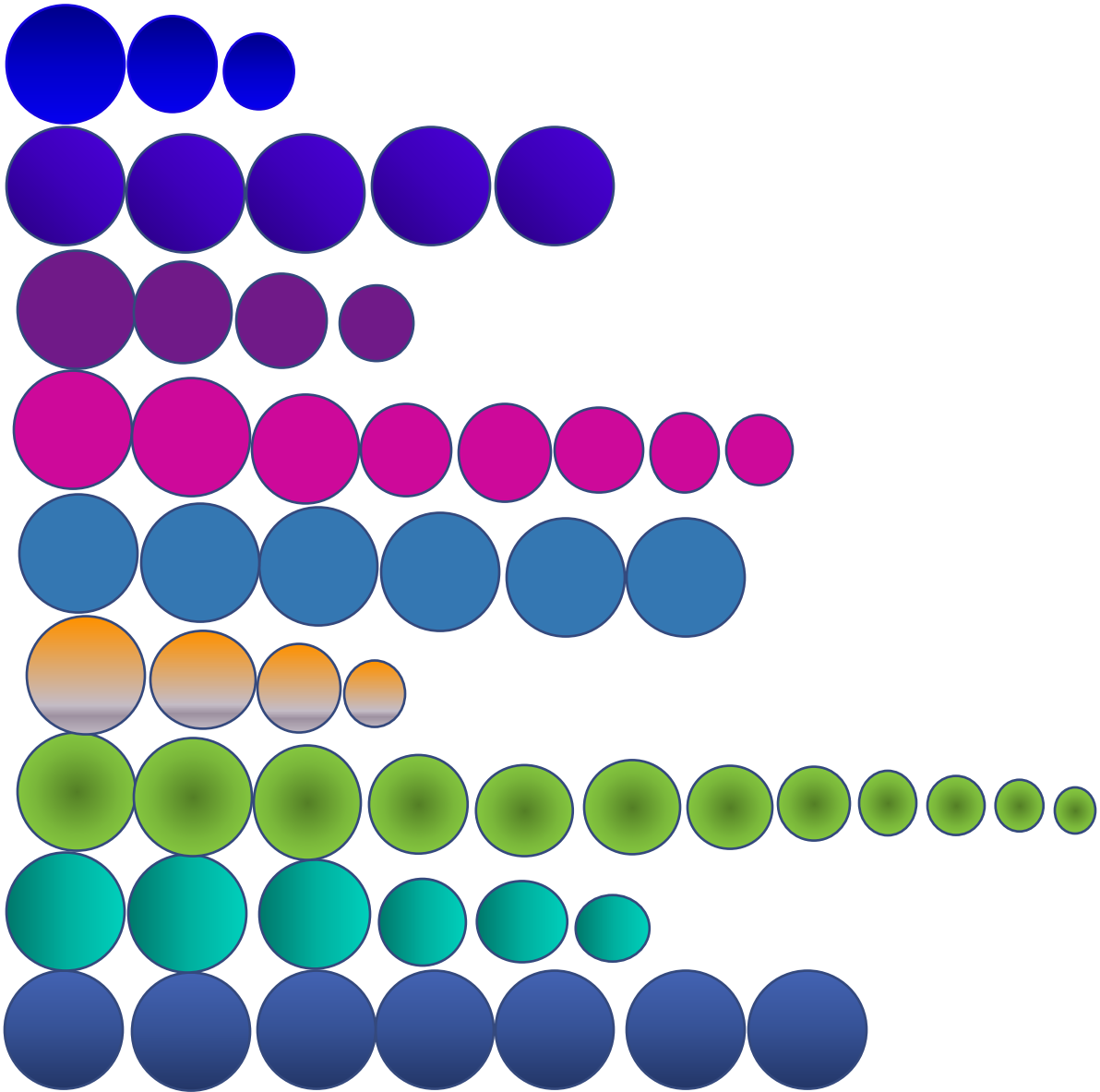
The Republic of Sudan, Federal Ministry of Health

Primary Health Care General Directorate

Expanded Programme on Immunization

NATIONAL IMMUNIZATION COMPERHENSIVE MULTI-YEAR PLAN (cMYP)2021-2025



April 2020

FORWARD

Over the past years the health system in the country faced many challenges. This strategy comes after the revolution and with the new political context in the country, aiming to stop the deterioration and enables safe recovery of the health system. As we enter a new decade with continued optimism despite tremendous uncertainty, we remain focused on supporting the wellbeing of our people, addressing their health needs, making equity our priority.

Today, 94% percent of children of Sudan received their basic immunizations. Sustaining this achievement and reaching the last 6 percent is going to be much harder. It's important to be transparent about our failures as well as our successes—and it's important to share what we've learned. The unreached children are some of the most marginalized children who live in fragile states where conflict prevents the health system from working well for anyone. Immunization is a key component of primary health care and is making huge contributions towards universal health coverage and accelerate the progress towards the 2030 Sustainable Development Goals (SDGs). Immunization matters now more than ever.

Government of Sudan confirms its commitment to saving children's lives and protecting people's health by increasing access to PHC and immunization services and vaccines. FMOH is committed to coordinate the call to scale up immunization actions to achieve the immunization goals and targets. Despite all efforts and improvement being made, there are many targets moving forward in the right direction but have not been achieved yet. Goal 3 of the SDGs is "to ensure healthy lives and promote well-being for all at all ages." This broad goal embraces the unfinished agenda of the MDGs and goes beyond to virtually end preventable maternal, newborn, and child deaths. By moving toward this goal, we are working to protect the future and well-being of Sudanese population. For all of us working in the public health arena, the immunization Agenda 2030 (IA2030) is crucial. Now more than ever we need a health system that is resilient and able to withstand and even facilitate the control of emerging diseases, outbreaks, and other threats to health security. Immunization is a key driver of sustainable development, enabling other development priorities such as education and economic development to take hold.

The cMYP 2021 – 2025, provides a strategic framework that will guide a dynamic operational phase, responding to country needs and global context over the next five years. It builds on the IA2030, EMVAP, NHSS and the country immunization policy. It has been developed in consultation with wide stakeholder and key immunization actors. This multi-year plan lays out goals, the strategies and actions needed to scale up harmonized implementation over the next five years. Immunization Program management and staff will use the cMYP to guide the national, states and partners operational plans, tracking and evaluate of progress. It will also be used as a tool to communicate with stakeholders and partners.

The plan, financing, and delivery of services need to be guided by the best available scientific knowledge on the efficacy of interventions and effectiveness of the programs. It is designed to be a living document, subject to review and change in response to shifts in operating context.

Through the collective endeavors of all stakeholders we believe that, this plan will act as a foundation to combat VPDs in Sudan and will contribute to have optimal health impact on the Sudanese population.

Dr. Akram Mohamed Eltom, Sudan Federal Minister of Health

Acknowledgement

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Acronyms

AD	Auto -destruct	GII	Gender Inequality Index
AEFI	Adverse Events Following Immunization	GoS	Government of Sudan
AFP	Acute Flaccid Paralysis	HDI	Human Development Index
ANC	Antenatal care	Hep B	Hepatitis B Vaccine
BCG	Bacille Calmette and Guirene	Hib	Hemophilus Influenzae type B
BMS	Bacterial Meningitis Surveillance	HPV	Human Papilloma Virus
CCEM	Cold Chain Equipment Management	HRL	High Risk Localities (Districts)
CCEOP	Cold Chain Equipment Optimization Platform	HSS	Health System Strengthening
CDC	Communicable Diseases Control	JRF	Joint Reporting Format
CHE	Current Health Expendature	IA 2030	Immunization Agenda 2030
CHWs	Community Health workers	IACC	Inter-Agency Coordinating Committee
CMW	Community Midwives	IEC	Information Education Communication
cMYP	Comprehensive multi-year plan	IPV	Injectable Polio Vaccine
CRS	Congenital Rubella Syndrome	IiSC	Immunization Supply Chain
DOR	Drop Out Rate	KAP	Knowledge, Attitude and Practice
DoV	Decade of Vaccines	LB	Live Births
DQA	Data Quality Assessment/Audit	MCH	Mother and Child Health
DQS	Data Quality Self-assessment	MCV	Measles Containing Vaccine
DTP	Diphtheria Tetanus Pertussis vaccine	MDGs	Millennium Development Goals
EMR	East Mediterranean Region	MICS	Multiple Indicator Cluster Survey
EVM	Effective Vaccine Management	MLM	Mid-Level Management
FMOH	Federal Ministry of Health	MNT	Maternal and Neonatal Tetanus
GAVI	Global Alliance for Vaccines and Immunization	mOPV	monovalent Oral Polio Vaccine
GDP	Gross Domestic Product	MR	Measles Rubella
GHE	Government Health Expenditure	MRCV	Measles Rubella Containing Vaccine

NHSCC	National Health Sector Coordinating Committee	WPV	Wild Polio Viruses
NHSSP	National Health Sector Strategic Plan	YF	Yellow Fever
NGOs	Non-governmental Organizations		
NHIF	National Health Insurance Fund		
NITAG	National Immunization Technical Advisory Group		
NIDs	National Immunization Days		
NMPB	National Medicines &Poisons Board		
NRA	National Regulatory Authority		
OOP	Out-Of Pocket		
PAB	Protection At Birth		
PCA	Programme Capacity Assessment		
QI	Quality Index		
RCC	Regional Certification Committee		
RCV	Rubella Containing Vaccine		
RED	Reach Every District		
REC	Reach Every Community		
SDGs	Sustainable Development Goals		
SHHS	Sudan Household Survey		
SIAs	Supplementary Immunization Activities		
SWOT	Strength, Weakness, Opportunities, Threats		
THE	Total Health Expenditure		
TT	Tetanus Toxoid		
VDPV	Vaccine Derived Polio Viruses		
VF	Verification Factor		
VPD	Vaccines Preventable Diseases		
VSSM	Vaccine Store Stock Management		
UNICEF	United Nations Children's Fund		
WHO	World Health Organization		

Executive Summary

Immunization is a vital component of primary health care that reaches more people than any other health and social service, It is an investment in the future, benefits individuals, communities, countries, and worldwide. A life-course approach to immunization further promotes integration with other age-appropriate interventions through this effective delivery platform.

More than 90% of children are reached by the first dose of a diphtheria-tetanus-pertussis-containing vaccine, making immunization the most accessible health service. It is the only intervention that brings the majority of households into contact with the health system five or more times during the first year of a child's life. This offers a unique opportunity to reach communities with additional primary health care services. Routine immunization is one of the most equitable health interventions. for example, girls and boys are reached at equal rates with immunization.

Immunization plays a critical role in achieving the Sustainable Development Goals (SDGs) as it directly and indirectly contributes to most of the SDGs. With a high return on investment, immunization impacts positively on education outcomes and productivity. Every US$ 1 invested in immunization generates a return of US$ 54 in broader societal benefits, enabling a virtuous cycle of social and economic development[1].

Sudan with 18 states is characterized by a strategic geographical location, bordered by seven countries. The rural population represents about 65-70%, while nomads represent 8%, there are 2.2 million, internally displaced people, and refugees from neighboring countries amount to another 2 million.

Difficult access to some areas, rural-urban migration, natural disasters, and limited resources had a significant impact on the provision of health care services. Therefore, there are variations within the country in delivery of services, vaccination coverage and disease incidence.

The foundation of the immunization programme in Sudan is composed of a well-defined structure at all levels which cover the essential system components for delivering immunization services. The immunization programme had achieved good progress through the previous cMYP cycle, despite these improvements, there are many targets moving forward in the right direction but have not been achieved yet. The national routine immunization coverage varies with different antigens in the national immunization schedule, Vaccines like BCG, Pentavalent and polio vaccines, PCV & Rota had achieved and maintained high coverage of more than 90% over the last five years. DTP3 national immunization coverage is 93% by end of 2019, with 51% of the target population received their vaccinations in fixed immunization sites, the remaining were covered through out-reach services. Measles first dose is in progress but did not reach the target (89.5%), while measles second dose and TT coverage are lagging behind (74% & 52 consequently) for the last five years.

[1] WWW.Gavi.org, #vaccineswork

The new & underutilized vaccines planned to be introduced (YF,MR,HPV, Hep B zero dose) were not introduced into the system as of end of 2019.

Polio eradication strategies had been implemented successfully, polio free status maintained, IPV vaccine introduced with 90% coverage by end of 2019.

Sudan was targeting measles elimination by 2020, target not achieved. Many measles outbreaks were reported, catch-up and follow up campaigns were implemented. Sudan has not yet introduced rubella containing vaccine (RCV) into its immunization program and is experiencing nationwide outbreaks of rubella.

Neonatal tetanus has remained a major public health problem in Sudan and elimination target remains a challenge. Despite previous attempts to accelerate the MNTE, very little progress was achieved due to several challenges including unavailability of funds which delayed the implementation of the required TT vaccination campaigns in the high risk localities in addition to the low TT2 routine coverage and the unsafe birth practices in some areas.

A through situation, and SWOT analysis was done, for developing this cMYP, the main challenges were identified. The goals of this plan are guided by fundamental principles which are **ownership, equity, integration, innovation and sustainability.**

Sudan population enjoy lives free from vaccine preventable diseases, leaving no one behind is the vision of this strategy. The mission is to ensure sustainable equitable access to all communities and individuals especially disadvantaged populations, to vaccines of assured quality and enhance demand for vaccination as individual right.

The Strategy Goal is to enhance immunization throughout the lifespan, reducing vaccine preventable diseases morbidity and mortality contributing to universal health coverage for Sudanese population.

Building on a detailed situation analysis, IA2030, literature search and other countries experiences, the following foive objectives were developed to achieve the goal and reach the required outcomes.

- **Reach high immunization coverage for all essential vaccines in the national immunization schedule at national level and in all districts in Sudan by 2025.**

Key areas of Focus;

  - Increase coverage of essential vaccines among most disadvantaged populations
  - Expand the delivery of vaccines beyond childhood immunization and throughout the life course, to cover people's entire lives.
  - Reduce the number of zero-dose children

- **Introduce and scaling-up coverage of high-impact, new improved vaccines and technologies of national priority**

Key areas of Focus;

- Introduce Rubella vaccine to under one-year children with demonstration of disease burden
- Introduction of Hepatitis B birth dose to maintain Prevalence of chronic hepatitis B virus infection to less than 1% among children under less than 5 years old by 2025
- Introduction of YF vaccine into the routine services.
- Introduction of booster doses beyond infancy
- Demonstration of HPV disease burden in an intention to introduce HPV to 14 years of age girls if appropriate.
- Demonstration of typhoid disease burden in an intention to introduce the new typhoid vaccine if proved of priority.
- Scale up innovative immunization-related products.

- **Meet national eradication, elimination and control targets**

Key areas of Focus;

- Sustain Sudan Free poliomyelitis
- Elimination of Measles and Rubella in all the country by 2025
- Elimination of Neonatal tetanus in all the country by 2025
- Sustain Prevalence of chronic hepatitis B virus infection to less than 1% among children under less than 5 years old by 2025

- **Decrease in number and magnitude of outbreaks of epidemic-prone vaccine-preventable diseases**

Key areas of Focus;

- To strengthen the capacities to prepare for, prevent and rapidly respond to infectious disease outbreaks
- To ensure essential immunization services with other health care services are maintained in areas affected by conflict, political instability, and other emergencies

- **Build effective, efficient and resilient immunization system with all essential components as part of national primary health care systems aimed at achieving universal health coverage.**

Key areas of Focus;

- Extend immunization service delivery sites and create demand
- Ensure availability adequate health workforce for immunization at all levels
- Attain high quality supply chains and effective vaccine management to facilitate equitable coverage in immunization and establish synergies with other PHC supply chains where possible.
- Ensure comprehensive vaccine-preventable disease surveillance supported by strong and reliable laboratory-based systems.
- Ensure sustainable funding and increased share of immunization programme expenditures coming from domestic resources
- Sustain coverage of all vaccines after the transition from donor financing

The implementation of this strategy will require coordination, collaboration harmonization of implementation among multiple sectors. Implementation, monitoring and evaluation of the cMYP is a major function of the immunization Programme, joint planning and implementation will facilitate effective resource mobilization, and streamline aid effectiveness.

The strategy has outcome-based monitoring framework (will be completed by end of 2020) to measure the short term achievements as well as the long term impact of the strategy interventions. The monitoring framework include indicators for all levels of the outcome chain.

Evaluation will be conducted at the end of the last year of the strategy to measure achievement of the strategy objectives and outcomes and the overall impact on health status in Sudan.

Annual work-plans with integrated and consolidated activities will be developed on the basis of this cMYP for each of the years 2021 through 2025. The cMYP has to be regarded as “work in progress” which needs to be revised on an annual basis in light of new developments in the immunization and vaccines field and/or possible changes in financial contributions from both the Government of Sudan and international donors.

Costing and financing of this cMYP will be completed by the end of 2020.

Introduction

Sustainable Development Goal 3 for health, calls for all countries to move toward providing health care and financial protection to everyone through universal health coverage, emphasizes the importance of reducing out-of-pocket spending, providing financial risk protection, and focuses on equity in accessing health services across socioeconomic strata. The universal health coverage (UHC) goal and equity focus set by the 2030 Agenda for Sustainable Development, require new ways to deliberately extend health services to un/under- served population. Immunisation plays a critical role in achieving the SDGs, most directly, it contributes to SDG3—"Ensure healthy lives and promote well-being for all at all ages"—while also contributing directly or indirectly to the other 13 SDGs.

"Immunization is, and should be recognized as, a core component of the human right to health"[2] It is a key component and part of the foundation of primary health care (PHC) and is making huge contributions towards universal health coverage. It reaches more people than any other health service. It is considered as a lifesaving and life-enhancing intervention saving millions of lives every year all over the world. Vaccines are critical to the prevention and control of infectious-disease outbreaks, they reinforce global health security and will be a vital tool in the battle against antimicrobial resistance. Vaccines are known to have substantial health impact and to be cost-effective, based on the costs of illnesses averted, it is estimated that projected immunizations will yield a net return about 16 times greater than costs over the decade[3].

In Sudan, – more than 1.5 million of infants vaccinated annually – more than 90% of all babies born – has been reached with the third dose of DTP containing vaccine. More than 12 previously life-threatening diseases are now being prevented by immunization in Sudan, Since 2010, more than 5 new and under used vaccines have been introduced and being used to prevent key

[2] *Global vaccine action plan 2011–2020. Geneva: World Health Organization; 2011 (http://www.who.int/immunization/global_vaccine_action_plan/ GVAP_doc_2011_2020/en/, accessed January 2020)*

[3] S.*Ozawa,S.Clark,A.Portnoy,S.Grewal,L.Brenzel,andD.G.Walker,"Return on investment from childhood immunization in low- and middle-incomecountries,2011–20."HealthAff(Millwood),35,no.2(2016):199–207.*

diseases such as Pneumococal disease, Rotavirus, Meningitis A, Cholera and Yellow fever infections.

Immunization is an investment in the future and will contribute to the National and Global Development.

Country Profile

Sudan land covers an area of 1,8 million square kilometers. It shares its borders with 7 countries, where the Sudanese population and those of the neighboring countries move freely across these borders. The northern part of the country is an extension of the Sahara Desert, the contrapuntist a dry savannah area and the southern part has a rich savannah. Climatic factors can contribute to humanitarian emergencies related to drought and floods, and ecological factors expose much of the population to major infectious diseases. Difficult access to some areas, rural-urban migration, natural disasters, the longstanding civil war in the South and limited resources had a significant impact on the provision of health care services. Therefore, there are variations within the country in delivery of services, vaccination coverage and disease incidence. The total population is estimated to be 47.9 million in 2019 (projected from 2008 census) with an annual growth rate of 2.4 %, with total fertility rate of 4.5, family size ranges from 5-6 members. Children less than 5 years old represent 15.2% of the total population, while those less than 18 years old represent 50.6%. The rural population represents about 65-70%, while nomads represent 8%. Disparities between rural, semi-rural and urban areas are evident with a poverty rate of 67.4% in semi-rural and 64.8% in rural areas. The population is unevenly distributed in the 18 States, with majority in 3 States (Khartoum, Gezira and South Darfur). There are 2.2 million internally displaced people, and refugees from neighboring countries amount to another 2 million.

Life expectancy at birth, a measure of the general health condition and an indicator of the standard of living was estimated to be around 63 years. The infant mortality rate was estimated according to 2010 SHHS as 60 per thousand LB.

Table (1): Demographic indicators, 2019

Indicator	Value
Total Population (Estimated from 2008 census projection)	47,938,040
Growth rate	2.4%
Under-1 year population	1,635,788
Under-5 years children	7,570,397
Pregnant women	1,641,751
Infant Mortality Rate / 1,000 live births	52 (MICS 2014)
Under five Mortality Rate / 1,000 live births	68 (MICS 2014)
Maternal Mortality Ratio / 100,000 live births	133 (MDR)
Crude birth rate / 1,000	37.8
Rural population	70%

Primary education enrolment is 46%; with 82.2% of the cohort entering primary school completing primary education. The adult literacy rate in Sudan is 69%, while it is 45.2% among women aged 15-24 years.

Decentralization was introduced in 1994 as a system of governance compatible with the needs of the multi-ethnic and multi-cultural society of Sudan. The country comprises of 18 states which are divided into 189 localities (3 localities in South Kordofan state are completely inaccessible) . The constitution and the Federal System Act (1999) regulate the relationship between the three tiers of the political system (federal, states and localities). The decentralized health system defines the roles and responsibilities of different levels. The National level is concerned with policy making, planning, supervision & co-ordination. The state governments are empowered for planning, policy making and implementation at state level. There is an uneven distribution of financial resources and manpower between states and between rural and urban areas.

Economic Situation

Although Sudan is rich of natural and human resources, economic and social development remained below expectations. The country is classified as a low middle-income country according to the World Bank standards. On the Human Development Index devised by UNDP, human development is also extremely low in Sudan, in 2019, Sudan ranked 168 out of 189 countries for which the index was calculated, Human Development Index value (HDI) is 0.507 (world: 0.731). Multidimensional poverty index showed that, population in multidimensional poverty, headcount is 52.3%, with intensity of disparities of 53.4%[4]

Economically, in 2017 Sudan was categorized as middle-income country (2,899 US$ GDP per capita). However, in 2018 the country economy went through several financial crises, inflation rate reached more than 60% in 2018, devaluation of the national currency with scarcity in hard cash, the GDP per capita fell to 1229 US$ which re-categorized Sudan as Low-middle income country *(Ministry of Finance and Economic Planning).*

The EPI in Sudan is funded by international donors complementary from the government of Sudan and private sector (for profit and not for profit). The domestic funds (public and private) used mainly to cover staff overhead costs besides establishing EPI fixed services points.

Table (2): Selected aspects of health financing in Sudan (Source: Sudan SHA 2018)

Indicator	Value
Total expenditure on health as percentage of gross domestic product	4.78 %
General government expenditure on health as % of total government expenditure	9.9 %
Out-Of-Pocket (OOP) % out of total Current Health Expenditure (CHE)	69.2%
GDP Per capita total expenditure on health	1229 $
National Health Insurance Fund (NHIF) coverage	66.8%

[4] Human Development Report Office 2019, UNDP

cMYP Development Process

cMYP (2021-2025) developed by the Federal Ministry of Health with consultative process and collaboration with related partners namely WHO and UNICEF. This updated cMYP is established in discussions and deliberations of senior EPI in consultations with EPI representatives at sub national level, PHC and planning officials together with full involvement of key partners. It is based on in- depth situation analysis, the plan takes the previous EPI Five-Year Plan 2017-2020 forward, taking into account new interventions with consideration to the challenges that might be faced during the polio and Gavi transition phase.

The cMYP must be regarded as "work in progress" which needs to be revised on an annual basis in light of new developments in the field and/or possible changes in financial contributions from both the Government of Sudan and international donors.

Annual work-plans with integrated and consolidated activities will be developed based on this cMYP for the years 2021 through 2025.

Situation Analysis

The Comprehensive Multi-year Plan 2017–2020 (cMYP) for immunization was developed to guide and realize the vision of the Decade of Vaccines 2011-2020 and the National Health Sector Strategy 2017-2020, aiming that all Sudanese individuals and communities enjoy lives free from vaccine preventable diseases. Immunization acts as a foundation for sustained decrease in morbidity and mortality from vaccine-preventable diseases across the life-cycle of all individuals.

At the bigger picture, the cMYP 2017–2020 created a comprehensive framework for addressing immunization key issues, uniting disease eradication and elimination initiatives as well as routine immunization. As a national strategy and advocacy tool, it helped to maintain keeping immunization's visibility and overall, contributed most to the enabling political environment for immunization. Sudan immunization programme has achieved a good progress through the previous cMYP cycle, despite these improvements there are many targets moving forward in the right direction but have not been yet achieved. cMYP targets were aspirational, however, the timelines for their achievement may have been unrealistic. Many of the 'failures' to achieve

targets reflect highly challenging circumstances – particularly the impact of conflict, political instability and availability of sufficient resources.

The six cMYP guiding principles although, were not fulfilled completely, they helped to shape the strategy and interventions throughout its cycle and will remain relevant for the next cycle. While all were important, equity was a strong guiding principle. It fostered shared responsibility and partnership. Application of the core principles was not clearly defined (the how) from the start and was not monitored, early planning for ensuring the application of the agreed upon principles will be considered for the new cycle.

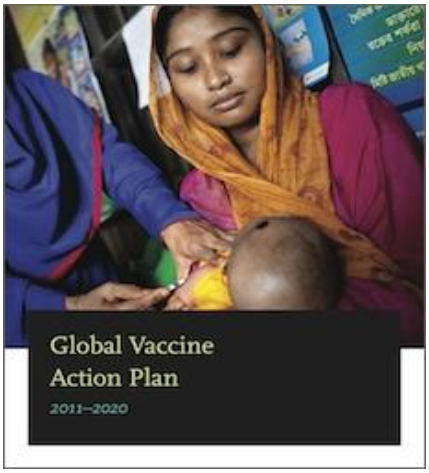
This situation analysis will review the progress of the cMYP's 2017–2020 goals and objectives. It will reflect on the achievements and shortcomings of previous cMYP cycle, and makes recommendations for the development, content and implementation of the new cMYP 2021-2025.

Sudan cMYP 2017-2020 at a Glance

The previous **cMYP 2017-2020** development was guided by the global immunization strategy; Global Vaccine Action Plan (GVAP), and the National Health Sector Strategy (NHSS) 2017-2020.

Vision: Sudan population enjoy lives free from vaccine preventable diseases.

Guiding principles



1. **Country ownership** - Country has the primary ownership and responsibility for establishing good governance and for providing effective and quality immunization services.
2. **Shared responsibility and partnership** – Immunization against vaccine-preventable diseases is an individual, community and governmental responsibility that transcends borders and sectors
3. **Equity** – Equitable access to immunization is a core component of the right to health giving more attention to vulnerable populations.
4. **Integration** –Strong immunization systems, as part of broader health systems and closely coordinated with other primary health care delivery programmes, are essential for achieving immunization goals
5. **Sustainability** – Informed decisions and implementation strategies, appropriate levels of financial investment, and improved financial management and oversight are critical to ensuring the sustainability of immunization programmes
6. **Innovation** – The full potential of immunization can only be realized through learning, continuous quality improvement and innovation across all aspects of immunization.

Goal

To reduce vaccine preventable diseases morbidity and mortality and enhance immunization throughout the lifespan of population.

