities by providing extensive training and deployment of community health workers and integration of immunization initiatives into community health programmes to address culturally specific vaccine hesitancy and barriers. As a result, South Africa has observed increased community engagement and empowerment in health care decision making which contributed to enhanced immunization coverage in hard-to-reach populations.
Mobile health technologies	Mobile health technologies, such as MomConnect, involve the use of innovative tools, such as mobile applications, to directly communicate information about immunization and MCH to parents and caregivers. These technologies leverage the widespread use of mobile devices to deliver targeted health messages and support health care decision making. The mobile apps have been developed to provide parents and caregivers with personalized reminders about immunization schedules and essential health care visits. These apps also offer educational resources and support services, allowing individuals to access information and assistance from the comfort of their homes. The implementation has led to increased awareness and understanding of immunization and MCH among parents and caregivers, and has also contributed to improving immunization coverage rates and reducing missed opportunities for vaccination ⁷².
Road to Health book	Since November 2018, South Africa has been distributing the Road to Health book to all newborns, regardless of whether they are born in public or private health care facilities, through a national side-by-side campaign. The main objective of this initiative is to foster collaboration between health care workers and caregivers, with the overarching goal of improving child health outcomes, including ensuring timely vaccinations. The booklet serves as a comprehensive guide, containing essential information to support a child's growth and development milestones. Key features of the Road to Health book include recording of growth and development milestones and information on vaccination schedules (immunization appointment). It is accessible digitally through a dedicated app, enabling caregivers to maintain a digital record of their child's health information which facilitates the identification of children who may have missed their vaccine doses.
Integrated child health catch-up drive/Vaccine catch-up drive/Project Jiki'izinto	To address the immunization backlog during the COVID-19 pandemic and prevent further declines in coverage, the South African Government initiated a childhood immunization catch-up drive starting on 1 November 2020. The purpose of the drive was to restore and intensify routine immunization services and provide catch-up doses to children who missed vaccinations. The drive, was also being used as a platform for providing other child health services, including Vitamin A supplementation, de-worming, growth monitoring and HIV services. The plan covered all 52 districts in the country, with 12 priority districts identified due to their high number of under-vaccinated children ⁷³. The catch-up drive formed part of the Side-by-Side Campaign, a national mass communication campaign designed to empower and support caregivers and families in providing comprehensive care for children. The initiative involved collaboration between the National Department of Health, UNICEF, WHO and the Clinton Health Access Initiative (CHAI) ⁷⁴.

Commodities/logistic system	
Equitable distribution	The commodities and logistics system prioritizes the equitable distribution of vaccines and supplies to health care facilities across the country, including those in remote and underserved areas. In South Africa, equitable distribution efforts have led to improved vaccine coverage in historically underserved areas.
Strengthening supply chain, cold chain and vaccine management, commodities and logistic al system strengthening	Maintaining the quality and potency of vaccines is essential for ensuring their efficacy, prevent vaccine wastage and ensure that vaccines remain effective from production to administration. Investments in cold chain infrastructure have resulted in improved vaccine storage and distribution capabilities. This has enabled the country to effectively deliver vaccines to remote and hard-to-reach areas, even in regions with limited access to electricity or refrigeration facilities.
Digital stock monitoring- Stock Visibility Solution (SVS)	To enhance the availability of medicines, including vaccines, in PHC facilities, the South African Department of Health introduced the Stock Visibility Solution (SVS). This innovative mobile application allows for the capture and monitoring of stock levels of essential medicines through mobile phones. The SVS system enables real-time access to stock levels for managers across the supply chain, facilitating proactive responses to shortages at health facilities. This proactive approach is crucial in preventing interruptions in vaccine supply. Pilot studies have shown promising results, indicating the potential of SVS to mitigate stockouts and improve vaccine availability in PHC settings. The SVS represents a valuable tool in addressing gaps within the vaccine supply chain and has the potential for scalability to further enhance immunization coverage across South Africa
Human resources	
Capacity building for CHWs	Building capacities of CHWs leads to better dissemination of essential health practices and improved immunization coverage. Trainings and capacity-building initiatives have been provided for CHWs to promote essential health practices and facilitate immunization access in collaboration with UNICEF.
Training and retention of health workers	A well-trained and motivated health care workforce is essential for delivering high-quality health care services, particularly in areas with limited access to resources. In South Africa, investments in training and retention have helped build a skilled and dedicated health care workforce capable of serving rural and underprivileged urban areas. For example, initiatives such as improving working conditions, providing career advancement opportunities and offering competitive compensation packages have helped to retain health care professionals in underserved areas, reducing turnover rates and ensuring continuity of care for patients.
Budget and expenditure	
Financial support for immunization equity	The National Department of Health allocates a significant portion of its budget to immunization programmes, ensuring that adequate resources are available to implement pro-equity strategies such as targeted outreach campaigns, mobile vaccination clinics and community engagement initiatives. The government has also provided technical assistance and monitoring support to health care facilities and programme implementers to ensure the smooth implementation of vaccination campaigns and the effective delivery of immunization services. UNICEF also provides substantial financial contributions and technical support to bolster immunization equity in South Africa.

