

Immunization Coverage and Equity Assessment in Rwanda



Final Report

June 2021

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Executive Summary

1.0 Introduction and objectives

Inequality in immunization exists in all countries in many forms and multiple dimensions such as wealth, education of mother, gender, place of residence, level of awareness, access to services and other system-based barriers that create vulnerabilities leading to inequitable access to services. Based on the review of available documents, key informant interviews, focus group discussions with service providers in the low performing communities, this assessment attempts to improve our understanding about the coverage, trends and inequity in immunization in Rwanda. The objectives of review are to assess the trend and magnitude in inequities in immunization; identify the key determinants of inequities; and examine the system-based barriers that impede services and create inequities in coverage. By synthesizing key findings, a set of recommendations are proposed that would improve coverage and reduce inequity in immunization in Rwanda.

2.0 Assessment approach

An integrated and mixed approach was adopted to conduct the immunization coverage and equity assessment (CEA) as suggested by UNICEF (UNICEF 2019a). According to this framework, the process of assessing coverage and equity was organized around the following steps: i) providing overview of the country context; ii) assessing immunization coverage and trends; iii) assessing immunization inequity by high-risk population and district; iv) prioritizing interventions to improve coverage and equity; and v) developing tailored strategies and interventions to improve coverage and equity. To ensure impartiality and lack of biases, information was collected from multiple sources and triangulated for validation.

3.0 Key findings and recommendations

3.1 Coverage, trends and equity in immunization

3.1.1 Immunization coverage and trends

Childhood immunization coverage in Rwanda is very high compared to most African countries. About 95.5% of children have received all basic vaccinations¹ and 84.4% have received all age-appropriate vaccinations² in 2019/20 (NISR 2020). The proportion of zero dose children³ has been reducing to reach only 0.3% in the country. Trends in immunization coverage showed fluctuation in the earlier years after introducing the program in 1980s indicating that immunization program and service delivery system were not steady and viable. To achieve and sustain universal coverage, it is crucial to establish and institutionalize a mechanism to routinely track and vaccinate zero-dose children and ensure completion of all doses of vaccines.

3.1.2 Inequity in childhood immunization

In Rwanda, inequities in childhood vaccination exists in many forms and multiple dimensions. Key determinants of disparities in coverage, as found in the desk review, were household wealth and birth order. Geographic (province) location was also a significant predictor of inequity. Also, immunization coverage varied by sex of child, education of mother, parental level of awareness, access to services

¹ All basic vaccinations include BCG, three doses of DPT-HepB-Hib (pentavalent), three doses of oral polio vaccine (excluding polio vaccine given at birth), and one dose of measles.

² All age-appropriate vaccinations include BCG, hepatitis B (birth dose), three doses of DPT-HepB-Hib (pentavalent), four doses of oral polio vaccine, one dose of inactivated polio vaccine, three doses of pneumococcal vaccine, and one dose of measles.

³ Children who get zero vaccines.

and other gender & system-based barriers. Inequity in immunization coverage has slowly narrowed down as a result of the expansion of services and steady increase of coverage regardless of economic condition or parental education. Place of residence has been a major determinant of inequity as gaps in immunization coverage by province and district have remained very wide in Rwanda. It is recommended that RBC should now focus on under-served communities in low performing districts, identify chronically missed settlements, involve local communities to generate demand for immunization, and expand outreach services, if needed, to reach missed children for vaccination.

3.1.3 Percent of district with DPT3 coverage at 80% or above

In 2019, the DPT3 coverage was above 80% in 29 out of a total of 30 districts in the country. A large number of districts have reported to achieve coverage above 95%. Overall, the target set by the *Global Vaccine Action Plan* of WHO that ‘percent of district with DPT3 coverage should be 80% or above’ has been achieved in Rwanda.

3.1.4 Coverage and equity of immunization by district

Inequity in coverage by district was quite high. Significant disparities existed in parental perception of the need and benefits of childhood vaccination by district. The disparity in dropout rates between doses of antigens by district was very high probably due to long time gap (such as 6 months for MCV) between the two doses. Potential reasons were neglect, forgetting the next dose or the lack of awareness among caregivers regarding the need to complete doses. It is recommended that the immunization program should follow up of all children to ensure that they received all doses. The negative effect of COVID-19 on immunization coverage has not been even or equal across districts although the coverage was maintained reasonably high in most districts.

3.1.5 Effects of gender-related barriers on equity

Gender-related barriers have both direct and indirect negative effects in accessing immunization services in Rwanda. Lack of awareness and cultural values restrict women’s mobility, access to income-generating activities, decision-making and interactions outside home have prevented mothers from seeking immunization services for their children. The government has endorsed policies to promote women’s empowerment and gender equality. It is recommended to develop national strategy and activities to empower women in all major sectors to improve their self-esteem, build negotiation skills in public, improve capacity to be economically productive, and become self-reliant.

3.2 Prioritization of interventions to improve coverage and equity

3.2.1 Removal of barriers to reach remote communities

About 21.6% women reported to face serious problems in accessing health care due to distance to health facilities in 2015 indicating that distance related inaccessibility has been a significant barrier to improve immunization coverage in most remote and hard-to-reach communities (NISR 2015). This barrier should be removed by expanding both fixed and outreach services in the underserved communities in collaboration with PHC services, private sector and CSOs.

3.2.2 Demand promotion and community engagement

Lack of awareness of the benefits of immunization, vaccine hesitancy, and social norms have been the key challenges to promote demand for vaccination in the low performing areas. Lack of demand for vaccine has been reinforced by financial barriers that have restricted access to health services especially for the poorest households. It is expected that reaching the under served communities with

culturally appropriate message and immunization would raise the demand for services and improve immunization coverage in the low performing under services communities.

3.2.3 Elimination of system-based barriers and bottlenecks

Although the immunization program is generally understaffed in Rwanda, each sector has at least one Health Center with qualified nurses who can provide standard vaccination services. The district health service delivery system in Rwanda has gaps in leadership, planning, budgeting and management. Funding was insufficient to fully implement the health services in some districts. Communication between sectors and districts, and between districts and district-level health sector constituents has also been inadequate.

3.2.4 Mapping resources for better programming through GIS

The Geographic Information System (GIS) or other digital systems may be used in Rwanda to map resources and key features of the geographically remote villages to identify chronically missed settlements, identify gaps and sub-national inequities in access to immunization resources, help better targeting of immunization resources and re-allocate catchment or outreach areas for the community health workers and vaccination team.

3.2.5 Strategy to reduce the COVID effects on immunization

Due to COVID-19 pandemic, immunization services in Rwanda were constrained in several ways (United Nations 2020). It has been recommended that the program should: restore immunization services by leveraging existing networks of vaccine delivery; continue vaccinating missed children by establishing additional facilities; expand routine services to zero-dose communities with additional human and financial resources in addition to developing strategies and launching COVID-19 vaccines for the priority population group.

3.3 Strategies and interventions to improve coverage and equity

Based on the assessment of the performance of immunization services in Rwanda, the following interventions are proposed:

3.3.1 Updating micro-plan and implementing RED/REC strategy to identify missed settlements

Immunization program should update the micro-plan and implement RED/REC strategy to identify missed settlements with zero-dose children and for better planning of immunization resources (such as establishing new fixed and/or outreach facilities). This should be done routinely in low performing areas with the participation of local communities to increase demand for immunization services, strengthen the delivery of services, and improve access to marginalized and vulnerable communities.

3.3.2 Identification of zero-dose children for vaccination

Most of the zero-dose children were living in the Kigali province. A very high proportion of them were children of highly educated mothers and richest wealth quintile (NISR 2020). They should be identified from two sources: i) birth registration office and ii) primary health care (PHC) facilities in addition to routine household visits by the community health workers (CHWs) in their catchment areas. The CHWs should be involved in birth registration process and routinely contact PHCs and maternity care to identify newborn to update the list of eligible children for vaccination.

3.3.3 Expansion of facilities to increase access to services in the low performing areas

Long distance trekking in mountainous areas, high transportation and other indirect costs have discouraged low-income households to visit facilities to vaccinate their children although childhood immunization is free in Rwanda. It is suggested that RBC should conduct an independent assessment to identify locations where new facilities should be established in collaboration with PHC services, private sector and CSOs.

3.3.4 Improving communication and IEC strategies to raise demand for vaccination

Although immunization coverage is nearly universal in Rwanda, the demand for childhood vaccination is significantly lower than the coverage. This finding indicates the need to reformulate BCC and social mobilization activities to generate demand for immunization. Existing communication strategies should be re-examined and more closely geared to the barriers to and drivers of immunization to reduce misinterpretations and negative beliefs about vaccination. IEC efforts should be designed towards heightening risk awareness about the vaccine preventable diseases to be more effective. Interpersonal communication strategy should be supplemented by mass media such as the radio, TV and mobile phones.

3.3.5 Improving the management of logistics and cold chain in the low performing districts

Frequent vaccine stockout is not very common in Rwanda. The cold chain system in health centers in the remote communities generally works well except occasional power failure. Lack of transportation sometimes restricts conducting outreach sessions particularly in rainy seasons. Rwanda has been improving vaccine storage capacity as only a few health facilities has recorded stock out of vaccines in recent years. To ensure the quality and safety of vaccine, the vaccine storage system need to be re-examined.

3.3.6 Reaching the urban low performing settlements to track 'zero-dose' and dropout children

The key challenge in the urban immunization program is to track children for vaccination due to high population mobility within the city. Updating micro-plan in cooperation with the PHC and delivery facilities would facilitate tracking eligible children for vaccination. Service hours in the health facilities and wait times for vaccination are also barriers for many working parents or working single mothers who are employed in formal and informal sectors. It is suggested that the health facilities should adopt flexible approach for immunization service delivery to reach and vaccinate missed children living in the urban slums and underserved areas. Special immunization campaigns may also need to be conducted to reach the missed children and those with incomplete vaccination.

3.3.7 Monitoring the shortcomings of interventions and modifying the strategies

The immunization program should routinely monitor the effects of pro-equity immunization interventions on the coverage and inequities including improvement in access to and utilization of services in the under served and unreached populations (UNICEF 2011). In addition, the service delivery including the program needs, capacity of human resources, logistics, availability of staff, quality of performance, staff turnover and gaps, supportive supervision, etc. should also be carefully monitored. Monitoring results should be analyzed to identify the gaps and shortcomings of the interventions and modify accordingly.

4.0 Concluding remarks

Given that immunization targets have been changing with new or additional doses of vaccines, it is time to rethink the existing service delivery strategy of immunization. Rather than stand-alone vertical

approach of providing immunization, integration of immunization program with broader PHC services would be more appropriate, meaningful and cost-effective in the long run. In the context of the challenges and opportunities in the country, the immunization program in Rwanda should be concerned not only about currently un-immunized children but also about the children who will be born in coming years and need to be reached for vaccination.

The assessment concludes that inequity in immunization exists in Rwanda. Reduction of inequities and improvement of coverage in Rwanda would require concerted efforts among the government, partners (such as Gavi, UNICEF and WHO), advocacy groups, communities and the beneficiaries at the grassroots level.

1.0 Introduction

1.1 Background

The benefits of immunization as one of the most successful and cost-effective health interventions are well recognized (WHO 2020a; WHO 2019; Doherty et al. 2016). Although access to and use of immunization services are expanding, vaccine-preventable diseases remain as major causes of morbidity and mortality in the world (WHO 2020b). Inequities in the use of immunization services persist between as well as within countries (Chopra et al. 2020; CDC 2012).

Despite progress, nearly 20 million children globally each year have insufficient access to vaccines (WHO 2020a).⁴ About 85% of infants worldwide received three doses of DTP3 containing vaccines globally in 2019 indicating to lack of access to immunization services for many children in 2019 (WHO 2020b). Most of them are marginalized and living in underserved communities with a risk of being sick. WHO along with other partners updated the Reaching Every District (RED) guide in 2017 to expand the provision of services to achieve more equitable coverage in immunization in the African Region (WHO 2017). RED and other strategies such as National Immunization Day and periodic intensification of routine immunization were reported successful in extending immunization services to the unreached populations. These strategies, however, had difficulties to reach populations who live in isolation beyond the traditional social and governmental structures (Soeung et al. 2013; WHO 2013).

The World Health Assembly endorsed a framework for universal access to immunization to reaching under-served populations and reducing disparities in immunization both within and between countries (WHO 2013). With the support of countries and partners, WHO has set a new global vision and strategy (called *The Immunization Agenda 2030*) in 2020 to address the immunization challenges for the decade 2021–2030. The IA 2030 agenda “envisions a world where everyone, everywhere, at every age, fully benefits from vaccines to improve health and well-being” (WHO 2020c). The strategic priority goals of IA2030 are to i) reach ‘high equitable immunization coverage’ at national and sub-national level; ii) increase immunization coverage among the most disadvantaged populations; and iii) reduce the number of children not reached through the immunization program (‘zero-dose’ children) (WHO 2020d).

Figure 1.1 Map of Rwanda



Inequity in immunization coverage has not been new in developing countries (Delamonica et al. 2005). What is new is the recognition that closing the immunization coverage gap is possible which will help reaching the desired millennium development goals (Bishai et al. 2011; CDC 2015; Vandenant 2015).

⁴ The immunization coverage might have declined further in 2020. WHO (2020e) reported that the coverage has declined in 85% countries as result of COVID-19.

Rwanda has one of the most successful Expanded Program on Immunization (EPI) in Africa and has maintained relatively high vaccination coverage for several decades compared to most other African nations (UNICEF 2020). The country launched the expanded program of immunization (EPI) in 1980 (RBC 2012). Since then, the coverage has gradually been increasing.

Despite steady high coverage for all vaccines over the last two decades, the country still reports 0.3% children who never received any vaccines and 4.2% children who failed to receive all doses of vaccines in 2019 (NISR 2020), the government has requested UNICEF to undertake immunization coverage and equity assessment in Rwanda (UNICEF 2020).

1.2 Purpose and specific objectives

The purpose of this assignment is to conduct Immunization Coverage and Equity Assessment (CEA) and identify strategies to improve coverage and equity in Rwanda.

The specific objectives of the assessment are to:

1. Provide an overview of the country with a focus on current situation of health and immunization, longer-term trends in immunization coverage, and financing & human resources for immunization program.
2. Analyze the immunization coverage and equity and investigate to what extent the low coverage and inequities in immunization were determined by⁵ the
 - sociodemographic factors such as sex of child, birth order of the child, education of mother and household wealth;
 - residential characteristics such as place of residence (urban vs. rural), geographical location (province and district); and
 - gender-related barriers to access services arising from social and financial restrictions to women's mobility, decision-making and interactions outside the home given that most primary caregivers are women.
3. Prioritize interventions to improving coverage and equity in immunization as they might be associated with the
 - demand promotion, community engagement, quality of services, financial barriers and integration with broader health services;
 - system-based barriers and bottlenecks such as inadequate human resources, poor logistics and service delivery;
 - leadership, management & coordination (LMC) and advocacy for political will, accountability and commitment;
 - removal of barriers to reach remote communities and access immunization and ANC services by adopting new technology to improve access; and
 - reduction of the negative effects of COVID-19 on immunization.
4. Synthesize key findings and propose strategies and recommendations to
 - develop evidence-based and realistic immunization strategies and activities that improve coverage and reduce equity gaps by addressing the root causes of inequities; and
 - provide essential services to reach the 10% of zero dose Rwandan children.

1.3 Scope of the assessment

The findings and recommendations of the review are expected to be used in developing an integrated strategy to reduce inequities in vaccination outcomes, address gender-based and financial barriers,

⁵ Immunization coverage is determined by multiple factors. The report uses determinants based on the availability of data.

improve demand for vaccination, and manage the problems in logistics, cold chain and human resource that affect immunization coverage in Rwanda.

2.0 Methodology

The study looks explicitly at the equity dimensions of interventions and provides assessments of what works and what does to reduce inequity. It highlights results for worst-off groups as well as the gaps between best-off, average and worst-off groups by paying particular attention to the process and contextual analysis.