Objectives

1. Meet routine vaccination coverage targets at national, state, locality and community levels
2. Sustain Sudan free of poliomyelitis
3. Meet National control and elimination targets
4. Introduce new improved vaccines and technologies of national priority
5. Strengthen Immunization programme system; ensure sustainable funding and quality supply.

Implementation and Progress of cMYP 2017-2020

The **cMYP 2017-2020** provided a framework for aligning priorities, activities, and assessing progress. Enormous progress has been made towards its targets, yet some targets are not likely to be achieved by 2020. Even so, the 'off track' label masks steady progress in many areas. The progress in many areas will be reflected as target achieved, in steady progress or off track.

"Routine Immunization" – one term, two perspectives: immunization system strengthening and coverage improvement.

The immunization system, as part of a functioning health system, is the foundation for achieving and sustaining coverage targets, successfully introducing new vaccines and sustainably reducing or eliminating vaccine-preventable disease and mortality .Like all preventive health programmes, the immunization programme has to be aligned within the broader health system, and as such has to conform with the universal health coverage concept promoted by WHO, and to the principles of the International Health Partnership(IHP)+platform.

The term "routine immunization "is understood in two distinct ways that relate to the foundation of the health system and activities to improve coverage, It is important to distinguish between these perspectives, as many activities to strengthen routine immunization systems may not result in short-term or rapid improvements in immunization coverage. Equally, many activities specifically designed to rapidly increase routine immunization coverage may not result in the long-term strengthening and sustainability of the programme[5].

[5] Global Routine Immunization Strategies and Practices, WHO, 2016

Securing the Foundation, Strengthening the Immunization System

Immunization system" refers to the part of the health system that facilitates vaccination service delivery to the eligible population. The term encompasses system components which are;

- Programme management, planning and financing
- Human resource for immunization and primary health care services implementation
- Vaccine supply, logistics support and quality assurance
- Communication and demand creation
- Monitoring, evaluation, surveillance and data management

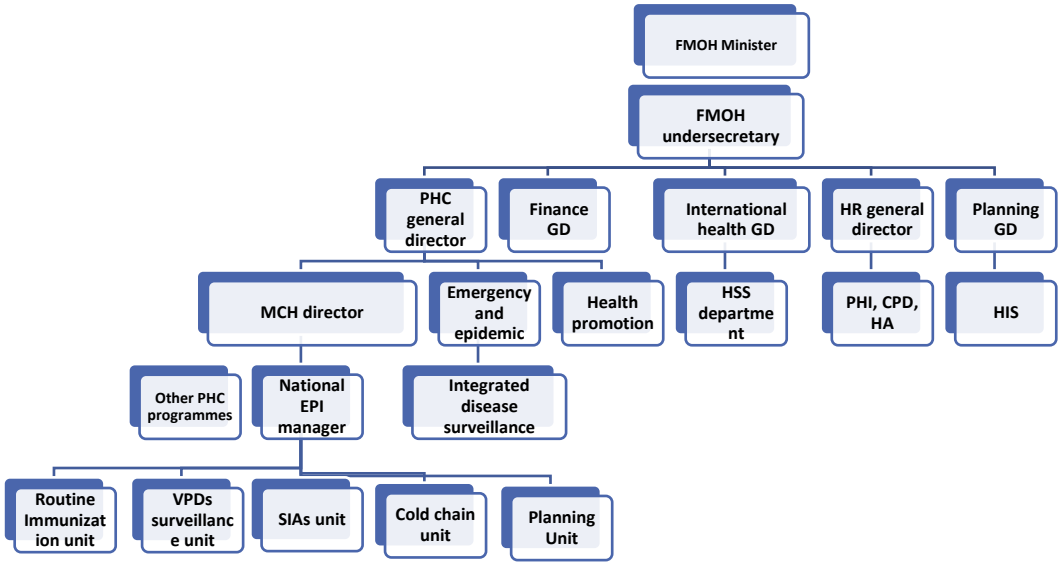
They are the foundation on which the immunization programme is built on and are part of the overall health system in the country.

Immunization Programme Structure and Management

The Expanded Programme on Immunization in Sudan was established in 1976. Immunization services is the responsibility of the Expanded Programme on Immunization, which comes under the Maternal and Child Health Department, which is one of the 4 departments under the Basic Health Care Directorate which in turn under the supervision of the Undersecretary FMOH.

The Programme comprises of five main sections: Planning and policy, supply chain, Supplementary Immunization Activities (SIA), monitoring and evaluation including operational research, Polio eradication and integrated disease surveillance. The EPI Manager oversees the overall Programme.

Fig (1): Organogram of the Federal Ministry of Health



Immunization services structure is composed of four levels as following:

- **The National (central) level:** It is responsible for national policy formulation, decision-making, development of strategies and plans, development of guidelines and tools, resource mobilization, monitoring and evaluation and coordinating the immunization services delivery in the country.

- **Sub-national Level:** the states levels is the next level in the federal structure, all states have an EPI manger under the supervision of the state Director General administratively and under central EPI supervision technically. They are responsible of developing and implementing the immunization plans for their states, monitoring and evaluation and coordinating immunization activities in the state and supervise the levels under them.

- **Districts (Locality) level:** district level is the third tire in the federal structure; it is considered as the lowest administrative level. There is an immunization officer in each district, responsible for implementation and monitoring the immunization activities and services in his/ her district. Shortage of adequate human resources, especially in remote

areas is a concern for the EPI and the health system at the sub national and districts levels as well.

- **Health Facilities:** The health facility is the last tier in the immunization services structure which is the service delivery points. The data/ reports are generated at facility level to its districts on immunization related coverage and activities. At the service provision level, implementation of immunization activities is done by a PHC cadre or immunization officer who is responsible for immunization, social mobilization, outreach activities and record keeping. With the new scope of integrated PHC service delivery the immunization service providers have been trained to deliver PHC package of services including nutrition. Staffs have high moral obligation and commitment towards immunization but they lack motivation due to scarcity of fund with the increasing load of work.

The EPI has a well-defined organogram and structure covering all immunization services with clear ToR. At the central level 98% of the its structure is occupied by related personnel. There are staffing gaps and low capacity observed at localities and health facilities level., no mechanism in place to regularly review and update the structures of EPI, in order to ensure that the structure is aligned with the need and fit for purpose. Technical competencies of the personnel at Federal level are considered adequate, however, staff capacities at states, localities and service delivery , need to be strengthened both in terms of number and skills. According to Programme Capacity Assessment (PCA) findings, training and capacity building activities are usually adhoc and lack quality assurance.

Immunization systems as an integral part of health system

The health system in Sudan is still fragile and challenging, health system blocks are below the WHO standards. EPI is considered as one of the well performing programmes, verticality and donor dependency remained a challenge for sustainability and affect the performance in some localities with extremely weak health system.

The success of the immunization programme in attaining its goals and becoming financially sustainable depends upon the presence of a well-functioning health system. The several components of the immunization system require multi-disciplinary attention in order to build a cohesive, non-fragmented and well-functioning programme that coordinates and works in synergy with other primary health care programmes.

The EPI as a programme within the MCH department is working in synergy with the other PHC peogrammes, many activities and services are delivered in an integrated approach in routine services as well as during SIAs, for example distribution of Vit A to under five children within the NIDs campaigns and the capacity building for skill birth attendants along with the MNTE programme. Comprehensive approach for pneumonia and rotavirus control was addressed through the communication components along with the delivery of these two new vaccines.

Further work is needed in order to strengthen the different components of the immunization programme within the context of overall health system strengthening, including human resource capacity building, procurement and logistics system, vaccine-preventable diseases surveillance, laboratory capacity, improving immunization data quality, and monitoring and supervision;

Private Sector Engagement in Immunization Services Delivery

The global immunisation community is increasingly urging countries to engage more closely with the private sector in coordinating, planning and monitoring immunisation activities, particularly to reduce inequities in availability of services between geographic areas and population groups and increase overall coverage of immunisation services. Given the prolonged conflict, economic turmoil and limited human and institutional capacity of the government, Sudan has explored ways of regulating, and expanding partnerships with private providers to deliver health and immunisation services to inaccessible and difficult-to each population. For more than two decades, the private sector in Sudan, including non-governmental organisations and for-profit providers have played a key role in delivering immunisation services, especially in conflict-affected Darfur region and in the populated Khartoum state. The agreements necessitate that they are licenced; by the state's governments, follow the national immunisation policy, use the

vaccines supplied by government, offer vaccinations free-of-charge and compel to reporting and supervision requirements of the EPI.

Fifty-five per cent of private health facilities in Sudan (411 out of 752) provide immunisation services, with 75% (307 out of 411) based in Khartoum state and the Darfur region. In 2017, private/non-governmental health providers administered around 16% of DTP containing vaccine third dose to target children[6].

Involvement of the private sector in immunization service delivery, reflect the importance of strengthening public–private collaboration with clear policy regulations by incorporating them into the immunisation programme's decision-making, planning, monitoring and evaluation to ensure their compliance with immunisation guidelines and ensure quality of services.

Moving forward, with projected income growth, Sudan will be transitioning out of donors' financial assistance, strategic engagement with the private sector will become more important.

Immunization Coordination and Technical Forums:

The EPI has well-functioning different supporting bodies who provide advisory technical and regulatory support to the programme. EPI is working towards operating these bodies in close collaboration to each other. National Health Sector Coordination Committee (NHSCC) is the coordination forum responsible for Gavi related support, for oversight, coordination and for discussing critical issues affecting the implementation of Gavi/GFATM HSS programs. The NHSCC acts for the immunization and the health system strengthening (HSS) as well. It is responsible for revising and endorsing the plans, applications for Gavi support, and progress reports.

This committee currently has no well-established links to the health partners forum or its related four committees. To be eligible for new Gavi vaccine or financial support, country needs to demonstrate a functioning coordination forum. Recognizing the critical role of the Coordination Forums (CFs) for effective and efficient management of projects and programmes and to have a catalytic impact on its successful implementation, FMOH under the Gavi support through technical support from the Global Health Development (GHD), reviewed the coordination

[6] Private sector engagement and contributions to immunization service delivery and coverage in Sudan, Ahmed N, et al, BMJ, Glob Health 2019

mechanisms, identified and recommended ways to strengthen and link it to the existing related coordination mechanisms within the Health Partners Forum, which is the Development Program Steering Committee (DPSC), aiming to demonstrate a practical model that can be applied with other partners' related support forums.

National Immunization Technical Advisory Group (NITAG) is another supporting body for the EPI to decide on the programmatic technical decisions and interventions such as new vaccines introductions. It is well functioning group meeting the WHO standard criteria and indicators of performance. Coordination and participation of NITAG chair/member in the NHSCC is recommended.

The National Regulatory Authority (NRA) is a committee formulated under the National Medicines and Poisons Board (NMPB) which is responsible for vaccine quality, registrations and post marketing surveillance follow up.

Specific Surveillance/ Technical Expert Committees are in place such as;

- Measles Expert Committee: supports the measles and rubella surveillance.
- The Causality Assessment Committee: supports the classification of AEFI cases.
- Validation & Certification Committee, AFP Expert Committee and the National polio lab WPV containment Committee supporting the polio eradication and AFP surveillance.

Immunization Planning: As part of the Reach Every Community (RED) approach adopted by the immunization programme since 2005, districts micro plans have been prepared based on multiyear and annual EPI plan targets, microplans are annually updated by the district's operation officers for all districts. In the recent years the new shift to Reach Every Community strategy (REC) was adopted, plans are addressing population by area in order to minimize the inequities within districts and ensure universal immunization coverage; Micro plans include clear execution of immunization sessions by different strategies, fixed and outreach sessions are usually organized according to actual population size, geography, and community needs. Strategies to reach and immunize hard to reach, special and disadvantaged population are usually identified. Despite the REC that, implementation of locally tailored interventions to cover under-immunized and un-

immunized children is still not satisfactory as some areas and populations did not achieve the targeted coverage yet. This has been well focused on and prioritized during this cycle of the cMYP to ensure equitable access to immunization services.

Immunization Partnership

Sudan has signed the International Health Partnership + Global Compact in 2011, aiming to promote stronger, more effective partnership that can enhance the country progress towards global health goals. The immunization programme is working in partnership-based action in collaboration between Federal, state, related sectors, communities, NGOs, private sector, civil societies and development and humanitarian partners. The capacity of different partners with relevant skills and expertise is well recognized and maximized through collaborative actions. Main partners of the EPI are WHO, UNICEF and the Gavi Alliance; they provide technical and financial support to the programme for routine services as well as for the supplementary immunization activities. The immunization programme in this plan cycle will participate actively to involve a broad range of national and international development partners to assess progress towards achieving targets and maintain sustainability of the immunization programme.

Human Resource for Immunization

The immunization programme structure in Sudan has a satisfactory human resource distributed at all levels of the programme management and service delivery. It is headed by the EPI manager at National level, 18 states EPI managers, and the locality operation officers at districts level, supported by AFP and VPD surveillance officers, the supply chain officers, admin staff and vaccinators. During the last 5 years the program faced high turnover of the staff at the different management level, either due to new competing opportunities abroad with better financial rewards and salaries or due to frequent political and administrative changes, this in addition to the concern regarding equitable distribution of the service providers. 50% of immunization service providers are volunteers / temporary staff. 81% of the vaccinators in the fixed immunization sites are females, while the mobile services are delivered mainly by males,

Feminization of health workforce, including EPI, limits the ability to address the inequitable distribution of health workforce particularly, in rural and hard to reach areas.

Table (3): EPI Human Resources: Numbers and Distribution across Levels (EPI Micro plan, 2019)

Staff Categories	Target	Current	Permanent staff	Temporary staff
Federal EPI Staff (technical staff)	58	49	40	9
States EPI staff	90	88	88	0
Locality Operation Officers	189	185	185	0
IVPDs Surveillance officers	203	203	203	0
Vaccinators (service delivery level)	6829	6809	3353	3456

Although the FMOH moved towards the new approach of integration of services, minimizing the programs verticality , multi- task shifting was endorsed for more holistic approach for service delivery, in order to reduce the impact of staff shortage at service delivery points, this was not reflected relatively on the high dependence on volunteers or temporary vaccinators working at the service delivery points due to services expansion.

The system of incentives to the immunization staff based on performance and targets achievement was not effective during the last few years. There was no retention policy, or interventions and no promotion for the medical doctors and public health officers working in the programme to encourage them to continue working for the EPI, except for the top up payments for some staff at central level, which is supported by the partners.

With fast-going development of immunization services, technology and innovations, quality of immunization programme system and services depends on its ability to ensure that the knowledge and skills of its staff, managers and vaccinators are up to date . Despite that, there is a well-established programme of capacity building for each level and by type of cadres, the implementation of different in-service training courses was weak during the past planning cycle due to different reasons. Programme Capacity Assessment (PCA) conducted in 2018 revealed that there is no comprehensive skills and training needs assessment for EPI at all levels especially

state and locality. Training and capacity building activities are adhoc and there was no comprehensive training plan available.

Comprehensive vaccinators pre-service training programme and career development pathway which was planned to be implemented during the previous cycle, was not implemented. It is a priority target for this plan cycle to revise and update the current vaccinators pre-service and in-service training programmes and curriculum.

The challenges of high turnover of managers and other staff, and the weak capacity building programme is a threat for quality immunization services and sustainability.

Immunization Supply Chain(iSC)

Immunization supply chain and logistics is an essential system and backbone for the immunization program, it is a system for storing and transporting vaccines at recommended temperatures from point of manufacture to the point of use, thus ensuring the potency and safety of vaccines throughout transportation and storage phases.

With the new vaccine's introductions in Sudan and the greater storage capacity required at every level, the country maintained enough cold store capacity at all levels. The supply chain was expanded to meet the changing requirements of the immunization program to maintain enough cold store capacity for all levels up to the recommended quality standards and to prevent equipment breakdowns.

The supply chain system is satisfactory functioning, it complies with the good storage and distribution practices. Preventive and curative maintenance systems are operational for cold-chain equipment, storage buildings, and vehicles used to distribute vaccines with variable performance at different levels of the supply chain.

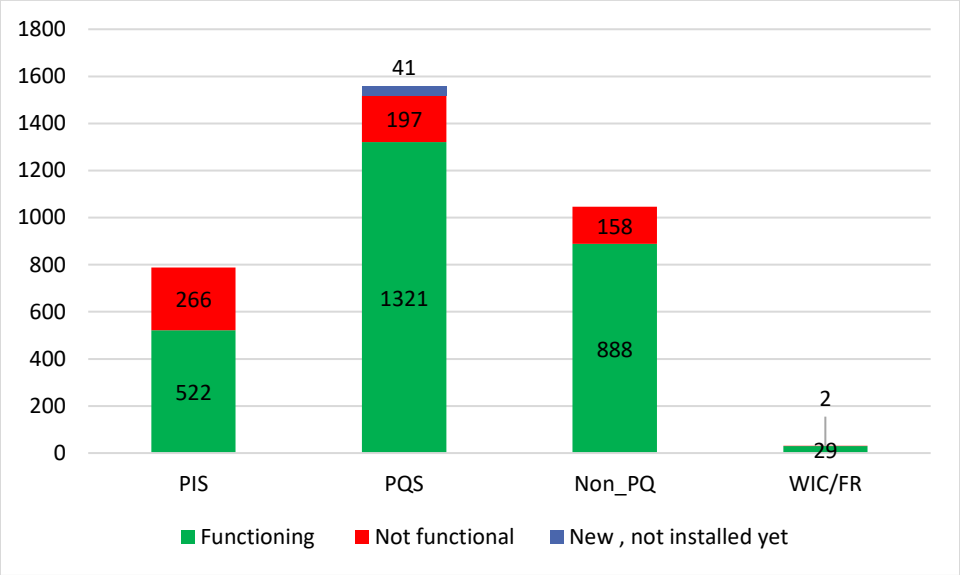
Immunization Supply Chain in Sudan operates as a vertical supply chain system featuring four levels; central vaccine store, state vaccine store, locality vaccine store and health facility.
For each level of the supply chain certain cold chain equipment are used according to the status of the area (availability of electricity power supply) and the population size.

The Sudan Central Cold Store was one of the best stores in EMR, since 2004 advanced technologies for vaccine stock management (VSSM) and temperature monitoring was introduced into the central cold store. It was certified by WHO and UNICEF many times (2008-20016), with high certification standard (score of more than 90% for the 10 vaccine management global criteria's). In 2009, it has awarded the award of excellence in vaccine stock management from GAVI.

National Cold Chain Equipment Inventory

Sudan has conducted comprehensive national cold chain equipment inventory in October 2016, updated in August 2018 with a major objective of quantifying and characterizing the condition of the cold chain equipment throughout the country. The inventory aimed to investigate the functionality, models, source of energy and reasons for non-functionality of refrigerators/freezers. It also shows distribution of other cold chain equipment like the cold box and vaccine carrier. The findings of the inventory showed that; total functional CCE in the country for all types (PQS, PIS and Non-PQS including cold and freezer rooms) are 2,760 (81%), while only 1,559 (45%) are PQS pre-qualified equipment, out of which, 1,321 are functional. Obsolete CCE were 23% (more than 10 years of age), according to WHO protocol, equipment for vaccine storage is no longer optimum in performance after 10 years of operation, hence its continuous use could lead to compromising vaccine potency and those that do not perform well will need to be replaced gradually.

Fig(2): Distribution of CEE per PQ norms and functional status, 2018



Source: Sudan Updated Cold Chain Equipment Inventory Report, 2018

Supply Chain Storage Capacity and Expansion

Based on the inventory assessment findings, in 2018 EPI has distributed 475 refrigerators, 172 went for extension, 104 expansion and 199 for replacement. In 2019 EPI distributed 65 refrigerators to fill the cold chain capacity gap for Yellow Fever Campaign at state and Locality level, accordingly state level cold capacity was increased from 149,189 litters in 2016 to 224,434 litters by 2019. At locality level it increased from 69,811 litters in 2016 to 77,731 litters in 2019. At the Central level cold capacity remained the same as in 2016. At the National cold store there are 7 walk in cold rooms and one freezer room with storage capacity of;

Gross vaccine storage capacity at (2 - 8 C) = 219,324 Liters

Gross vaccine storage capacity at (-15 - -25 C) = 10,000 Liters

Cold chain inventory assessment results guided the cold chain rehabilitation, expansion and extension planning. According to the requirement for increasing the cold storage capacity at all levels, a remarkable investment in the cold chain expansion was implemented. CCE support from Gavi in line with the CCEOP window of support ***('initial support' and 'scale-up support'***) for the years 2019 -2020 with total budget of US$ 6,109,312. CCEOP support based on the GDP and joint

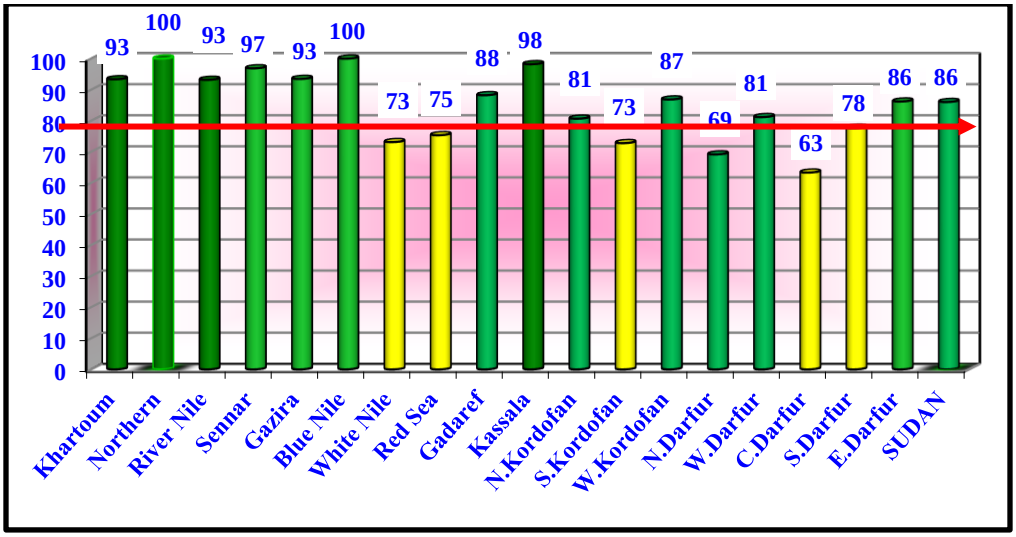
investment of 50% by the Government, Sudan is expected to contribute to about US $3,054,656, this support will address some of challenges facing the immunization supply chain especially for facilities in hard to reach areas and those with no equipment which will ensure provision of quality immunization services and sustainably, thereby contributing to UHC and equity in these areas. Yet, there is a remaining gap that is not covered by CCEOP, the country is working to cover part of this gab through Non-CCEOP from HSS2 budget reprogramming, Solarization project, Expansion project and partners (UNICEF, WHO) and other agencies.
The expansion of the immunization services and the supply chain will be guided by the Ministry of Health map of the strategic health reform and expansion plan for health services to achieve universal health coverage and equity.

Table (4): Supply chain Expansion 2016-2019.

Category	Refrigerators (AC&SDD)	%
Extension	172	32%
Expansion	169	31%
Replacement	199	37%
	540	

Cold chain Functionality should not be less than 90% at any point of time in order to maintain good quality vaccines. Rehabilitation and maintenance plans were implemented in all states with variable degrees, resulting in maintaining the cold chain functionality at 86% for the national level in 2018, despite that, functionality was less than 80% (63% - 78%) in five states in 2018. Recurrent break outs of aging equipment, and solar refrigerators spare parts and batteries are usually a challenge for the national level; given that the refrigerators are scattered around the wide country while the states and districts do not have the capacity to conduct the maintenance, in addition to the high cost of spare parts and operations.

Fig(3): Sudan Cold Chain Functionality, Dec 2018



Vaccine Management

The recent Effective Vaccine Management assessment (EVM) conducted in March 2020, reflected that there is a backward progress in the performance between the previous EVM, where the overall score was 89% in 2016, compared to the recent EVM implemented in March 2020, the country overall scored is 69% for the different EVM criteria. The central level score is 86%, state, locality and health facility scored 78%, 70% and 65 % respectively.

The assessment showed that only 55% of the previous EVM improvement plan of 2016 was implemented, this is reflected in the EVM 2020 findings, gabs and deteriorations were observed in both EVM operations (E1-E9) and management (M1-M4) criteria.

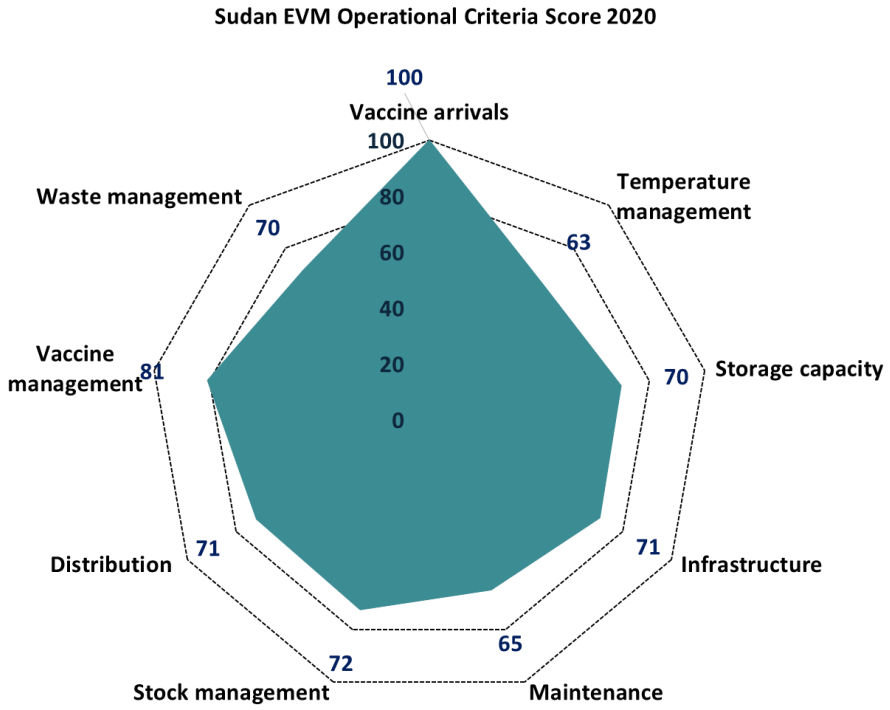
Gaps were identified in areas as annual planning, temperature management, maintenance and repair, stock management, vaccine wastage system, and immunization supply chain performance monitoring.