Management and coordination	
Comprehensive, collaborative and multi-sectoral approach	Adopting a comprehensive and multi-sectoral approach linking primary care clinics and early childhood development (ECD) centres in communities have been implemented to strengthen collaboration between health care providers and ECD practitioners to ensure seamless continuity of care for infants and young children. This includes training ECD practitioners to monitor child growth and development, promote healthy behaviours and identify early signs of health problems, as well as establishing referral pathways between ECD centres and health care facilities. South Africa has been able to improve access to care and support for babies and young children, ultimately contributing to better health outcomes and ECD by integrating health promotion and preventive services into ECD programmes.
Social norms	
Community engagement and social mobilization efforts	Community involvement and social mobilization increases awareness and demand for vaccination services. In South Africa, community engagement efforts have involved collaboration with local community leaders, religious institutions and organizations to create community-based awareness programmes and discussions about immunization. Religious leaders and local influencers have been actively involved in delivering messages about the importance of vaccination during religious services, community gatherings and on social media platforms. Despite facing initial resistance and mistrust, consistent engagement, communication and support for community-led initiatives have yielded success in building trust and confidence in vaccination efforts. The community engagement efforts have resulted in increased community acceptance of vaccines, reduction in vaccine hesitancy and higher participation in immunization programmes. Monitoring data have shown a positive shift in attitudes towards vaccination among community members who have been engaged through these initiatives.
Legislation and policy	
Advocacy for equity-focused policies	Advocacy involves championing the development and implementation of equity-focused policies and strategies to address immunization disparities, with a particular emphasis on prioritizing vulnerable populations and those in underserved areas. Advocacy efforts have played a crucial role in shaping immunization policies and programmes to prioritize equity in South Africa. Advocacy campaigns led by CSOs and health care professionals have raised awareness of disparities in vaccine access and highlighted the importance of addressing these inequities. Policy makers have taken steps to implement targeted interventions, such as mobile vaccination clinics and outreach programmes to reach underserved communities and improve vaccine coverage rates among vulnerable populations.
Data-driven policy	Data-driven policy involves using immunization data to inform the creation and implementation of policies that target areas with low coverage rates and disparities. It is assumed that evidence-based decision making is essential for optimizing immunization programmes and reducing disparities. The use of immunization data to inform policy has led to targeted intervention. The analysis of immunization data revealed geographical areas with low vaccine uptake or specific population groups with high rates of vaccine hesitancy. Based on this information, policymakers implemented targeted outreach efforts, communication campaigns and community engagement initiatives to address these challenges and improve vaccine coverage rates among vulnerable populations ⁷⁵ .

UNICEF equity-focused immunization interventions in South Africa

Aligned with South Africa's core health objectives, UNICEF prioritizes immunization equity over several operational areas (see Table 28).