2.1 Assessment approach

An integrated and mixed approach was adopted to conduct the immunization coverage and equity assessment (CEA) as suggested by UNICEF⁶ (UNICEF 2019). According to this framework, the process of assessing coverage and equity was organized around the following steps: i) providing overview of country context; ii) assessing immunization coverage and trends; iii) assessing immunization inequity by high-risk population and district; iv) prioritizing interventions to improve coverage and equity; and v) developing strategies and activities to improve coverage and equity. To ensure impartiality and lack of biases, information was collected from multiple sources (such as desk review, key informant interviews, FGDs and stakeholder consultation) and triangulated for validation.

2.2 Areas of inquiry

The immunization coverage and equity assessment (CEA) was conducted through the following steps:

2.2.1 Overview of country context

The process began by collecting and reviewing relevant documents of the demographic and socioeconomic condition, national health system, situation analysis of health and trends in immunization coverage in Rwanda. The findings were categorized into the following sections:

2.2.1.1 Country overview

This section included a brief description of the

- demographic situation such as population growth, number of surviving infants, the projected increase population and children, urbanization rate, and urban-rural distribution of the population; and
- socioeconomic condition including GDP per capita, poverty indicators, trend and projected economic growth, literacy rates and educational attainment by gender.

2.2.1.2 Situation of health

The situation of health section has focused on:

- infant mortality rate (IMR), under-five mortality rate (U5MR), maternal mortality ratio (MMR),;
- major causes and determinants of under-five mortality and morbidity in the country;
- malnutrition and iron, vitamin A and iodine deficiencies;
- utilization of MNCH services such ANC, skilled birth attendance and institutional delivery; and
- immunization program; drop-out rates, and disparities in Rwanda.

2.2.1.3 National health system

This section has provided a description on:

⁶ Coverage and Equity Assessment Toolkit for Addressing Inequity in Immunization Services. CEA Toolkit for Reaching Every District Approach.

- national health service delivery;
- health manpower; and
- health financing, expenditure per capita and GDP.

2.2.2 Assessing immunization coverage and trends

In this section, the level and variation of immunization coverage as well as continuity of doses in Rwanda were presented based on DHS survey data. This was followed by the description of trends in coverage by key determinants including sex of child, household wealth, education of mother, place of residence, zero-dose children, etc.

2.2.3 Identifying equity gaps by high-risk population and district

To identify poor performance and inequitable outcomes, the priority has been given to identify high risk populations and locations (districts) in Rwanda. The high-risk children were identified by examining sociodemographic factors such as sex of child, birth order of the child, education of mother and household wealth. The hard-to-reach communities were identified by examining residential characteristic such as province and place of residence (urban vs. rural). The magnitude of the gaps (in numbers and proportions) was examined and analyzed. Other potential indicators to identify high-risk communities were districts where DTP-HepB-Hib3 vaccination coverage (based on administrative data) was below 80%⁷ and the dropout rate from MCV1/MR1 to MCV2/MR2 in 2019 (MOH 2020).

2.2.4 Prioritizing strategies and interventions

In this stage, barriers and challenges faced by the parents to access immunization services at district and health facility levels; and system-based bottlenecks experienced by the providers to deliver immunization services were identified and investigated. The demand-related challenges in Rwanda depend on the availability of services, distance to service facilities, vaccine hesitancy, perception of the quality of services which influence caregivers' intention or ability to bring their child to the facilities for vaccination. During the system-based bottleneck analysis, the challenges were examined from the perspectives of i) recipients (knowledge, awareness and belief of the caregivers and communities; and access to ANC services and skilled birth attendance); and ii) service provision to identify high priority areas to develop interventions to overcome the challenges.

2.2.5 Developing tailored strategies and activities

After analyzing the underlying reasons (root causes) of low coverage and inequities from the broader health system perspective and from the perspective of program management, the communities and families - the strategies and activities were developed to improving coverage and equity. Previous assessments and recommendations to improve coverage and equity were also used. The strategies and activities proposed in this assessment are evidence-based, informed by experience and knowledge, realistic, and designed for specific communities and contexts (such as urban poor, remote rural or gender related deprivations, etc.) considering the availability of resources to the national immunization program.

2.3 Sources of data

Data were collected primarily from three different sources:

2.3.1 Desk review

A comprehensive desk review was conducted to get a clear understanding of the current status as well as the key challenges of EPI in Rwanda. The review included both quantitative and descriptive reports.

⁷ Although the commonly set threshold is 5%, we propose 20% in estimating the disparities given that the coverage rates are very high in Rwanda.

The quantitative data were extracted from large national surveys such as Demographic and Health Survey (DHS) datasets, official estimates of immunization coverage (released by the MOH), administrative data on morbidity and mortality, and immunization coverage survey to assess trends in coverage and to identify the determinants of inequity in immunization in Rwanda.

The descriptive reports used in the review were the National Health Sector Strategic Plan of Rwanda (2018 – 2024), Situation Analysis of Children in Rwanda 2018, Socioeconomic Impact of COVID-19 in Rwanda (conducted by United Nations Rwanda), Joint Appraisal Reports (of Gavi), comprehensive Multi-Year Planning (cMYP) of Rwanda, National Supply Chain Assessment Report 2017, Rwanda Poverty Assessment 2015 (World Bank), Demand Promotion Indicators 2017 (used by the EPI), Immunization System Indicators 2017, Rwanda Statistics Summary (of WHO), reports from other health programs including nutrition, reproductive health, maternal, neonatal & child health, WHO-UNICEF-Gavi policies and strategies, and international publications on CEA among others. The review identified the population groups and communities with lower vaccination coverage and determinants associated with inequities in immunization (e.g., geography, education, poverty, gender-related, hard to reach, vulnerable groups, single parents etc.).

2.3.2 Key informant interviews and Focus Group Discussions (FGD)

Both Key Informant Interviews (KII) and Focus Group Discussions (FGD) were conducted with health professionals including immunization service providers, program staff at various implementation levels and other relevant stakeholders to validate the desk review findings. A total of twelve key informant interviews (KIIs) and six FGDs were conducted in two low performing districts (Huye and Kamonyi) in the Southern province and one urban district (Kicukiro) in Kigali.

2.3.3 Stakeholder consultation

A national consultative workshop was conducted to review the assessment findings and enrich the interpretation of the immunization coverage and assessment data. The participants of the workshop were the key stakeholders and donors including key officials from the MOH, Rwanda Biomedical centre (RBC), WHO, UNICEF, and NGOs providing health services where the key findings of the desk review, KIIs and FGDs were shared and discussed to enrich the interpretation of those findings about the determinants of immunization coverage and inequities in Rwanda.

2.4 Compilation and analysis of data

A repository of all relevant data sources available in Rwanda has been developed. Based on the available data, an index of performance and determinants by district were constructed. Where possible, data were triangulated to ensure the validity. Based on the desk review findings along with key informant interviews and FGD data, the immunization equity assessment report has been finalized. The report included summary of data and major findings; tables classifying pro-equity strategies, prioritized strategies and interventions; and conclusions with key recommendations detailing strategies and activities that reach identified equity groups.

3.0 Key Findings

3.1 Overview of country context

3.1.1 Country overview

Rwanda is one of the smallest countries on the African mainland. It is a landlocked country located in the Great Rift Valley bordered by Uganda, Tanzania, Burundi, and the DR Congo (Dion 2020; CIA 2020). As a highly elevated country, its geography is dominated by mountains in the west and savanna to the east with numerous lakes throughout the country. The climate is subtropical with two rainy seasons and two dry seasons. The entire country is at a high altitude. The central region is predominantly rolling hills while the eastern border region consists of savanna, plains and swamps. The primary transport system is the road network between Kigali and other major cities and towns in the country.

Administratively, the country is divided into five provinces (*intara*) and thirty districts (*uturere*) including cities, municipalities, towns, sectors (*imirenge*), cells (*utugari*), and villages (*imidugudu*). The provinces are Northern, Southern, Eastern, Western and the Municipality of Kigali. The primary responsibilities of the districts are coordinating public service delivery and economic development. Districts are divided into sectors. The sectors are responsible for the delivery of public services as mandated by the districts. The cells and villages are the smallest political and administrative units and served as a link between the people and the sectors (Dion 2020).

3.1.1.1 Demographic situation

The population of Rwanda was estimated to be 13,276,517 in 2020 living on 26,338 km² (10,169 mi²) of land (UNICEF 2021). Rwanda is one of the most densely populated countries in Africa (CIA 2020). The majority of the population live in the central regions of the country as well as on the shores of Lake Kivu in the West (Dion 2020).

A high birth rate has led to rapid population growth in Rwanda. Population growth rate was estimated as 2% in 2020 (Dion 2020; CIA 2020). Total fertility rate (TFR) in 2020 was 3.52 children born per woman (CIA 2020). The overall sex ratio of the country is 95.9 males per 100 females. The life expectancy is 67.67 years (69.27 years for females and 67.11 years for males). The number of pregnant women and the number of live births was estimated 376,494 in 2019. The number of surviving infants, who were eligible for vaccines were estimated as 364,820 in 2019. The total number of women with child-bearing age was 3,350,295 in 2019 (Gavi 2019).

With a densely populated country except the savanna land and Akagera National Park in the east, Rwandan population is predominantly rural. About 17.4% of population were living in the urban areas in 2020 (Dion 2020; CIA 2020). The rate of urbanization was estimated as 2.86% in 2020 (CIA 2020; Dion 2020). Kigali is the largest city, with a population of approximately 1.2 million. The city is made up of three districts namely Gasabo, Kicukiro and Nyarugenge.

3.1.1.2 Socioeconomic condition

Although Rwanda has undergone rapid industrialization in recent years, its economy is based mostly on subsistence agriculture by local farmers using simple tools. About 80% of the population are rural and most (85%) of the poorest population are dependent on agriculture. There are wide regional variations in poverty. Compared to the Northern or Eastern Provinces, a higher proportion of poor are living in the Southern and, to a lesser extent, in the Western Provinces (Bird et al. 2019). While coffee and tea are the two major cash crops for export, tourism is also a fast-growing in the country and became the leading foreign exchange earner sector. Rwanda is a country of few natural resources.

In Rwanda, the percent of population living in poverty had reduced from 57% to 45% between 2006 and 2011. An estimated 38.2% of the population live below the poverty line in 2016 (Dion 2020). The

country had a gross domestic product (GDP) per capita of US\$748 in 2017 according to the World Bank. In 2019, total GDP was estimated to increase to \$10.12 billion with per-capita GDP (PPP) estimated at \$2,444 in 2019. Annual growth rate of GDP is estimated as 9.41% (Dion 2020).

The literacy rate (% population of age 15 and over who can read and write) in Rwanda was 73.2% in 2020 (Dion 2020). The rate was significantly higher among male (77.6%) than female (69.4%) in 2018 (CIA 2020).

3.1.2 Situation of health

3.1.2.1 Mortality and morbidity

Infant mortality rate (IMR) was at about 26.3 per 1,000 live births in 2019 (NISR 2020). IMR was much higher among male than female children. Maternal mortality ratio (number of maternal deaths per 100,000 live births) was 248 in 2020 (UNICEF 2021).

Rwanda has made extraordinary improvements in reducing mortality after the genocide period and in progressing towards achieving the SDS. The sharp reduction of mortality rate in recent years may be explained by the reforms implemented in the health sector. The country has seen improvement on key health indicators in recent years. For example, life expectancy had increased from 55.2 to 64.0 and IMR had reduced from 117.4 per 1,000 live births in 2000 to 26.3 per 1,000 live births in 2019 (ONAPO 2000; NISR 2020). Under-five mortality rate (U5MR) was also reduced from 101.2 in 2000 to only 34.3 per 1,000 live births in 2019 in Rwanda (ONAPO 2000; NISR 2020).

The most frequent types of illnesses among under-five children were diarrhoea and other infectious gastroenteritis (333,502) followed by pneumonia (212,777). Other reported illnesses included pulmonary tuberculosis (388), measles (76), rubella (6) and neonatal tetanus (1) in 2019. Pneumonia (246) and diarrhoeal diseases (122) were the major causes of death among the under five children in 2019 (Gavi 2019). However, the health profile of the country remains dominated by diseases and deaths despite these improvements. The primary causes of death were pneumonia, birth asphyxia, and meningitis among neonates and malaria, acute respiratory infections, and HIV/AIDS-related death among non-neonates (Gupta et al. 2018). The key causes of morbidity were lower respiratory infections and neonatal disorders.

Malnutrition and iron, vitamin A and iodine deficiencies were reported serious public health problems among children in Rwanda (ODI 2011). Although some progress has been made, malnutrition has remained very high with nearly a fifth of all children suffering from moderate malnutrition (ODI 2011). According to a recent estimate, prevalence of stunting among children under 5 years was 38% in 2015 (USAID 2018).

3.1.2.2 Utilization of MNCH services

Use of antenatal care (ANC) is low in Rwanda. About 47.2% women (aged 15-49 years) attended any provider at least four times during pregnancy in 2020. Safe delivery is very high in the country as 94.3% of deliveries were attended by skilled health personnel in 2020 (UNICEF 2021). About 70.3% of women (aged 15-49 years) received postnatal care (PNC) within two days of giving birth in 2020 (UNICEF 2021). Recent data on postnatal care (PNC) for newborns are not available. According to an estimate, only 19.2% of newborns had a postnatal contact with a health provider within two days of delivery in 2015 (UNICEF 2021).

3.1.2.3 Immunization program

Rwanda has one of the most successful Expanded Program on Immunization (EPI) in Africa and maintained relatively high vaccination coverage for several decades compared to most other African

nations (UNICEF 2020). The country launched the extended program of immunization (EPI) in 1980 (RBC 2012). Since then, the coverage has gradually been increasing.

The current program is financed by the Government and its partners. Key partners of the Rwandan national EPI are Gavi – the Vaccine Alliance, UNICEF, WHO and USAID. While the Government pays all the traditional vaccines and co-finances the new and under used vaccines, GAVI supports all new vaccines by financing 90% of the total cost. Currently, these new vaccines include DPT-HepB-Hib, PCV13, Rotavirus Vaccine and HPV vaccine (MoH 2016).

The need for vaccines is estimated based on the request/ requisition of the number and type of vaccines and doses received from the service delivery points throughout the country. UNICEF directly procures vaccines from Gavi for Rwanda on behalf of the government which ensures that vaccines are delivered in a timely manner (Wong et al. 2019). Rwanda has as a robust logistics system with a sound and reliable centralized cold chain storage system for vaccines that allows for efficient supply chain management (Wong et al. 2019). No vaccine stock-outs are reported in 2019 according to Rwanda JFR data (MOH 2020).

Total expenditure for immunization was \$4,098,345 in Rwanda in 2011. Immunization expenditure per capita was only US\$ 0.4 while cost per DPT3 child was US\$12.8 in 2011. The government expenditure on vaccines used in routine immunization was US\$ 1,294,554 while the total expenditure from all sources (government, domestic private and international partner agencies) on vaccines used in routine immunization was US\$ 9,227,054 in 2019 (MOH 2019). The percent of total expenditure on vaccines financed by government funds was 14% in 2019 (Gavi 2019). The country has dedicated budget line items.

3.1.3 National health system

Health care in Rwanda is delivered by governmental, faith-based organizations and private health providers. The health system in Rwanda is organized as a three-level pyramid (MoH 2017). The central/national level has the directorates of the Ministry of Health (MoH), Rwanda Biomedical Center (RBC) which is the implementing agency of the MoH, and the national referral hospitals (MoH 2016).

3.1.3.1 Health service delivery

Health care responsibilities vary according to administrative level. At the central/national level, the Ministry of Health is responsible for the development of health policy and strategies along with guidelines to provide health services. It coordinates resources at the national level and carry out monitoring and evaluation of health services. In addition, the central level coordinates intermediary and peripheral levels; provides them with administrative, technical and logistical support; and manages the national referral hospitals (MoH 2016). In addition, the referral hospitals are managed at this level which provide tertiary care.

At the provincial level, the responsibilities are to help the health centres to implement health policy and norms developed at central level; coordinate activities; provide technical, administrative and logistical support; train and supervise health workers at the health centres; ensure equitable distribution and efficient utilization of resources among districts; collect and analyze health data; and provide evidence-based guidance to deliver health services (MoH 2016).