Table (5): Sudan EVM2 Overall Assessment Score, March 2020

		Infrastructure	Equipment	Information technology	Human resources	Policies & procedures	Financial resources			TOTAL
		C1	C2	C3	C4	C5	C6	OUTPUTS	PERFORMANCE	
Vaccine arrivals	E1			100	100	97		100		99
Temperature management	E2			68	77	71		73	41	63
Storage capacity	E3	98	66		67	71	100	67	87	70
Infrastructure and equipment	E4	61	78	76			100	74		71
Maintenance and repair	E5			33	67	51	96	57	81	65
Stock management	E6			82	71	73		68	72	72
Distribution	E7		94	38	56	49	100	76	96	71
Vaccine management	E8				86	72		84		81
Waste management	E9		66		66	66	100	65	80	70
Annual forecasting	M1				69	71		77	86	75
Annual planning	M2				43	42	88	37	65	52
Supportive supervision	M3	98	95	73	70	60	99	71		78
iSC performance monitoring	M4			84	57	69		57		62
TOTAL		65	73	75	65	64	94	65	75	69

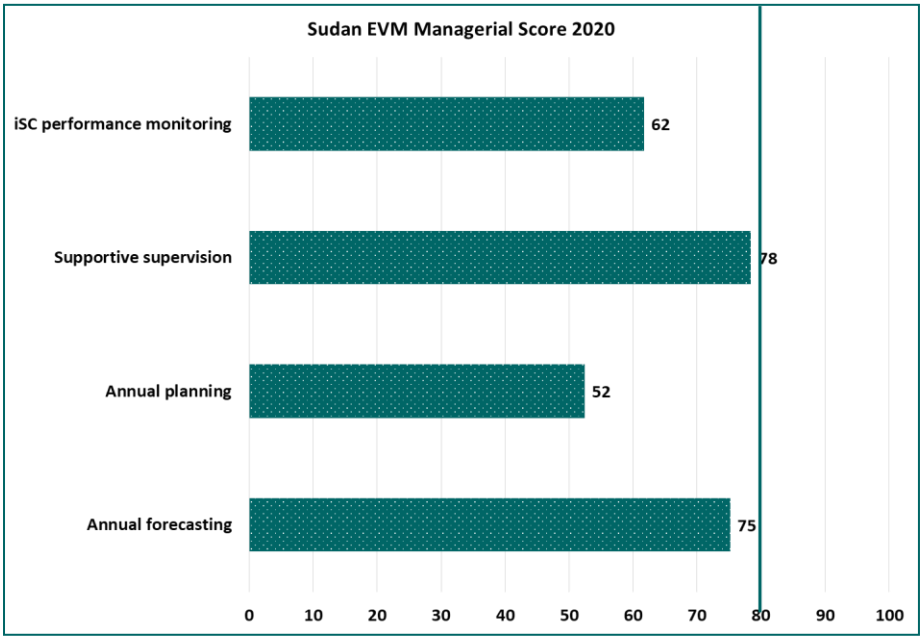
Source: Sudan EVM Report, 2020

Fig (4): Sudan EVM Operational Score, March 2020



Source: Sudan EVM Report, 2020

Fig (5): Sudan EVM Management Score, March 2020



Vaccine management performance indicators

The EVM assessment showed that there are good vaccine arrival procedures in place, this ensure that all vaccines arrived at the country are in good condition & transported to the national store within 24hrs. Vaccines were available at all levels, no stock-out was detected. Store keepers and health workers hasgood knowledge about the required storage temperature for all vaccines, they have good manual system for recording and documentation of temperature. Cold chain equipment in majority of the facilities were in good condition.

Table (6): Vaccine Stock outs 2016-2019

Level	2016	2017	2018	2019	Reason
Central	IPV	IPV	X	X	Global shortage
States	IPV	IPV	X	X	Global shortage
Localities	IPV	IPV	X	X	Global shortage
Health facilities	IPV	IPV	X	X	Global shortage

Fig (6): Vaccines Wastage Rate, 2018

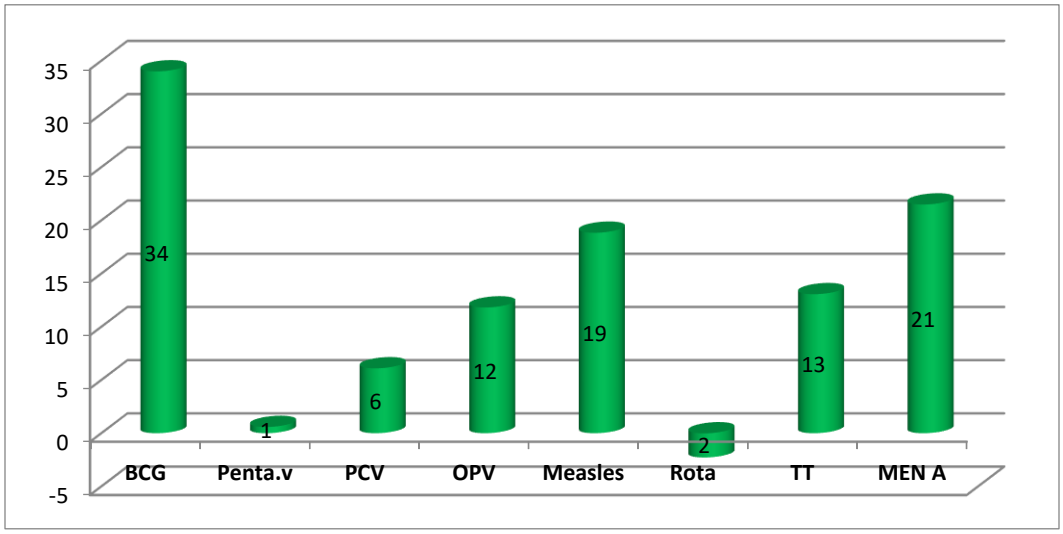
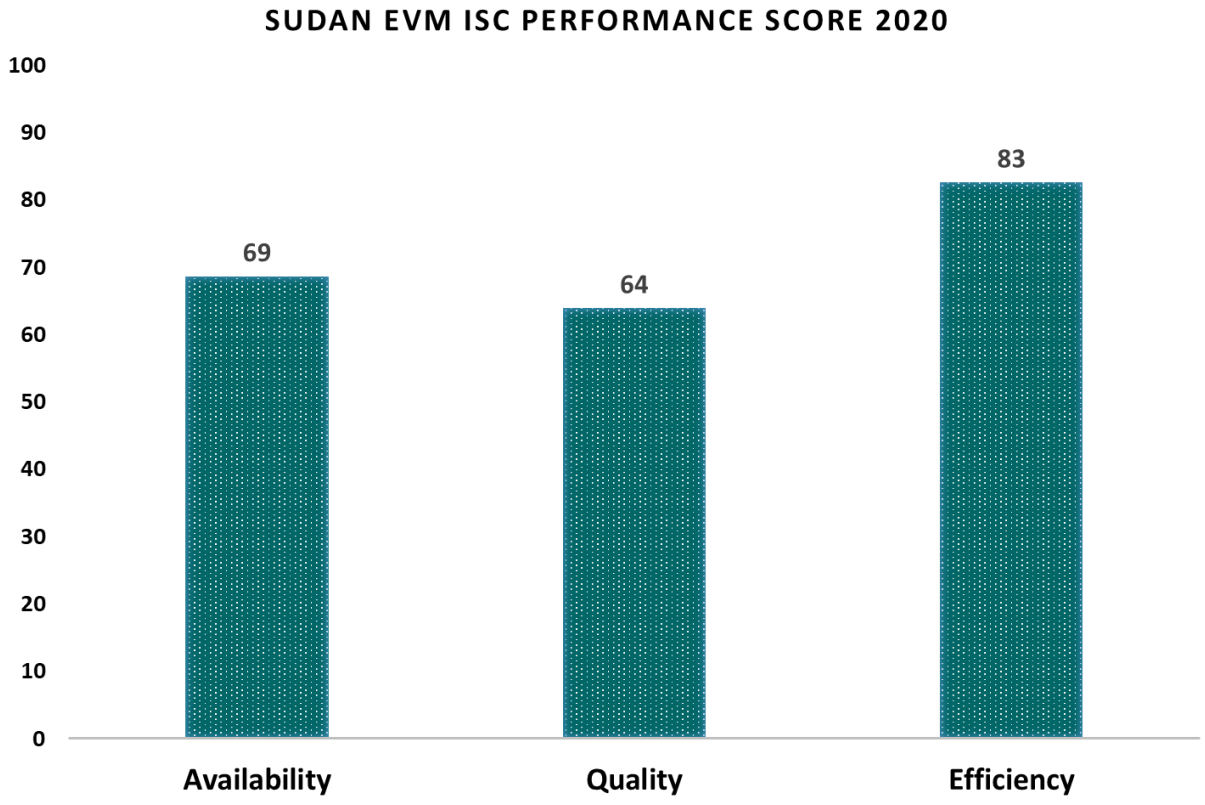


Fig (7): Sudan EVM iSC Performance Score, March 2020



Source: Sudan EVM Report, 2020

The EVM assessment report has recommended certain interventions for the detected gabs and EVMIP prepared. EVM improvement plan 2020 and cost are included as part of this comprehensive plan.

SOWT Analysis for immunization Supply Chain

Strengths and Weaknesses

Component	Strengths	Weaknesses
Cold Chain Maintenance	• capacity building for 96 Cold Chain Technicians • 25 certified cold chain installers • Investment by UNICEF to train technicians in temperature mapping • Spare parts made available through HSS2	• Aging equipment • Absence of well-equipped maintenance workshops • Weak Information system • Poor implementation monitoring and documentation of cold chain maintenance activities • Poor allocation of fund and prioritization of maintenance activities at sub national level
Supply Distribution	• distribution system performance • Direction for gradual integration with NMSF distribution system	• No refrigerated vehicles for vaccines transportation. • Limited use of VSSM and web-based supply management • Poor capacity of the dry store at state and locality level • Provision of shelves at Dry store for proper storage • Lengthy process for outsourcing contracting and the gap between one contract and the other
HR for Supply Chain	• TOR for iSC officer was developed. 10 out of 18 states nominated a dedicated supply chain officer • 96 technician trained	• Insufficient number of cold chain technicians • Reliable transportation to perform maintenance (preventive/curative) and monitoring activities • High staff turnover among CCE technicians
Temperature Monitoring	• Electronic Temperature Monitoring Devices(TMD) distributed to all facilities (30 Days Data Logger and Freeze indicators) • Guidelines for devices developed and distributed • Temperature mapping conducted to all cold and freezer rooms • Staff capacity building completed for future mapping • Temperature monitoring for vaccine during transportation under implementation	• Remote temperature system at National level is not working properly since Dec 2016 • Dependency in manual temperature monitoring, • Weak staff capacity in temperature monitoring
Building and Equipment	• Good condition cold store buildings at national and state level . • Most of cold rooms comply with WHO PQS	• Access to company back-up for the electronic system (current system)

		• Some of the buildings are old, not rehabilitated and not comply with the requirement • Some equipment is not PQS Poor work environment for storekeepers
Stock Management	• Sufficient cold store capacity at national and states levelS • Computerized system to record and dispatch supplies used at national level • Regular physical count carried out regularly • Cold and dry store capacities is adequate • Distribution of 534 CCE (ILRs and SDD) to cover the capacity gap at lower level • 2 cold rooms deployed to states to overcome stock store gap • 3,300 fridge logger and 3,000 freeze tag made available to the program • Provision of computers, bicycle and motorcycle to support stock management • Comprehensive system to record and report vaccine wastage	• Three states have gap in the required capacity • Need to improve manual recoding system at all levels • Overstock with campaigns' vaccine
EVM-IP	• 51% of the EVM recommendations has been implemented • 38% under process • Multiyear budgeted action plan has been developed to address the identified bottlenecks	• 14% of EVM-IP recommendations were not implemented • cIP is not translated into annual costed plan (until recently) • Poor ongoing planning and monitoring of cIP activities

Opportunities and Threats

COMPONENT	OPPORTUNITIES	THREATS
Cold Chain Maintenance	• Adoption of preventive maintenance through training for lower level staff • CCEOP (Training and service bundle cost already included +10 years grantee) • Procurement of category A equipment • Cold chain maintenance system (under development) Cold Chain decommissioning system (under development)	• On-going conflicts (Destruction and looting of CCE) Climate condition and building situation
Supply Distribution	• Temperature Monitoring Study during vaccine transportation (completed) • Integration and coordination with NMSF distribution and store system	• Economic situation (companies not accept long term contract)

	• Implementation of Optimization iSC study recommendations • Expansion in AC coverage (ILRs instead of solar)	
HR for Supply Chain	• Vaccinator training in preventive maintenance	• HRH turnover an unavailability threats • Poor or lack of motivation
Temperature Monitoring	• Remote temperature monitoring system with web-based and monitoring dashboard possibility • All CCEOP equipment will come with TMD	
Building and Equipment	• PHC expansion and UHC • Donor support for building in Eastern Sudan (UNICEF)	• Government budget allocation for development (under funding for construction of building and procurement of equipment
Stock Management	• Moving towards advanced electronic stock management system • CCEOP (state, locality and SF level) • NMSF stores at state and locality level	
EVM-IP	• CCEOP proposal as a systematic investment to resolve most of the identified problems • Solarization project (will contribute to reduction of storage gap, expansion and reduce running and maintenance cost	• Fund allocation form the government specially for refrigerated vehicles, spare parts and maintenance activities

Priorities for the Immunization Supply Chain

Main challenges that needs to be addressed during this new planning cycle as a priority are;

- Identified gaps in the (Gap Analysis Tool) that will not be fully covered by CCEOP (additional 856 CCE needed from government fund and partners)
- Establishment of Operational Maintenance System
- Rehabilitation and expansion of dry stores
- Provision of refrigerated vehicles and outsourcing of qualified transporter
- Establishment of electronic supply management system with dashboard

Advocacy, Communication and Demand Creation

"Demand" refers to the actions that individuals and communities take to seek, support, or advocate for vaccines and vaccination services. It is dynamic and varies by context, vaccine, vaccination services provided, time, and place. Demand is fostered by governments, immunization programme managers, public- and private-sector providers, local leadership, and civil society organizations hearing and acting on the voices of individuals and communities[7]

Communication addressing the public and clients plays an important role in increasing the utilization of EPI's services through influencing the initial performance and sustain the continuation of behaviour till the completion of the immunization schedule. Despite the success EPI achieved which is clearly reflected in the good access, high coverage and strong working environment, with cumulative experiences which lead to expanding the package of vaccines and also producing many immunization experts contributed in the national and international immunization achievements and success, despite that, there is weak routine social mobilization planning and implementation. Many challenges and new turning points appeared which requires strong, well-structured and clear strategic communication plan aiming to maintain high quality immunization services reaching every child with effective stakeholders' engagement and client satisfaction and demand supported by good advocacy demonstrating this success.

Strengths of Communication in the EPI

Communication is deeply impeded in EPI program since its early start, this became well formulated with the commitments towards disease elimination and eradication targets for which the multi strategies implemented, especially for polio end game and measles elimination initiative, resulted in a strong communication network of volunteers in the ground and good engagement of community leaders. Means of communication plays an important role in the

[7] Final Report from the Informal Working Group on Strategic Objective 2 (SO2) of the Global Vaccine Action Plan (GVAP) to the Strategic Advisory Group of Experts (SAGE) of the World Health Organization GVAP Working Group" (April 2017).

practice of caregiver during campaigns, the announcement and information about the campaign usually carried out through simple means such as mobile microphone, TV and radio which proved to be effective. On the other hand, the production of health education messages regarding vaccine preventable diseases were well developed.

Main challenges for communication

The evidence available showed low coverage, high dropout for immunization services and non/or poor utilization where services are available across many localities and communities of the eighteen states of Sudan. Frequent measles outbreaks in some states majority of the cases were un-vaccinated or partially vaccinated with high case fatality rate (CFR) attributed by surveillance data to late reporting to health facilities due to the community beliefs, norms and tradition about treating and seeking treatment for measles. conservative societies hold the belief that prevention or protection against disease is from God and that vaccines have nothing to do with prevention.

There are no enough documented evidences on the causes of low MCV2 coverage in Sudan. A recent study explored the opinions of EPI officers at SMoH, WHO, UNICEF and vaccine care providers in primary healthcare centres in Khartoum about measles coverage and outbreak, majority of participants confirmed the existence of measles vaccine hesitancy in Khartoum state[8]. Various determinants were identified including context, groups and vaccination influences. The main contextual determinant as reported is the presence of "anti-vaccination" groups, they belong to particular religious and ethnic groups. Parents' beliefs about prevention and treatment of measles are the main determinants of the group influences. Attitude of the vaccine providers, measles vaccine schedule and its mode of delivery were the main vaccine related determinants. The study concluded that Measles vaccine hesitancy in Sudan appears complex and specific to local circumstances. To better understand the magnitude and the context-specific causes of measles vaccine hesitancy and to develop tailored strategies to address them, the study recommended to further investigate measles vaccine hesitancy among parents.

[8] Sabahelzain et al, 2019

During the Tetanus Toxoid (TT) vaccination campaign, there were reports of persistent refusal cases mostly about misbeliefs linking the TT vaccine with infertility. Such instances potentially affect community perceptions on immunization. Other unreported norms or believes could be present too. Incidents of vaccine refusal were reported among some families and tribes in east Sudan linking deaths and other perceived side effect to immunization.

Socio demographic: With open borders, inter countries population movement, multi ethnic with big cultural disparities, different local linguistic, relatively high illiteracy, poverty rates and lifestyle in some rural areas are still hindering the utilization of available immunization services. The socio-demographic picture shape the community's behaviour, attitudes and beliefs, along with the environmental conditions, 70% of the population are rural population and 8% are nomadic, this is in addition to about 3.2 Million migrant and refugees with their cultural, beliefs and language barriers, affect the uptake of Immunization routine services and consequently affect the coverage of different antigens.

The routine immunization yet need comprehensive communication and social mobilization planning and specific interventions considering the cultural and language barriers. It is important to improve the compliance and communication skill of the immunization cadres; hence it's one of the pillars for improving utilization and decreasing the defaulter's rates especially in hard to reach population and new areas under peace. Strengthening the capacity for interpersonal communication and involvement of the community health workers and community midwifes is a key interventions to strengthen the communication and improve utilization and reduce the dropout rates, efforts will be made towards strengthening the communication across the program and use the integrated approaches.

A qqualitative study of immunization barriers conducted in 2018 showed the following;[9]

Community Knowledge regarding Immunization

The study findings showed that, participants mentioned that their communities know about immunization with majority of participants perceived immunizations as very important in

[9] Barriers to immunization, Sara Lavinia Brair, FMOH, UNICEF, Alneelain University, 2018

preventing childhood illnesses. Misconceptions regarding immunization was in the past, while now the communities are very welcoming to immunization services.

Some parents fear from the side effects of the immunization like fever and crying baby, so they might not vaccinate their children or not complete the scheduled doses. Others have deep misconceptions of the association of immunization with serious conditions like paralysis, infertility and death.

Knowledge about the immunization services was very good, all participants knew where to access immunization services in their communities, the immunization services provision schedule is shared with the community. Some respondents in some areas reflected that health centers are far, takes 3-6 hours to reach with no transportation and health education about immunization is not enough in health centers. Mobile teams do not have a known schedule and do not stay long enough in the village.

Perception about immunization services was good, majority of respondents mentioned that the immunization services are highly accepted by their communities. They are satisfied with the services provision. In some areas participants complained about the long waiting time and lack of privacy in some service points. Participants served by mobile teams also mentioned that the teams sometimes stays for short period in the village which does not allow all children to be vaccinated and they also mentioned that the teams might not come for couple of months which will lead to missing the children doses or the parent has to travel long way to receive services.

Perception about Service providers

The community perception towards services providers was very good and they were satisfied about the services they are providing

Practices related to immunization and service demand:

When asked about adherence to immunization services majority of respondents mentioned that people in their communities are aware of the importance of the immunization and they vaccinate their children, they became more adherent to it because now it is required for children education. Lack of awareness about the importance of immunization, ignorance and some are busy with other things were the main

reasons for parents/care givers does not start or complete immunization services. Misconception related to the immunization effects or fear from side effects were also mentioned as reasons for not utilizing services

Source of information, for advertising and promoting for immunization, the best information source is found to be the TV, radio microphone announcements during campaigns and health care provider. Family and friends are also a good source for sharing information with others.

The study recommended to;

- Raise awareness on vaccination providing in-depth explanation on vaccines, its actions and side effects to encourage people to seek vaccination and complete all the doses.
- Target misconceptions specifically to remove barriers to immunization that is still present in certain states.
- Community outreach through training mothers to train other on vaccination
- Train staff working in health canters regarding vaccines and immunization and improve their communication skills.
- Plan, implement and monitor the programmatic gabs mentioned.

Advocacy and commitment: Being a Gavi supported country, dramatic change in the program performance in term of access, coverage, partnership, system strengthening, and new vaccines introductions has generated an excellent government financial commitment.

With economic growth and new classification for the country by the World Bank, Sudan has entered the Gavi transition phase, moving towards full financing of the new vaccines introduced with support from Gavi starting 2024. This will require well organised communication and advocacy activities to keep immunization in the top agenda of the new government, especially with respect to resources, to ensure sustainability of the programme financing and avoid any future collapse of the programme.

Stakeholder's engagement: EPI is one of the good models of stakeholder's engagement from both national and international community. More engagement of public, politician, staff, community groups and CSO, Technical committees, health and pharmaceutical councils,

associations, academies, private sectors in the EPI became more crucial, which requires more advocacy , renewal of the stakeholders analysis and prioritization and bilateral plans to sustain the support should be developed.

Monitoring & Evaluation (Information Management, VPD Surveillance)

Monitoring and evaluation are essential program elements for ensuring and improving efficiency of program operations. National immunization programme, supported by all partners, has built a satisfactory system for monitoring the programme performance and disease occurrence. The EPI monitoring system is covering all the programme components through a network of information functioning through all levels. All programme components are monitored by the related EPI sections, data analysed and indicators generated by the planning and monitoring section.

Information System: The information system includes coverage and disease data, supply chain and vaccine management data and communication data. The official national immunization coverage figures are based on administrative reported data produced at the facility & the outreach services level. The reliability and accuracy of the reporting system is assessed using data quality self assessment (DQS) which is implemented as part of the supervison activities where most of the important issues of quality of the system are included, this had reflected gabs in the immunization data quality. Flow of information follow the administrative structure of the country from the health facility level, locality, state to the national level.

The information system policy and design is made at the national level, with preparation of all the required guidelines and tools for recording and reporting. Refresher training programme for information management is part of the EPI capacity building programme which was not well implemented during the previous cycle .

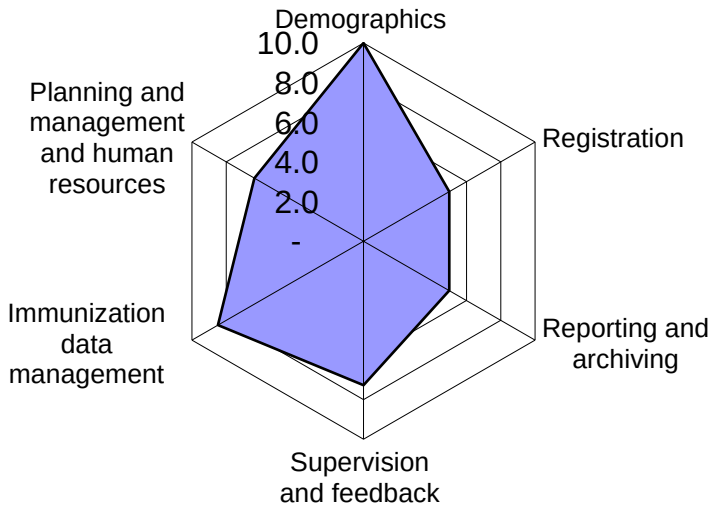
In general, the system is functioning with remaining areas for improvement like denominator issues, use of data at locality and HF level, disaggregated data by special groups (Nomads, IDPs)

and socioeconomic, disaggregated data for all antigens by gender, use of technology for data collection and analysis, and computerized recall system for defalulter tracing.

Recent Data Quality Assessment was conducted in March 2019, findings reflected many gabs at different levels and showed the followings;

The overall Quality Index (QI) at the federal level is 74%. Fairly good scoring are in the area of demographics and immunization data management , however areas related to registration , reporting and achieving as was planning and management are not optimum and needs improvement.

Figure (8): Federal Level Quality Index



The overall states QI was 87%, The overall localities QI was 70% and the overall health facilities QI was 73%.

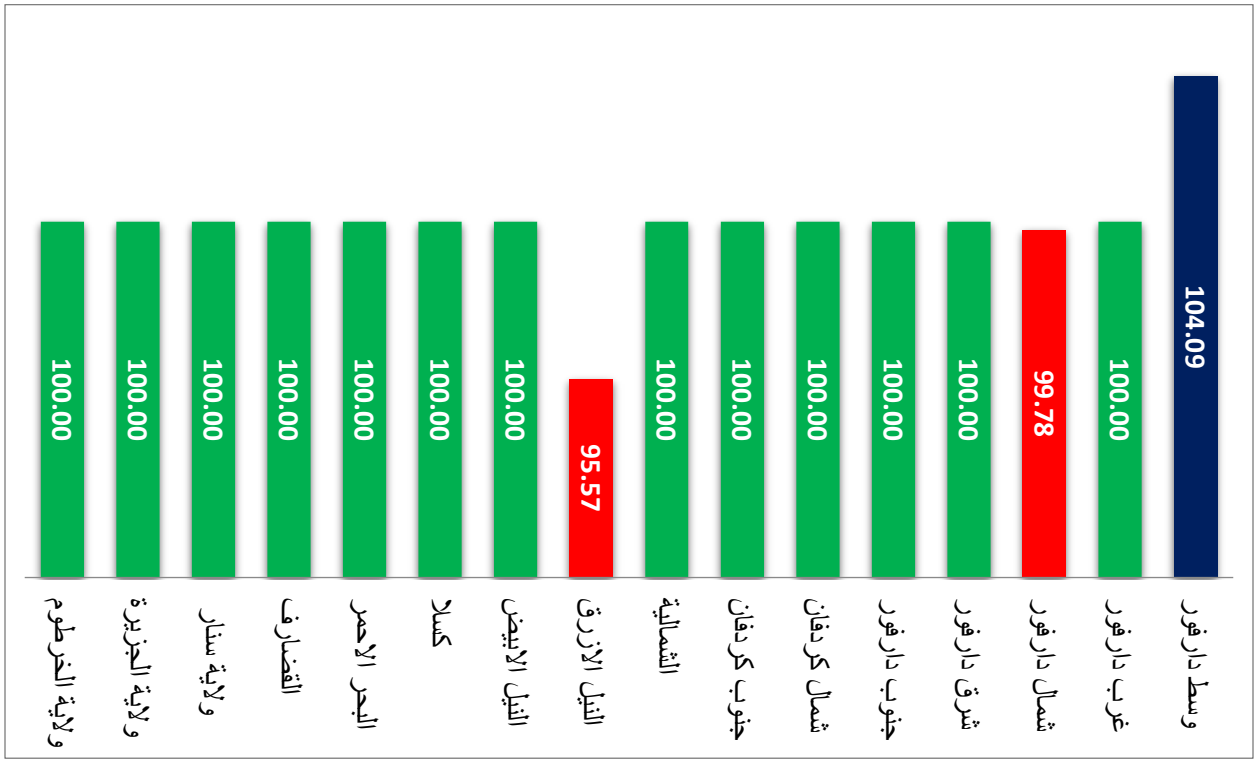
Table(7): States Quality Index (QI) by Domain, 2019

Domain	ولاية الخرطوم	ولاية الجزيرة	ولاية سنار	القضارف	البحر الاحمر	كسلا	النيل الابيض	النيل الازرق	الشمالية	جنوب كردفان	شمال كردفان	جنوب دارفور	شرق دارفور	شمال دارفور	غرب دارفور	وسط دارفور	Av. Total
Demographics	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.3	10.0	10.0	10.0	10.0	**9.9**
Registration	10.0	10.0	10.0	10.0	7.1	8.6	10.0	10.0	10.0	10.0	7.1	7.6	8.1	6.7	8.6	8.6	**8.9**
Reporting and archiving	10.0	10.0	9.6	9.2	8.8	10.0	10.0	10.0	9.6	8.4	9.2	9.3	10.0	8.4	8.8	6.8	**9.3**
Supervision and feedback	8.2	7.3	2.7	7.3	10.0	10.0	7.3	10.0	7.3	2.7	5.5	2.5	4.5	7.3	2.7	4.5	**6.2**
Immunization data management	9.4	10.0	6.1	9.1	9.1	9.4	7.6	10.0	9.1	7.9	6.7	8.2	7.3	8.5	7.9	4.2	**8.2**
Planning and management and human resources	10.0	10.0	10.0	10.0	10.0	10.0	8.2	10.0	8.2	10.0	8.2	6.0	9.1	10.0	10.0	5.5	**9.1**
QI	**97**	**97**	**82**	**93**	**90**	**96**	**89**	**100**	**92**	**84**	**78**	**76**	**83**	**84**	**82**	**66**	**86.8**

10 ***7-10*** ***< 7***

SOURCE: Data quality Self-assessment (DQS) Mar 2020 Sudan

Figure (9): States Aggregated Accuracy Ratio (AR), 2019 (number of registered Penta 3 doses compared to number of reported doses)



SOURCE: Data quality Self-assessment (DQS) Mar 2020 Sudan

Completeness and Timeliness; Number of reports received at a level and timing of sending the reports, Completeness and timeliness at state level was found 98.4% and 77.2% respectively. At locality level it was 96.2% and 89.9%.