Table 28: UNICEF Equity-Focused Immunization Interventions in South Africa

Strategies/pro-equity interventions	Major assumptions, implementation experiences (challenges, successes...) and evidence on intervention effectiveness
REC approach	UNICEF applies the Last Mile approach to address immunization inequity in South Africa, targeting to reach marginalized populations. It overcomes geographical and cultural barriers to improve immunization coverage. UNICEF employs a range of strategies to bridge the gap between current immunization coverage and the goal of universal vaccine access for all children. To achieve this, UNICEF supports: - Targeted outreach efforts such as mobile vaccination clinics, community health worker programmes and door-to-door campaigns. Through these initiatives, communities with low immunization coverage have been reached. - Community engagement: UNICEF collaborated closely with communities to raise awareness about the importance of immunization and address misconceptions or concerns hindering vaccine uptake. - Data-driven decision making: UNICEF used immunization data to identify areas with low coverage rates; and targeted interventions accordingly. - Equity-focused policies: UNICEF advocated for the development and implementation of equity-focused policies and strategies to address immunization disparities. This includes prioritizing vulnerable populations such as migrants, refugees, indigenous communities and those living in remote or underserved areas.
Comprehensive and multi-sectoral approach	UNICEF collaborated with the government and other partners to adopt a comprehensive and multi-sectoral approach to address barriers preventing babies from receiving adequate care. This approach includes two key strategies: Expanding immunization coverage to increase the reach and acceptance of immunizations to ensure more babies receive essential vaccine, leveraging innovative mobile health technologies such as MomConnect to directly communicate with parents and caregivers, educating them about their babies' health needs and facilitating access to necessary maternal, newborn and child health (MNCH) services. UNICEF South Africa played a critical role in the development of the comprehensive essential MNCH package, known as the Mother Baby Package.
Supporting vaccine catch-up drive	UNICEF plays a crucial role in supporting the expansion of the vaccine catch-up drive across 52 districts. This support includes providing technical expertise, monitoring assistance and deploying cold chain specialists to ensure the smooth implementation of the vaccination campaign. UNICEF has also collaborated with global partners and funders to promote vaccine advocacy online, to build public confidence in vaccines and foster a culture of vaccination.

Health system strengthening and capacity building	UNICEF worked with the South African Government to bolster the overall health system's technical and financial support, particularly in rural and underprivileged urban areas. The activities included infrastructural enhancement, training and retention of health workers and improved health care coverage, which encompassed various key activities: ▪ Analysis of zero-dose children and vaccine stockout reasons: UNICEF supported the analysis of zero-dose children and the identification of reasons for vaccine stockouts, enabling the identification of areas with high zero-dose children and underlying reasons for these zero-doses, and to develop targeted interventions and strategies to enhance immunization coverage and equity.⁹ ▪ Supporting the development of Reach Every District Strategy and National Cold Chain Manuals: UNICEF played a pivotal role in developing standardized guidelines and procedures to optimize vaccine distribution and management across the country.³⁶ ▪ Training, coaching and mentoring of frontline health workers: UNICEF facilitated training, coaching and mentoring programmes for frontline health workers, equipping them with the necessary skills and knowledge to effectively administer vaccines and manage immunization programmes at the grassroots level.³⁶ ▪ Procurement of cold chain equipment: UNICEF supported the procurement of cold chain equipment, ensuring the availability of essential infrastructure to store and transport vaccines at the required temperatures, thereby maintaining their efficacy.³⁶ ▪ Emergency response to measles and polio outbreaks: UNICEF contributed to emergency response efforts during measles and polio outbreaks, including preparedness activities and rapid response initiatives. This assistance benefited a wide range of stakeholders, including frontline health workers, health facilities, vaccine depots and millions of children under the age of five across the country.
Social mobilization and advocacy	UNICEF conducted advocacy and communication activities to improve public trust and knowledge about immunization. This included working with community leaders to address misconceptions and promote positive health behaviours.
Policy development and implementation	UNICEF contributed to the development of policies to reduce inequities in immunization and health care, ensuring a more inclusive approach.