The district hospitals deal with secondary care, including surgery and management of complicated cases such as severe malaria. The health centers provide primary health care, including outpatient & inpatient services, and preventive services such as vaccination. The first point of contact in the referral system, particularly in rural areas, is the community health worker who is trained to deal with basic illnesses (ODI 2011). The peripheral (district) level is the operational unit represented by the health

centers and health posts which provide primary health care to the population within the health catchment area. The responsibilities include running district hospital and a network of health centres; ensuring administrative functions and logistics including the management of resources and supply of drugs; and supervising community health workers (MoH 2016; ODI 2011).

3.1.3.2 Health manpower

Health workforce and health infrastructure in the country are inadequate. The number of health facilities in Rwanda had increased from 1,161 in 2014 to 1,221 in 2015 (United Nations & UNICEF 2017). The total number of physicians was 742 in 2015. According to an estimate, the number of population per doctor was 15,479 in 2017 (United Nations & UNICEF 2017). Although has improved in recent years, Rwanda still has a shortage of medical professionals, with only 0.84 physicians, nurses, and midwives per 1,000 residents.

3.1.3.3 Health care financing

Health care financing in Rwanda is heavily dependent on funding from external sources. A large proportion of health expenditure was financed from external assistance. Other sources are internal private sources including the *Mutuelle* and government sources (ODI 2011). The government has also instituted performance-based financing (PBF) that consists of attaching monetary incentives to performance contracts. This allows the health facilities to receive additional money on the basis of institutional performance. The government supplements health workers' salaries on a performance basis. Rwanda introduced the Community-based Health Insurance (CBHI) scheme which has improved health standards particularly among the poor by subsidizing contributions for the poor and vulnerable. This has significantly reduced out-of-pocket (OOP) payments that helped to extend coverage to otherwise excluded groups.

According to an estimate, expenditure on health of Rwanda increased from US\$ 178 million in 2004 to US\$ 717 million in 2018 with an average annual increase of 10.97% (World Bank 2019). Health expenditure in Rwanda was 6.6% of GDP in 2017 which has increased to 7.5% in 2018 (CIA 2020; World Bank 2019). Per capita health expenditure of Rwanda increased from US\$ 21 in 2004 to US\$ 58 in 2018. The rate of increase has been 8.25% per year (World Bank 2019). In 2018, health expenditure per capita based on PPP for Rwanda was estimated US\$ 170.

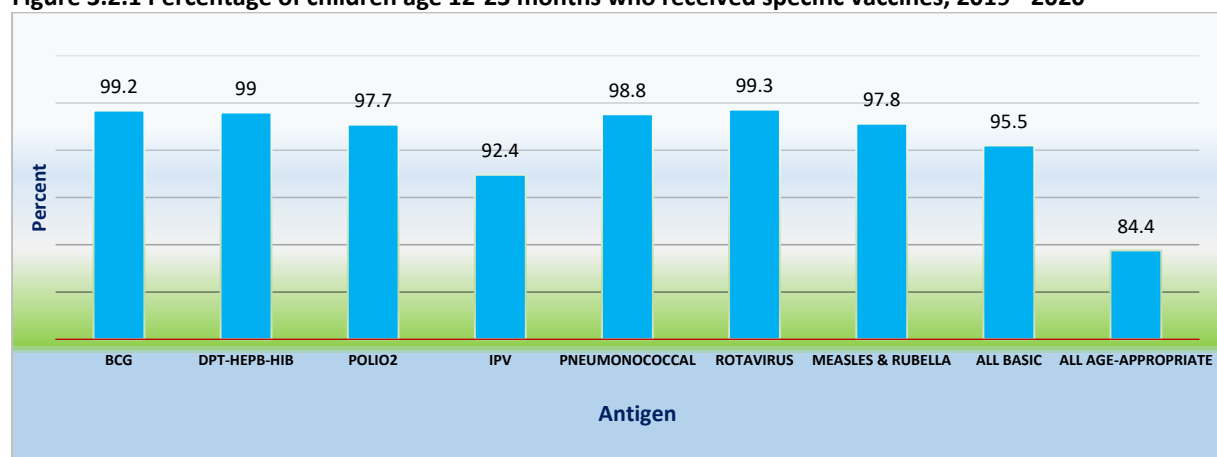
3.2 Immunization coverage and trends

3.2.1 Immunization coverage

Expanded Program of Immunization (EPI) was launched in Rwanda in 1980 (RBC 2012). Rwanda has established a schedule for the administration of all basic childhood vaccinations based on the World Health Organization’s guidelines. All basic vaccinations are given to children during the first year of life (NISR 2020). In Rwanda, vaccines against Hemophilus influenza type B and hepatitis B are used in combination with DPT and is called pentavalent. The pneumococcal conjugate vaccine (PCV) was commenced in 2014 in Rwanda (NISR 2020). Another critical measure of immunization coverage is all age-appropriate vaccinations (or full vaccination) when the proportion of children age 24-35 months who have received all vaccinations.

A recent demographic and health survey (DHS), conducted in 2019-2020 in Rwanda, indicated that 95.5% of children have received all basic vaccines, and 84.4% have received all age-appropriate vaccines (Figure 3.2.1). Nearly 99.2% of children have received BCG, 99% have received the three doses of pentavalent, and 97.7% have received three doses of oral polio. Coverage of vaccination against measles has been 98%. Only 0.3% of children have not received any vaccinations. The reasons of relatively lower coverage of all age-appropriate vaccines than all basic vaccines are not clearly explored.

Figure 3.2.1 Percentage of children age 12-23 months who received specific vaccines, 2019 - 2020



Source: NISR 2020

To achieve universal coverage and sustain that coverage, it is crucial to identify and track those children who were never or only partially vaccinated. Another important issue that needs to be considered is to ensure continuity of doses of specific vaccines.

Table 3.2.1 Continuity of doses of vaccines, 2019 - 2020

Vaccines	Dose			
	0	1	2	3
DPT-HepB-Hib	--	99.6	99.4	99.0
Polio	93.9	99.6	99.3	97.7
Pneumococcal	--	99.6	99.3	98.8
Rotavirus	--	99.5	99.3	--

Source: NISR 2020

Table 3.2.1 shows that the continuity of doses of specific vaccines was very high in 2019. While the coverage of DPT-HepB-Hib, rotavirus and pneumococcal vaccines were nearly universal for all doses,

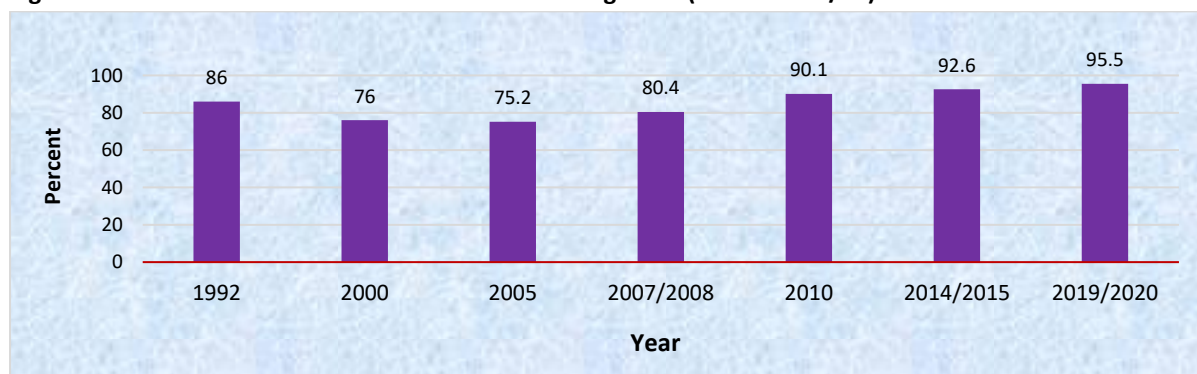
it appears that polio at birth (Polio 0) was relatively lower than the subsequent doses. The coverage tended to become lower at polio 3.

A recent Lancet study (2018) identified several factors that have contributed to Rwanda’s success in immunization program (Bao et al. 2018). Some of these are i) engaging a cadre of community health workers to sensitize the communities regarding the benefits of vaccinations and follow up to ensure that eligible children are vaccinated, ii) ensuring vaccine procurement and timely distribution to vaccine delivery points at the local level, iii) strong political will among the government policy makers to provide universal health services, iv) decentralization of EPI management at the district and village level to tailor appropriate approaches to reach the target population, v) practicing *imihigo* (or signing performance contracts to achieve certain targets by the management), and vi) strengthening leadership and capacity enhancement in supply chain management (Bao et al. 2018).

3.2.2 Trends in coverage by key determinants

Rwanda has one of the most successful Expanded Program on Immunization (EPI) in Africa and has maintained relative high vaccination coverage for several decades compared to most other African nations (UNICEF 2020).

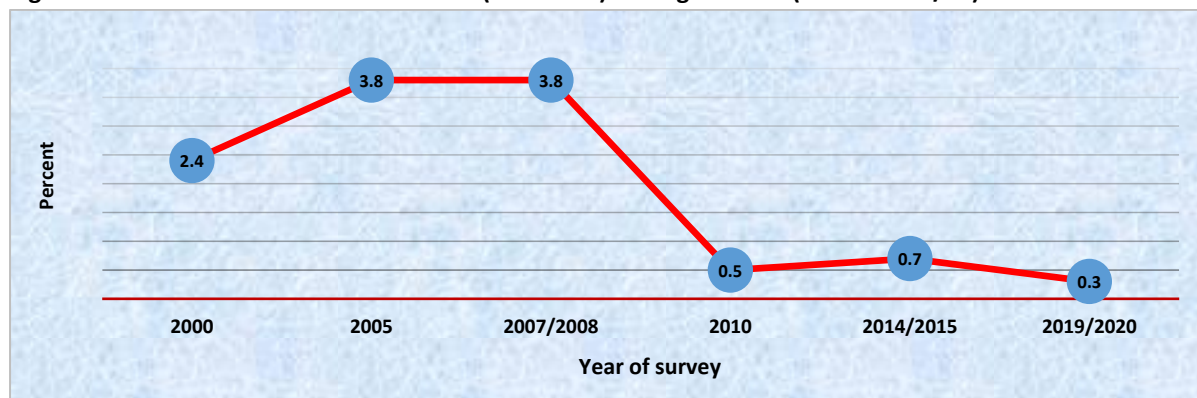
Figure 3.2.2 Trends in childhood immunization coverage rate (1992 – 2019/20)



Source: ONAPO 2001, INSR 2006, MOH 2009, NISR 2012, 2015, 2020.

Childhood immunization coverage was 86% in the first DHS survey in Rwanda conducted in 1992. Figure 3.2.2 shows that immunization coverage of basic vaccines declined to 76% in 2000 and to 75.2% in 2005. Since then, the immunization coverage has gradually and consistently increased in Rwanda and has reached to 95.5% in 2019/2020.

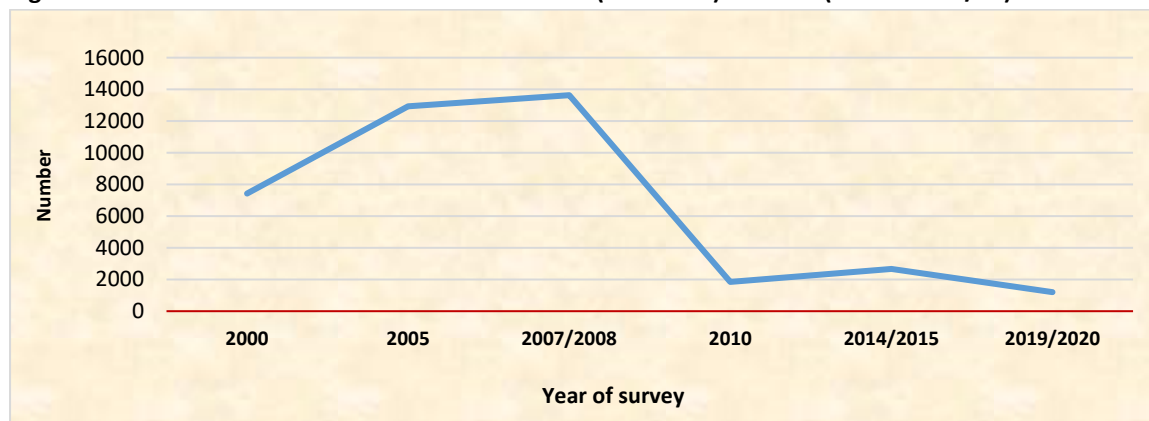
Figure 3.2.3 Trends in non-vaccinated rate (zero-dose) among children (2000 – 2019/20)



Source: ONAPO 2001, INSR 2006, MOH 2009, NISR 2012, 2015, 2020.

Zero-dose children has traditionally been low in Rwanda. Figure 3.2.3 shows that the proportion of children who never vaccinated had increased from 2.4% in 2000 to 3.8% in 2005 and 2007/2008 surveys. The proportion significantly dropped to 0.5% after two years in 2010. Since then, the proportion of zero-dose children has remained low and less than 1% till 2019/2020.

Figure 3.2.4 Trends in the number of non-vaccinated (zero-dose) children (2000 – 2019/20)

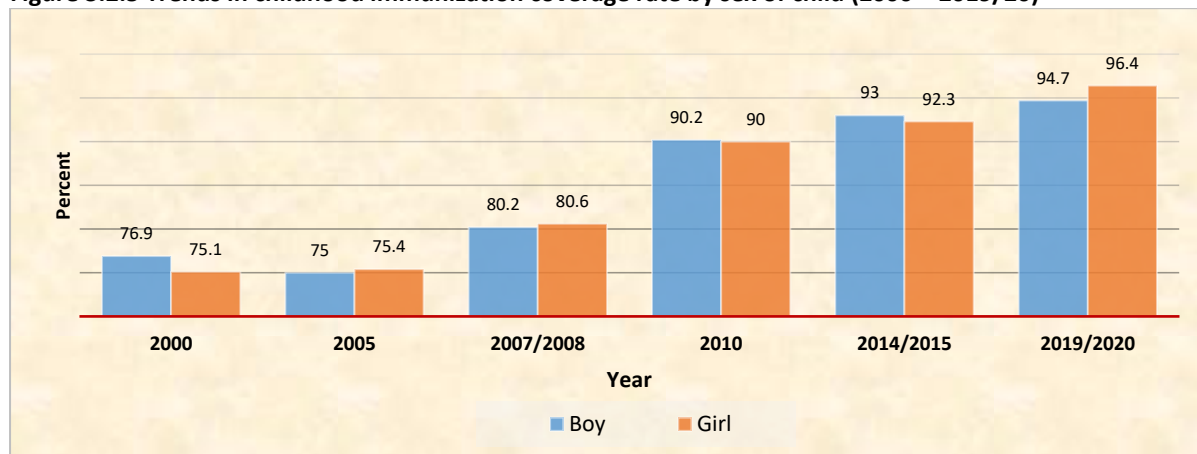


Source: ONAPO 2001, INSR 2006, MOH 2009, NISR 2012, 2015, 2020.

Figure 3.2.4 shows the changes in number of children who never received vaccines from 2000 to 2019/20. Zero-dose children was estimated as 7,426 in 2000 which increased to 12,933 in 2005 and increased further to 13,631 in 2007/08 in Rwanda. Since then, the number of non-vaccinated children declined and was 1,844 in 2010. In 2014/15, the number increased to 2,667 but dropped again to 1,203 in 2019/2020.

In 2019/20, the proportion of zero-dose children was higher in the urban (0.8%) than rural (0.2%) areas. Most of the zero-dose children were living in Kigali province (1.0%) while non-vaccinated children were 0.3% or less in other provinces. Education of mother and household wealth were not associated with non-vaccination of children. The proportion of zero-dose children was reported highest among the children of highly educated mothers (1.9%) and among the children of richest wealth quintile (0.8%) compared to other education and wealth categories in 2019 (NISR 2020). This indicates that the immunization program had difficulties in reaching the zero-dose children of highest socioeconomic categories in Kigali province.