Vaccination verification

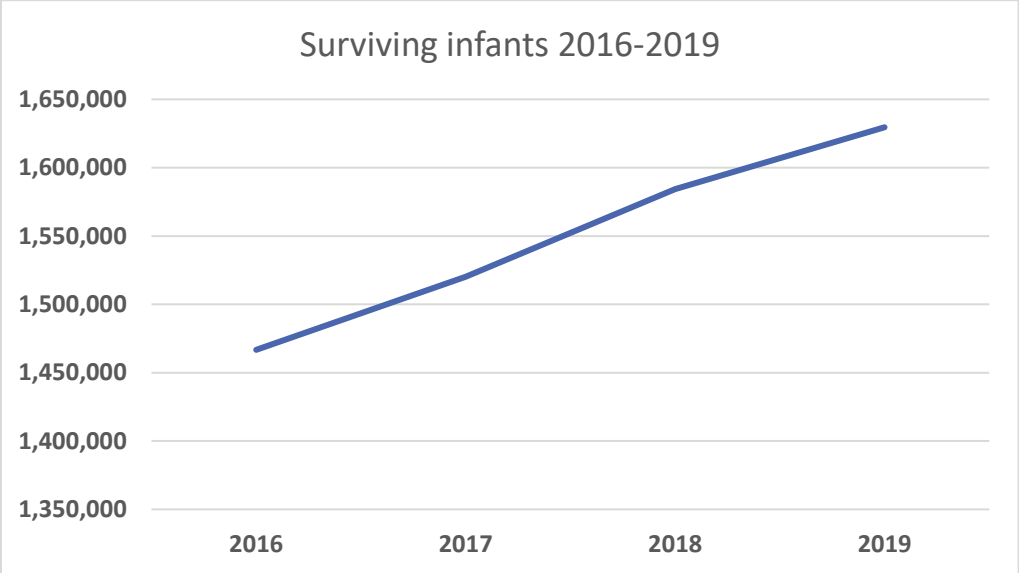
Comparing vaccination status of a number of children (MCV1) in the registry with actual vaccination of the child checked in the community. 5.6% of information found during community check were NOT consistent with that in the permanent register.

Based on the DQA findings analysis and recommendations, an improvement comprehensive plan prepared for each state and level.

Denominators: The vital statistics in Sudan are not updated, it is based on 2008 census data. EPI denominators are estimated from the 2008 census projections based on the population growth rates. In some states there are IDPs due to conflicts , population movement (nomads),open borders with no regular registeration of rufgees ,the estimated projected denominators could be lower than the actual population size in some localities, The EPI in such cases for example when the fisrt DTP dose coverage acheived is higher than the estimated projected population or more than 100% coverage, operational targets are used (total number of infants vaccinated with first DTP dose) in these states the higher figure is taken as a denominators. Therefore the country denominator used for infant is analyzed and revised annually and targets estimated based on mixed procedures as mentioned above.

Despit the denominator challanges, administrative coverage is thought to be true based on the fact that EPI program is well structured at all levels, Sudan is polio free since 2009, in addition to the documented impact of many antigens e.g. reduction of gastroenteritis cases after Rota introduction, zero cases of Meningitis A after MenAfriVac, and no yellow fever outbreak after YF vaccination.

Fig (10): Sudan Denominator 2016-2019



In addition to the information system management, other monitoring activities are implemented which includes:

Supportive supervision: Supportive supervision activities are planned for all programme components and implemented at all levels. A software tool is used for supervision, analysis and feedback. Specific supervision activities are also conducted for cold chain, surveillance, etc.

Review meetings: A comprehensive review covering all levels is a core component of programme evaluation. It is conducted by the national immunization programme bi annually involving EPI staff from sub national level and partners; it provides a snapshot of the strengths and weaknesses of the immunization and broader health system and provides additional recommendations on possible remedies to challenges and shortcomings.

Evaluation assessments: Coverage validation surveys are conducted for routine immunization as well as after campaigns, last routine immunization Coverage Evaluation Survey was conducted in 2015 (final report not released yet). In addition to that different EPI assessments conducted including PIE, EPI review, EVM, etc as per need, to identify the programme gaps and improve the performance.

Vaccine preventable diseases surveillance

Disease surveillance provides insight into the effectiveness of immunization programmes, informs their optimization, and serves as early warning of potential outbreaks. Sudan continues to experience outbreaks of measles, diphtheria, and other vaccine-preventable diseases like cholera, as well as of newly emerging infections such as Covid-19. Immunization and disease surveillance department are critical for preventing, detecting, and controlling infectious-disease outbreaks. Polio, measles and rubella case-based surveillance form the backbone of VPD case surveillance and are an absolute requirement in disease eradication and elimination programmes. Other VPD case reporting were established and maintained with a need for improvement and strengthening, including MNT, diphtheria, pertussis and congenital rubella surveillance. The reporting of AEFIs follows the same basic structure, AEFI reporting is integrated in overall case reporting systems.

Table (8): VPDs surveillance system

Surveillance	Type	Geographical coverage
Acute Flaccid Paralysis (AFP)	Cased based & lab based	Nationwide
Measles and Rubella		
Diphtheria, Pertussis		
Rota gastroenteritis and Meningitis		Sentinel sites in 3 states
Pneumonia	Cased based & lab based	Sentinel sites in one states
Neonatal Tetanus	Cased based	Nationwide
Adverse Events Following Immunization (AEFI)		

The global and regional polio and measles rubella laboratory networks in Sudan, have established an excellent record of providing rapid confirmation of case-based suspected disease occurrences. The existing network infrastructure and expertise were expanded into integrated disease surveillance. Based on the success of the AFP surveillance system, measles and neonatal tetanus surveillance was integrated with the AFP surveillance system as case-based surveillance since 2006.

For the new vaccines introduced, disease burden and programme impact is mainly measured through a laboratory-based sentinel hospital surveillance system. Sudan as a member state in the EMR has joined the BMS and Rotavirus surveillance network since 2007. Surveillance is based on a sentinel surveillance which provided general disease information. Currently, invasive bacterial disease (IBD) sentinel surveillance is being put in place since 2012 in one sentinel site (Omdurman pediatric hospital) as case based surveillance for under 5 years children to monitor bacterial meningitis and bacterial causes of pneumonia and document the circulating strains for new vaccines and to serve as a baseline data to assess the impact of introduction of these vaccines. During the period 2016 to 2019 total XXXX uspected cases were reported, XXX (XX%) were positive. Nisseria meningitides is X%, Hib X%, Streptococcus pneumonia X% and XX% were other bacteria. The system has been improved to give evidence based data for Rotavirus GE and BMS. The data collected and analyzed by the program was used for decision making for the new vaccines introductions and will be used to monitor the trend of the VPD. The surveillance data (2016-2019) showed that:

- Proportion of rotavirus gastroenteritis among reported gastroenteritis in under 5 yrs children from the selected sites is XX%
- Proportion of Pneumococcal meningitis among confirmed bacterial meningitis in under 5 yrs children from the selected sites is XX%.
- Proportion of Nisseria meningitides meningitis among confirmed bacterial meningitis in under 5 yrs children from the selected sites is XX%
- Neonatal tetanus
- Diphtheria

During the last 3 years Diphtheria outbreak was reported from 20 states. Khartoum, North Kordofan and West Kordofan continued reporting every year during this period, while North Darfur reported an outbreak in two consecutive years (2016-2017). Other states mainly are Darfur states, Gezira, Northern, River Nile, Sennar, White Nile and Kassala. South Darfur state that reported low vaccination coverage during the past three years, had reported an outbreak in 2016 and 2019, in which 98 cases were reported (97 from Alsunta locality and 1 case from Merchang locality) with CFR of 12.3.

EPI is challenged by the high turnover of expert surveillance officers especially at the State level. In addition, maintaining laboratory supplies and procurement of sample collection kits and reagents kits represents another reason for low reporting of confirmed cases.

Integrated VPD Surveillance

National EPI is providing leadership in the adoption of an integrated approach for VPDs surveillance through program design and implementation at national level, this approach needs further enforcement at state, locality and reporting site levels. The integration is important to overcome the challenges and constrains for individual disease surveillance. This integrated approach is designed to unify the existing fragmented surveillance units, maximize the utilization of available resources, and to improve the knowledge and skills of surveillance staff and enhance the exchange and dissemination of data. The integrated system is based on three strategies:

- Building the surveillance capacity to make use of data at all levels.
- Monitoring and supervision of all surveillance activities.
- Resource mobilization to support surveillance activities.

FMoH is working, with technical support from WHO and GF, to implement an Integrated Disease Surveillance and Response System (IDSRS). A road map has been developed through technical support from WHO and includes developing minimum data sets for each of the identified priority health condition, and how the information will be collected and reported, developing/adapting surveillance tools, standards, guidelines and policies, developing policies and framework for National Laboratory. To implement a successful IDSR, commitment from different programmes is crucial, in addition to securing required financial resources as well as human resources are critical elements towards functioning integrated system. Other challenges include expansion of sentinel sites, quality of reporting, capacity building, coverage and quality of telecommunication network, reporting rate from non-selected health facilities during emergencies/outbreaks and involving the private sector in the system.

Immunization safety

Immunization safety system was established many years ago in the EPI with implementation of the different components of the immunization safety.

Injection safety practises are implemented by using of Auto Destruct (AD) syringes for all vaccine as well as safety boxes for the collection and disposal of used injection. AD syringes and safety boxes are distributed bundled with the vaccines to the states and are available and used by all centres.

Waste Management: All health service providers are aware and practice health care waste disposal. Safety boxes are burnt either in the general waste disposal area or burnt and buried. During immunization campaigns, standard guidelines for safe injection and waste disposable is prepared, in addition injection safety assessment is monitored.

AEFI and Pharmacovigilance

As the safety of vaccines is often a prime concern, all countries should have a functional, robust safety system. A comprehensive safety monitoring system requires coordination and collaboration between the national regulatory authorities responsible for licensure of drugs and

vaccines and the immunization programme authorities who implement immunization policy , practice and services.

The report of the Council for International Organizations of Medical Sciences (CIOMS) and the WHO Working Group on Vaccine Pharmacovigilance defined an AEFI as; any untoward medical occurrence which follows immunization, and which does not necessarily have a causal relationship with the usage of the vaccine. The adverse event may be any unfavorable or unintended sign, abnormal laboratory finding, symptom or disease[10]. Adverse Events Following Immunization (AEFI) surveillance system was established in the 18 states ten years back, unfortunately it was not well functioning during the last five years (low reporting frequency for AEFI cases). No record of reported AEFI cases from routine immunization services. During SIAs vaccinators are trained to report AEFI with variable implementation, reporting and analysis. 50 cases of AEFI were reported during measles campaigns, 98 AEFI cases in meningitis campaign with one death and 73 cases during tetanus vaccination campaign. AEFI causality assessment committee that had been established in 2012 to investigate serious AEFI cases is not functioning as well.

To foster public trust in the programme, during this planning cycle vaccine pharmacovigilance system should be re-established and operationalized, to include activities for detection, assessment, understanding and communication of "adverse events following immunization" (AEFI) and other vaccine- or vaccination -related issues and the prevention of untoward effects of vaccines or vaccination. Essential element of pharmacovigilance is post-licensure surveillance of AEFI, which involves;

- Safety surveillance system for detecting serious AEFI,
- Means for storing and reviewing collated reports of AEFI,
- Process for investigating serious AEFI and clusters of AEFI,
- Process for assessing causality in selected reports and
- Process for further investigation and communication of serious AEFI.

[10] *Definition and application of terms for vaccine pharmacovigilance. Report of CIOMS/WHO Working Group on Vaccine Pharmacovigilance. Geneva: Council for International Organizations of Medical Sciences; 2012 (https://www.who.int/vaccine_safety/initiative/tools/CIOMS_ report_WG_vaccine.pdf, accessed 13 May 2019*

Situation Analysis of cMYP Targets

Objective (1): Meet routine vaccination coverage targets at national, state, locality and community levels

Target: Achieve at least 95% national coverage and not less than 80% in every district with three doses of diphtheria-tetanus-pertussis containing vaccines by 2020

2019: National DPT3 coverage reached 93%.

91% of localities achieved more than 80% coverage .

National coverage with three doses of DTP had plateaued at 90% to 94% during the period 2016 - 2019. The country sustained high DTP3 coverage above 90% although the national target of 95% coverage is not achieved yet, the year 2019 showed slight decline of Penta3 national coverage which dropped to 93.2%. More children received three doses of DTP before their first birthday, about 1.5 million infants received the recommended three doses of DTP by end of 2019, with about 180,992 more infants vaccinated than in 2016. Nationally, coverage has increased for many vaccines, while coverage rates vary substantially between subnational and locality levels. About 89% of states met the target of 80% or greater DTP3 coverage in every district. Although coverage has improved for many vaccines, equity remains elusive within as well as between states.

The national, state and locality coverage of most antigens had dropped slightly in the year 2019. This decline is attributed mainly to the country's political instability and economic dip resulted in severe fuel and cash flow shortages impacted negatively on all public health interventions in the country.

Fig (11): Sudan Immunization coverage 2015-2019 (JRF 2015- 2019)

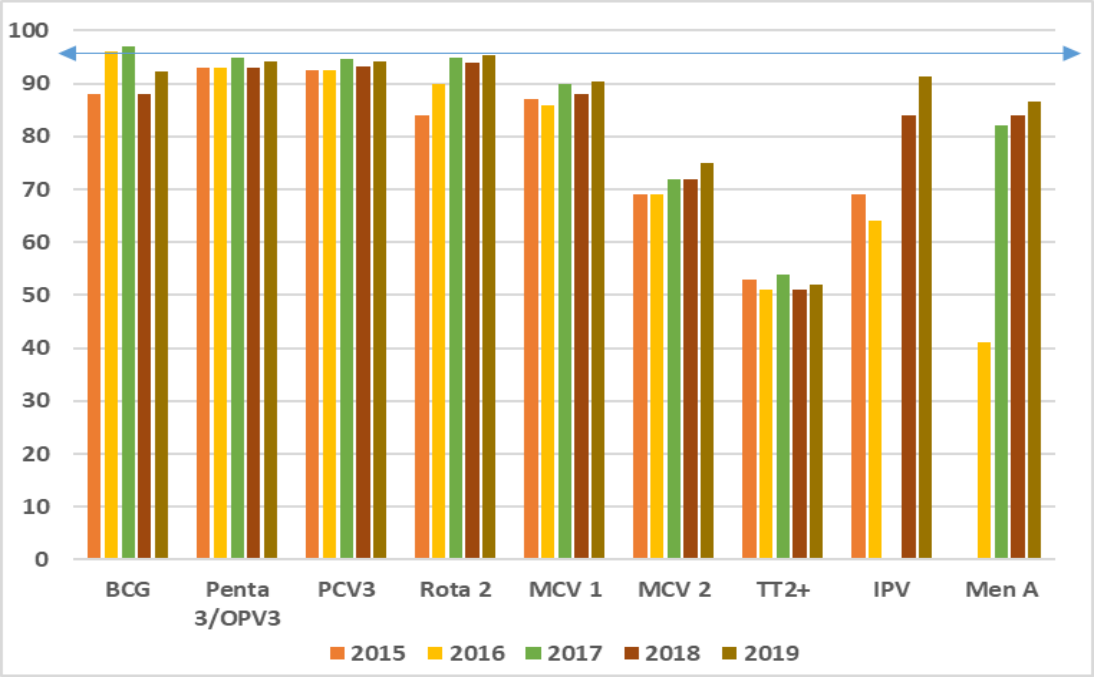
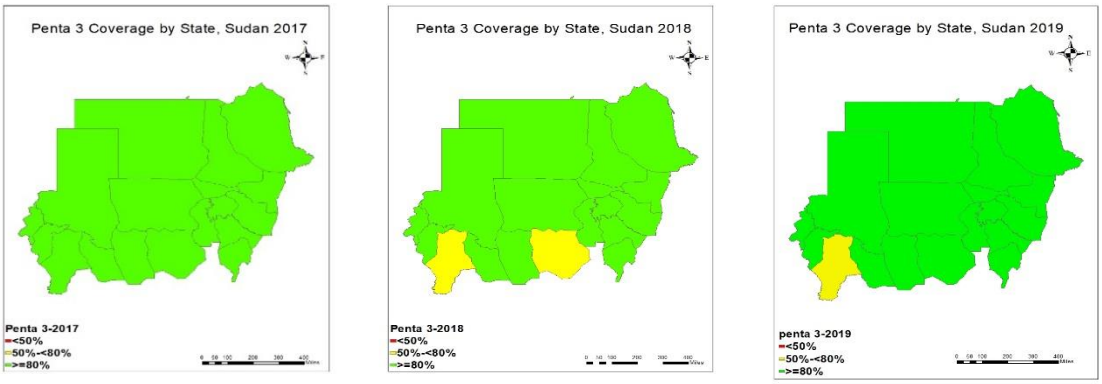


Fig (12): Heat maps showing Penta3 coverage by state 2017-2019 (JRF, 2017-2019)



Coverage at locality level: 91% of localities achieved more than 80% Penta3coverage by end of 2019. Seventeen localities reported < 80% Penta3 coverage in 2019, (JRF 2019), all of these localities are in Darfur states.

In the last quarter of 2019, The programme conducted an in-depth analysis of coverage by localities, the findings showed that 92 localities were not achieving the target coverage for Penta3. Accordingly, the programme had implemented acceleration campaign supported by WHO and UNICEF which resulted in reaching many children and improvement of the locality coverage by end of 2019.

Administrative coverage in 2019, showed that 9% of the localities achieved Penta3 coverage of 50% - less than 80%. These localities are in South Darfur state (16 localities) and one locality in West Darfur. This elucidates the reported Diphtheria outbreak during the last quarter of 2019 from South Darfur where almost all the probable cases were un-vaccinated. In the remaining 16 states, all localities coverage is above 80% to more than 90%, these states did not report any VPDs outbreak with exception of measles which is expected as they are far below the target measles coverage.

Figure (13): Reported Penta 3 coverage by locality 2019 (EPI Annual Report, 2019)

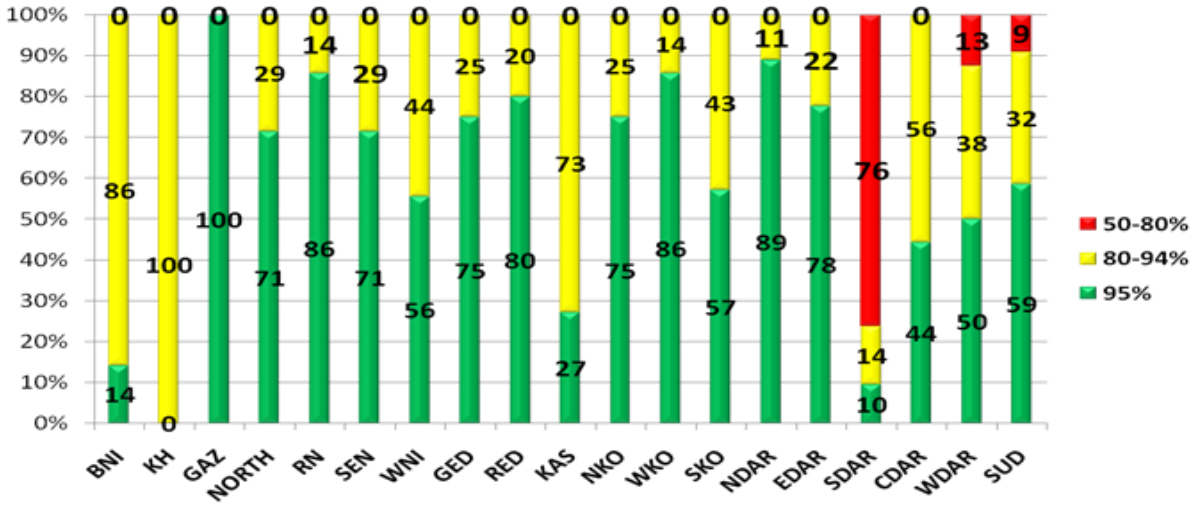


Fig (14): Heat maps showing Penta3 coverage by locality 2017-2019

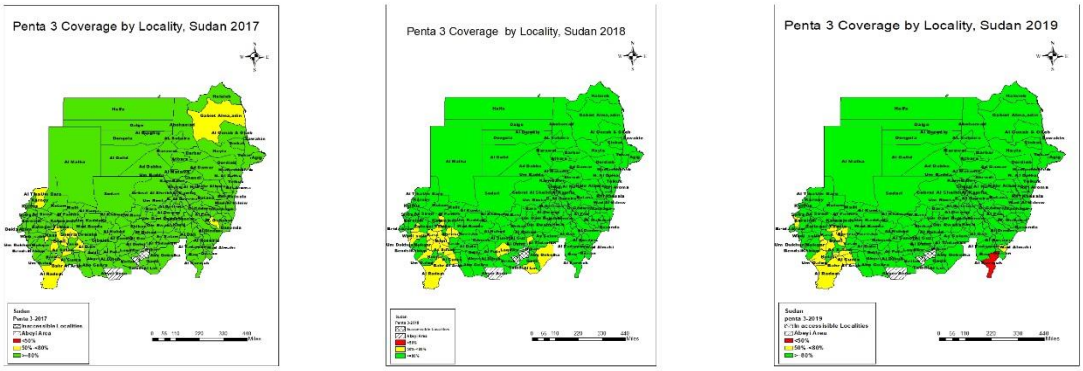
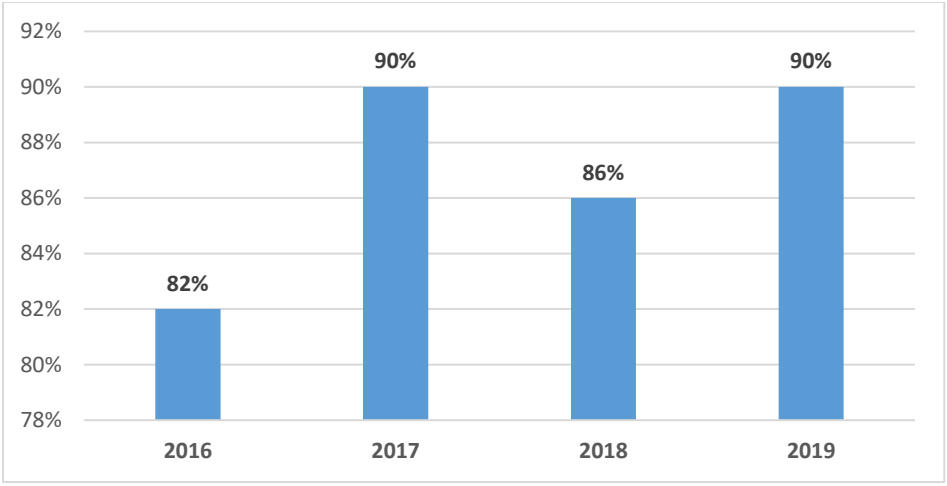
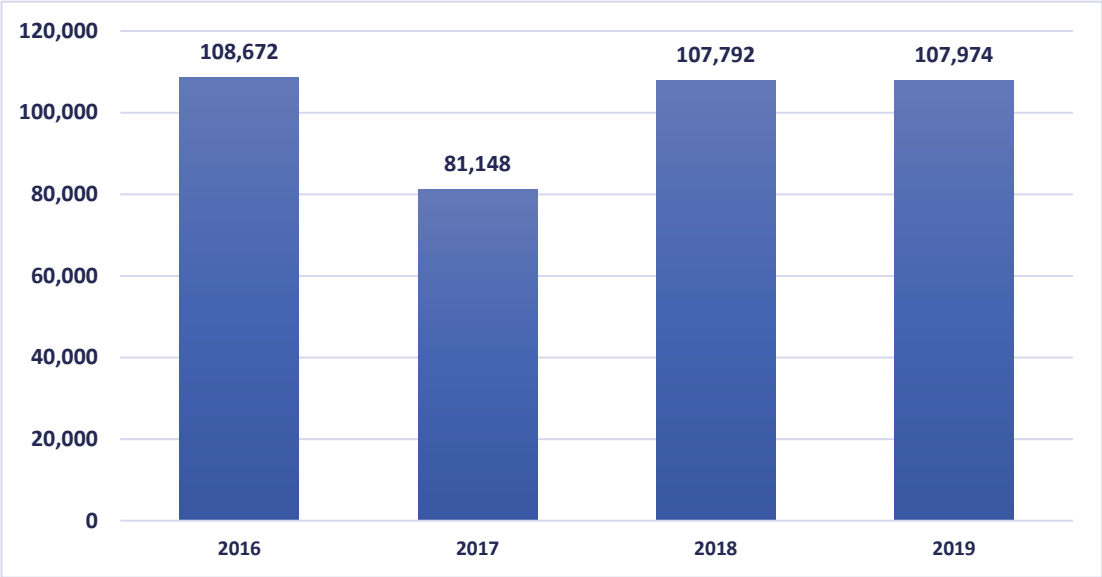


Figure (15): Percentage of districts with Penta3 coverage greater than 80%, 2016-2019



Un-immunized children: DTP1 overage is used as standard measure to identify unvaccinated children in Sudan, in 2019 there were about 107,947 (JRF 2019) un-vaccinated children. During the last four years about 405,586 unvaccinated children were distributed over 11 states. AFP zero dose children reports are used as indicator for risk grading of localities, close monitoring of those localities performance usually implemented.

Figure (16): Un- immunized children, Sudan, 2016-2019 (EPI Annual Report, 2016-2019)



Under-immunized Children: National Dropout rate between the first and the third dose of DTP vaccine (DTP1-DTP3 DOR) measures the immunization utilization and reflect delivery effectiveness. DOR (DTP1-DTP3) for 2019 was estimated at 6.2%, DOR is within the acceptable limit of less than 10%. At state level, DOR ranged between 0.5-10%, except for South Darfur state (21%) and West Darfour state (12%).

Target: Achieve at least 95% national coverage and not less than 80% in every district with measles containing vaccine by 2020.