SWOT analysis on equity-focused interventions in South Africa

The zero-dose and pro-equity-focused initiatives have several strengths that have contributed to the improvement of immunization coverage and equity in South Africa. Despite the progress made in recent years, the immunization programme in South Africa still faces significant challenges to ensure sustainable immunization coverage and

equity. The key strengths, weakness, opportunities and threats contributing to the implementation and effectiveness of immunization services are summarized in Table 29 below:

Table 29: SWOT analysis on Zero-Dose and Immunization Equity Agenda in South Africa

Strengths:	Weaknesses:
Integrated health care system: South Africa's EPI is integrated in the PHC system, ensuring that vaccination services are widely accessible.	Health system: ▪ Inadequate health care infrastructure, ▪ Inadequate health prevention and promotion, ▪ Poor compliance by metropolitan and district municipalities,¹⁰ ▪ Inadequate information and communication technology Infrastructure.¹⁰
Community engagement: South Africa has strong partnerships with community organizations, NGOs, and civil society groups to promote immunization and address barriers to vaccine access. Community engagement efforts involve collaborating with local leaders, CHWs, and religious institutions.	Logistical challenges: The country faces logistical challenges in delivering vaccines to remote and underserved areas. Limited funding, transportation infrastructure and human resources can hinder the timely and equitable distribution of vaccines.
Research and innovation: South Africa has a robust research and innovation ecosystem that contributes to the development and implementation of evidence-based immunization strategies. Academic institutions, research organizations and public health agencies collaborate to conduct studies on vaccine efficacy, safety and effectiveness, as well as to pilot new approaches for vaccine delivery and monitoring.	Health literacy: Vaccine hesitancy and misinformation contribute to low vaccine acceptance and uptake in certain communities. South Africa's diverse population encompasses various cultural and linguistic groups, requiring culturally sensitive communication strategies to effectively convey the importance of immunization and address concerns about vaccine safety and efficacy.
Political commitment: South Africa demonstrates strong political commitment to immunization, as evidenced by the government's prioritization of vaccination programmes and allocation of resources to support vaccine procurement, distribution and delivery.	Equity gaps: Despite efforts to promote equity in immunization, disparities persist in access and coverage among marginalized populations. Socio-economic factors, including poverty, unemployment and inadequate access to health care services contribute to inequities in vaccine uptake. Vulnerable groups, such as rural communities, informal settlements and migrant populations face additional barriers, such as language barriers, cultural beliefs and discrimination, further worsening health inequities.
Effective interventions: South Africa's immunization programmes are supported by evidence-based strategies that have demonstrated impact in improving vaccine coverage and reducing vaccine-preventable diseases. These interventions include targeted outreach campaigns, school-based vaccination programmes and innovative approaches to address specific challenges, such as vaccine hesitancy and access barriers.	Data quality and surveillance: South Africa faces challenges related to data quality and surveillance systems for immunization, including incomplete or inaccurate reporting of vaccination coverage, delays in data entry and analysis, and gaps in monitoring vaccine-preventable diseases.
	Capacity: Shortages of human resources in critical positions, shortage of skills in MCH services. ¹⁰