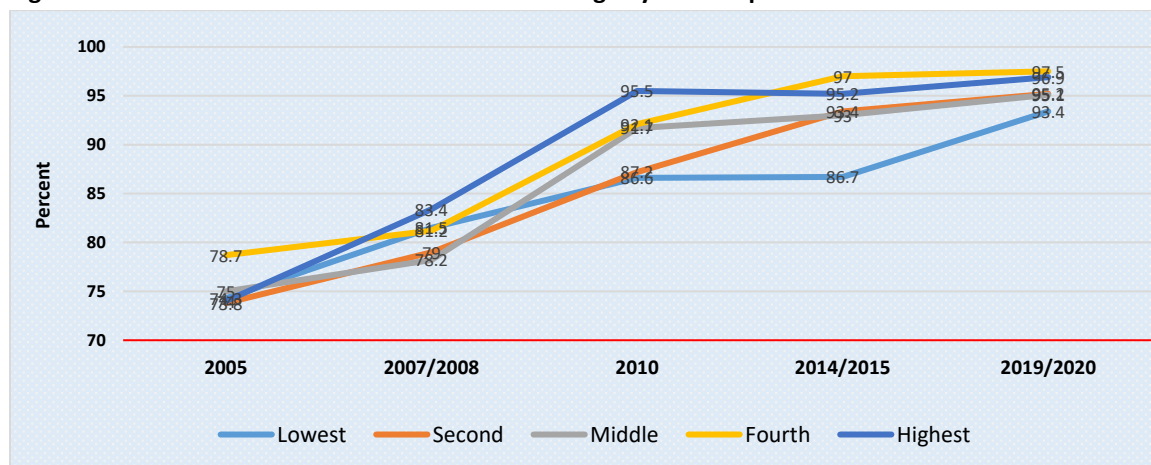
Figure 3.2.5 Trends in childhood immunization coverage rate by sex of child (2000 – 2019/20)



Source: ONAPO 2001, INSR 2006, MOH 2009, NISR 2012, 2015, 2020.

Figure 3.2.5 shows the gender variation in immunization coverage in six survey periods. No significant disparity was found when immunization coverage between male and female children were compared except in 2019/2020 when coverage was found slightly higher among female than male children. This finding confirms that gender-based inequity in immunization coverage has nearly been eliminated in Rwanda.

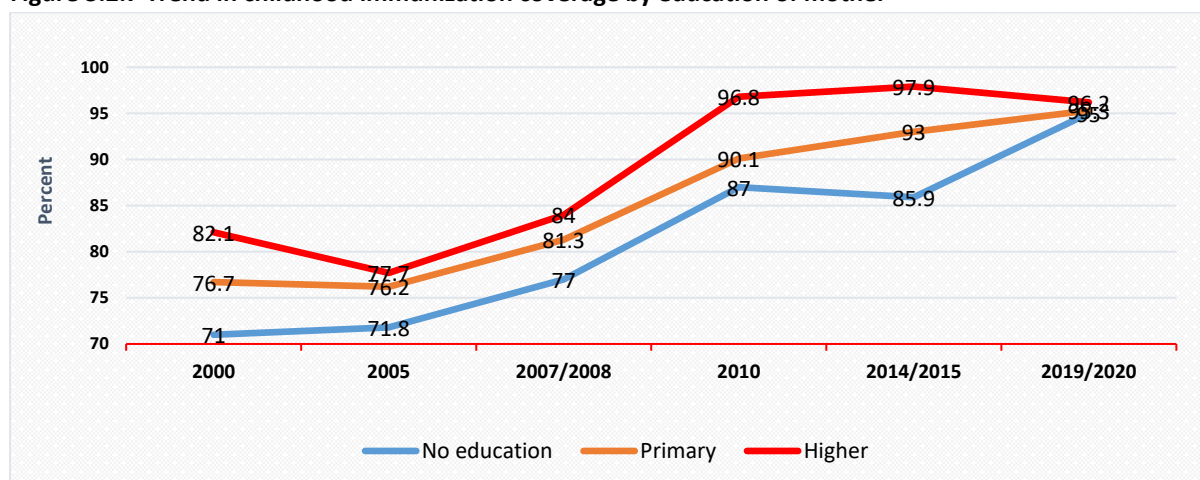
Figure 3.2.6 Trend in childhood immunization coverage by wealth quintile



Source: INSR 2006, MOH 2009, NISR 2012, 2015, 2020.

Several socioeconomic determinants were identified that created inequities in immunization in Rwanda. Figure 3.2.6 shows the trend in inequity in immunization coverage by household wealth between 2005 and 2019/20. Although immunization coverage has increased in all wealth categories, no systematic pattern of change in coverage by wealth was reported. There was no difference between the lowest, 2nd middle and highest quintile in 2005. It is not known whether vaccine hesitancy or difficulty in accessing immunization services among the highest quintile played a role to have relatively lower coverage. It appears that the absolute difference in coverage between the lowest and highest wealth quintile had systematically increased from 2005 to 2014/15. The range of inequity was lowest in 2005 (from 74% to 78.7%) and highest in 2014/2015 (86.7% to 97%). The immunization coverage in lower wealth quintile has consistently remained lower throughout the period.

Figure 3.2.7 Trend in childhood immunization coverage by education of mother

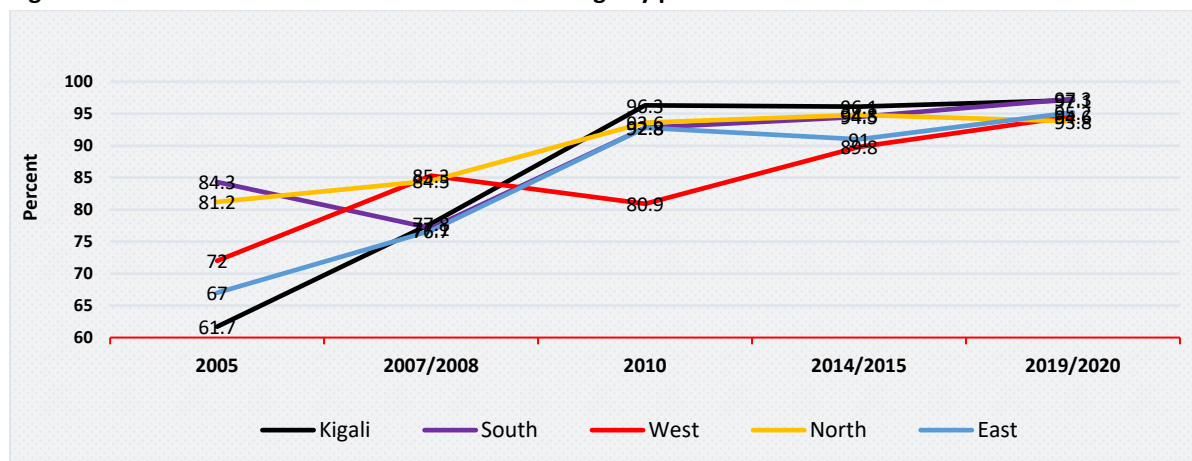


Source: ONAPO 2001, INSR 2006, MOH 2009, NISR 2012, 2015, 2020.

Inequity in immunization coverage by education of mother was very wide in 2000 ranging from 71% to 82.1% (Figure 3.2.7). The percent difference in coverage among the education categories narrowed

down in 2005 primarily due to reduction of coverage in higher education categories. Since then, gap in coverage (in terms of percent differences) among the categories continued to expand till 2014/2015 when the coverage among children of mother with higher level of education was nearly 22 percentage point higher than the coverage among children of mother with no education. However, the gap in coverage appeared to narrow down significantly in the 2019/2020 survey.

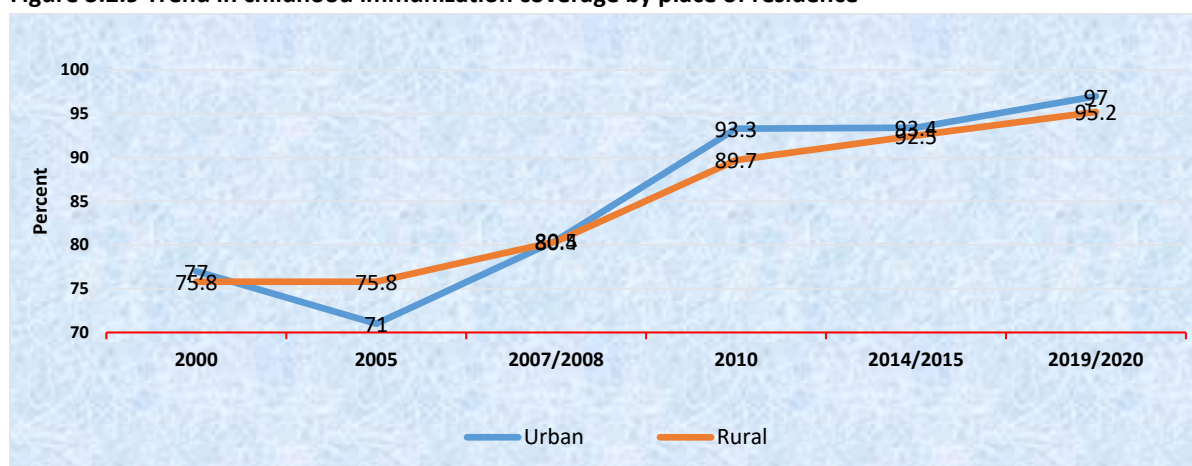
Figure 3.2.8 Trend in childhood immunization coverage by province



Source: INSR 2006, MOH 2009, NISR 2012, 2015, 2020.

Figure 3.2.8 displays the differences in immunization coverage by geographic region (province) and their change overtime. Regional inequity in immunization coverage has always been very high in Rwanda although the gaps narrowed in last two surveys as shown in the figure. The coverage ranged from 61.7% to 84.3% in 2005 and became much closer in 2007/08. The gaps increased again in 2010 ranging from 80.9% to 96.3%. Since then, the coverage gaps have narrowed down and the immunization inequity by region was recorded lowest in 2019/20.

Figure 3.2.9 Trend in childhood immunization coverage by place of residence



Source: ONAPO 2001, INSR 2006, MOH 2009, NISR 2012, 2015, 2020.

When inequity in immunization coverage is examined by place of residence of the child, no systematic and sustained scenario is observed. Figure 3.2.9 provides the trend as well as gaps in immunization coverage by place of residence. Immunization coverage was marginally higher in the urban than rural areas in 2019/2000. The gap was reversed in 2005 when the coverage in urban areas had significantly dropped. In 2007/08, the urban immunization coverage had increased significantly to eliminate the

rural-urban difference in coverage. Since then, the vaccine coverage was higher in the urban than rural areas till 2019/20 survey in Rwanda.

3.3 Immunization inequity by high-risk population and district

As indicated earlier, the DHS uses two measures of childhood vaccination coverage: basic vaccines (BCG, three doses of DPT-HepB-Hib, three doses of oral polio vaccine excluding polio vaccine given at birth, and one dose of measles) and age-appropriate vaccines (BCG, birth dose of hepatitis B, three doses of DPT-HepB-Hib, four doses of oral polio vaccine, one dose of inactivated polio vaccine, three doses of pneumococcal vaccine, and one dose of measles). In this section, inequities in both the basic and age-appropriate vaccine coverages are examined by socioeconomic, demographic and residential characteristics in Rwanda.

3.3.1 Socioeconomic factors⁸

Among the socioeconomic predictors that determine immunization inequities in most countries in Africa, household wealth and education of mother were strongly associated with vaccine coverage.

Table 3.3.1 Inequity in immunization coverage by socioeconomic determinants, 2019-2020

Socioeconomic factors	Basic vaccines			Age-appropriate vaccines		
	%	Difference ⁹	Ratio ¹⁰	%	Difference	Ratio
Wealth quintile						
Lowest (reference)	93.4	0.0	1.00	80.2	0.0	1.00
Second	95.2	1.8	1.02	81.2	1.0	1.01
Middle	95.1	1.7	1.02	84.3	4.1	1.05
Fourth	97.5	4.1	1.04	91.2	11.0	1.14
Highest	96.9	3.5	1.04	85.8	5.6	1.07
Education						
No education (reference)	95.0	0.0	1.00	83.6	0.0	1.00
Primary	95.3	0.3	1.00	83.3	0.3	1.00
Secondary	96.6	1.6	1.02	87.6	4.0	1.06
Secondary +	95.8	0.8	1.00	87.1	3.5	1.04
All	95.5			84.4		

Source: NISR 2020

Table 3.3.1 shows that 95.5% of children (12 – 23 month) had basic vaccinations while 84.4% had all age-appropriate vaccines in 2019/20. Household wealth (categorized in quintile) appears to be positively associated with both basic and age-appropriate vaccination. In addition to immunization coverage (in percent), socioeconomic inequity is estimated in two other forms. For example, inequity in immunization by wealth quintile is measured as: absolute difference (in percentage points) between the lowest and other estimates; and relative ratio between the lowest and other estimates. Absolute differences and the relative ratios of basic vaccine coverage, as shown in the table, have not indicated that inequity in vaccine coverage by wealth quintile were very wide. Inequity in coverage by wealth quintile appears to be relatively wider for age-appropriate vaccines. Data indicate that household wealth quintile was a key determinant of immunization coverage in Rwanda (UNICEF 2020a). This finding was consistent with the results found in other studies (Soeung et al. 2013; Lauridsen & Pradhan 2011; Halder & Kabir 2008). The reasons of relatively lower immunization coverage among the

⁸ Recent DHS (2019-2020) survey has only two socioeconomic indicators (wealth quintile and education of mother) available to examine immunization inequities in Rwanda.

⁹ Absolute difference (in percentage points) between the lowest and other estimates.

¹⁰ Relative ratio between the lowest and other estimates.

children of poorer households were not clearly understood when the services were provided free of charge.

The notion that mothers' educational status as a key predictor of immunization coverage of their children has changed particularly where the vaccination coverage is very high. In most traditional societies, poor education of mother was reported significantly associated with the lower likelihood of immunization of their children because women with less education were less likely to know the benefits of vaccination (Mohamud et al. 2014). In Rwanda, maternal education was not a significant determinant of inequity in basic vaccine coverage (Table 3.3.1). Both absolute differences and the relative ratios show that the gaps in coverage were minimum. However, education of mother appears to be positively associated with age-appropriate vaccination. Inequities were more visible when the coverages were compared between the low and high education groups. This finding was supported in a study in Rwanda where educational status of mother determined completion of immunization doses among under five year-old children (Nwankwo & Orua 2020; UNICEF 2020a).

3.3.2 Demographic determinants

The Rwanda DHS 2019-2020 has provided two demographic variables (sex of child and birth order) to examine the disparities in coverage by demographic factors.

Table 3.3.2 Inequity in immunization coverage by demographic determinants, 2019-2020

Demographic factors	Basic vaccines			Age-appropriate vaccines		
	%	Difference	Ratio	%	Difference	Ratio
Sex of child						
Boy (reference)	94.7	0.0	1.00	83.2	0.0	1.00
Girl	96.4	1.7	1.02	85.7	2.5	1.03
Birth order						
1	96.1	4.1	1.04	85.3	7.0	1.09
2 - 3	96.7	4.7	1.05	86.6	8.3	1.11
4 – 5	94.8	2.8	1.03	83.0	4.7	1.06
6 (reference)	92.0	0.0	1.00	78.3	0.0	1.00
All	95.5			84.4		

Source: NISR 2020

Inequity in immunization coverage by demographic factors are presented in Table 3.3.2. Sex of child has been a predictor of vaccination status as girls were more likely to be vaccinated than boys for both basic and age-appropriate vaccines. Gender inequity in coverage was also reflected in both absolute differences and relative ratios of coverage in both basic and age-appropriate vaccines. When the gender gap in coverage was explored further, it was revealed that the administration of polio at birth dose was much lower among boys (92.8%) than girls (95.1%). It is suggested that RBC should investigate whether there is any ritual or cultural context of this outcome.