National measles coverage (MCV1) was stagnant for many years not reaching the elimination target coverage of 95%. In 2017 and for the first time, the MCV1coverage reached 90%, declined to 88% in 2018 and 90% in 2019. At the sub-national level in 2019, two states (South Kordofan and South Darfur) reported 70% & 72% MCV1 coverage respectively. South Darfur constantly reported MCV1 coverage of less than 80% for the last four years.

For the first time in 2019, MCV1 coverage reached 90% and MCV2 reached 74% coverage .

At locality level, 43,53, and 55 localities reported < 80% MCV1 coverage during the period 2016- 2018 respectively, 71%, 52% and 60%of them were from Darfur states (JRF, 2016-2018). In 2019, about 15 % of localities (29 locality) reported < 80% MCV1 coverage, 22 (76%) are from Darfur states.

Figure (17): Reported MCV1 coverage by locality 2019 (EPI Annual Report, 2019)

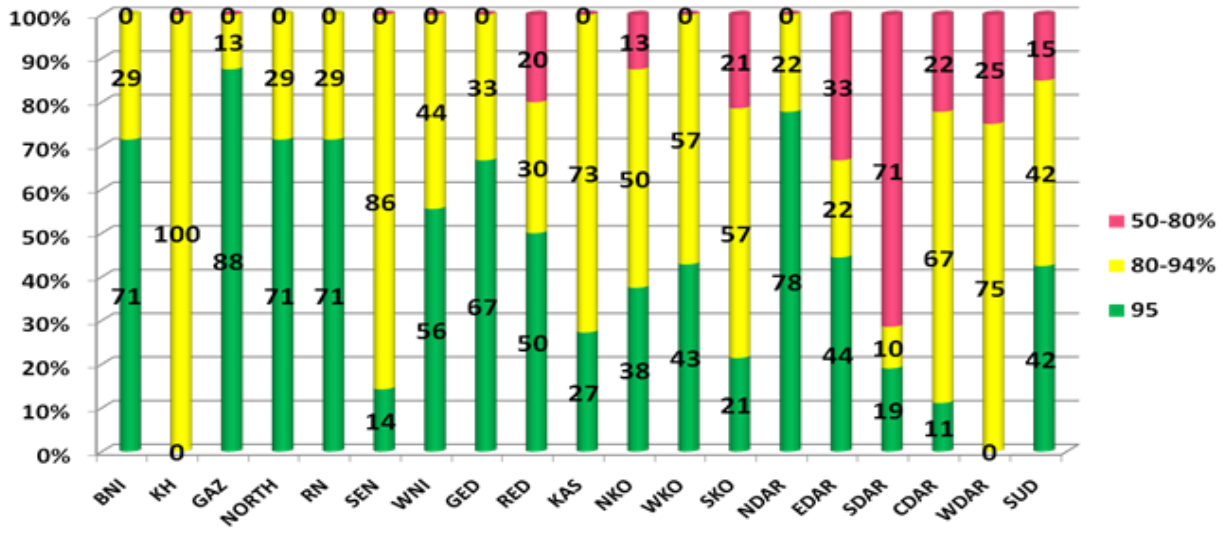
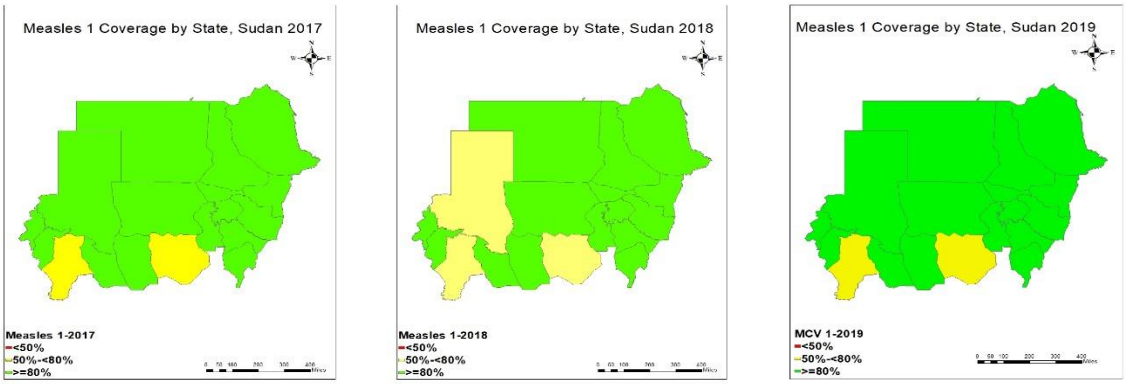
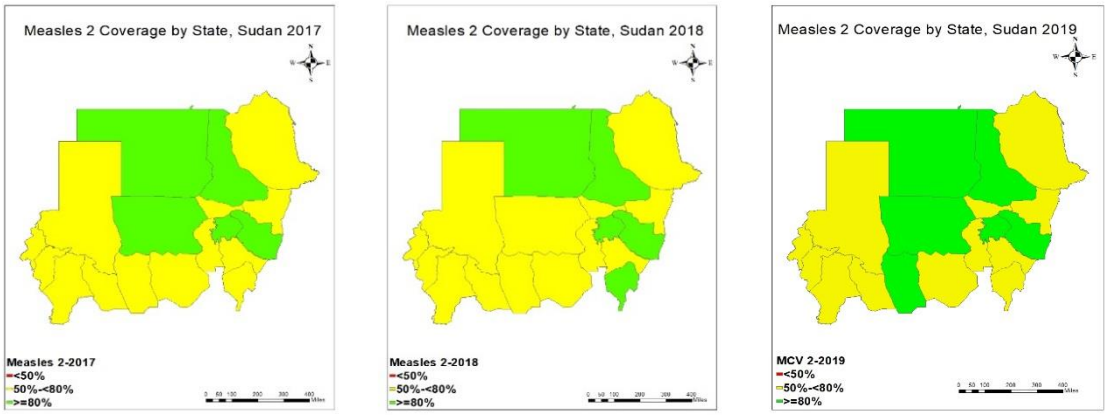


Fig (18): Heat maps showing MCV1 coverage by state 2017-2019 (JRF, 2017-2019)



Measles Containing Vaccine second dose (MCV2) coverage remained low. National coverage raised from 61% in 2014 to 74% in 2019. Aggregate coverage data at state level showed that 11 states reported MCV2 Coverage of < 80% . at locality level 64% of the localities reported MCV2 coverage < 80% in 2018 compared to 64% & 74% in 2017 & 2016 respectively (JRF, 2016-2018).

Fig (19): Heat maps showing MCV2 coverage by state 2017-2019 (JRF, 2017-2019)



DTP1-MCV1 measures dropout over a longer time interval between doses, hence thought to be a better measure of overall programme effectiveness. National DOR MCV1-MCV2 was 20.7, 19.3, 17 and 16.9 for the period 2016 - 2019 respectively, At sub-national level, six states reported DTP1-MCV1 DOR of more than 10% in the last three years with four of them reported DOR more than 20% last year. At locality level, 53 localities reported DTP1-MCV1 DOR > 10% repetitively in the last three years.

Table (9): Un-vaccinated & Under-vaccinated children per state (EPI Annual Report, 2019)

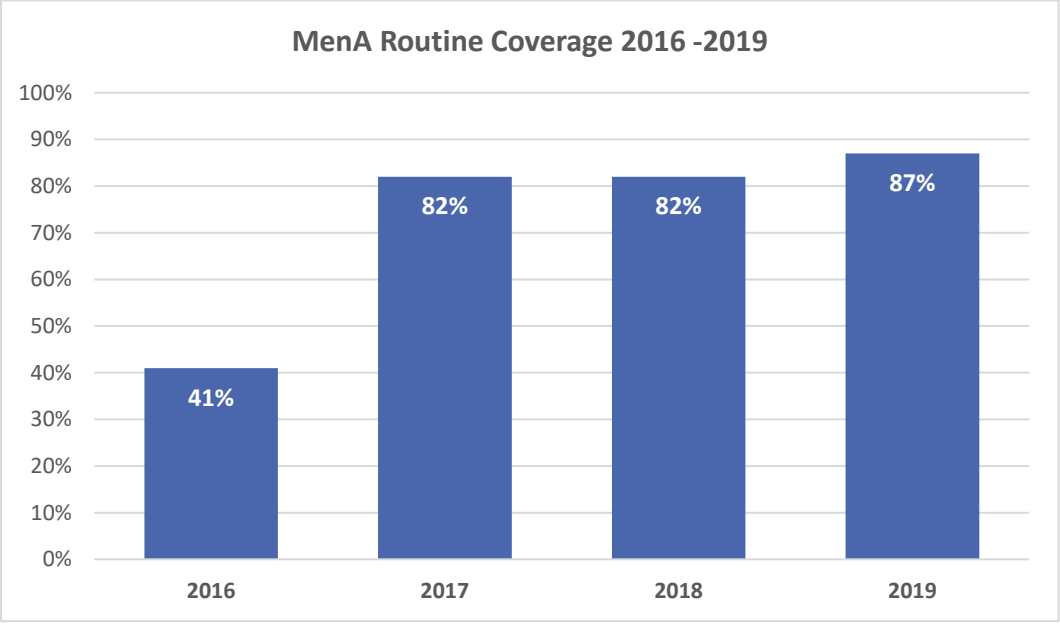
State	Accessible target	Total surviving 2019	Coverage data (Admin data)				# Unvaccinated children	# Under immunized children	
			Penta1	Penta3	MCV1	MCV2	from Penta1	Penta3	MCV1
Blue Nile	3288	45725	42721	38,269	39718	35948	3004	7,456	6,007
Central Darfur		54081	58459	56,100	46473	36197	0	0	7,608
East Darfur		52980	59429	57,918	45771	35827	0	0	7,209
Gazira		207712	207381	201,270	203030	182232	331	6,442	4,682
Gedaref		103085	103590	99,947	100316	87889	0	3,138	2,769
Kassala		84752	83384	78,165	76457	61597	1368	6,587	8,295
Khartoum		262165	239707	237,311	230998	179212	22458	24,854	31,167
North Darfur		122124	136146	126,821	120888	96077	0	0	1,236
North Kordofan		87889	89175	85,335	81827	71821	0	2,554	6,062
Northren		22246	22876	21,890	22238	20560	0	356	8
Red Sea		26855	26695	25,343	23833	17972	160	1,512	3,022
River Nile		47076	47002	45,845	45954	43011	74	1,231	1,122
Sennar		78448	81283	76,572	69184	52858	0	1,876	9,264
South Darfur		160577	147020	116,690	115897	91461	13557	43,887	44,680
South Kordofan	10209	63011	54381	50,626	44307	40295	8630	12,385	18,704
West Darfur		59115	61758	54,385	48011	37558	0	4,730	11,104
West Kordofan		67833	76047	70,399	65954	59578	0	0	1,879
White Nile		90115	92516	84,928	84676	67074	0	5,187	5,439
Sudan	13497	1635788	1,629,570	1,527,814	1,465,532	1,217,167	49,582	122,194	170,256

Target: Achieve and sustain at least 90% national coverage and 80% in every district with the current new vaccines and new vaccines yet to be introduced by 2020.

Sudan has introduced new vaccines more rapidly in this Decade (two cMYP cycles) than ever before. About 4 vaccine introductions since 2010, inactivated poliovirus vaccine (IPV) , pneumococcal conjugate vaccine (PCV), rotavirus vaccine and Meningitis A Vaccine (menA, PCV, ROTA,IPV,). The coverage of the new vaccines maintained high above 90% except for Men A vaccine (87%) which was introduced into the routine immunization services in 2016 after implementation of nationwide vaccination campaigns for the target population during the period 2012 -2015.

Under-utilized vaccines like Cholera was used during epidemics in certain states and refugees' camps. Catch up Yellow fever vaccination campaigns were implemented in 2019 in preparation for the introduction of YFV into the routine immunization services, which was anticipated in 2020.

Figure (20): Routine MenA national vaccination Coverage 2016 -2019



Target: Achieve 70% national coverage and not less than 60% in every district with tetanus vaccine by 2020

Routine immunization coverage in the country varies with different antigens; there are vaccines that have achieved coverage of more than 90% since 2008 (BCG, Penta3 and polio3), while the second dose of TT vaccination remained stagnant low, the coverage of (TT2) ranged between 51% - 54% for the last four years with noticeable high DOR between first and second TT dose ranged between 46% to 49%. The national target nor district target could be reached. Despite that the protection at birth (PAB) is calculated at 82% by end of 2019. Yet no booster TT doses are administered as part of the routine services .

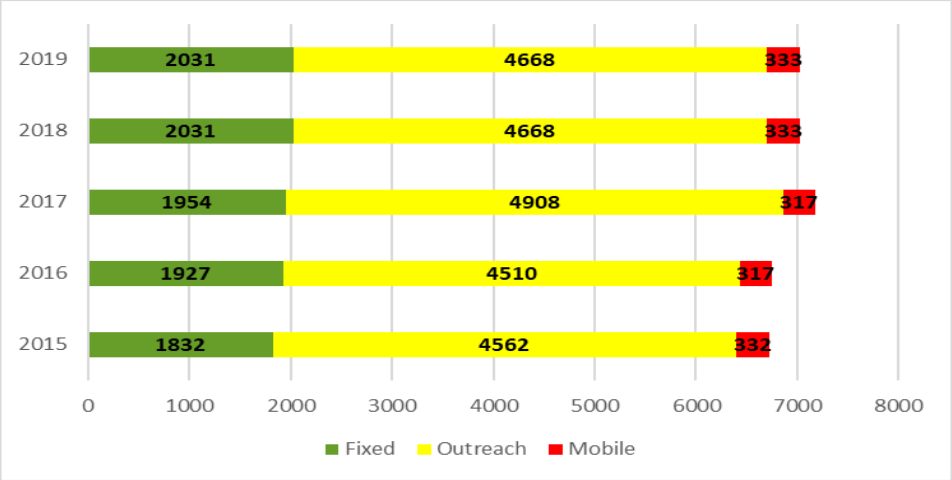
Immunization Service Delivery

The immunization programme has adopted the Reach Every District/ Community strategy to achieve its routine immunization targets. As part of the strategy of maximizing the reach, the programme deliver immunization services through three strategies; fixed, outreach and mobile services.

By end of 2019, immunization services network is composed of more than 2,031 fixed immunization sites which represents 29% of overall immunization posts, around 4,668 outreaches representing 66% of the immunization posts, and 333 mobile services.

The ministry of health Implemented the PHC Expansion Project which resulted in an increase of health facilities providing PHC basic package from 24% in 2011 to 63% in 2018. Out of the 6000 primary health care facility, fixed immunization services are delivered in about 34% only. The sustainability of the service provision depends on expanding the fixed immunization posts and reducing outreaches, mobile and accelerated immunization activities which are costly and need more resources.

Figure (21): Immunization fixed sites, outreach sites & mobile sessions over the last 5 years (EPI Annual Report, 2015-2019)



53% of DPT3 containing vaccines are delivered by fixed immunization sites in 2019, while the remaining were served through outreach (25%) and mobile strategies (23%). In Darfour states three rounds of accelerated immunization activities are usually implemented to reach the target children in many localities.

Figure (22):% of contribution of EPI delivery strategies in Penta 3 coverage, 2015-2019 (EPI Annual Reports, 2015-2019)

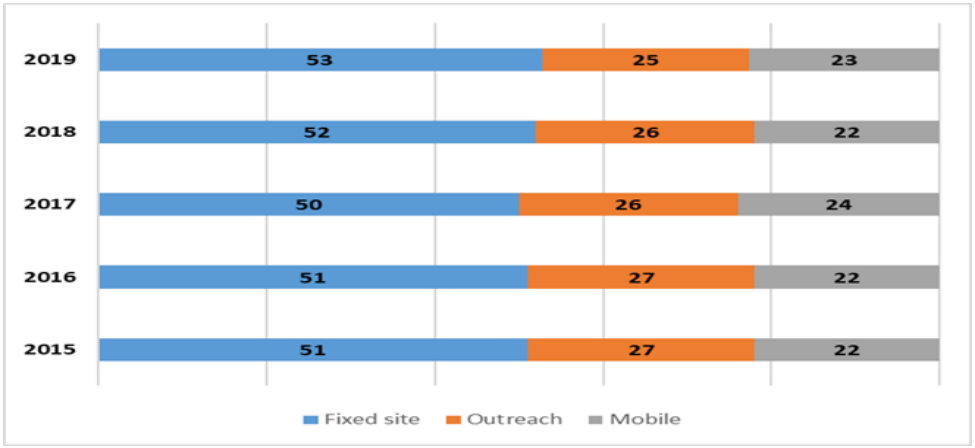
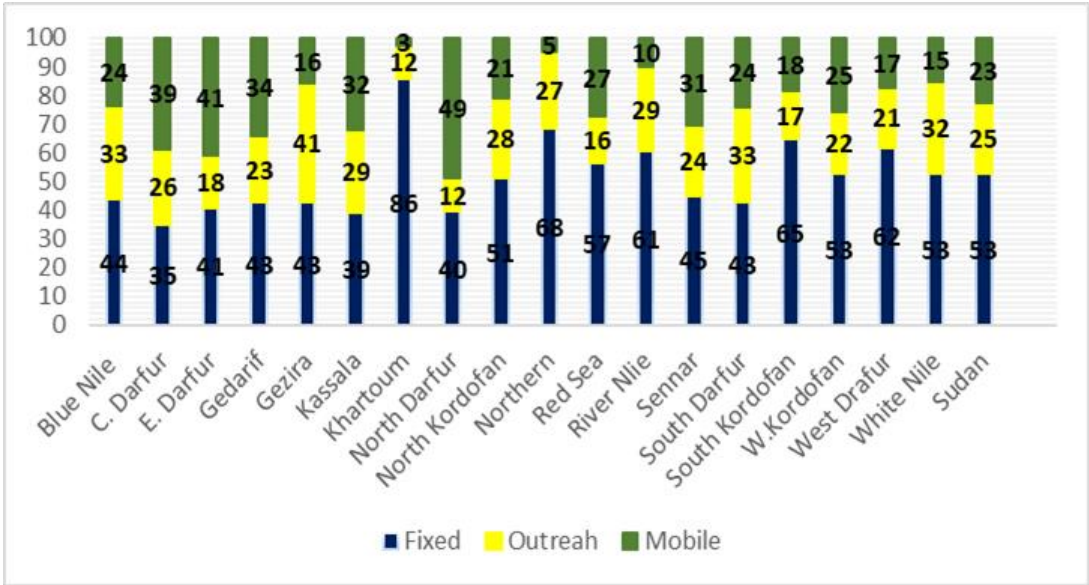


Figure (23): contribution of immunization delivery strategy in delivering Penta3 by state, 2019 (EPI Annual Report, 2019)



Role of the private sector in immunization service delivery, Private sector has a noticeable role in delivering immunization services to children and pregnant women. Fifty-five per cent of private health facilities in Sudan (411 out of 752) provide immunisation services, with 75% (307 out of 411) based in Khartoum state and Darfur region. In 2017, private providers administered around 16% of all third doses of Penta3 vaccine to children[11] Private immunization services have been critical in filling gaps in government services in hard-to-reach areas and among marginalized population, reducing inequities to access.

The programme is aiming to expand fixed sites and minimize mobile and outreach strategies to ensure programmatic and financial sustainability aligned with the national PHC expansion project.

[11] (Ahmed et al, 2019).

Equity and Vaccination trends by Wealth, Education Geographical (urban-rural) and Gender

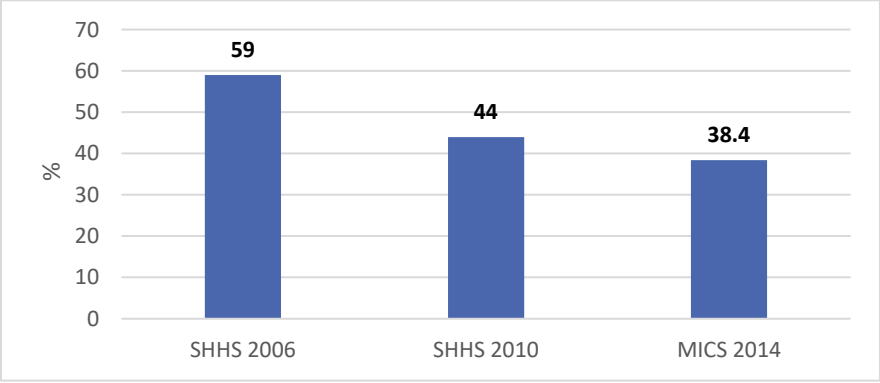
Multi Indicators Cluster Survey conducted in 2014 (MICS 2014) showed a slight difference between the gender overage of BCG and Penta 3, high association was visible between coverage rates and residence (urban/rural), level of mothers' education and economic status of the household as shown on table (4) below.

Table (10): Vaccinations by background characteristics (MICS 2014)

Background characteristics		BCG	Penta3
Sex	Male	**83.7**	**72.6**
	Female	**86.9**	**75.2**
Area	Urban	**92.0**	**82.1**
	Rural	**82.8**	**70.8**
Mother's education	None	**76.6**	**63.2**
	Primary	**88.9**	**77.6**
	Secondary	**94.1**	**85.9**
	Higher	**92.5**	**82.9**
Wealth index quintile	Poorest	**68.0**	**50.3**
	Second	**79.8**	**63.2**
	Middle	**91.6**	**83.1**
	Forth	**94.0**	**86.7**
	Richest	**94.6**	**88.7**

Comparing the MICS 2014 findings with Sudan Household Surveys 2006 & 2010, a decreasing trend in coverage difference between the lowest and highest wealth quintiles is noticed (figure (X) below), which is still far beyond meeting the minimum equity benchmark of (20%).

Figure (24): Coverage Gaps between Highest and Lowest Wealth Quintiles



The country is planning to conduct a round of the MICS in collaboration with UNICEF to update the information on immunization coverage and other immunization-related indicators.

Gender

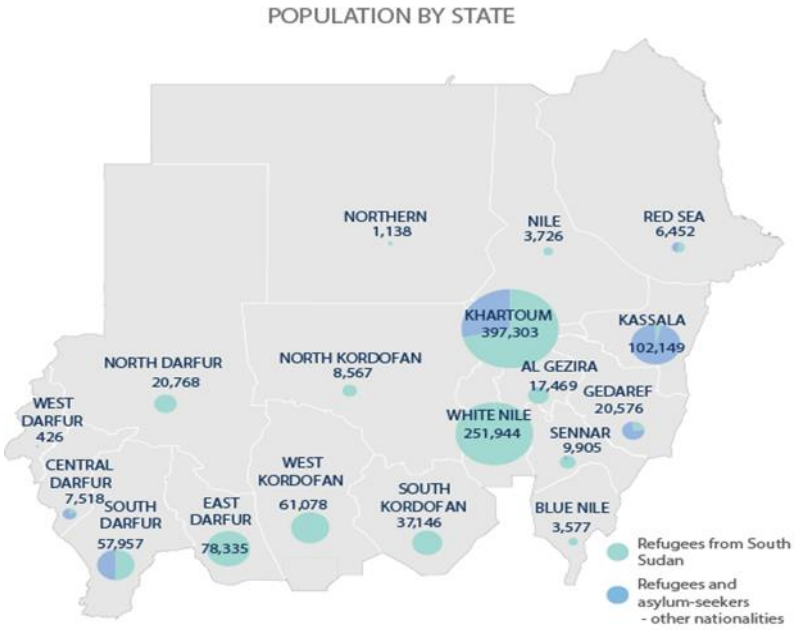
Gender Inequality Index (GII), Sudan rated 0.560 (world: 0.439) in 2018, GII is a composite measure reflecting inequality in achievement between women and men in three dimensions: reproductive health, empowerment and the labor market[12]. Although Sudan is a diversified country, gender disparity could not be ruled out. There is no documented evidence to conclude existence of gender-based disparities in accessing PHC/immunization services in Sudan, the existing routine immunization Penta3 coverage in 2019 shows that, it is almost equal percentage of vaccinated children, males' coverage is (49%) and females is (51%). Furthermore, in some rural areas that have certain norms related to limiting women contact with foreigner males (e.g. Eastern zone of Sudan), vaccination teams are usually selected from the local communities, and female volunteers as much as possible in order to overcome gender and culture-related barriers to vaccination.

Special Groups

Sudan total population accounts to 43 million people (CBS, 2019), out of which around 70% lives in rural areas and 8% are pastoralists. Special population groups represent, 13% of all children targeted with routine immunization services, they include nomads, IDPs, displaced persons, refugees, crossing points and tribes with customs and traditions that negatively affects immunization services, closed communities with cultural/geographical barriers living in conflict-affected areas and difficult-to-access area. There are 2.2 million internally displaced people (IDPs), and refugees from neighboring countries amount to another 2 million. Based on 2020 microplans for Darfur states, there are about 1,578,663 IDPs (51,526 are under 1 year children) living in 99 IDPs camps in 32 localities. IDPs usually resign in accessible areas, they are covered through the fixed or outreach services. Three rounds of accelerated routine immunization activates are usually implemented in the weak coverage localities in Darfur states.

[12] Human Development Report Office 2019, UNDP.

Figure (25) : Number & distribution of refugees and asylum seekers by state



Source: UNHCR Annual Report, 2019

Nomadic population represent 4% of the population scattered in 17 states, 106 localities.

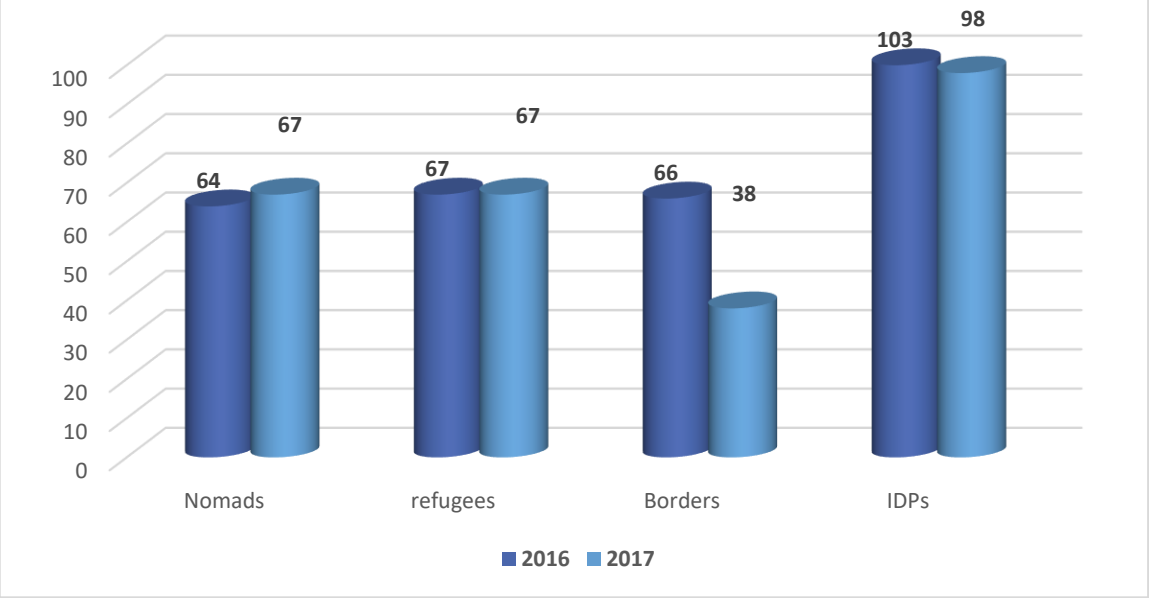
Table (11): Demographic characteristic & distribution of nomad by states, 2019

State	Loc.	Demographic Data				
		Pop	under 1yrs	under 5yrs	under15yrs	Preg
S Dar.	18	444,929	16,178	75,547	194,746	26,389
N.Dar	5	118,688	4,350	20,219	52,875	4,866
E.Dar	5	125,118	4,558	21,258	54,627	5,130
W.Dar.	5	39,670	1,190	6,347	17,455	12,819
C.Dar						
White Nile	5	174,345	6,483	29,520	79,510	7,169
B.Nile	7	457,138	19,343	70,505	188,090	24,113
Algazira	6	38,021	1,380	6,334	15,760	1,498
sinnar	5	38,182	2,393	6,428	17,037	2,704
Algadarif	9	73,175	13,306	45,613	37,573	20,809
Red Sea	6	22,419	683	2,706	8,261	741
Kassalla	7	267,210	8,991	41,631	109,235	10,101
S.Kordfan	3	27,023	948	4,450	12,334	1,071
N/Kordfan	8	40,043	1,535	7,075	19,606	1,736
Northern	3	11,001	337	1,553	4,306	374
River Nile	1	14,694	463	2,138	5,903	510
W.Kordfan	13	101,704	4,241	15,161	42,896	4,956
	106	1,993,360	86,378	356,485	860,215	124,984

Source: EPI Microplans, 2019

Special groups are addressed in the annual Microplans, by different strategies to reach them. Coverage of special groups is closely monitored, evaluated and corrected during periodic planning (microplanning and mid-year review).