Opportunities:	Threats:
Policy support: South Africa's National Health Insurance (NHI) system presents an opportunity to strengthen health care delivery and improve access to immunization services. ³¹	Vaccine misinformation: Vaccine hesitancy and anti-vaccine movements fuelled by misinformation and disinformation pose a threat to immunization efforts in South Africa. Misleading information about vaccine safety, efficacy and side effects erodes public confidence in vaccines and undermine vaccination campaigns.
Technology: Technological innovations offer promising opportunities to enhance vaccine delivery and tracking systems in South Africa. Digital health solutions, such as electronic immunization registries, mobile health applications and geographical information systems (GIS) improve data collection, monitoring and surveillance of immunization programmes.	Global health security threats: South Africa is vulnerable to global health security threats, including emerging infectious diseases, pandemics and bioterrorism, which can pose significant challenges to immunization programmes and public health systems. Emerging infectious diseases, such as pandemics, pose a significant threat to health care delivery and immunization programmes in South Africa. Outbreaks of diseases, such as COVID-19, disrupt routine immunization services, strain health care resources, and undermine public trust in vaccines.
Partnerships: Collaboration with NGOs, private sector partners and international agencies can strengthen South Africa's immunization programmes and address resource gaps. Partnerships provide opportunities for leveraging expertise, funding and resources to expand vaccine coverage, improve service delivery and innovate solutions to complex challenges. Engaging with civil society, academic institutions and community-based organizations fosters a multi-sectoral approach to immunization, ensuring that interventions are contextually relevant and responsive to community needs.	Vaccine safety concerns: Public confidence in vaccine safety is essential for maintaining high vaccination coverage and preventing vaccine-preventable diseases. However, concerns about vaccine safety, such as adverse events following immunization and vaccine-related controversies erode trust in immunization programmes and lead to vaccine hesitancy.
	Vaccine supply chain disruptions: South Africa is vulnerable to disruptions in the vaccine supply chain, including shortages, stockouts and delays in procurement and distribution. These disruptions are caused by various factors, such as global health emergencies, geopolitical tensions and logistical challenges.
	Health inequalities: Socio-economic factors, including poverty, unemployment and inadequate access to health care contribute to health inequalities in South Africa. These disparities disproportionately affect vulnerable populations, such as rural communities, informal settlements and marginalized groups, limiting their access to immunization services and increasing their risk of vaccine-preventable diseases.
	Budget constraints: There is lack of adequate funding to meet health services delivery. ¹⁰

Good practices and lessons learnt

Utilizing communication interventions such as MomConnect

MomConnect leverages mobile phone technology to deliver personalized health promotion messages to pregnant women and mothers of infants across South Africa. The programme uses a short messaging service (SMS) platform that sends stage-based educational ANC information to mothers via mobile phones during pregnancy and continues sending child health information for one year after delivery. These messages cover a range of topics, including ANC visits, immunization schedules, nutrition, breastfeeding, family planning and ECD. MomConnect empowers caregivers/pregnant women to make informed decisions about their health and that of their infants. The MomConnect model demonstrates scalability and replicability in settings with similar health challenges and mobile phone infrastructure. For example, it has been successfully implemented in Rwanda.⁴⁰ Data from South Africa Health Review reveals that a significant number of infants born to MomConnect users completed the EPI schedule, compared to infants born to non-users. These findings underscore the positive impact of MomConnect on improving health service use and immunization coverage among mothers and infants.⁴¹

Road to Health book

South Africa has initiated a significant health intervention by distributing the Road to Health book to all newborns within the country since 2018. The campaign aims to bridge the gap between health care providers and caregivers, establishing a united front in the pursuit of better health outcomes for children, including universal vaccinations. The Road to Health book serves multiple functions, including tracking growth and development, vaccination information and digital accessibility to support a child's health journey from birth. The initiative presumably has made positive impact towards improving child health outcomes. The provision of both physical and digital records aids caregivers and health care workers in keeping a detailed account of a child's health journey, especially regarding vaccinations.

The Road to Health book has potential for replicability and scalability. The intervention is grounded in simplicity and the universal need for child health care support, making it adaptable to various contexts. The addition of a digital platform further amplifies its scalability, allowing for widespread distribution without significant increases in cost or complexity.

Implementing multi-tier strategy

In certain remote districts, a gap was identified where children were not receiving the full course of recommended vaccinations. The problems were multi-faceted, ranging from supply chain issues to vaccine hesitancy in local communities. UNICEF supported the implementation of a multi-level intervention that involved reinforcement of the vaccine supply chain, including improved cold storage capacity and transportation, training health workers on community engagement and launching information campaigns to address vaccine hesitancy. This approach was cost-effective due to its use of existing infrastructure and resources and required moderate training for scalability. It is replicable in regions with similar geographical and social contexts. As a result, there was a notable increase in immunization rates in targeted districts within a year of implementation, along with improved community attitudes towards vaccination.