Immunization coverage was strongly and negatively associated with birth order of child for both basic and age-appropriate vaccine categories. Absolute differences and relative ratios of coverage also indicate the gaps in coverage. Inequity in coverage appears to be much wider for age-appropriate than basic vaccines.

3.3.3 Residential characteristics

Inequities in immunization coverage are examined by two residential characteristics available in the Rwanda DHS 2019-2020. These are geographic location by province and place of residence (urban-rural).

Table 3.3.3 Inequity in immunization coverage by residential characteristics, 2019-2020

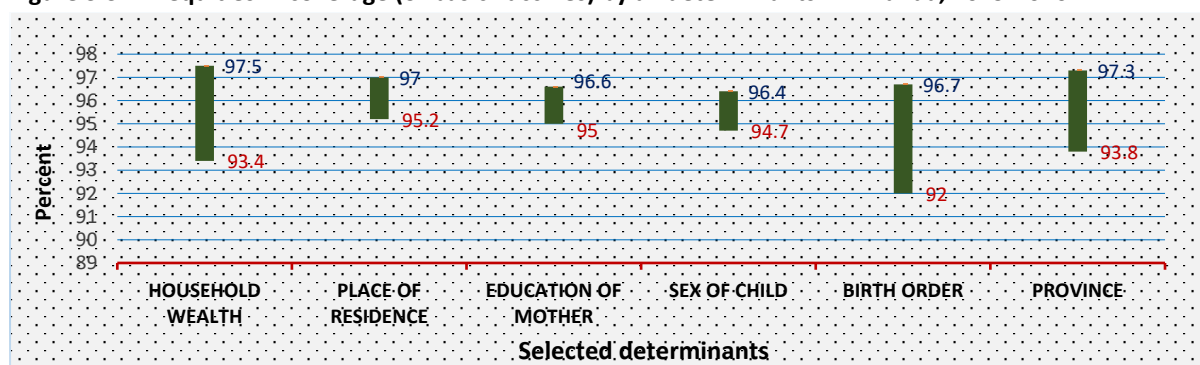
Residential factors	Basic vaccines			Age-appropriate vaccines		
	%	Difference	Ratio	%	Difference	Ratio
Region / Province						
Kigali	97.1	3.3	1.04	91.2	17.8	1.24
Southern	97.3	3.5	1.04	85.3	11.9	1.16
Western	94.6	0.8	1.01	89.1	15.7	1.21
Northern (reference)	93.8	0.0	1.00	73.4	0.0	1.00
Eastern	95.2	1.4	1.01	83.1	9.7	1.13
Place of residence						
Urban	97.0	1.8	1.02	88.1	4.4	1.05
Rural (reference)	95.2	0.0	1.00	83.7	0.0	1.00
All	95.5			84.4		

Source: NISR 2020

Table 3.3.3 presents the inequities in immunization by region or province. Among the five geo-political regions/ provinces, the Northern Province had the lowest coverage for both the basic vaccines (93.8%) and age-appropriate vaccines (73.4%) in 2019-20. When disparities in coverage with other provinces are compared, it appears that Kigali and the Southern Province had performed significantly better in basic vaccine coverage while Kigali and the Western Province did very well for age-appropriate vaccine coverage compared to other provinces/regions. Absolute differences and relative ratios of coverage in both basic and age-appropriate vaccines also reflect the gaps in coverage. Data indicates that age-appropriate vaccine coverage was 1.24 times higher in Kigali and 1.21 times higher in the Western province compared to the Northern province.

Place of residence and geographic distance from the service providers had also considerable influence on immunization inequity (Otieno et al. 2014; UNICEF 2016). A geographic focus is, therefore, needed particularly in the less developed countries to reach underserved populations where immunization coverage is lowest (WHO 2013). Place of residence was also a key determinant if inequity in immunization in Rwanda (Table 3.3.3). The coverage was much higher in the urban than rural areas for both basic vaccines and age-appropriate vaccine coverage. Compared to basic vaccine coverage, the urban-rural gap in coverage was much higher in age-appropriate vaccine coverage.

Figure 3.3.1 Inequities in coverage (of basic vaccines) by all determinants in Rwanda, 2019-2020



Source: NISR 2020

Inequities in immunization coverage by all determinants discussed above are summarized in Figure 3.3.1. The number shown in 'blue' indicates the highest and 'red' indicates the lowest immunization coverage. Absolute difference in coverage shows that household wealth and birth order were the two main determinants of immunization inequity. Geographic (province) location was also a significant predictor of inequity in Rwanda. Immunization coverage varied widely by place of residence, sex of child and education of mother in the country.

Table 3.3.4 Inequities in receiving ANC visits, protection against neonatal tetanus, delivery in health facility and receiving postnatal check (PNC) by socioeconomic and residential characteristics, 2019-2020

Background characteristics	Percent of women			
	Had 4 or more ANC visits	Protected against neonatal tetanus	Delivered in a health facility	Had PNC within 2 days after birth
Residence				
Urban	49.2	80.6	97.5	72.9
Rural	46.8	78.9	92.2	69.8
Province				
Kigali	46.2	80.6	97.0	73.0
South	49.6	82.3	91.6	73.4
West	47.3	76.7	91.9	58.3
North	46.9	80.0	95.5	67.0
East	45.9	77.8	92.1	79.1
Mother's education				
No education	41.7	79.8	82.3	62.4
Primary	45.2	78.4	93.1	69.6
Secondary	51.0	77.3	98.0	73.8
Secondary +	72.7	85.0	100.0	81.2
Wealth quintile				
Lowest	38.3	75.6	87.0	65.2
Second	44.0	78.8	91.2	66.3
Middle	47.9	79.9	93.6	71.3
Fourth	51.3	80.4	96.8	73.7
Highest	56.3	82.2	98.8	76.9
Total	47.2	79.2	93.1	70.3

Table 3.3.4 shows disparities in receiving ANC visits, protection against neonatal tetanus, delivery in health facility and receiving postnatal check by socioeconomic and residential characteristics in Rwanda. About 47.2% women had four or more ANC visits in 2019. Inequity in ANC coverage existed by all four determinants although the disparities were relatively wider by mother's education and household wealth. About 79.2% of women received needed doses of tetanus toxoid to protect their last birth against neonatal tetanus. The tetanus coverage had also varied by all determinants. Women in the lowest wealth quintile were slightly less likely to have had their last birth protected from tetanus. In Rwanda, delivery of birth in a health facility was very high (93.1%) compared to other African countries. Urban women and women living in Kigali had better chance to deliver birth in a health facility compared to other women. As expected, the coverage was highest among the highly educated women and women from the richest quintile. About 70.3% mothers received postnatal care (PNC) in the first 2 days after birth. Use of PNC was higher in the urban than rural areas. The proportion of women receiving PNC was slightly higher in urban than rural areas and substantially increases with increasing education and wealth.

3.3.4 Coverage and equity of immunization by district

This section provides immunization coverage by district using the administrative data. The purpose is not to show the continuity of immunization coverage found in the DHS data because the DHS and administrative data are not comparable in terms of the method used to collect data. The administrative data helps to examine the immunization coverage by district, to identify the low performing districts by year, and to examine the trends in coverage by districts.

Table 3.3.5 District coverage reported in 2019, Rwanda

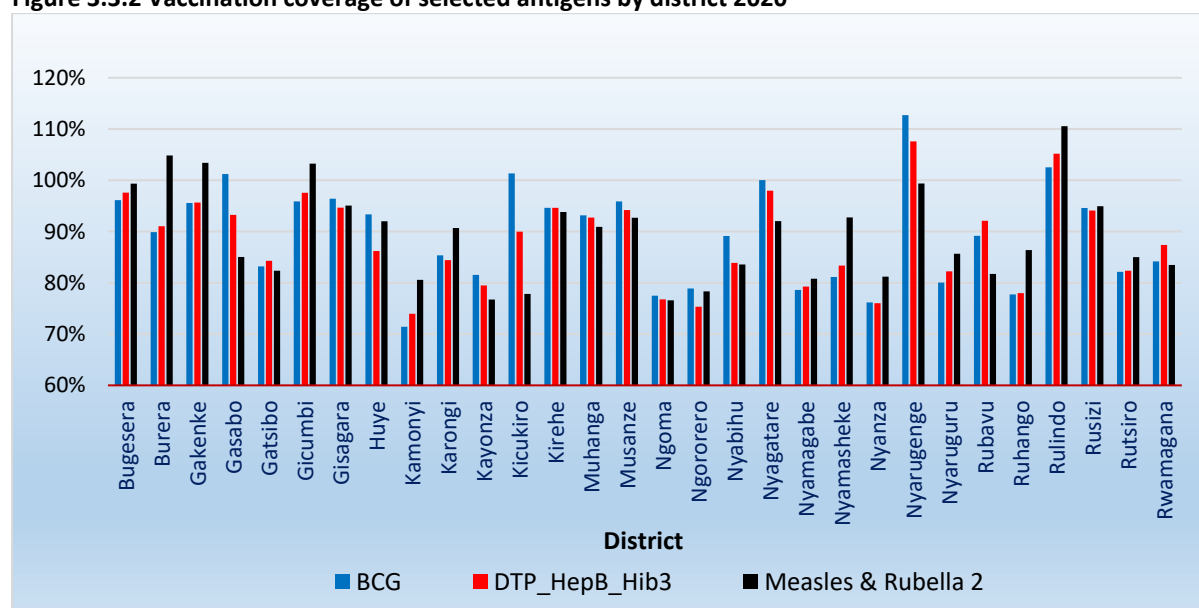
District coverage	DPT3	Measles
Number of districts in the country	30	30
% of districts reporting	100	100
Number of districts with coverage		
○ Below 50%	0	0
○ Between 50 – 79%	1	2
○ Between 80 – 89%	12	12
○ Between 90 – 94%	5	3
○ Above 95%	12	13

Source: MOH 2020

Rwanda has 30 districts located in all five provinces. The MOH data has released information regarding the district coverage in 2019 in the country. Table 3.3.5 shows that all districts had submitted coverage reports. Data shows that there was no district with less than 50% coverage in DPT3 and measles. The coverage was below 80% in a single district for DPT3 and two districts for measles. A large number of districts had reported to achieve coverage above 95% (12 districts for DPT3 and 13 districts for measles). Overall, the performance in achieving the DPT3 coverage was at 80% or above (as proposed in *Global Vaccine Action Plan* by WHO) has been achieved in Rwanda.

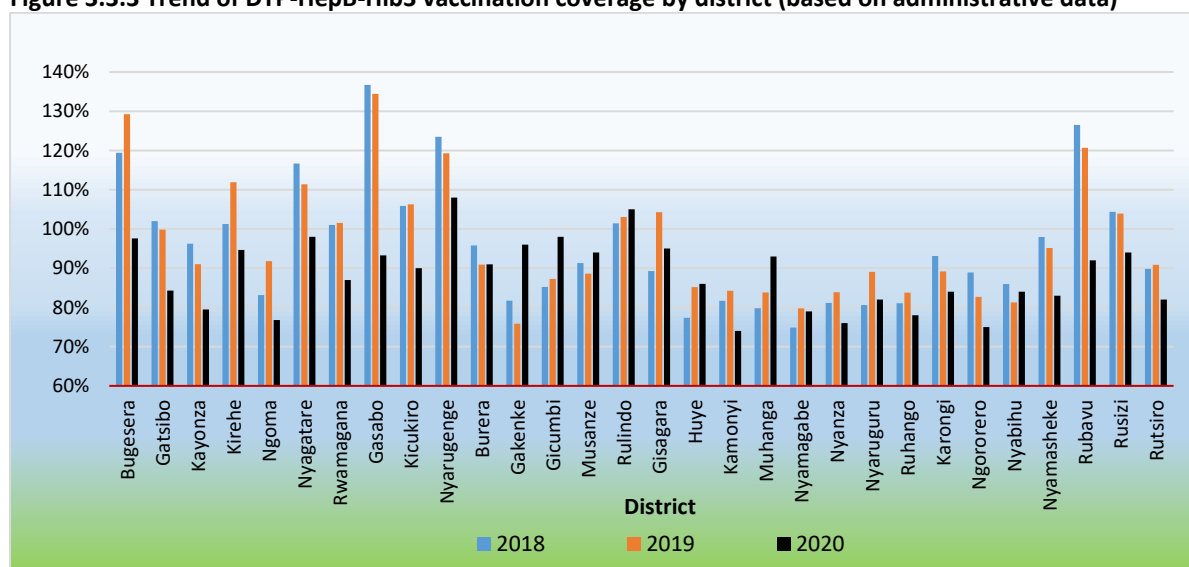
The national administrative coverage data for the year 2020 showed that the immunization coverage was maintained reasonably high considering the negative effects of global pandemic of COVID-19 (MOH 2021). In 2020, the BCG coverage was 92% while the coverage rates were reported 91% for DPT-HepB-Hib3 and Measles & Rubella 2 according to the administrative data (MOH 2021).

Figure 3.3.2 Vaccination coverage of selected antigens by district 2020



When the immunization coverage is examined by district, significant differences in coverage by district as well as by antigens are shown in Figure 3.3.2. The BCG coverage ranged from 71% in Kamonyi to 113% in Nyarugenge district. Among the vaccines, the coverage appears to be highest for Measles & Rubella 2 in most districts compared to the other two antigens. Key finding of this figure is that about half (15 out of 30) of the districts were able to maintain the coverage above 90% while only a few districts (6 for BCG, 7 for DPT-Hep-Hib3 and only 4 for Measles & Rubella 2) had reported that coverage was less than 80%. Considering the COVID-related restrictions, achieving this coverage indicates that the country has commitment to continue providing services for the children of Rwanda.

Figure 3.3.3 Trend of DTP-HepB-Hib3 vaccination coverage by district (based on administrative data)



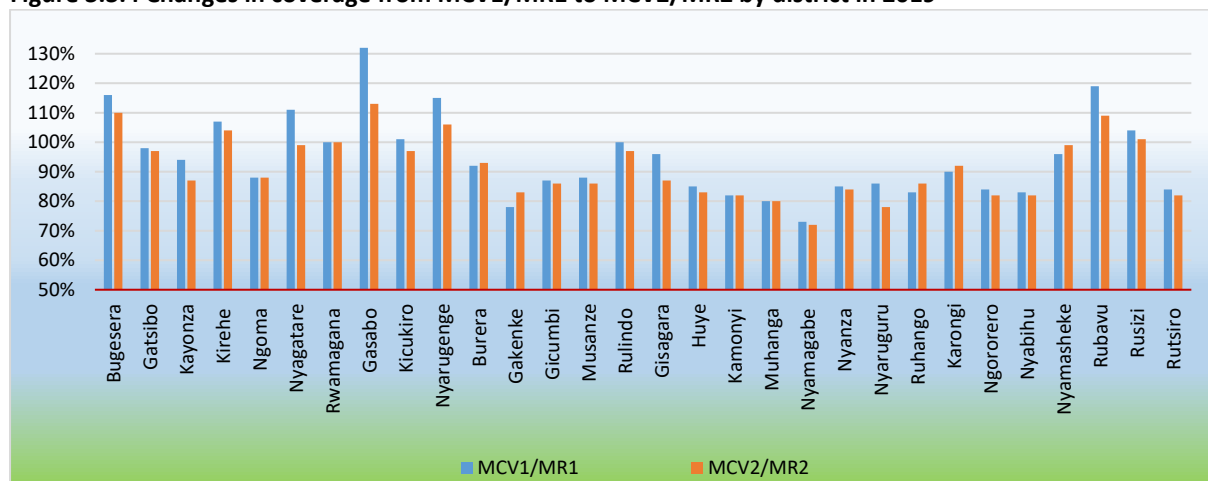
Source: MOH 2019, 2020 & 2021

Figure 3.3.3 shows the trend of DTP-HepB-Hib3 coverage by district. As found earlier, the inequity in immunization coverage by district has remained high in the country. Using the Rwanda approach¹¹, a total of eight low performing districts (with coverage less than 80% in the last three years) were identified based on the administrative data. These were: Kayanza, Ngoma, Huye, Kamonyi, Nyamagabe, Nyanza, Ruhango and Ngororero districts. Of these, performance was consistently lower in Nyamagabe, Huye and Kamonyi districts. To better understand the causes of low immunization coverage and inequities, immunization service providers in selected low performing areas of the Kamonyi and Huye districts were consulted.