Figure(26): Penta3 coverage for special groups 2016-2017



Source: EPI Annual Report

Objective (2): Sustain Sudan free of poliomyelitis

Polio eradication efforts achieved tremendous progress and target is on track. Sudan had reached the status of polio-free since 2001, the year that witnessed the last indigenous wild poliovirus case. Since then, the country was exposed to four wild poliovirus importations, the first one was in 2004 which caused a large polio epidemic which contained successfully. The subsequent importations in 2007, PV1 from Chad was detected in South Darfure state. In 2008 Sudan detected two polio cases due to P3 wild poliovirus imported from Chad. In 2009 five polio cases were imported from South Sudan; one in Khartoum State and four in Red Sea State. The last case was reported in Port Sudan, Red Sea State in 15thof March 2009. Wild poliovirus type 3 has not been detected since 2009.

As for VDPVs only two ambiguous vaccines derived polio viruses (aVDPVs) were detected in South Darfur State in 2012 and 2013.

WPV2 certified as eradicated in 2015.

No WPV3 since 2009

IPV introduced into the routine immunization services

The country has remained free of wild polio viruses and vaccine derived polio viruses for more than 10 years. The final national document for regional certification was accepted by the RCC in April 2015. Wild poliovirus type 2 was certified as eradicated in 2015.

IPV was introduced into the routine immunization services in June 2015, in conjunction with the withdrawal of type 2 oral poliovirus vaccines, April 2016, Sudan has launched the "National Switch Day" for the Switch off from tOPV to bOPV. It was interrupted due to global shortage of the vaccine. Vaccination with IPV resumed in February 2018.

In conjunction with the withdrawal of type 2 oral poliovirus vaccines, containment of polioviruses in all lab facilities (health services, high education, veterinary services and research bodies) possibly collecting, handling or storing material potentially infectious for polioviruses was completed. This was followed by conduction of containment activities in December 2018 of Phase 1 GAP 111 plan.

To enhance the immunity of under five years children National Immunization Days/ Sub National Immunization Days (NIDs & SNIDs) were implemented during the previous four years to ensure high immunity profile for under five years children.

Fig (27): NIDs & SNIDs , Sudan 2016 - 2019

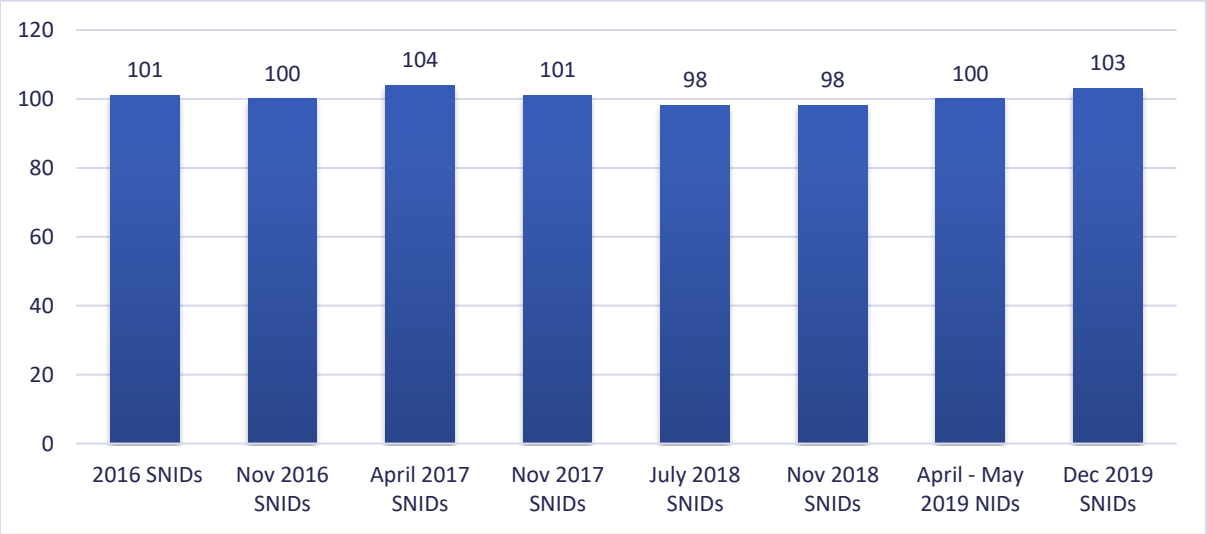
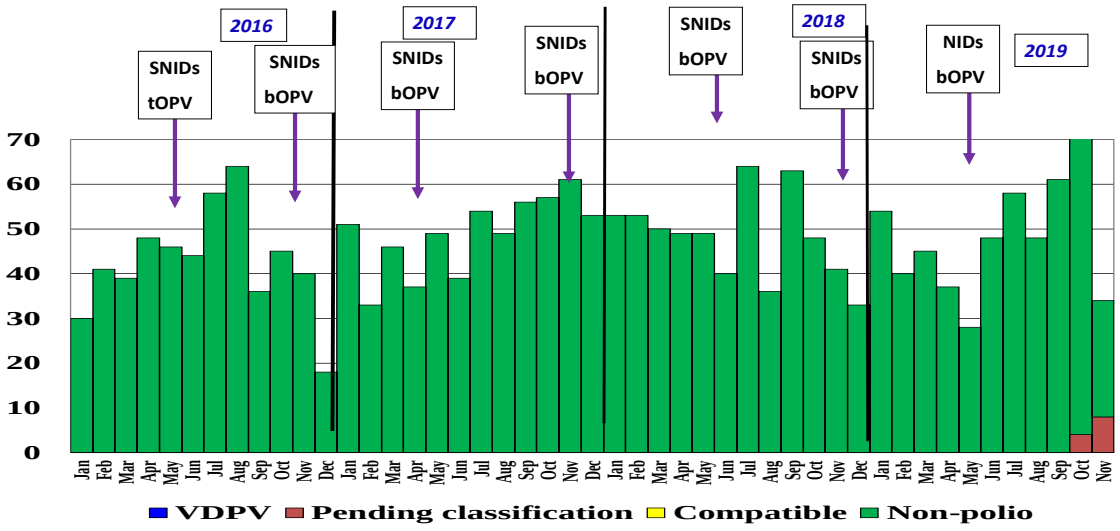


Fig (28): Distribution of AFP Cases by Classification, Month of Onset & SIA Activities 2016-2019*



*Up to week 49.

Immunity level among non-polio AFP cases, showed very good progress during the last five years. The proportion of children less than 60 months who received 4 OPV doses or more was above 95% since 20016 as shown in the figure

Fig (29): Distribution (%) of AFP cases 6-59months of age by OPV doses 2014-2019

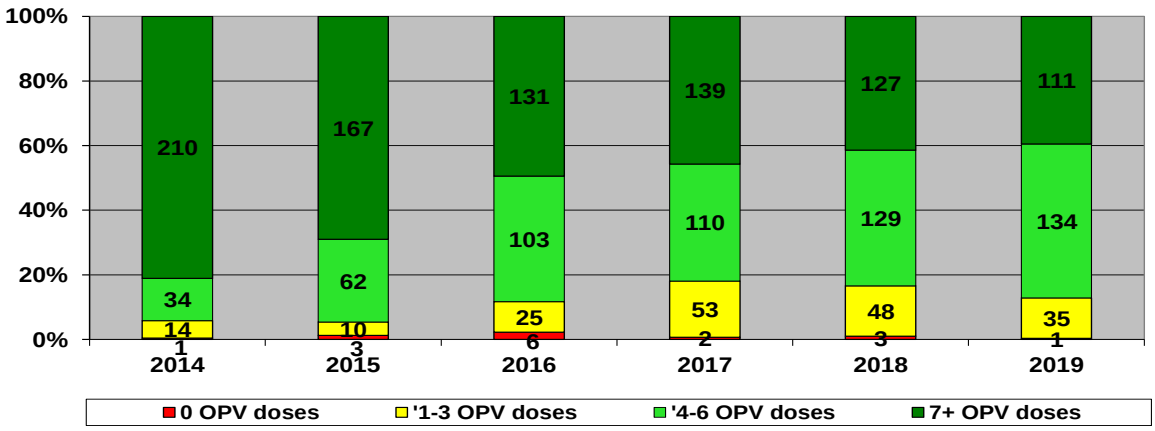
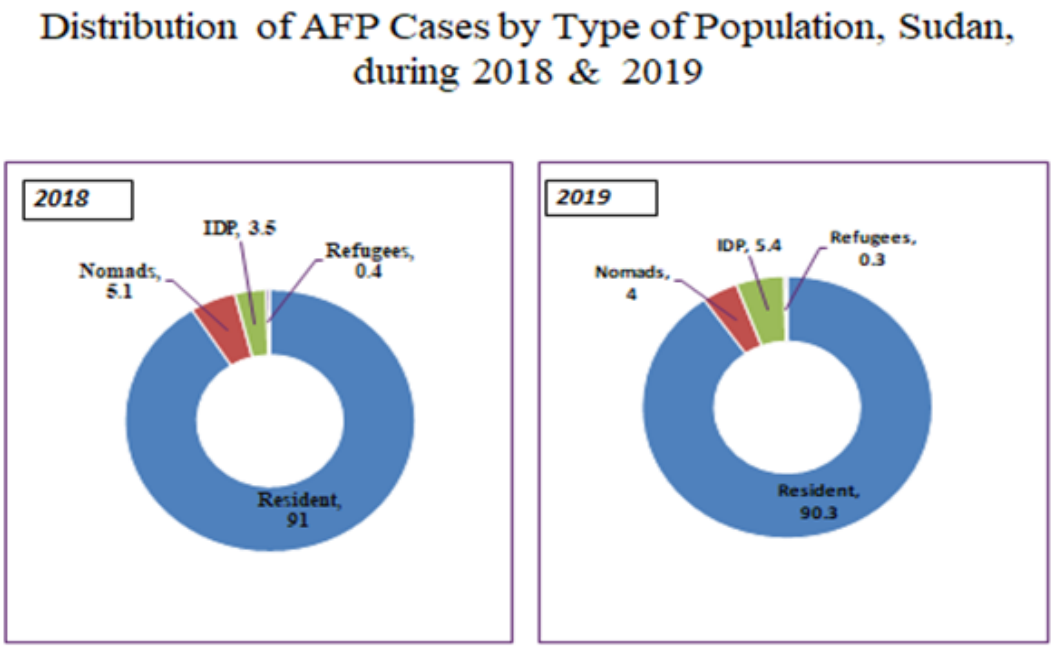


Figure (30): Distribution of AFP cases by type of population in 2018 & 2019



Source: EPI Annual Report, 2019

AFP surveillance performance indicators have reached the certification standard since 2001. These indicators remained above the target for the subsequent years up to date.

Table (12) : AFP surveillance Performance Indicators, Sudan 2016 – 2019

Indicator	2016	2017	2018	2019*
Expected AFP cases	**340**	**345**	**360**	**371**
Reported AFP cases	**509**	**570**	**579**	**552**
Discarded AFP cases	**509**	**570**	**579**	**529****
Non polio AFP rate	**2.9**	**3.3**	**3.1**	**3.2**
Specimens adequacy rate %	**97.6**	**96.3**	**97**	**97**
NPEVs rate (per 100 000 <15 years children)	**9**	**12**	**11**	**14**
GBS rate (per 100 000 < 15 years children)	**1.25**	**1.28**	**1.99**	**1.22**

*Up to week 49.

** 23 cases pending primary culture results.

Polio Transition Planning: At global level, 16 countries receive more than 90% of GPEI support globally; these countries have been identified as priority countries for polio transition. Four out of these 16 countries are in the Eastern Mediterranean Region including Afghanistan, Pakistan Somalia and Sudan. Sudan has developed polio transition plan aligned with the thirteenth general program of work 2019-2023. The country recently developed implementation framework in order to identify key activities and defined timeline for monitoring.

The country office with WHO support had completed the following activities:

- Human resource mapping updated and completed
- Physical assets mapping updated and completed
- Intangible assets mapped
- Risk assessment completed
- Transition scenarios, and their feasibilities drafted

The way forward for polio transition planning in the country is to update the transition plan based on the assessment mission findings and recommendations.

Objective (3): Meet National control and elimination targets

Target: Measles eliminated in all the country by 2020

The EMR target is to interrupt the measles endemic virus transmission latest by 2020. Sudan was placed in the elimination group, unfortunately the country could not achieve the elimination target as planned.

Sudan was committed to measles elimination by 2020. Vaccination has reduced measles cases by 83% since 2016. However, measles cases have recently rebounded in all states, and the national incidence per million population was 41, 15, 107, and 67 for the years 2016 to 2019 (up to wk49) respectively. The country faced large scale outbreaks started since 2011- and continued on an annual basis up to 2018. Multiple outbreaks continued through 2016-2019., where measles virus continued to circulate uninterrupted in all states of Sudan.

measles cases were reduced by 83% since 2016.

National measles Catch-up vaccination campaign implemented in all 18 states by 2019

National coverage with the first dose of measles vaccine has plateaued at around 86% -90%, with major variations in coverage across and within states, National coverage with the second dose has increased steadily, from 69% in 2016 to 74% in 2019. However, nearly one-quarter of target children still do not receive the two doses needed to maximize protection. The coverage still low to achieve elimination, which is below the required 95 % to ensures high population immunity in order to prevent outbreaks and achieve measles elimination.

Following a nation-wide campaign in 2013 Sudan achieved a reduction in the number of measles cases; however, in 2015 a surge of measles cases was reported again in 18 states with total 3536 confirmed cases and 71deaths (2% case fatality rate), which affected almost all states; 72% of cases were not vaccinated. Reference to the measles risk assessment data, 71 localities were of very high, high risk and moderate risk of outbreaks. The epidemiology data showed that 72% and 45% of the measles cases in 2015-2016 and 2017 respectively were not vaccinated. The age group of the measles outbreak cases showed that, under 10 years children are at risk group. Frequent and large scale population movements inside the country (conflict induced IDPs, pastoralists, economic migration) and through the open borders with neighboring countries (South Sudanese refugees, Sudanese returnees) are significantly increasing the risk of continuation of measles outbreak. Phased outbreak responses were implemented by the Ministry of Health, with support from WHO, UNICEF and Partners in the affected localities during 2015 and 2016, the target cohort group covered were children aged 6 months to less than 15 years. These campaigns have had a substantial impact on the reduction of measles morbidity and

mortality, where it is reduced to 1738 confirmed cases and 20 deaths with (1.17% case fatality rate) during 2016. The incidence decreased from 104/M pop in 2015 to 40,1/M pop in 2016. Several fragmented sub-national/response campaigns were implemented, but it had minimal impact on measles outbreaks.

Measles outbreaks continued to 2018 with total 4980 confirmed cases, 57% of them were unvaccinated. Even in states with high coverage, clusters of unvaccinated children and adults preserve the risk of measles outbreaks. The joint Measles outbreak response taskforce which includes Ministry of Health, WHO and UNICEF, followed the recommendation of the EMRO Inter Country Meeting, decided that, Sudan is in urgent need to conduct a nation-wide larger scale Measles vaccination campaign. Based on the epidemiological data and modelling (target age range, geographical scope, timing), the Government with support of GAVI and partners had implemented measles SIAs in all 18 states during 2019, High measles vaccination coverage (99% and more) was reported from 16 states, two states coverage was less than 95% target coverage.

Fig(31): Measles Cases VS Routine and Campaign Coverage 2000-2018 (

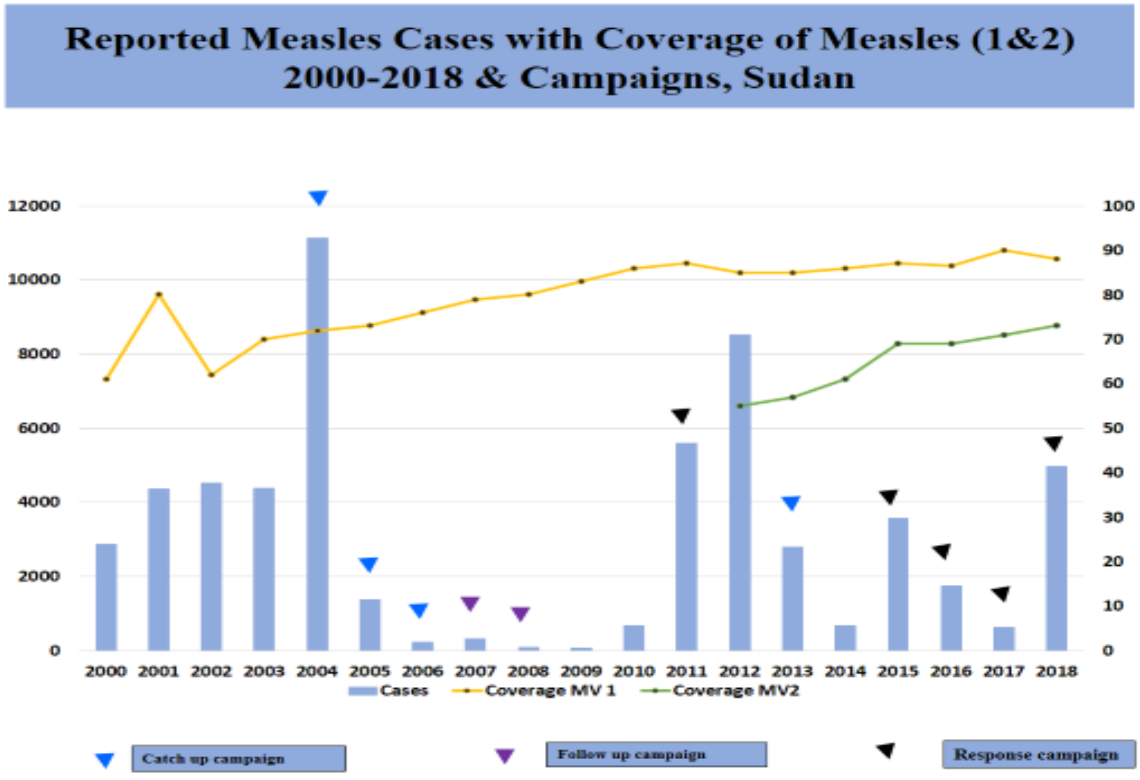
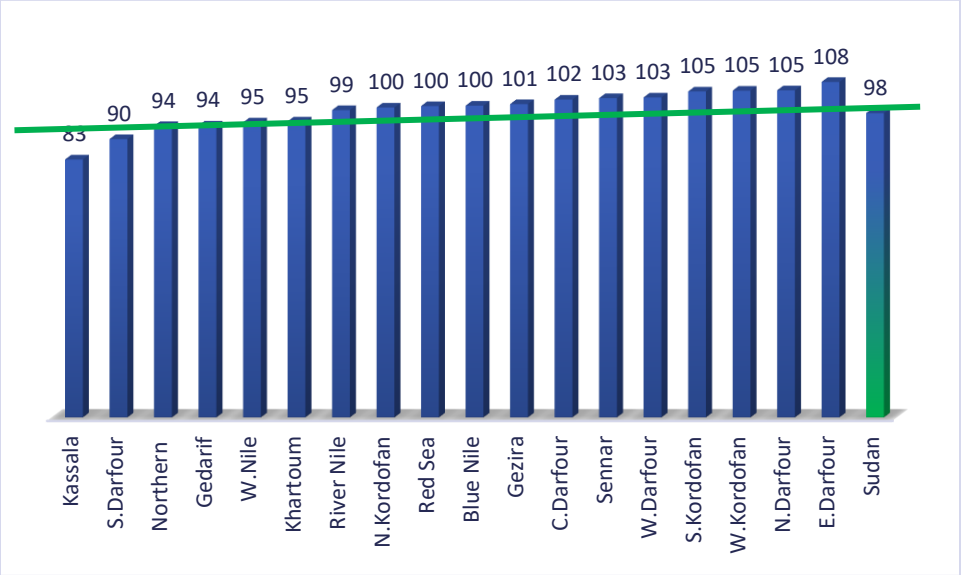
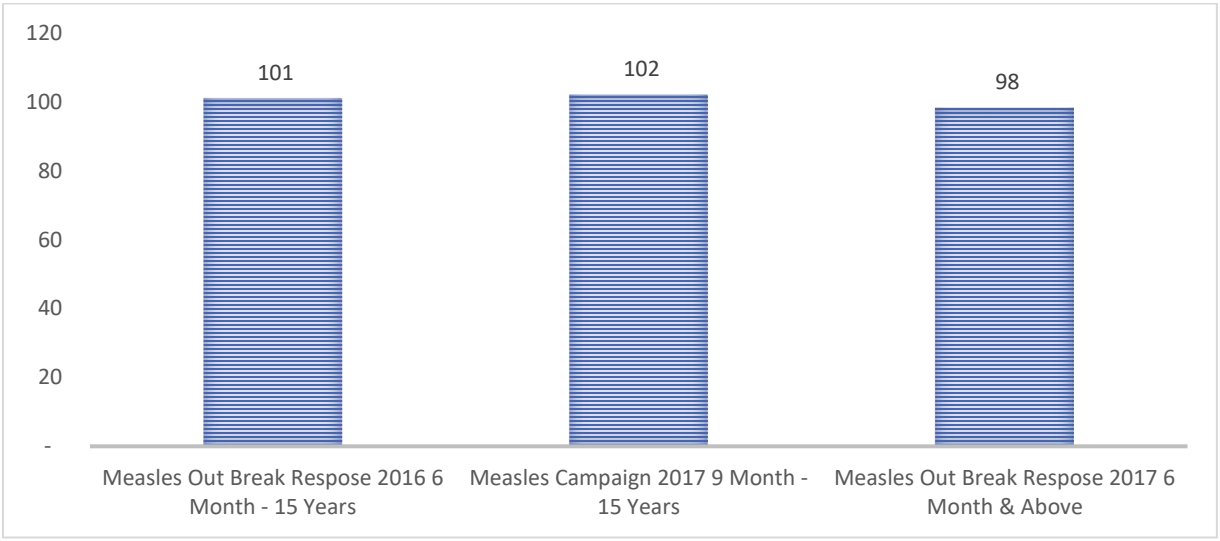


Fig (32): Coverage of Measles catch up Campaigns 2019



Source: EPI Annual Report, 2019

Fig (33): Measles SIAs outbreak response 2016-2017

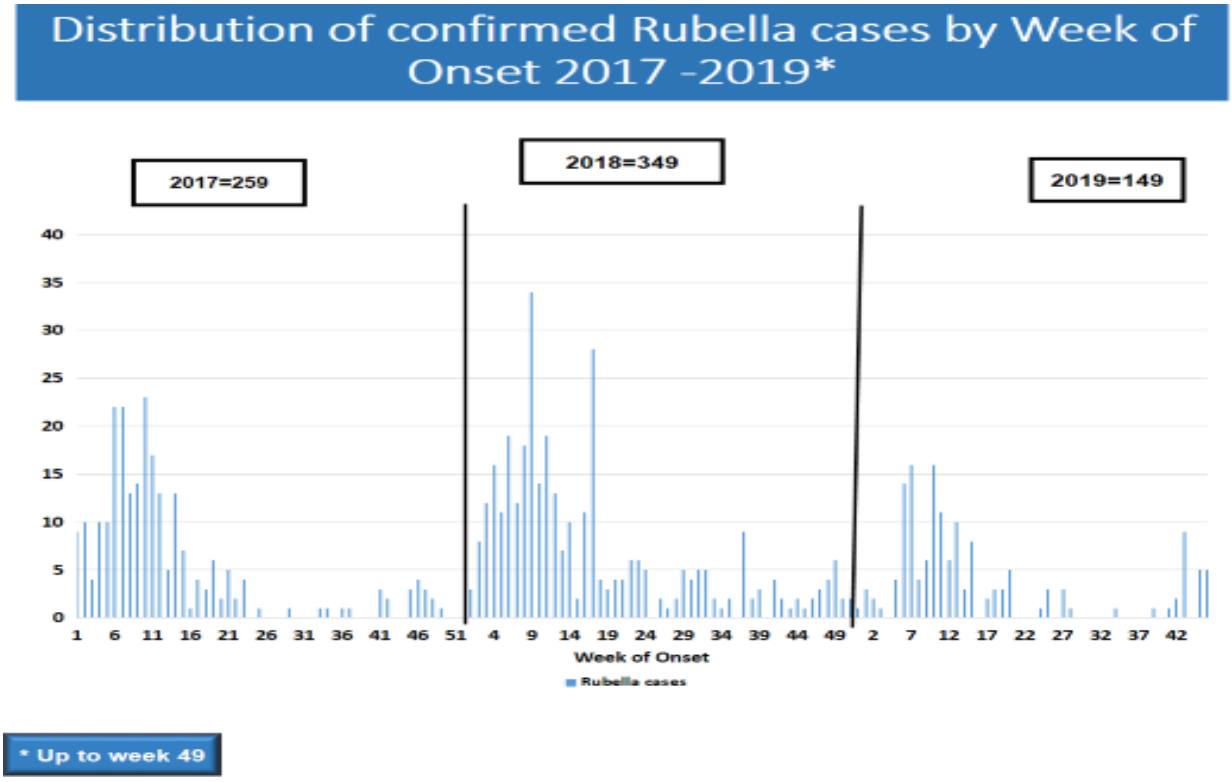


Source: EPI Annual Report, 2019

Measles and Rubella Surveillance

Measles and rubella case based surveillance was established and implemented in all states with laboratory investigation as an integral part for establishing effective measles surveillance. Rubella case base surveillance was established with laboratory confirmation since 2006 along with measles surveillance. The surveillance data showed that Rubella is an endemic disease, with increasing incidence in winter season, disease occur in under 15 years, and more affected age group is the school age (5-9) years, reported outbreaks occur in different states.

Fig (34): Distribution of Confirmed Rubella Cases, Sudan 2017 - 2019



Source: EPI Annual Report, 2019

Since 2007 measles and rubella case based surveillance was strengthened and most of the surveillance indicators met the standard requirements (>80%) , the B3 &D4 virus was isolated from a circulating point of an outbreak.