Integrating immunization with other child welfare services

In areas with limited access to health care facilities, children were often missing out on vaccinations because visits to clinics were infrequent due to long distances and lack of transport. UNICEF supported a programme that integrated immunization services with other child welfare initiatives, such as coordinating immunization schedules with food distribution days, to ensure parents who came for food aid also got their children immunized and combining immunization with health check-ups and nutritional assessments to provide a comprehensive health care package. This integrated approach can be cost-effective and has potential for wide adoption, leveraging existing community gatherings to optimize health care service delivery. This integrated service delivery model facilitated higher immunization

rates and ensured children received a broader range of health services.

Recommendations for South Africa

General recommendations

- 1) Strengthen funding engagements: Continue to collaborate with the National Treasury and other relevant stakeholders, including donor funders, to secure additional financial resources for immunization programmes.¹⁰
- 2) Enhance ICT infrastructure: Ensure that adequate ICT infrastructure is provided to public health facilities to support the effective delivery and monitoring of vaccination services.
- 3) Implement proven strategies to improve vaccination coverage: District and provincial EPI managers, along with relevant stakeholders, should focus on implementing the following evidence-based strategies:
 - a. Use SMS or phone calls for vaccination reminders and communication.
 - b. Introduce electronic vaccination cards with built-in reminder systems.
 - c. Conduct caregiver education and community outreach to boost demand for vaccination.
 - d. Strengthen regular vaccination checks at schools and kindergartens and organize catch-up vaccination campaigns to reach children over two years old with incomplete vaccination records.
- 4) Expand mobile community-based clinics: Scale up mobile vaccination clinics to serve children in remote, hard-to-reach areas, rural regions, urban poor communities and conflict zones, reducing the number of unvaccinated children.¹⁸
- 5) Intensify vaccination campaigns: Conduct intensified vaccination campaigns to achieve significant gains in immunization

coverage.¹⁸

- 6) Leverage digital platforms for awareness and reminders: Increase awareness and provide relevant vaccination information through platforms such as MomConnect, incorporating vaccination reminders to improve coverage.¹⁸
- 7) Resolve vaccine stock issues: Address vaccine stock challenges by implementing real-time electronic systems that link pharmacy inventories with health facility records to enhance stock management and ensure vaccine availability.¹⁸
- 8) Use real-time data for monitoring: Invest in real-time data collection, collation, and analysis systems to monitor progress, identify gaps and sustain improvements in vaccination coverage.

Recommendations for UNICEF

- 1) Continuously support training and capacity building in collaboration with the MOH and implementing partners.
- 2) Update training manuals to include new vaccines, employing human-centred design and adult learning principles.
- 3) Work on reducing geographical inequities by mapping underserved communities and tailoring micro-planning activities.
- 4) Leverage existing work and participatory approaches in micro-planning, supported by regular coverage and equity analysis.
- 5) Address both demand and supply barriers to improve vaccine acceptability, uptake and use.
- 6) Use national campaigns and community surveys to break vaccine-related myths and make evidence-based decisions.
- 7) Consider scaling up digital tools, such as SMS reminders, for appointments.
- 8) Strengthen technical and financial support to tackle challenges in vaccine supply chains and the training of health personnel.

- 9) Enhance the management of vaccine supplies using digital tools and establish a regional warehouse for emergencies.
- 10) Explore public-private partnerships for innovative solutions in vaccine supply.
- 11) Increase technical and financial assistance for community outreach activities.
- 12) Support the investment in CHWs and leverage human-centred approaches for community engagement.
- 13) Assist in embedding the equity agenda in national EPI policies and advocate for updates in line with global and regional strategies.
- 14) Engage in technical working groups to advocate for the equity agenda and identify champions for policy revisions.
- 15) Advocate for increased government funding for routine immunization and pro-equity interventions.
- 16) Identify traditional and non-traditional funding sources, including corporate social responsibility (CSR) opportunities.
- 17) Develop a common framework for monitoring the progress of pro-equity interventions.
- 18) Implement data integration platforms for actionable visualization and targeted interventions.
- 19) Improve documentation of the progress of pro-equity interventions, good practices and lesson learnt for future consideration and replicability to other countries with similar contexts.

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