Continuity of services is an indicator of the strength of immunization program. However, dropout from one dose to the next dose is very common everywhere (Ayele et al. 2009; Kii 2012; Lang’at et al., 2020). A child was considered dropout if s(he) who received the first dose and who were eligible but did not receive the second dose.

¹¹ There is no universally accepted definition of ‘low performing community’. Given the vaccination coverage is very high in Rwanda, we used 80% coverage rate as cut-off level. This cut-off line can be changed if needed.

Figure 3.3.4 Changes in coverage from MCV1/MR1 to MCV2/MR2 by district in 2019

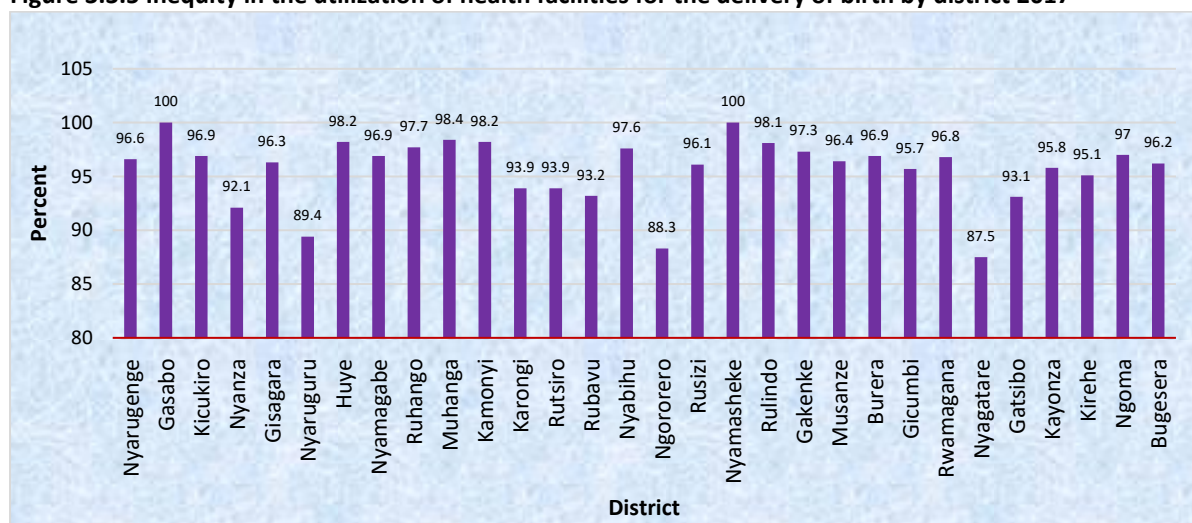


Source: MOH 2020

The first dose of MCV/MR was 96% which was dropped to 92% in 2019 according to the administrative data. Figure 3.3.4 shows the changes in coverage from MCV1/MR1 to MCV2/MR2 by district in 2019. In most of the districts, the coverage of MCV/MR had dropped. The dropout rate was high in Gasabo, Rubavu, Nyarugenge and Nyagatare districts. On the other hand, the coverage had increased from dose 1 to dose 2 in Nyamasheke, Karongi, Ruhango and Gakenke districts.

Data indicates high dropout between MCV1 (97.9%) and MCV2 (87.9%) in 2017 which might be due to long time gap (6 months) between the two doses. A large number of mothers/caregivers might forget the time to get their children received this dose (United Nations & UNICEF 2017). A recent study, conducted in Rwanda, has identified i) domestic priority over vaccination of children and ii) lack of awareness of the need to complete the immunization schedule were the determinants of dropping out (Nwankwo & Orua 2020). In Kenya, distance to the health facility was reported as the predictor of dropout of vaccination (Lang’at et al., 2020). Based on the findings, it is suggested that the immunization program should follow up of all children who receive MCV1 to make sure that they come back for the 2nd dose (United Nations & UNICEF 2017).

Figure 3.3.5 Inequity in the utilization of health facilities for the delivery of birth by district 2017¹²

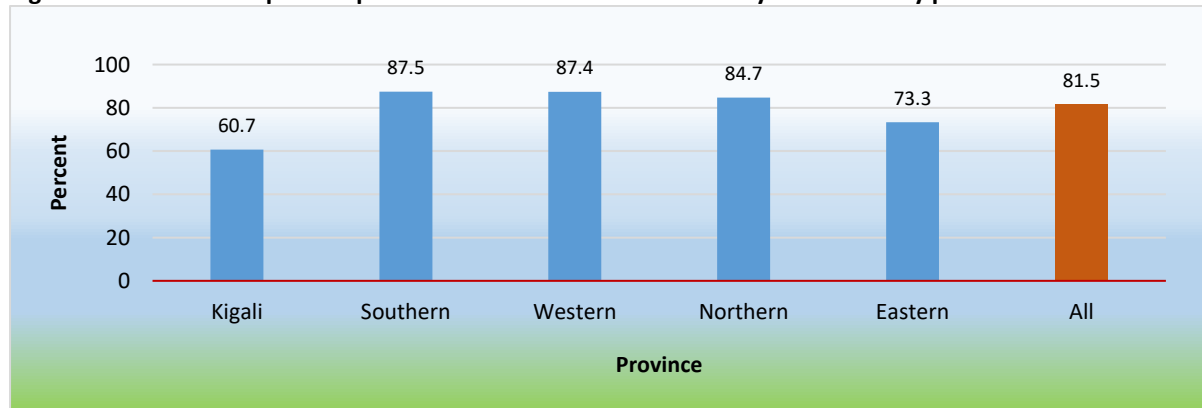


Source: United Nations & UNICEF 2017

¹² The last *Immunization Coverage Survey* was conducted in 2017 in Rwanda.

Institutional (or facility-based) delivery of birth is very high in Rwanda. It is, therefore, expected that the children born in the facility would receive all required vaccines after birth. Thus, institutional delivery is a proxy indicator of immunization equity. Figure 3.3.5 shows the disparities of the utilization of health facilities for delivery of birth by district. The coverage of institutional delivery was 95% or above in 22 (out of 30) districts while the coverage was below 90% in only three districts (Nyaruguru, Ngororero and Nyagatare). However, COVID-19 might have reduced the coverage in some areas due to restrictions and fear of being infected during delivery of birth in 2020.

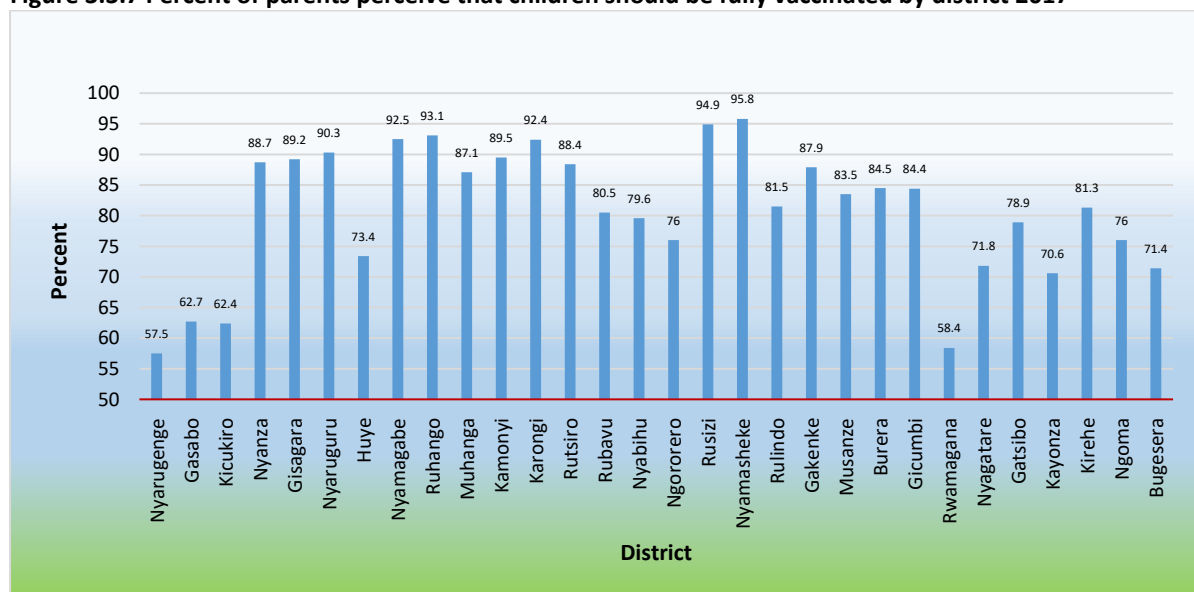
Figure 3.3.6 Percent of parents perceive that children should be fully vaccinated by province 2017



Source: United Nations & UNICEF 2017

The perception of mothers/caregivers and communities regarding immunization indicate whether and to what extent they would accept vaccines for their children. Recent data of the parental perception about child vaccination are not available in Rwanda. Based on 2017 Immunization Coverage Survey, Figure 3.3.6 shows the variation of perception about vaccination by province (United Nations & UNICEF 2017). While 81.5% parents felt that children should be fully vaccinated, the provincial disparity in perception was quite high. As expected, the parents living in the Southern province had high approval rate (87.5%) for immunization. It is surprising, however, why the approval for full vaccination was lowest in Kigali (only 60.7%).

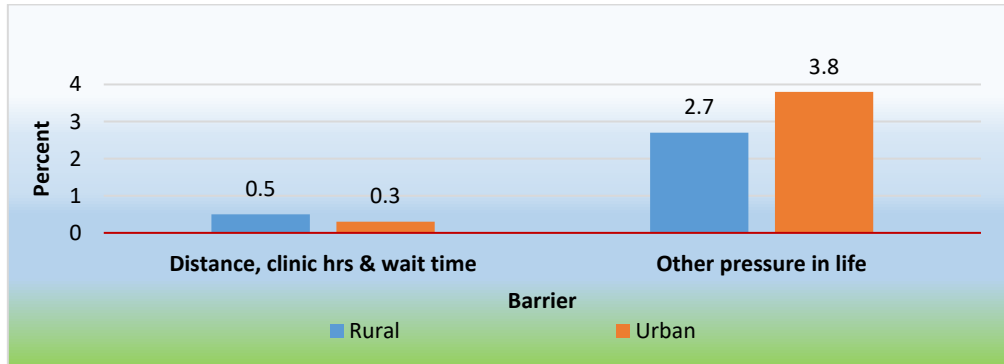
Figure 3.3.7 Percent of parents perceive that children should be fully vaccinated by district 2017



Source: United Nations & UNICEF 2017

Figure 3.3.7 shows the distribution of parental perception of childhood vaccination by district. The approval rate was 80% or above in 18 districts while there were at least two districts (with approval rate below 60%) where the parents/caregivers did not perceive that children should be fully vaccinated. Key finding of this data is that the disparities or inequities in perception regarding vaccination for children by district were quite high and significant in Rwanda.

Figure 3.3.8 Barriers preventing from getting children immunized by place of residence



Source: United Nations & UNICEF 2017

The 2017 coverage data indicated that barriers that prevent mothers/caregivers from getting their children immunized were insignificant. Figure 3.3.8 indicates that less than 0.5% parents felt distance to clinic from home, clinic hours and wait time had prevented them to access immunization services. On the other hand, only a small proportion of parents/caregivers reported that ‘other pressure in family life’ prevented them to get vaccines for their children. When the findings are disaggregated by place of residence, no significant difference was reported between rural and urban areas regarding distance, clinic hours or wait time. However, more urban parents (3.8%) felt *other pressure in life* had prevented them to access immunization services for their children than rural parents (2.7%).

3.3.5 Effects of gender-related barriers on equity

Gender-related barriers are reported to have both direct and indirect negative effects in accessing immunization services (Gavi 2019). Caregivers are generally women with less education who generally stay home, take the responsibilities for child rearing, and who might have limited information and low awareness about the benefits of vaccination than men (Porth et al. 2021; Chopra et al. 2020; Restrepo-Mendez et al. 2016; Hajizadeh 2018). In addition, religious practices or cultural values generally restrict women's mobility, their involvement in formal income-generating activities, decision-making and interactions outside the home which prevent women from seeking immunization services for their children (Gavi 2019). A recent study in Kenya reported that children of wealthy and empowered¹³ women have higher vaccination coverage than others (Porth et al. 2021). Women's empowerment along with their access to earn income might have increased their ability to take their children to health facility for immunization (Chopra et al. 2020).

In Rwanda, women undertake the majority of care responsibilities for children with minimal resources and few options as found in most traditional societies (USAID 2014). Although about 83.4% women participated with their husbands in making joint decisions about their health care, only 23.2% of them could decide solely about their health care in Rwanda (NISR 2015).

Gender-based inequalities have been in-built in Rwandan culture that require persistent and long-term efforts to bring about change. The government has developed policies and strategies to support women's empowerment and gender equality (USAID 2014). To improve gender relations in Rwanda, one study recommended to develop national strategy to empower women in all major sectors so that they could improve their self-esteem, build negotiation skills in public, improve capacity to be economically productive, and become self-reliant (USAID 2014). The study also suggested to support to adopt effective strategies to engage men to bring about positive social change related to gender norms and support the health needs of their wives and children (USAID 2014).

¹³ A construct based on income and education of women.

4.0 Prioritization of Interventions to Improve Coverage and Equity

4.1 Demand promotion and community engagement

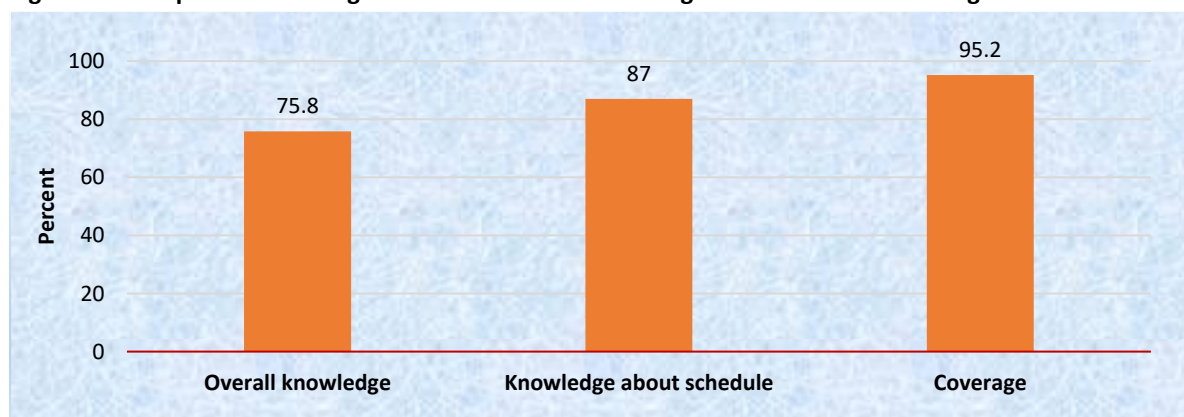
4.1.1 Demand for services

The demand for vaccination is associated with several issues including awareness and the benefits of immunization, social norms, vaccine hesitancy, distance to facilities, financial accessibility and perceptions about the quality of services (UNICEF 2018). Engaging with communities and mobilizing them to raise demand for quality services had positive effects in improving immunization services (Agarwal et al. 2005). In several countries in Africa, mass media, workplace networks, and face-to-face communication were found very effective in mobilizing communities to demand for immunization services (Dietz & Cutts 1997). It is suggested that immunization program in Rwanda should adopt and implement policies to generate demand for vaccination to maintain and increase the current immunization coverage in the country.

4.1.2 Communication strategy for immunization

In Rwanda, the communication strategy to promote immunization at the district level is primarily interpersonal based on face-to-face meetings with caregivers in the health facilities as well as in the communities (PRIMSON 2021). The community health workers (CHWs) routinely visit households in their respective areas to promote the benefits of vaccination, number of vaccines and doses needed for a child, and when and where to go for vaccination. In addition, they also discuss about the benefits of breastfeeding, hygiene, ANC services, growth monitoring, family planning services, health insurance, malaria, etc. The existing communication strategy seems appropriate but there is room for further improvement.