Table (13) : Measles and Rubella Field Surveillance Indictors 2017 -2019 (wk49)

Indicator	Target	2017	2018	2019*
Annualized Rate of Non- Measles Non-Rubella cases /100,000 pop.	2:100,000	2.9	4.2	1.8
Representativeness (states with non measles non rubella reporting rate ≥2)	≥ 80%	56%	61%	11%
% Cases with adequate serology samples	≥ 80%	96%	95%	95%
% Cases with adequate investigation	≥ 80%	99.7%	99.6%	97.4%
Lab confirmation	≥ 80%	97.1%	98.7%	97.6%
5 Sample received within 5 days of collection	≥ 80%	93%	87%	85%
% results reported back within 4 days	≥ 80%	96%	96%	24%

CRS Surveillance

WHO has outlined the benefits of CRS surveillance in countries planning to introduce rubella containing vaccine and with rubella and/or CRS control goals, Identification of infants with CRS is important in monitoring progress towards elimination of measles and rubella, the initial establishment of the surveillance system in Sudan was in 2014, to provide reliable trend data to assess and monitor the situation of CRS in Sudan and while identifying sustainable surveillance approach for the future. During 2017-2019, suspected CRS 84 cases were reported. 93% of the reported cases have had a diagnostic specimen, 5% were positive.

Target: Neonatal tetanus eliminated in all the country by 2020

Maternal and neonatal tetanus is strongly associated with poverty, so its incidence can be used as a marker of the quality of health services being delivered to marginalized and under-served populations, and of care seeking by these groups. MNTE will reduce neonatal mortality, which has declined more slowly than for children under five years of age. The current MNTE strategies target only pregnant women and women of reproductive age, leaving older male children, male adults, and elderly men unprotected from tetanus. Implementing strategies for the vaccination of all populations, using a life-course approach, will help overcome these gender disparities.

Implementation of three rounds TT SIAs in 15 states

Sudan is one of the remaining 12 countries not yet eliminated Maternal and Neonatal Tetanus. It is still a major public health problem and its elimination is considered as a real challenge for Sudan facing numerous threats. Despite recurrent efforts for MNTE elimination since late 1990s; The elimination Progress has been steady, elimination target is not met and not likely to be met by 2020.

Despite previous attempts to accelerate the MNTE, very little progress was achieved due to several challenges including unavailability of funds, delayed the implementation of required TT vaccination campaigns in high risk localities. Another factor contributed to the slow progress toward NNTE is the low coverage of antenatal care with 72.3% of the deliveries happening at home (MICS 2014) with poor pregnancy and pregnancy related care.

By end of 2016, FMoH with partners involved in MNTE elimination (UNICEF, WHO and UNFPA), singed a renewal of commitment to eliminate MNT from Sudan by 2020. Risk analysis was conducted during; identified 81 localities at risk.

During the period 2016-2019, three rounds of TT SIAs, targeting Women of childbearing age (15-49 Years) were implemented in 15 states for XX high risk localities. Although the first dose coverage was more than 100% in all states, the third dose coverage is below the target coverage (80%) in six states.

Table (14): MNTE SIAs Coverage by state, 2016-2019

States	Target	TT1 % Cov	TT2 % Cov	TT3 % Cov
N.Darfour	221,473	112	100	88
W.Darfour	358,111	106	94	79
E.Darfour	156,857	101	88	86
Gedarif	557,776	107	100	90
W.Nile	46,813	104	81	76
Gezira	79,203	108	101	92

Sennar	41,415	112	97	87
N.Kordofan	146,701	106	94	87
W.Kordofan	38,703	100	94	89
S.Kordofan	151,726	119	86	48
Kassala	31,228	127	88	55
S.Darfour	628,972	110	94	68
Red Sea	242,687	110	98	85
Blue Nile	140,479	107	67	58
C.Darfour	302,921	113	100	95
Sudan	3,145,064	109	95	80

TT surveillance has been included in the integrated VPD surveillance in an attempt for strengthening, better oversight and reporting. 200 neonates died of tetanus infections during this cMYP cycle. Community surveillance was planned to be structured, but it was not implemented.

Target: Sustain Prevalence of chronic hepatitis B virus infection to less than 1% among children under 5 years old by 2020

Hepatitis B vaccine was introduced into routine immunization services as Pentavalent vaccine for under one-year children since 2005 with support from Gavi alliance, with no birth dose in the immunization schedule.

NITAG recommended the introduction of Heb B birth dose, yet to be introduced

WHO position paper, July 2017, recommended Hepatitis B Birth dose for all children worldwide. As Sudan is the second out of the five countries contribute to 85% of the Hepatitis B burden in the EMR and the occurrence of Hepato-cellular Carcinoma (HCC) in young individuals because of the vertical transmission of HBV in the country, as well the WHO resolution (2009) advised the

countries to expand hepatitis B vaccination programme to include provision of a birth dose of vaccine to all infants within the first 24 hours of life. Looking at situation and evidence from country, regional, global and WHO recommendation, NITAG recommended the introduction of HB vaccine birth dose into routine immunization services as one of the essential interventions needed for control of the viral hepatitis.

Unfortunately, this target could not be achieved due to unjustifiable financing reasons, while it is one of the low-cost vaccines. At the same time, the high percentage (>70%) of deliveries taking place at home is a challenge and introduction of HebB vaccine birth dose will be highly considered during this planning cycle.

The Hbs sero-prevalence assessment was not conducted as planned to update the country situation.

Objective (4): Introduce new improved vaccines and technologies of national priority

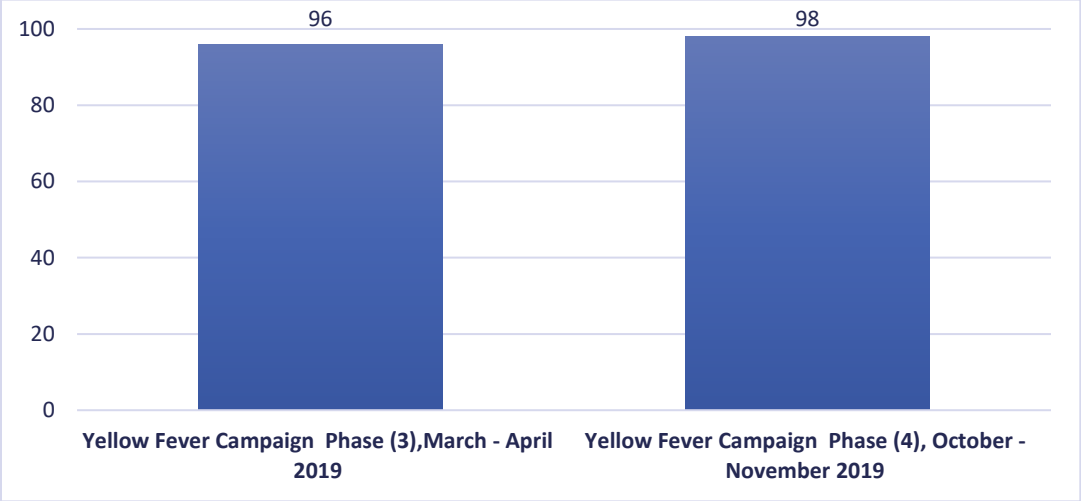
Sudan Immunization policy 2012, stated that; "The introduction of new vaccines shall be evidence-based as recommended by NITAG". Since 2009 NITAG was formulated and has guided the introduction of all new vaccines introduced into the country. They technically guide, advice and recommend the introduction of new vaccines into the country based on scientific evidence and according to disease burden, country context and priorities. NITAG had recommended the introduction of Rotavirus, Pneumococcal vaccines, IPV, Men A and yellow fever vaccine. Sudan, being a Gavi- eligible country, the new and underutilized vaccines were introduced with support from the Gavi Alliance. The government of Sudan since 2008 up to date has contributed to the co-financing of the new vaccines introduced into the country.

The planned target of introduction of three new and underutilized vaccine was not met. YF vaccination campaigns implemented in all country. Demonstration of Rubella disease burden and establishment of HPV disease burden

During the previous strategy cycle, three new and underutilized vaccine were planned to be introduced into the routine immunization services, namely, Yellow fever, Rubella and HPV vaccines.

Yellow Fever: The routine YF vaccination for under one children is yet to be introduced into routine immunization services as part of the routine immunization schedule. Vaccination campaigns had been implemented for age groups 9 month to 60 years of age in all 18 states in phases with high reported coverage of more than 95%.

Fig (35): Yellow Fever Campaigns Coverage 2019



Source: EPI Annual Report, 2019

Rubella Vaccine: It was planned to introduce Rubella vaccine to under one year children with demonstration of disease burden, as of March 2020, Rubella vaccination has not been introduced into the country yet. According to WHO guidance for MR introduction the NITAG discussed the introduction of MR into the RI, they reviewed the WHO position papers regarding the global situation of measles and rubella diseases, the global measles and rubella strategic plan 2012-2020, with the opportunity of using the existing well-established measles immunization program, the NITAG made the decision of the introduction of MR by switching from MCV to MRCV.

The introduction of rubella containing vaccine (MR) into the routine immunization with implementation of a wide-age range campaign, will be planned during this plan cycle with support from Gavi. The vaccine will be administered at 9 and 18 months along with measles vaccine as MRCV.

Human papillomavirus (HPV) vaccine: The aim of the previous planning cycle was to introduce HPV vaccine to 14 years of age girls, with demonstration of the disease burden. The vaccine was not introduced during the cMYP cycle 2017-2020. The NITAG discussed the global and regional situation and the introduction of HPV, the information reflecting the magnitude of the disease in the country was found limited. According to National Cancer Registry (NCR) 2009 indicated that, the most common cancers were Breast cancer, Leukemia and Cervical cancer, with increase in number of deaths during 2012 – 2018 and number of new cases by 30% from 833 to 1084 per 100 000 in 2018, this number is expected to be double by 2040.

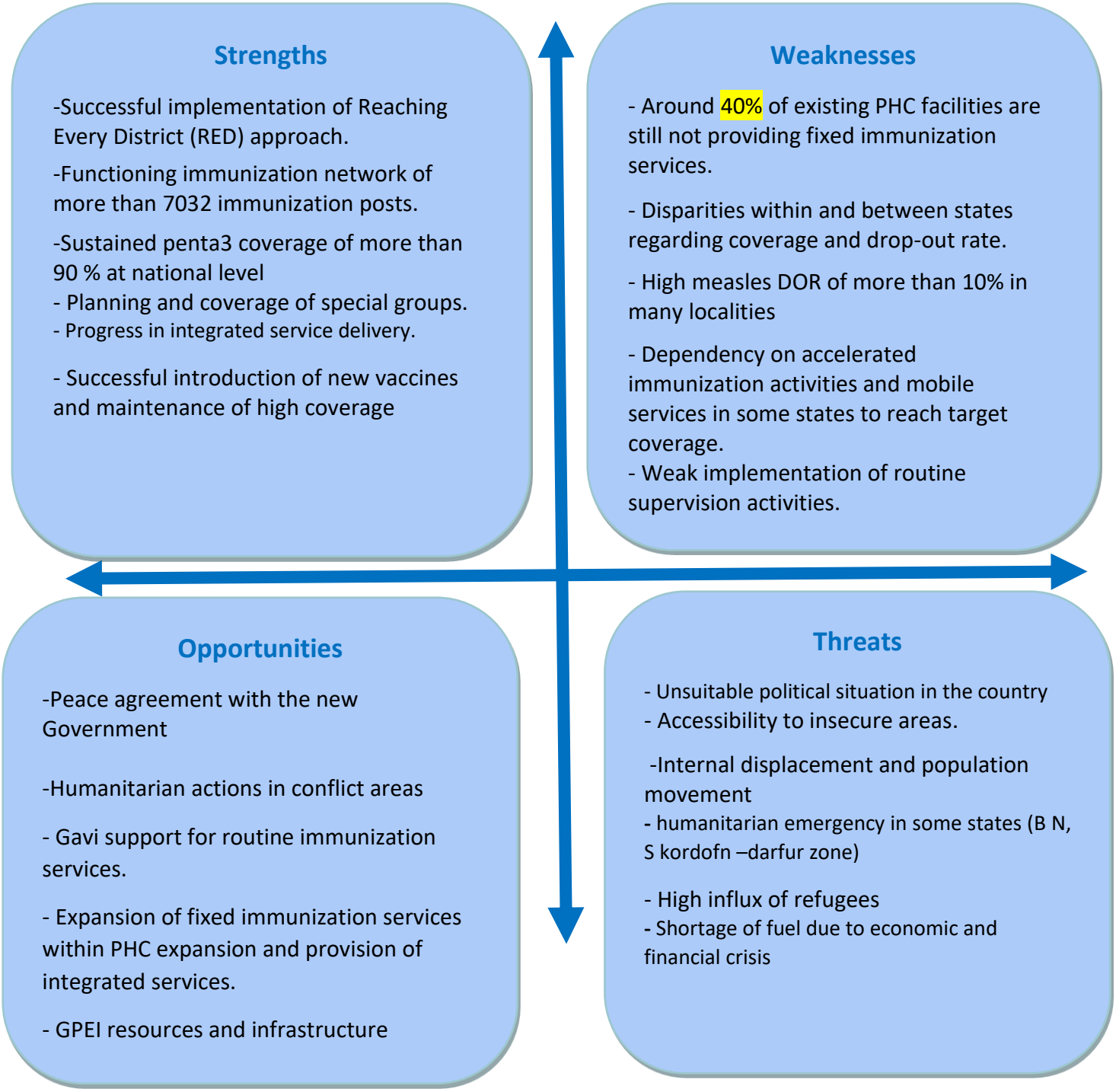
To access burden of HPV disease and have enough information, centers for screening were established in 5 states and it is planned to be expanded to another three states next year.

Considering the shortage of enough evidence showing the disease burden, the cost of vaccine and the country entering into the graduation phase, the NITAG did not recommend the HPV introduction for the time being and it will be considered upon availability of enough country evidence.

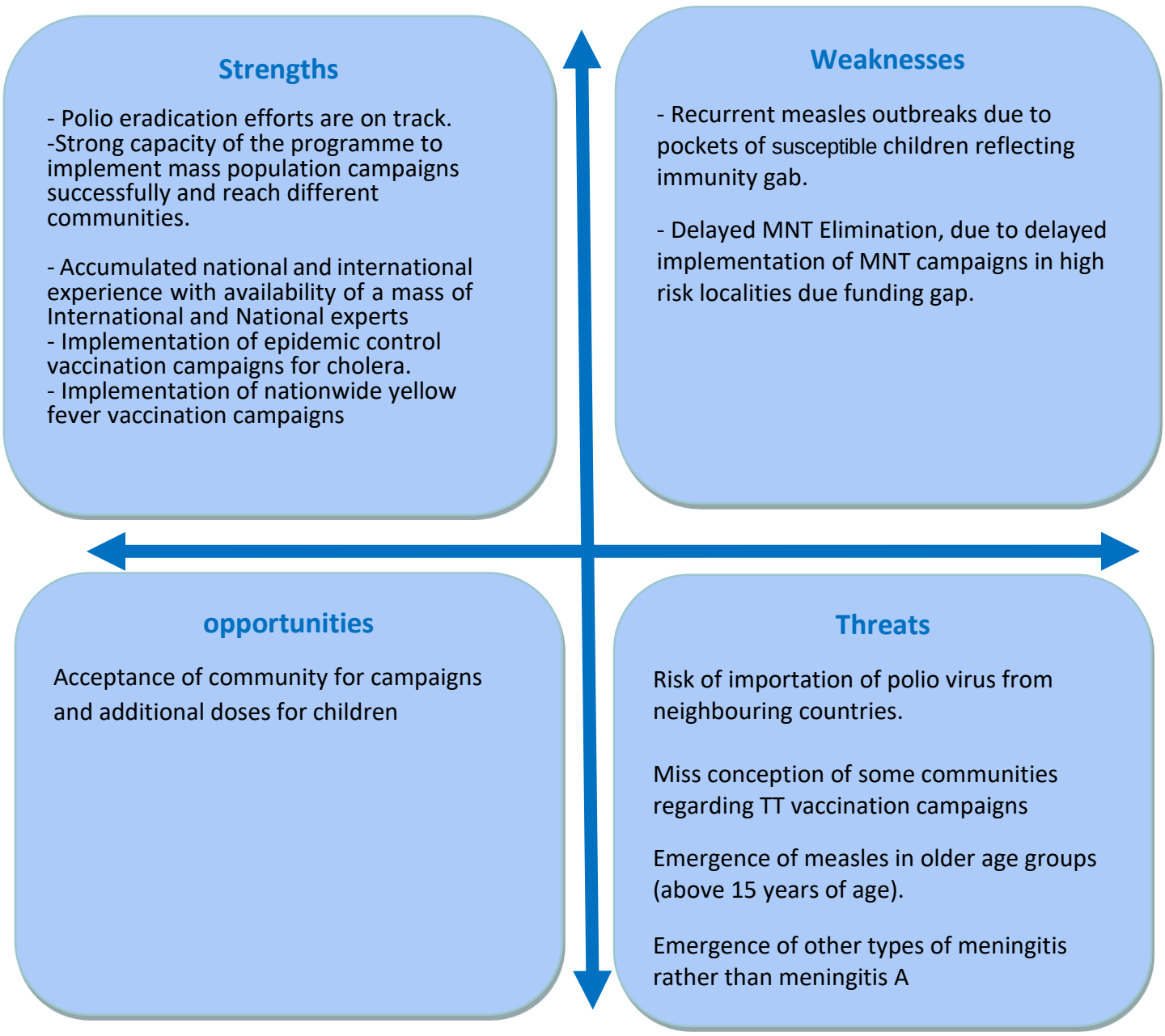
Immunization Programme Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

Programme Management

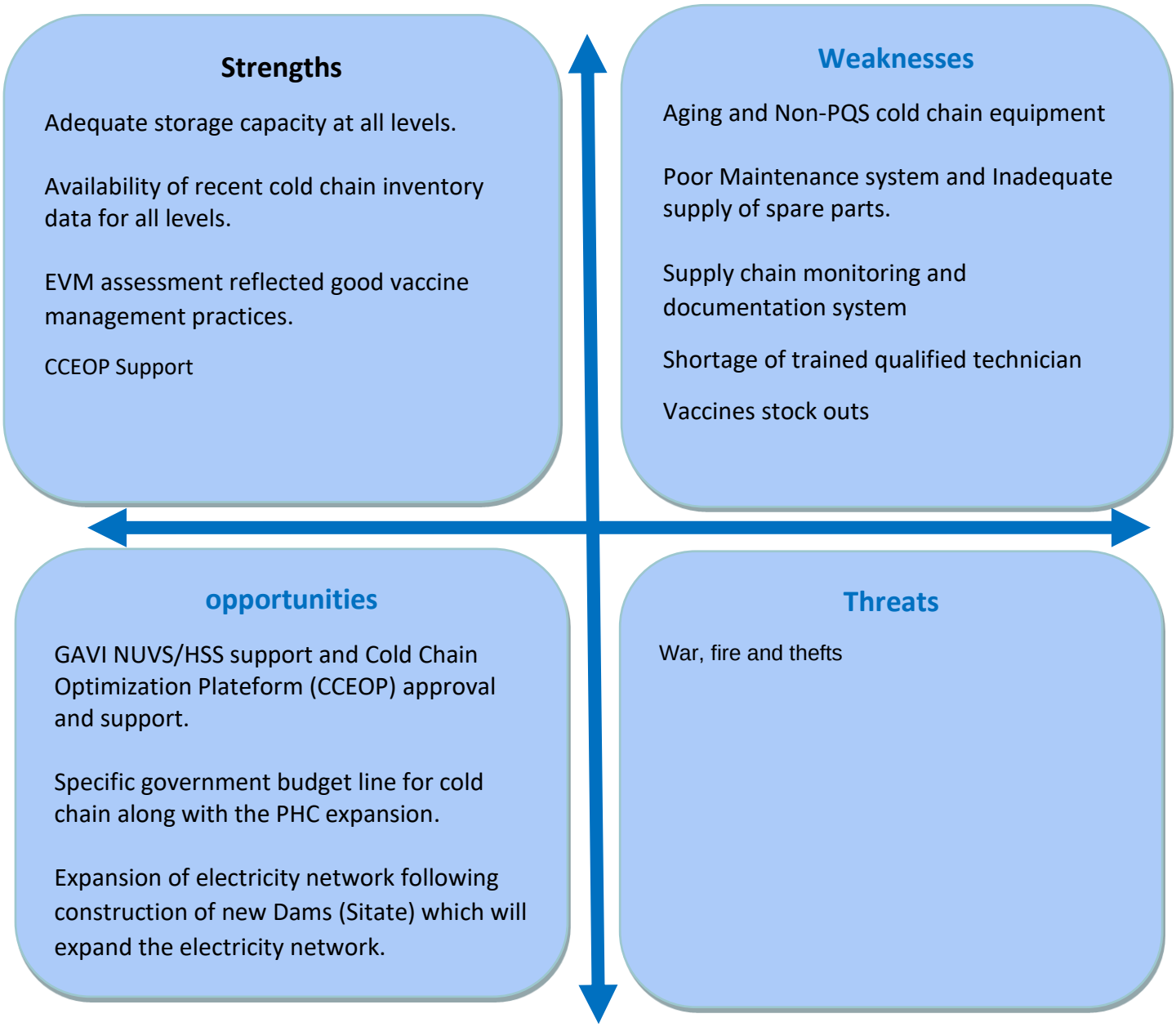
Service Delivery



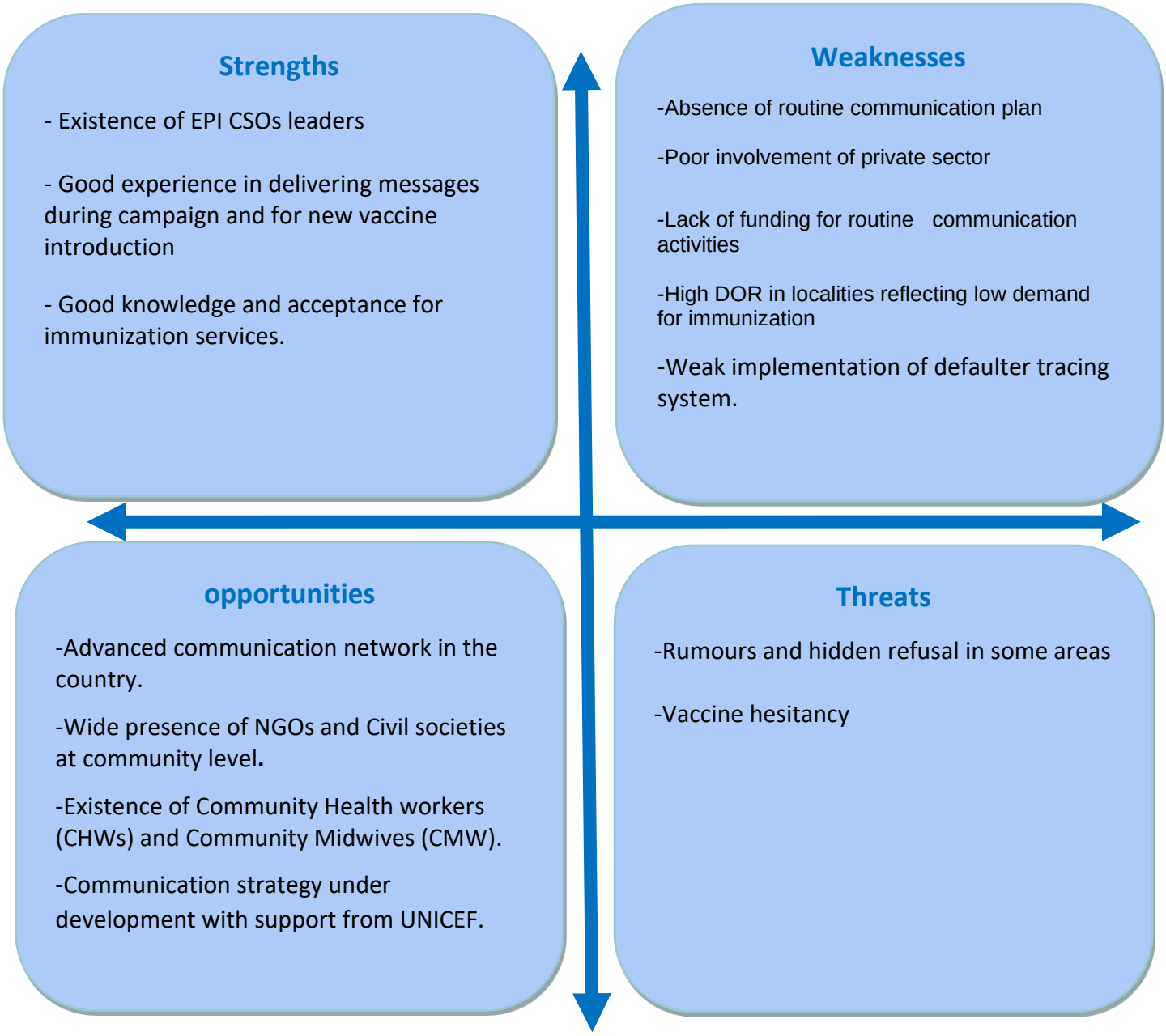
Accelerated Disease Control, elimination and eradication (SIAs)



Supply Chain and Vaccine Management



Advocacy and Communication



cMYP 2021-2025

Immunization services are critical elements for improving health and health equity. Immunization routinely reaches more children and households than any other health intervention, making it a solid platform from which to build universal health coverage. Concerted and focused efforts are needed to reach the un-immunized and under immunized children leaving no child behind and achieving the universal coverage, this will accelerate progress towards making Sustainable Development Goal target a reality

With a high return on investment, immunization impacts positively on education outcomes and productivity. Every US$ 1 invested in immunization generates a return of US$ 54 in broader societal benefits, enabling a virtuous cycle of social and economic development[13].

cMYP 2021-2025 Framework sets the vision and direction, the priorities and national goals for the 2021-2025 period. The immunization plan will be positioned within the broader National Health Sector plan and strategies, identifying clear synergies and opportunities for integration within the health programmes to support achievement of the overall objectives of reducing the nation's morbidity and mortality rates. The objectives, strategies, cost and financing information from the cMYP should be integrated within the national health plan and budget.

To accelerate equitable and sustainable progress towards universal health coverage (UHC), the cMYP is inspired by the Immunization Agenda 2030 and guided by overarching vision and global goals for the decade 2021–2030,.

This document provides a strategic framework that will guide dynamic operational phase, responding to changes in country needs and global context over this cycle, It outlines the road map for immunization interventions during the next five years**,** it will be complemented by detailed annual plans, which will translate this strategy into actions. Country implementation will be guided and accountability strengthened through monitoring and evaluation framework.

[13] Gavi .org

cMYP 2021-2025, aims to seize new opportunities to meet the continuing challenges of the immunization programme as a life-saving and life-enhancing, it aims to ensure that no one left behind without vaccination, the focus will be on those children who are still missing out (49,582 children who are still not receiving any routine vaccinations, 122,194 under immunized and 170256 not receiving measles vaccination).

What is New in cMYP 2021-2025

Recognizing the lessons from the previous planning cycles, as well as the changing context, cMYP 2021-2025 differs in the following aspects;

- **Adaptability to Changing Needs**: The cMYP 2021-2025 strategic framework is designed to adapt to changing needs and new challenges that emerge over its round.