Figure 4.1.1 Gap between caregivers' immunization knowledge and vaccination coverage of their children



Source: PRIMSON 2021

Figure 4.1.1 shows that there is considerable gap between the caregivers' knowledge of immunization and the vaccination coverage of their children in a recently conducted study in nine districts in Rwanda (PRIMSON 2021). It appears that the immunization program has focused more on raising the coverage rather than improving the knowledge of the benefits of vaccination. This finding reflects the need of improving the IEC activities in the communities further in order to sustain the immunization coverage and create the demand for vaccination. Communication efforts should be designed towards heightening risk awareness about the vaccine preventable diseases to be more effective. Existing interpersonal communication strategy should be supplemented by mass media such as the radio, TV and mobile phones. If needed, the health facilities can use SMS service to parents/caregivers with children who need vaccination as reminder.

4.1.3 Financial barriers

The situation analysis conducted in Rwanda in 2017 indicated that financial barriers have restricted access to health services especially the poorest households which might have reduced the demand for services for vaccination. Key financial barriers are the cost of transport and the opportunity cost of spending time to get the services (UNICEF 2018). Validation data indicates that the transport costs are very high for the low-income parents to reach the facilities for the vaccination of their children especially in the remote rural areas in Rwanda. The program should consider expanding outreach services to reduce the distance as well as the transport costs for many caregivers to utilize the services. It is expected that improvements in physical access as well as the quality of services would improve the coverage and promote the demand for vaccination in Rwanda (UNICEF 2018).

4.1.4 Perception of the quality of services

Quality of health services is a key determinant of the utilization of services. Poor quality and inadequate staff along with the lack of supportive supervision were overarching challenges to deliver immunization services in most countries. The perception of health services influence caregivers' decision to bring their child to the facilities for vaccination. While the quality of immunization services in Rwanda has not been assessed in recent years, immunization coverage survey in 2017 indicated that perceived quality of services was high as nearly 81.5% Rwandan thought that most parents should have their children vaccinated. Only 0.9% caregivers hesitated or reluctant to go to the health facilities to vaccinate their children in Rwanda (United Nations & UNICEF 2017). A recently conducted study, also indicated that about 90% caregivers generally trusted the quality of vaccines given to their children and 97.3% indicated that the health workers who administered vaccines were knowledgeable (PRIMSON 2021). However, perception of the quality of services varied by region. For example, a significantly higher proportion of caregivers in the Ngororero district hesitated to vaccinate their children compared to other districts (United Nations & UNICEF 2017).

4.2 Elimination of system-based barriers and bottlenecks

WHO (2009) identified several barriers and system-based bottlenecks that impede immunization service delivery system in resource-poor settings. Some of these were poor logistics and supply system, lack of adequate human resources, frequent vaccine stock outs, poor service delivery, lack of leadership, political will and commitment for the program.

4.2.1 Managing logistics and supply

The bottlenecks in logistics and supply chain to deliver immunization services were reviewed by examining vaccine stock-outs, transportation challenges and cold chain capacity. It appears that vaccine stockout has not been a major problem in Rwanda. In a recently completed KAP study, conducted in selected districts, 11.3% service providers reported the problem of the stockout of injectable vaccines (PRIMSON 2021). While the number or proportion of the delivery points without vaccines when needed were not known, this study indicated the existence of vaccine stockout in many health facilities particularly in the rainy seasons when the transportation of vaccines and other equipment to remote delivery points were difficult. RBC should identify those facilities, estimate the need of vaccines and stock adequate vaccines in advance to ensure continue providing services in those communities.

The cold chain system generally works perfectly throughout the year without any problem. However, during occasional power (electricity) failure, it becomes difficult to maintain the cold chain and store the vaccines in the health centers. It has been reported that the health centers without power supply were forced to temporarily transport their vaccines to other nearby health facilities or district hospitals to maintain the quality of vaccines.

Some of the health facilities have not adequate space and sitting arrangement in the waiting areas to accommodate caregivers. The crowding at those health facilities may increase the risk of spreading COVID-19. Immunization service providers working in the rural areas indicated that the lack of transportation has been a major barrier to reach remote villages for outreach sessions particularly in rainy seasons. As motorcycles were not always available, they had to spend the fuel budget to rent private motorcycles to conduct outreach sessions. This indicates the existence of the inequity in the distribution of resources in some areas.

It appears that the country has been improving vaccine storage capacity as only a few health facilities has recorded stock out of vaccines in recent years (Gavi 2019). To ensure the quality and safety of vaccine, the vaccine storage system need to be re-examined. In addition, the logistics and supply chain management capacity of the national health system including EPI/VPD commodities have to be strengthened further at all level.

4.2.2 Inadequate human resources

Immunization services along with most of the MCH services in Rwanda are delivered through health facilities in provincial and district hospitals, health centres and health posts. Although the immunization program is generally understaffed in Rwanda (PRIMSON 2021), there is at least one Health Center with qualified nurses in each sector who can provide standard vaccination services in the country (Gavi 2019). The community health workers (CHWs) play a crucial role in immunization program through the community health program in all 30 districts in the country. As part of strengthening the capacity of health centers, two nurses in each health center have been trained on reaching every child (REC) strategy to improve immunization coverage in 2018 (Gavi 2019). At the district level, staff were also trained in efficient management of vaccines and other medical supplies; and improving management skills (such as planning, coordination and supervision) of health managers (Gavi 2019).

At the district level, a single person oversees immunization program (PRIMSON 2021). Even in the health facility level in the low performing districts, the facilities do not have adequate number of nurses and vaccinators to carry out immunization services. The staff are over-loaded with tasks in the health centers which sometimes resulted in getting late at the outreach sites and affect their performance. The staff distribution by health facility is not proportional to the number of sites or target population. Rotation of staff is not easy due to the problem of understaffing in the health centers. As motorcycles are not always available for immunization program, it is difficult to conduct outreach sessions in remote areas particularly during the rainy season.

The staff retention is an issue in the health facilities in the remote areas. This problem is managed by teamworking to ensure the availability of staff when needed. As a result, many of them work extra hours as they have no choice but to accept the situation. It is suggested that the staff capacity in health facilities should be improved to adequately carry out the tasks. This should be accompanied by routine supportive supervision particularly in the low performing districts.

4.2.3 Microplanning for reaching every community

Micro-planning has not been used in immunization program in the low performing districts. Thus, it is difficult for the CHWs to identify all zero-dose children and children who started receiving vaccines but were dropped out before completing all doses. The high mobility in urban setting making it even more difficult to trace defaulters. The service providers in the low performing districts believe that most of the defaulters and zero-dose children can be identified by the community health workers in their routine household visits in the communities. It is suggested that micro-planning should be

adopted and updated routinely by the community health workers which would help them to identify missed households with zero-dose children.

4.2.4 Service delivery

The 2015 HSSP mid-term review reported that the district health service delivery system in Rwanda had gaps in leadership, planning, budgeting and management (UNICEF 2018). In addition, funding was insufficient for the full implementation of district health plans in some districts. Sustainability of funding was also a challenge as nearly 12–16% patients had no capacity for co-payments (UNICEF 2018). Communication between sectors and districts, and between districts and district-level health sector constituents was inadequate and irregular.

4.2.5 Leadership, management & coordination (LMC)

Poor management, coordination and governance of the immunization system were considered significant bottlenecks in most developing countries. In Rwanda, NITAG, AEFIs and MEV committees were established in 2017 and a priority of operationalizing them was developed for the immunization program. In 2018, the ICC meetings were held three times although were planned to meet on a quarterly basis as per the ICC terms of reference. However, it was reported that the NITAG had a low participation of core members during Programme Capacity Assessment in November 2018. As a result, additional core members were added to widen the composition of NITAG (Gavi 2019). The performance of the leadership, management & coordination (LMC) mechanisms is likely to have longer term effects on the performance of immunization program in Rwanda.

4.2.6 Advocacy for political will, accountability and commitment

The government of Rwanda has expressed its ownership of immunization program and commitment to equitable service delivery for all children including those living in the remote and hardest to reach areas (Wong et al. 2019; ODI 2011). Such political will and ownership of the program at the top level would help to ensure equity-driven programming, decentralized implementation, effective accountability mechanism, and transparency in using funds. Vaccination coverage would benefit from the *imihigo* system of accountability which would motivate the program staff and local leaders to achieve their set targets (Wong et al. 2019). It is the political leadership who would play the key role in developing policies and programs of good governance and accountability through which their will and commitments are implemented (ODI 2011).

It appears that barriers and bottlenecks existed at various levels and many forms in the health system in Rwanda that have caused challenges in promoting immunization services and reducing inequities. However, most of the bottlenecks could have been reduced by investing available resources, re-allocation of funds, ensuring supply of logistics when needed, and developing and implementing effective human resources planning and service delivery system.

4.3 Removal of barriers to reach remote communities

4.3.1 Barriers to access immunization services

In Rwanda, only 0.5% caregivers reported in 2017 that distance, timing of clinic, time needed to get to clinic or wait at clinic and/or costs in getting to clinic had prevented them from getting their children vaccinated (United Nations & UNICEF 2017). This finding does not correspond to the DHS data where it was reported that about 21.6% women had serious problems in accessing health care for themselves due to distance to health facilities in 2015 (NISR 2015). In some districts, inaccessibility due to distance was much higher than the national average. For example, 48.6% women in Nyamagabe district reported having problem in accessing health care due to distance to health facility.

Validation data also indicate that a large number of caregivers visit the health facilities from far away for vaccination. If transport is available, they can reach the facilities in 30 to 45 minutes. This finding corresponds to a recent study where distance to the nearest facilities is noted as a key barrier to accessing immunization services (PRIMSON 2021). The validation study also indicates that the cost of transport is very high for the low-income parents to reach the facilities for the vaccination of their children. The mothers/caregivers often have to wait for long time at the facilities before they can get help. This indicates the need of hiring more immunization workers at the district level. It is suggested that access to immunization services in remote communities should be increased by expanding outreach services in collaboration with PHC services, private sector and CSOs (PRIMSON 2021).

4.3.2 Access to ANC services

Access to antenatal care (ANC) services has been increasing in the country. In 2017, about 95.6% women visited any health facility for pregnancy care and 83.7% consulted a skilled health professional (United Nations & UNICEF 2017). In 2019, nearly all Rwandan women (98%) received antenatal care from a skilled provider at least once for their last birth. About 47% pregnant women visited ANC four times or more (NISR 2019). Immunization program should take the ANC visits and delivery in the health facilities as the opportunity to communicate with pregnant women to ensure that their children are vaccinated after birth.

4.3.3 Application of GIS to improve access to hard-to-reach communities

Rwanda has developed low-cost mapping of villages by Community Health Workers (CHWs). Analysis of the village-based data has facilitated to provide services in hard-to-reach villages. The key challenge of developing and updating village-based maps, however, has been to retain the capacity of community health workers to update maps and analyze the data at the local level. The immunization program has no GIS or phone-based information system.

Geographic Information System (GIS) has been introduced to improve immunization coverage and reduce inequities in many countries (UNICEF & Gavi 2017). GIS or other digital systems may also be used in Rwanda to map resources and key features of the geographically remote villages to identify chronically missed settlements, identify gaps and sub-national inequities in access to immunization resources, help visualize gaps and risks in immunization service delivery at the micro-level, help better targeting of immunization resources where most needed, improve transparency and accountability of vaccine delivery activities, create pressure on service providers to engage with local communities through better and geographically accurate data visualization, and re-allocate the catchment areas of the community health workers and vaccination team as needed based on the updated data (UNICEF & Gavi 2017).

Although the cost of using GPS device or GPS-enabled mobile phones is higher than involving local workforce in mapping activities, GPS-enabled maps are more accurate which would result in better rationalization of the supply, better distribution of catchment areas for the vaccinators, improved transparency & accountability, and ultimately would result in savings for the MoH and partners (UNICEF & Gavi 2017).

4.4 Reduction of the effects of COVID-19 on immunization

The COVID-19 had a devastating effect on the coverage as well as equity in receiving life-saving vaccines around the world. The main reasons of reduced immunization coverage were low availability of PPEs for health workers, travel restrictions, and low availability of health workers to provide the services (WHO 2020e). Most (89%) of the African countries reported the reduction of demand for immunization due to COVID pandemic. The causes for the disruptions in demand were the fear of

getting infected with COVID-19 in the health facilities during vaccination, limited availability of public transport, and physical distancing policies (WHO 2020e).

United Nations (2020) conducted an assessment of the impact of COVID-19 pandemic on immunization in Rwanda. It has estimated that the health services were constrained in several ways. During the lockdown period, use of ANC, accessing health facilities by pregnant women to give birth, and subsequent follow up were delayed (United Nations 2020). High transport cost was a challenge for the poor as it was difficult for many caregivers (with children) to maintain social distancing in public transport to reach the health facilities.

In 2020, about 1,036,141 children under the age of 24 months were in need of certain types of vaccination in Rwanda (United Nations 2020). It was estimated that nearly 35.5% children below 24 months from low-income households would have been severely constrained from accessing the vaccination (United Nations 2020). The administrative data of 2020, however, indicated that the effects of COVID-19 on coverage was modest and not that bad as anticipated (MOH 2021). A recently conducted study also showed that only 5% of caregivers had not visited health centers with their children due to COVID-19 pandemic (PRIMSON 2021).

The COVID-19 effects were validated in two low performing districts. Vaccination in the health facilities and outreach centers was suspended for about a month in the earlier period. Due to limitation of movements, many caregivers had difficulties to reach health facilities during that period. As a result, the immunization coverage in both fixed and outreach facilities was low. The community health workers (CHWs) had either stopped or reduced household visits for nearly four months as part of maintaining social distance.

It is suggested that Rwanda should continue implementing immunization program within the existing health structures. To recover from COVID-19 outbreak, the program should focus on enhancing community involvement and strengthening primary health care. The program should prioritize on:

- developing strategies and launching COVID-19 vaccines for the priority population group;
- restoring immunization services by leveraging existing networks of vaccine delivery along with delivering other critical health and nutrition services;
- vaccinating missed children to restore earlier coverage by expanding services. This will require temporarily establishing additional child vaccination facilities closer to home to ensure that caregivers, regardless of the economic status, can easily access needed services (United Nations 2020). NGOs and private sectors such as pharmacies can also play a wider role in the program; and
- expanding routine services to missed (zero-dose) communities (WHO & UNICEF 2020). Expansion of services for emergency period would require a strategic emergency recovery plan with additional human and financial resources. The process needs to begin as soon as possible.

It is widely believed that COVID-19 pandemic will remain for years. Thus, immunization and health service delivery will need to follow and comply with hygiene and social distancing requirements with protective personal equipment (PPE) to protect vaccinators and the recipients.

5.0 Strategies and Interventions to Improve Coverage and Equity

Based on the assessment of immunization program in Rwanda and the guiding principles¹⁴ suggested for the African countries, a set of strategies are developed. The proposed strategies and activities are evidence-based, informed by experience and knowledge, and designed for low performing districts and urban poor to improving immunization coverage and equity.

5.1 Updating micro-plan and implementing RED/REC strategy

Immunization coverage is lower in the unreached and under-served communities where the program has difficulties to identify all target children for vaccination. Updating the reach every district/community (RED/REC) strategy through wider involvement of the communities would promote to maximize accessibility and utilization of immunization services. It is suggested that each of the low performing cells and sectors should be enumerated and mapped to identify missed, zero-dose children, families and communities.

Updating micro-planning should be done routinely in those communities with the participation of local health, civil, political, traditional and religious leaders to increase demand for immunization services. This would help to identify missed settlements with zero-dose children, help better targeting of immunization resources where most needed and to get accurate and reliable administrative coverage data.