- **Targeted Ways to Address Inequities:** cMYP 2021-2025 aims to ensure that the benefits of immunisation are equitably shared among and within the whole country. It gives priority to those populations not currently being reached, particularly the most marginalised communities, those living in fragile and conflict-affected settings, mobile populations and refugees.

- **Stronger Focus on Systems Strengthening:** cMYP 2021-2025 positions sustainable immunization programmes, embedded within primary health care, as the basis for achieving high immunization coverage and advancing universal health coverage.

- **Measles as a Tracer**: As guided by IA 2030, cMYP 2021-2025 regards measles vaccination coverage and incidence - tracked through surveillance data as a tracer to measure the strength of immunization programmes, indicating communities and age groups that are un- or under- immunized and where more efforts are needed.

- **Beyond Infancy Vaccination:** cMYP 2021-2025 has a stronger focus on expanding the benefits of immunisation throughout the life course.

- **Accelerating Innovation**: A more robust operational research agenda to brings new opportunities to meet unknown future challenges. cMYP 2021-2025 concentrates on use of available innovations to improve programme performance.

- **Better Use of Existing Resources for Self-Sustainability**: cMYP 2021-2025 has a strong focus on maximising the impact achieved with existing resources. Efficient, effective, and resilient

national immunisation programmes delivered as a part of primary health care, backed by strong political commitment which is a key to future progress and long-term sustainability.

Values and principles

As mentioned above the cMYP 2021-2025 is founded on National health priorities and the 2030IA, Guided by and shares the following principles and values:

Ownership, accountability & transparency

Country has the primary ownership and responsibility for establishing good governance and for providing effective and quality immunization services. Promoting a sense of stewardship, accountability and transparency on the government part ,as well as other stakeholders for enhanced effectiveness and sustainability.

Shared responsibility and Partnership

Immunization against vaccine preventable diseases is an individual, community, governmental and shared partners responsibility that transcend borders and sectors, increasing coordination and maximizing impact. Emphasis will be put on developing new partnerships and strengthening the existing ones to ensure that the selected set of interventions are fully integrated in national, states and district health systems in a sustainable way. Four areas have been identified as a matrix for partners to fit in, namely; advocacy, technical expertise, resource mobilization and information and networking. Commitment to this framework must be clearly stated and translated into materialized actions that foster the implementation.

Equity

UHC means everyone will have access to essential health services – including safe, effective and affordable medicines and vaccines – without financial hardship. Equitable access to immunization is a core component of the right to health giving more attention to vulnerable populations ensuring UHC and equity. Emphasis will be on ensuring equal access to immunization interventions for all target groups. Increasing equity in immunization delivery will be the priority

of the immunization in the next strategic period aiming to reduce the number of under-immunized children and an intensified focus on reaching the unreached, especially 'zero-dose' children

Integration

Strong immunization systems, as part of broader health systems and closely coordinated with other primary health care delivery programmes, are essential for achieving immunization goals. All efforts will be made to implement the proposed priority interventions at various levels of the health system in a coherent and effective way responsive to the needs of the population.

Sustainability

Data driven informed decisions and implementation strategies, appropriate levels of financial investment, and improved financial management and oversight are critical to ensuring the sustainability of immunization programme.

Innovation

The full potential of immunization can only be realized through learning, continuous quality improvement and innovation across all aspects of immunization.

Vision

Sudan population enjoy lives free from vaccine preventable diseases, leaving no one behind.

Mission

Ensure sustainable equitable access to all communities and individuals especially disadvantaged populations, to vaccines of assured quality and enhance demand for vaccination as individual right.

Goal Enhance immunization throughout the lifespan, reducing vaccine preventable diseases morbidity and mortality contributing to universal health coverage for Sudanese population.

Objectives

Reach high immunization coverage for all essential vaccines in the national immunization schedule at national level and in all districts in Sudan by 2025.

Key areas of Focus;

- Increase coverage of essential vaccines among most disadvantaged populations
- Expand the delivery of vaccines beyond childhood immunization and throughout the life course, to cover people's entire lives.
- Reduce the number of zero-dose children

Introduce and scaling-up coverage of high-impact, new improved vaccines and technologies of national priority

- Introduce Rubella vaccine to under one-year children with demonstration of disease burden
- Introduction of Hepatitis B birth dose to maintain Prevalence of chronic hepatitis B virus infection to less than 1% among children under less than 5 years old by 2025
- Introduction of YF vaccine into the routine services.
- Introduction of booster doses beyond infancy
- Demonstration of HPV disease burden in an intention to Introduce HPV to 14 years of age girls if appropriate.
- Demonstration of typhoid disease burden in an intention to Introduce the new typhoid vaccine if proved of priority.
- Scale up innovative immunization-related products.

Meet national eradication elimination and control targets

Key areas of Focus;

- Sustain Sudan Free poliomyelitis
- Elimination of Measles and Rubella in all the country by 2025
- Elimination of Neonatal tetanus in all the country by 2025
- Sustain Prevalence of chronic hepatitis B virus infection to less than 1% among children under less than 5 years old by 2025

Decrease in number and magnitude of outbreaks of epidemic-prone vaccine-preventable diseases

Key areas of Focus;

- To strengthen the capacities to prepare for, prevent and rapidly respond to infectious disease outbreaks
- To ensure essential immunization services with other health care services are maintained in areas affected by conflict, political instability, and other emergencies

Build effective, efficient and resilient immunization system with all essential components as part of national primary health care systems aimed at achieving universal health coverage.

Key areas of Focus;

- Extend immunization service delivery points and create demand
- Ensure availability adequate health workforce for immunization at all levels
- Attain high quality supply chains and effective vaccine management to facilitate equitable coverage in immunization and establish synergies with other PHC supply chains where possible.
- Ensure better immunization data management and use for evidence-based decisions
- Ensure comprehensive vaccine-preventable disease surveillance supported by strong and reliable laboratory-based systems.
- Ensure sustainable funding and increased share of immunization programme expenditures coming from domestic resources
- Sustain coverage of all vaccines after the transition from donor financing

cMYP 2021-2025 Framework for Action

Outcome: High immunization coverage of 98% for all essential vaccines in the national immunization schedule is reached		
Targets/Outputs	**Strategies**	**Indicators**
Achieve 98% national coverage and not less than 90% in 90% of localities with three doses of diphtheria-tetanus-pertussis, by 2025.	-Maximize the reach and improve equity by implementing REC strategy and sustainable outreach services - Expand immunization fixed sites. - Appropriate vaccination accelerated activities for disadvantaged population - Manage the Programme efficiently -Increase the demand, link with community and social mobilization Ensure sufficient vaccine supply and logistics support - -Monitor the progress	-Proportion of under one children vaccinated with first dose of penta-valent vaccine - Proportion of under one children vaccinated with the third dose of penta-valent vaccine -Proportion of localities achieved 95% Penta3 coverage. - Special groups third dose coverage
Achieve 95% national coverage and not less than 90% in 90% of localities with MCV1 by 2025. **Achieve not less than 90% national coverage of MCV2 by 2025.**		-Proportion of under one children vaccinated with the First dose of measles vaccine. -Proportion of localities achieved 95% MCV1 coverage - Proportion of children vaccinated with the second dose of measles vaccine -DOR between measles1 and measles 2 coverage - DOR between Penta3 and measles 1 coverage
Achieve and sustain 98% national coverage and not less than 90% in 90% of localities with the new introduced vaccines (Rota, PCV, IPV and Men A) by 2025.		- New vaccines coverage -% of children who completed their immunization as per EPI Schedule.
Achieve 80% national coverage and not less than 70% in 90% of localities		- TT2 coverage - DOR between TT1 and TT2 coverage - PAB

district with tetanus toxoid vaccine by 2025.		

Outcome: High-impact, new improved vaccines and technologies of national priority are introduced		
Output	**Strategies**	**Indicators**
Introduce Rubella containing vaccine (MR) to under one year of age children with demonstration of disease burden	-Evidence based decision making. -New vaccine deployment with comprehensive control plan in synergy with other related health programmes. - Demonstration of HPV disease burden -Implement comprehensive approach for VPD control	-Introduction of RCV and % coverage
Introduction of HebB vaccine zero dose into the routine immunization services **Reduce Prevalence of chronic hepatitis B virus infection to less than 1% among children under less than 5 years old by 2025**		- Hep B zero dose coverage -Hbs less than 1% (Reduction of chronic hepatitis B prevalence to less than 1% among children under less than 5 years old) by 2025
Introduce YF vaccine into the routine immunization system		-% YF coverage of under one child through routine services
Introduce routine TD booster doses		- Booster doses introduced - Coverage of booster doses

for under 5 yr children		
Demonstration of HPV disease burden and Introduction of HPV to girls 14 years of age (if recommended by NITAG)		-HPV surveillance data for evidence-based decision taking. -Introduction of HPV and coverage (if recommended)
Demonstration of typhoid disease burden and Introduction of the new typhoid vaccine if evidence are indicative		-Typhoid surveillance data for evidence-based decision making. -Introduction of new typhoid vaccine and coverage (if indicated and recommended)
Introduce suitable immunization innovative technology and products.	- Scale up innovative immunization-related technology and products. -Establish and strengthen capacity to identify, generate, and manage innovation.	-Number of immunization/ vaccination innovations introduced

Outcome: National disease eradication elimination and control targets are met		
Output	**Strategies**	**Indicators**
Sustain Sudan polio free status and keep high immunity profile of the population	- High quality SIAs in high risk areas -Strengthen AFP surveillance system -High polio3 routine vaccination coverage. -High IPV vaccination coverage - Introduction of IPV second dose	- Zero all wild polio virus (WPV) -IPV first and second dose coverage - No circulating vaccine-derived poliovirus (cVDPV)

	- Implementation of polio transition plan and end game strategy - Strengthening emergency preparedness, detection and response capacity - Implementation of the International Health Regulations (2005). - Sustain progress in related programmatic areas and strengthen the health system to maintain polio-free status after eradication	- OPV campaigns coverage by finger marking - High AFP surveillance indicators
Achieve Measles and Rubella elimination in all country by 2025	-Maintain high MCV1 routine coverage of 95% or more - Maintain high MCV2 coverage - Measles case-based surveillance (within an integrated VPD surveillance) - High quality SIAs for target population	- Confirmed measles/ rubella cases/1000,000 population -Measles surveillance indicators -95% or more measles follow-up campaigns coverage - Measles (MCV1 & MCV2) vaccination coverage - Measles dropout indicators - Rubella vaccination coverage - Coverage of measles-rubella vaccination campaign
Achieve Neonatal tetanus elimination in all country by 2025	- Maintain high TT2 routine vaccination coverage for pregnant women -High quality SIAs for at risk localities - Strengthen NNT surveillance as part of Integrated VPD surveillance	-Proportion of HRLs achieved more than 80% TT3 coverage -Rate of NNT/1000LB -Certification of MNT Elimination

	-Community Based Surveillance in HRL that implemented MNT campaigns in coordination with maternal and child health and reproductive health programmes	

Outcome: Number and magnitude of outbreaks of epidemic-prone vaccine-preventable diseases is reduced		
Output	**Strategies**	**Indicators**
Decrease number and magnitude of outbreaks of epidemic-prone vaccine-preventable diseases and prevent epidemics among refugees and displaced persons	- Immunization in emergency and post-emergency contingency planning - Enhance capacities for prediction and early preparedness for infectious disease outbreaks (to prepare for, prevent and rapidly respond to outbreaks) - Integrated surveillance for priority and emerging infectious diseases - Ensure timely sufficient vaccines supply for outbreak response. - Maintain appropriate essential vaccination services along with other health care services in conflict, political instability, other emergencies and humanitarian crises (Vaccinate during and after humanitarian emergencies) - Ensure timely, well-organized responses to outbreaks of	- Number of outbreaks responses by vaccination activities as integral part of outbreak preparedness, detection and response plans and implementation. -Capacity strengthening interventions to prepare for, prevention and rapidly respond to infectious disease outbreaks

	epidemic-prone vaccine-preventable diseases.	

Outcome: Effective, efficient and resilient immunization programmes infrastructure with all essential components is strengthened		
Output	**Strategies**	**Indicators**
strengthen Program Governance, management capacity, decision making process, partnership and integration	-Strengthen the Foundation and governance of the immunization programme. - Build and sustain strong social and political commitment for immunization. -Enhance partnership and inter-sectoral collaboration -Strengthen immunization programme management capacity. -Improve efficiency and quality of the immunization services -Capacity building and maintain functional National Immunization Technical Groups/supporting bodies (NITG,ICC/HSSC) - Establish accountability frameworks involving all stakeholders at all levels - Integrate vaccines delivery with other essential health interventions - Use measles cases and outbreaks as a tracer to identify weaknesses in immunization programme	-Target immunization guidance and tools are in place. -Updated comprehensive annual immunization plans - Functional National Technical Advisory Group (NITAG) Meets the defined Criteria - Accountability framework - % of immunization service delivery points integrated with other essential health interventions

Ensure availability of adequate quantity and quality health workforce for immunization at all levels	-Capacity building and promotion of the programme management and leadership at all levels. - Ensure adequate human resources for immunization/PHC to deliver predictable quality services. - Ensure timely payment, adequate salaries and allowances. - Monitor and motivate the staff according to performance	-Proportion of EPI managers trained /promoted. - Proportion of EPI human resources received in-service training. -Proportion of immunization sites with permanent service provider. - Proportion of staff received incentive based on performance - Turnover rate of EPI staff - Percent of localities with functional health management teams
Increase access to immunization services to regularly reach under-immunised and "zero dose" children	-Expansion of fixed immunization services network. - - Identify and address barriers to immunization among disadvantaged population. - Ensure people and communities value, actively support, and seek out immunization services.	- % of fixed immunization service expansion - % health facilities offering immunization services - % of population covered by each service delivery strategy (fixed, out-reach, mobile) - Percentage of defaulter children traced and vaccinated - Difference in Penta3 coverage between children of urban and rural residences - Difference in Penta3 coverage between the highest and lowest wealth quintiles - Penta3 coverage difference between the children of educated and uneducated mothers/care-takers - Penta3 coverage difference between males and females
Maximize effectiveness and efficiency by	- Strengthen and modernize the supply chain planning and management system	- Proportion of new PQS cold chain equipment installed out of the targeted -90% Functionality of the cold chain.

Attaining high quality supply chains and effective vaccine management	-Redesign and use of technology in the immunization supply chain -Expand and rehabilitate the supply chain in relevance to immunization network - Maintain high functioning cold chain at all levels Implement VMA Improvement plan - Use of CCE Gap Analysis Tool to inform all investment in CCE to complement CCEOP investment	- No of vaccines stock outs at different levels. - Vaccine wastage rate(administrative and system) -EVM Score % CCE replacement/rehabilitation in existing equipped sites CCE extension in unequipped existing and/or new sites
Ensure comprehensive vaccine-preventable disease surveillance supported by strong and reliable laboratory-based systems.	- Enforcement and capacity building for implementation of integrated VPD surveillance system - Support laboratory capacity, supplies and equipment for integrated VPD surveillance. -Establish Community based surveillance	-Attaining surveillance performance indicators according to specific VPD targets (not less than 80%) - % of different levels involvement in integrated VPD surveillance. -% of localities with active community surveillance - Number of confirmed cases of diphtheria that have been reported
Ensure better information systems and immunization data to enable decision making.	-Invest on reliable information system to strengthen monitoring and evaluation mechanisms - Use of innovative technology for data recording, reporting, analysis and management - Implementation of DQA improvement plan	-DQA verification factor -Coverage survey's findings -New electronic information system in place - % point difference between Penta 3 national administrative coverage and survey point estimate

	- Invest on operational research implementation for evidence-based decisions making.	- Number of operation priority operation researches implemented out of target
Maintain efficient immunization safety system	-Functional NRA -Immunization safety and waste disposal. -Post marketing surveillance and AEFI	-% of old and new vaccines registered by NRA. - Number of adverse events reported -Achieve the expected reported AEFI for different vaccines. -% stock outs of supplies provided for the programme at all levels (any stock outs)
Ensure sustainable funding and increased share of immunization programme expenditures coming from domestic resources	Resource mobilization (internally and externally) to sustain coverage of all vaccines after the transition from donor financing -Generate government commitments to invest in immunization and increase trend of domestic expenditure on immunization -Efficient utilization of existing recourses -Innovative ways for potential immunization financing and support.	-Percent of expenditure on routine immunization program funded by government - Percent of expenditure on traditional vaccines funded by government -%Fulfilment of the GAVI co-financing timely -Number of new financial supporting partners -% funding gap total annual resource requirement (aim at decreasing trend)

Implementation Arrangements, Monitoring and Evaluation

Implementation Arrangements

Coordination

Actors of immunization will work together to achieve the goals of improving the immunization programme actions and outcomes. Implementation of this plan will be through the Partnership-based action with Federal, state, related sectors, local authorities, communities, NGOs, private sector, civil societies and development and humanitarian actors. Partnership is mainly to describe collaboration mechanisms and integration of strategies with FMOH informed by the stakeholders and situation analysis.

Implementation planning

Improvement in immunization services and outcomes, require collaboration among multiple sectors and partners. Coordination, harmonization of implementation, monitoring and evaluation are major functions of the EPI. In coordination with technical related sectors and partners the cMYP will be translated into annual operational plans, with clear roles and responsibilities for each party at all levels. The activities will directly be conducted by the EPI. The immunization programme has the obligation to ensure appropriate implementation of the endorsed plans. The indicators identified in the situation analysis and plan can serve to map priority order to enable phased implementation of required interventions as will be achievable during the five years cycle of the cMYP.

In order to effectively operate the intervention, an institutional structure is needed that will allow for ongoing capacity for management to support implementation and achieve better immunization outcomes to reach the programme goals.

cMYP Monitoring and Evaluation

Monitoring and evaluation are essential program elements. They are vital for ensuring and improving efficiency of program operations and reaching the target group in a cost-effective fashion. Protocols for monitoring and evaluation are developed as part of the overall program

design and implemented as part of the program. Indicators appropriate to monitor intervention impact will vary in accord with the intervention objective. The appropriate intervention-specific *impact* indicator(s) for each of these objectives will differ; in some cases process indicators will be appropriate, and in other cases biological indicators will be the most useful. If the desired *outcome* of the intervention is to document a change of a disease morbidity and mortality of the recipient population, biological indicators are ideal. Resource availability can limit the feasibility of direct biological evaluations because these indicators are usually more costly to obtain and evaluate than indirect indicator data.

The purpose of monitoring and evaluating the cMYP is to measure the short -term achievements as well as the long- term impact of the interventions on the overall health status of Sudanese population. However, it is recognized that the plan operates in a complex context where many factors interact to influence achievement of sustainable change and impact.

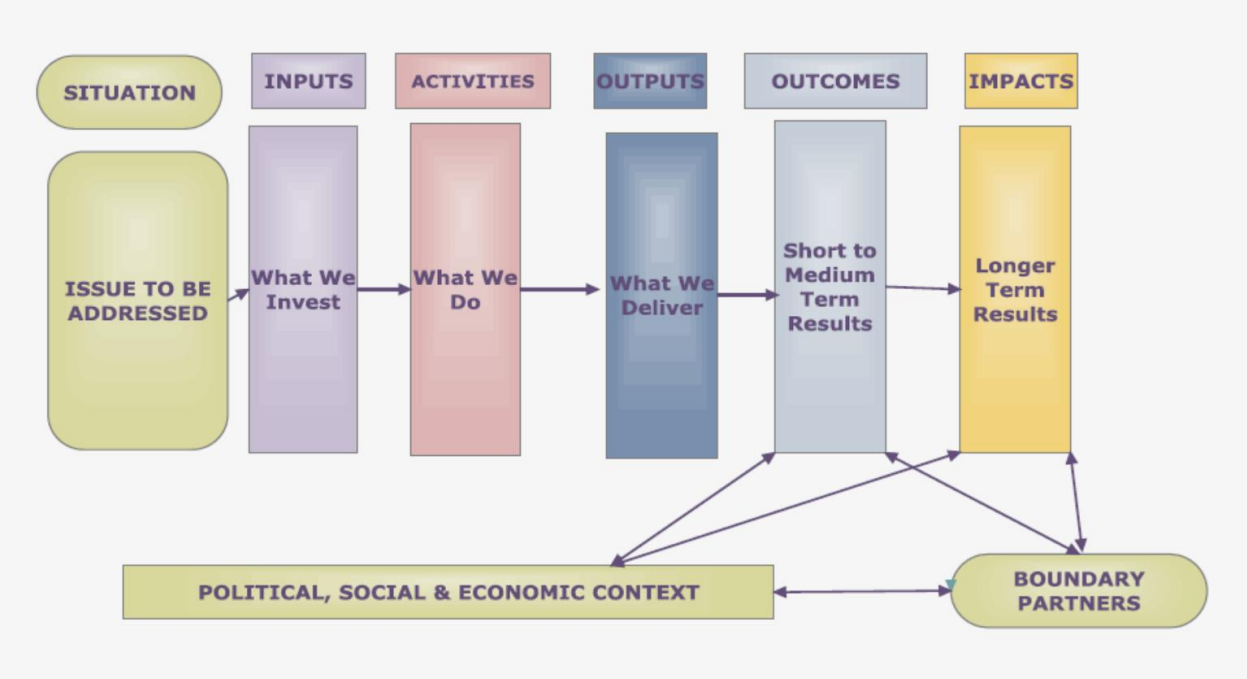
The strategy monitoring framework includes three types of indicator that allow to monitor the results' pathway towards the immunization targets:

- Primary outcome indicators that measure the progress towards the main immunization targets.
- Process indicators that monitor programme and situation specific progress.
- Policy environment and capacity indicators that measure the political commitments and programme capacity within the country.

The monitoring framework include indicators for all levels of the outcome chain; key activities and outputs, outcome and impact indicators. The M&E matrix summarizes the set of indicators needed to monitor and evaluate the cMYP, their periodicity and responsible entity. An annual monitoring report will be developed to assess progress towards the planned goals, based on the preset monitoring indicators. Progress will be discussed at annual meetings of the EPI. Other meetings and monitoring activities will be conducted with individual or group partner organizations as well. Reports on progress will be disseminated to donors, national and implementation partners on an annual basis.

The monitoring processes for the cMYP will follow the ***Program Logic Model.*** A Program logic model identifies the expected outcomes, the impacts arising from program activities, the outputs and presents a results chain or indication of how the activities and outputs are expected to lead to the achievement of the intended outcomes and impacts.

Figure (36): Program Logic Model



Source: Anne Markiewicz and Associates, 2014

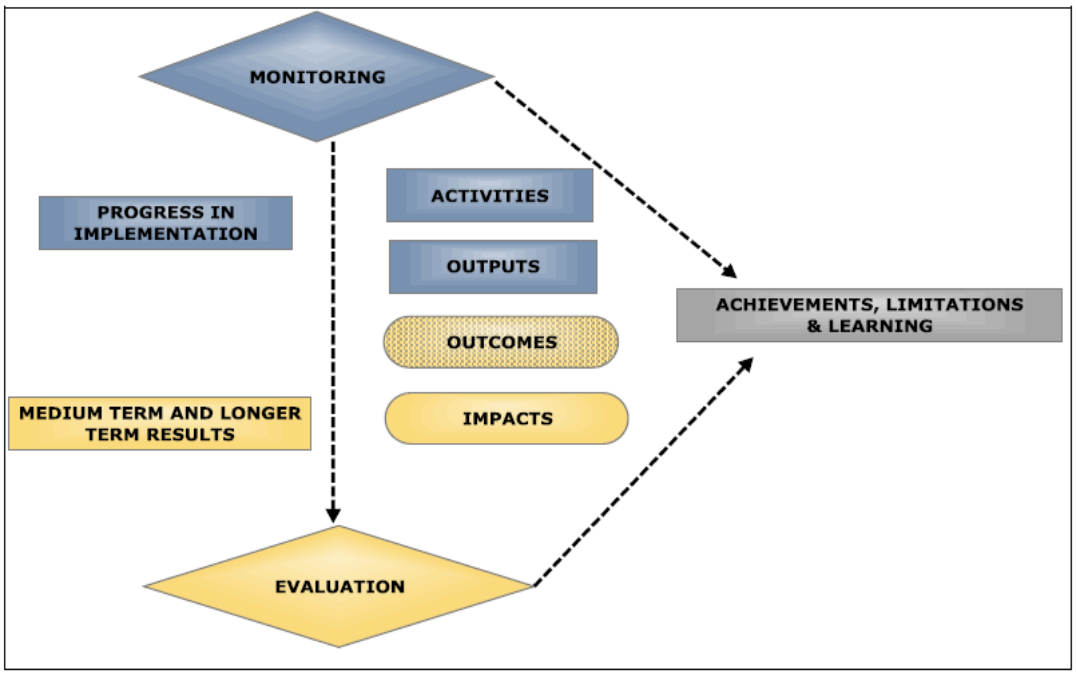
Indicators

Indicators are a set of core indicators and sub-set of extended indicators developed for the immunization programme. They address each stage of the results chain as set out in the framework. These indicators can be used for in depth analysis and for performance management. They are proposed in a way to give an overview of progress against the cMYP. The cMYP monitoring framework includes indicators for all levels of the outcome chain: key activities and outputs, outcome and impact indicators. The mapping of data sources for each indicator as well as data collection frequency is critical to this exercise. The indictor's framework also includes possible data sources for each of the proposed indicators. It will be important to develop better data collection and assessments tools and strengthen skills for interpretation.

Evaluation of the cMYP

Planned and periodic assessment of the planned programme results in key areas (e.g. appropriateness, effectiveness, efficiency, impact and sustainability). Evaluation will be conducted at the midterm and at the end of the last year of the plan cycle to measure achievement of the strategy goals and outcomes and discuss its impact on the sustainable health and development and equity national goals. The evaluation will be based on the preset goals and outcome indictors and will provide a base for the development of the new cMYP for the next five years. It will also aim at identifying successful interventions and their impact, opportunities for further development and implementation challenges.

Figure (37): Relationship between Monitoring and Evaluation



Source: Anne Markiewicz and Associates, 2014

cMYP2021-2025, Monitoring log-frame is attached as annex (1) , the targets and base line will be completed and updated by end of 2020.

Annex (2)

National Immunization Schedule

Vaccine	Age of Vaccination					
	Birth	6 weeks	10 weeks	14 weeks	9 months	18 months
BCG	☻					
OPV	☻	☻	☻	☻		
DPT- HepB - Hib	☻	☻	☻	☻		
HepB(Zero dose planned 2018	☺					
Measles					☻	☻
Rota virus		☻	☻			
PCV13		☻	☻	☻		
IPV				☻		
Mening A vaccine					☻	
Yellow Fever (planned)					☺	
MR (planned)					☺	
HPV (planned for 15-16yrs old girls) if indicated						

☺= Symbol for new vaccines planned to be introduced during

Tetanus vaccination schedule

Time of vaccination	
Dose	**Schedule**
TT1	At first contact
TT2	After one month
TT3	After six months
TT4	After one year
TT5	After one year

References/Documents Consulted

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6. *Sudan National Health Sector Strategic Plan*
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10. *Sudan, National Ministry of Health, Expanded Programme on Immunization: Acute Flaccid Paralysis (AFP) Surveillance Central Unit. Annual Reports 2016-2019*
11. *Sudan Cold chain inventory report 2018*
12. *Sudan Effective Vaccine Management Assessment (EVM) Report, 2020*
13. *Data Quality Assessment (DQA) Report 2020*