5.2 Identification of zero-dose children for vaccination

Although not fully functional, birth registration is mandatory in Rwanda. The official in charge of civil registration and vital statistics is responsible for this task (UNICEF 2018). While birth registration is not the priority of the government, immunization program in low performing districts may activate the birth registration initiative for its own purpose to update the list of eligible children for vaccination. Community health workers (CHWs) may play the key role (there are three CHWs to cover one village) in birth registration process of their catchment areas.

Antenatal care (ANC) services and institutional delivery of birth are quite high in Rwanda even in the rural areas. The community health workers (CHWs) may take the opportunity to routinely contact health facilities to identify newborn and update the eligible children for immunization in their areas. It is suggested that activation of birth registration and coordination with primary health care (PHC) services would facilitate updating the list of eligible children for immunization and reaching all population groups (WHO 2015).

5.3 Expansion of facilities to increase access to services

Although childhood immunization service is provided free in Rwanda, long distance trekking in mountainous areas, high transportation and other indirect costs (such as income loss due to absence in work) have discouraged low-income households to seek immunization services for their children. The DHS reported that about 21.6% women had difficulties in accessing health services due to distance to the facilities in 2015 (NISR 2015). In some areas, such as in Nyamagabe district, 48.6% women had reported accessibility as a major problem due to distance to the health facility (NISR 2015). This clearly indicates the need of expanding outreach services in the in hard-to-reach communities. It is suggested that RBC should conduct an independent assessment to identify locations where new facilities should be established in collaboration with PHC services, private sector and CSOs.

¹⁴ The guiding principles are country ownership and leadership; shared responsibility, partnership, and mutual accountability; equitable health outcomes; integration; sustainability; and innovation (WHO 2015).

5.4 Improving communication and IEC strategies

Although immunization coverage is very high in Rwanda, only 81.5% of the parents felt that their children should be vaccinated in 2017 (United Nations & UNICEF 2017). The vaccination coverage was found much higher than the caregivers' knowledge of immunization (PRIMSON 2021). A recent study in Rwanda also suggests that lack of awareness and knowledge regarding the benefits of vaccines discourages parents to bring their children to health facilities for immunization (Nwankwo & Orua 2020). This reflects that the primary focus of the immunization program has been to raise the coverage only with relatively less emphasis on promoting knowledge of immunization and generating demand for vaccines. The finding indicates that the BCC interventions and social mobilization activities for the immunization program have not been very effective.

Communication strategies should be re-examined and more closely geared to the barriers to and drivers of immunization. IEC efforts should be designed towards heightening risk awareness about the vaccine preventable diseases to be more effective. Interpersonal communication strategy should be supplemented by mass media such as the radio, TV and mobile phones. Modern social marketing techniques may be more widely used. Tailor made BCC interventions to reduce misinterpretations and negative beliefs of vaccination should be developed and implemented. Although the government expressed its will and commitment, the advocates need to be mobilized to reduce vaccine hesitancy and promote immunization knowledge and behaviour. In Rwanda, about 4.2% of children had incomplete vaccination in 2019/20. While the reasons are not known, the strategies could include sensitization of mothers to complete vaccination by emphasizing the benefits of childhood immunization.

5.5 Improving the management of logistics and cold chain system

About 11.3% immunization service providers in the districts had reported very frequent stockout of vaccines in a recently conducted study (PRIMSON 2021). The cold chain system generally works well. However, during seasonal power failure, it becomes difficult to maintain the cold chain and store the vaccines in the health centers. The health centers had to shift vaccines to other nearby health facilities to maintain the quality of vaccines.

Some of the health facilities are overcrowded with caregivers in the waiting areas which may increase the risk of spreading COVID-19 in the communities. Lack of transportation has been a major barrier to reach remote villages for outreach sessions particularly in rainy seasons. Rwanda has been improving vaccine storage capacity as only a few health facilities has recorded stock out of vaccines in recent years. To ensure the quality and safety of vaccine, the vaccine storage system need to be re-examined.

5.6 Increasing access to immunization services

Inaccessibility for women and children to visit the health facilities, particularly in the remote and hard-to-reach areas, was an important barrier to improve immunization coverage and equity. Gender-related barriers are also reported to have both direct and indirect negative effects in accessing immunization services (Gavi 2019). Limited access to hard-to-reach communities, as a result of transportation and other challenges, might have significantly compromised the performance of immunization program in several communities.

5.7 Reaching the urban settlements to track zero-dose children

Urban populations are increasing fast in Rwanda and are contributing to widening gaps in access to primary health care including immunization services. Kigali is emerging with the largest number of people living in informal settlements. Children in those settlements are likely to be less vaccinated and face different barriers to accessing vaccination services compared to rural populations.

The key challenge in the urban immunization program is to track children for vaccination due to high population mobility within the city or town. Immunization program should update the administrative database routinely to track children. This can be done by frequently updating micro-plan. Given that most of the pregnant women deliver births in the health facilities, vaccination card issued for the newborn should have record of vaccination data (such as BCG, Polio 0) and location (sector, cell and address). This information should be used to track the mobility of children within the city and update the list of eligible children for vaccination. Updated data would improve the accuracy of the estimation of monthly immunization coverage.

Other potential challenges are the differences in knowledge, attitude and perception of the population living in the same city. For example, the immunization coverage survey 2017 reported significant differences in belief among parents that vaccines could protect children from diseases within the districts in Kigali city. In addition, residents of informal settlements in urban areas may fear encountering public authorities that may restricts access to public services including immunization, especially in slums, etc. This indicates the need of the promotion of both formal and one-to-one health communication to reach the parents in the urban areas.

Most of the zero-dose children were living in Kigali province. A very high proportion of them were children of highly educated mothers and richest wealth quintile (NISR 2020). A large proportion of parents were employed in both formal and informal sectors in the cities. While recent disaggregated data are not available for urban Rwanda, it is possible that service hours in the health facilities and wait times for vaccination are not suitable for many working parents or working single mothers.

It is suggested that health facilities should adopt flexible approach for immunization service delivery to attract and vaccinate missed children living in the urban slums and underserved areas. Also, the program should ensure that EPI outreach centers operate in the informal settlements as well to reduce the transportation costs of low-income parents. Special immunization campaigns may need to be conducted to reach missed children and children who had dropped out (Nandy et al. 2018).

5.8 Monitoring the shortcomings and modifying the strategies

The immunization program should routinely monitor the effects of pro-equity immunization interventions on the coverage and inequities including improvement in access to and utilization of services in the under served and unreached populations. In addition, the service delivery including the program needs, capacity of human resources, logistics, availability of staff, quality of performance, staff turnover and gaps, supportive supervision, etc. should also be carefully monitored. Monitoring results should be analyzed to identify the gaps and shortcomings of the interventions and modify them accordingly. RBC should also consider undertaking implementation research in selected low performing districts to better understand the reasons for low utilization of immunization services and find options to improve the coverage and equity.

6.0 Conclusions and Policy Implications

Inequality in immunization exists in all countries in multiple dimensions such as wealth, education of mother, gender, place of residence, level of awareness, access to services and other system-based barriers. Based on the review of available documents, this study attempts to improve our understanding about the coverage, trends and inequity in immunization coverage in Rwanda. The findings revealed the existence of significant socioeconomic, demographic and geographic differences in immunization coverage. Routine immunization was provided free for all children regardless of gender, economic condition, education of parents or region of residence. Despite of this, the existence of inequities in immunization coverage in Rwanda deserves an explanation.

6.1 Coverage, trends and equity in immunization

Immunization coverage and trends

Immunization coverage in Rwanda is very high compared to most African countries. About 95.5% of children have received all basic vaccinations and 84.4% have received all age-appropriate vaccinations in 2019/20. The proportion of zero dose children has been only 0.3% in the country. Immunization coverage has increased from 86% in 1992 to 95.5% in 2020 in Rwanda. Trends in immunization coverage showed fluctuation in the earlier years after introducing the program in 1980s indicating that immunization program and service delivery system were not steady and viable. To achieve and sustain universal coverage, it is crucial to track and vaccinate zero-dose children and ensure continuity of doses of specific vaccines.

Inequity in childhood immunization

In Rwanda, inequities in childhood vaccination exists in many forms and multiple dimensions. Key determinants of disparities in coverage were household wealth, education of mother, sex of child, birth order, place of residence, parental level of awareness, access to services and other gender & system-based barriers. Inequity in immunization coverage has slowly narrowed down as a result of the expansion of services and steady increase of coverage regardless of economic condition or parental education. It appears that the coverage of polio at birth dose has been lower among boys than girls. It is suggested that RBC should investigate whether there is any ritual or cultural context of such outcomes. Place of residence has been a major determinant of inequity as gaps in immunization coverage by province and district has remained very wide in Rwanda. It is recommended that RBC should now focus on under-served communities in low performing districts, identify chronically missed settlements, involve local communities to generate demand for immunization, and expand outreach services, if needed, to reach missed children for vaccination.

Percent of district with DPT3 coverage at 80% or above

In 2019, the DPT3 coverage was above 80% in 29 out of a total of 30 districts in the country. A large number of districts have reported to achieve coverage above 95%. Overall, the target set by the *Global Vaccine Action Plan* of WHO that 'percent of district with DPT3 coverage should be 80% or above' has been achieved in Rwanda.

Coverage and equity of immunization by district

Inequity in coverage by district was quite high. Significant disparities existed in parental perception of the need and benefits of childhood vaccination by district. Dropout rates between doses of MCV were quite high probably due to long time gap (6 months) between the two doses. Potential reasons were neglect, forgetting the next dose or the lack of awareness among caregivers regarding the need to complete doses. It is recommended that the program should follow up all children who receive the 1st

dose to make sure that they come back for the 2nd dose. The disparities in the utilization of health facilities for delivery of birth by district were also significant. Inequity regarding the parental perception of the need and benefits of childhood vaccination by district was also noticeable. The negative effect of COVID-19 on immunization coverage has not been even or equal across districts although the coverage was maintained reasonably high in most districts.

Effects of gender-related barriers on equity

Gender-related barriers have both direct and indirect negative effects in accessing immunization services in Rwanda. Lack of awareness and cultural values restrict women's mobility, income-generating activities, decision-making and interactions outside the home which prevent mothers from seeking immunization services for their children. The government has endorsed policies to support women's empowerment and gender equality. It is recommended to develop a national strategy to empower women in all major sectors so that they could improve their self-esteem, build negotiation skills in public, improve capacity to be economically productive, and become self-reliant.

6.2 Potential barriers and challenges to promote equity

Demand promotion and community engagement

Lack of awareness of the benefits of immunization, vaccine hesitancy, and social norms have been the key challenges to promote demand for vaccination in the low performing areas. Lack of demand for vaccine has been reinforced by financial barriers that have restricted access to health services especially for the poorest households. It is expected that reaching the under served communities with culturally appropriate message about the benefits of immunization would raise the demand for services and improve immunization coverage in the low performing under services communities.

Elimination of system-based barriers and bottlenecks

Although the immunization program is generally understaffed in Rwanda, there is at least one Health Center with qualified nurses in each sector who can provide standard vaccination services in the country. The district health service delivery system in Rwanda had gaps in leadership, planning, budgeting and management (UNICEF 2018). In addition, funding was also insufficient for the full implementation of district health plans in some districts. Communication between sectors and districts, and between districts and district-level health sector constituents was inadequate.

Remove barriers to reach remote communities

About 21.6% women had serious problems in accessing health care due to distance to health facilities in 2015 indicating that inaccessibility due to distance has been a significant barrier to improve immunization coverage in most remote communities. This barrier should be removed by expanding both fixed and outreach services in the underserved communities in collaboration with PHC services, private sector and CSOs.

Mapping resources for better programming through GIS

The Geographic Information System (GIS) or other digital systems may be used in Rwanda to map resources and key features of the geographically remote villages to identify chronically missed settlements, identify gaps and sub-national inequities in access to immunization resources, help better targeting of immunization resources where most needed, and improve assessment of health facility catchment areas or outreach areas of community health workers and vaccination team.

Strategy to reduce the COVID effects on immunization

Due to COVID-19 pandemic, immunization services in Rwanda were constrained in several ways. It has been recommended that the program should: restore immunization services by leveraging existing networks of vaccine delivery; continue vaccinating missed children by establishing additional facilities; expand routine services to zero-dose communities with additional human and financial resources in addition to developing strategies and launching COVID-19 vaccines for the priority population group.

6.3 Key interventions to improve coverage and equity

Based on the assessment of the performance of immunization services in Rwanda, the following interventions are proposed:

Update micro-plan and implement RED/REC strategy

Immunization program should update the micro-plan and implement RED/REC strategy to identify missed settlements with zero-dose children and for better planning of immunization resources (such as establishing new fixed and/or outreach facilities). This should be done routinely in low performing areas with the participation of local communities to increase demand for immunization services, to strengthen the delivery of immunization services, and to improve access to marginalized and vulnerable communities.

Identify zero-dose children in the low performing communities for vaccination

Zero-dose children should be identified from two sources: i) birth registration office and ii) primary health care (PHC) facilities in addition to routine household visits by the community health workers (CHWs) in their catchment areas. The CHWs should be involved in birth registration process and routinely contact PHCs and maternity care facilities to identify newborn and update the list of eligible children for vaccination.

Expansion of the facilities to reduce the distance and costs of vaccination

Long distance trekking in mountainous areas, high transportation and other indirect costs have discouraged low-income households to visit facilities to vaccinate their children although childhood immunization is free in Rwanda. It is suggested that RBC should conduct an independent assessment to identify locations where new facilities should be established in collaboration with PHC services, private sector and CSOs.

Improve communication strategies to reach the remote communities

Although immunization coverage is nearly universal in Rwanda, the demand for childhood vaccination is significantly lower than the coverage. This finding indicates the need to reformulate BCC and social mobilization activities to generate demand for immunization. Existing communication strategies should be re-examined and more closely geared to the barriers to and drivers of immunization to reduce misinterpretations and negative beliefs of vaccination.

Managing logistics and cold chain in the low performing districts

Frequent vaccine stockout is not very common in Rwanda. The cold chain system in health centers in the remote communities generally works well except occasional power failure. Lack of transportation sometimes restricts conducting outreach sessions particularly in rainy seasons. Rwanda has been improving vaccine storage capacity as only a few health facilities has recorded stock out of vaccines in recent years. To ensure the quality and safety of vaccine, the vaccine storage system need to be re-examined.

Reaching the urban low settlements to track ‘zero-dose’ and dropout children

The key challenge in the urban immunization program is to track children for vaccination due to high population mobility within the city. It is suggested that eligible children for vaccination should be identified by frequently updating micro-plan in cooperation with the PHC and delivery facilities. In addition, the service hours in the health facilities and wait times for vaccination are not suitable for many low-income working parents or working single mothers who are employed in formal and informal sectors. It is suggested that the health facilities should adopt flexible approach for immunization service delivery to reach and vaccinate missed children living in the urban slums and underserved areas. Special periodic catch up immunization campaigns may need to be conducted to reach missed children and children who had dropped out.

Monitor the effects and modify the strategy

The immunization program should routinely monitor the effects of pro-equity immunization interventions on the coverage and inequities including improvement in access to and utilization of services in the under served and unreached populations. In addition, the service delivery including the program needs, capacity of human resources, logistics, availability of staff, quality of performance, staff turnover and gaps, supportive supervision, etc. should also be carefully monitored. Monitoring results should be analyzed to identify the gaps and shortcomings of the interventions and modify accordingly.

6.4 Immunization in the changing context

Given that immunization targets have been changing with new or additional doses of vaccines, it is time to rethink the existing service delivery strategy of immunization. Rather than stand-alone vertical approach of providing immunization, integration of immunization program with broader PHC services would be more appropriate, meaningful and cost-effective in the long run. In the context of the challenges and opportunities in the country, the immunization program in Rwanda should be concerned not only about currently un-immunized children but also about the children who will be born in coming years who need to be reached for vaccination (WHO 2015).

The assessment concludes that inequity in immunization exists in Rwanda. Reduction of inequities and improvement of coverage in Rwanda would require concerted efforts among the governments, partners (such as Gavi, UNICEF and WHO), advocacy groups, communities and the beneficiaries at the grassroots level.

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