Immunization Saves Lives: Maintaining Good Immunization Coverage To Prevent Potential Outbreaks

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Received: November 21, 2023
Accepted: December 27, 2023
Published: December 31, 2023

Cite this article as: Gasana et al. Immunization Saves Lives: Maintaining Good Immunization Coverage To Prevent Potential Outbreaks. *Rw. Public Health Bul. 2023. 4 (4): 11-15.*

KEY MESSAGES

Measles Rubella (MR2) Vaccination coverage in Rwanda decreased from 96% to 84% during the pandemic.
The drop in vaccination coverage has led to measles outbreaks in Rwanda.
Matching Rwanda Civil Registration and Vital Statistics (CRVS) and Immunization Tracker can improve vaccination coverage
Integrating Digitalized Rapid Convenience Monitoring with community health workers (CHW) led MR2 vaccination campaign Performance-based financing

PROBLEM STATEMENT

Globally, more than 140,000 people died from measles in 2018; during 2000– 2018, measles vaccination prevented an estimated 23.2 million deaths [1]. Global measles deaths have decreased by 73% from an estimated 536,000 in 2000 to 142,000 in 2018 due to MR2 Vaccination, and 9 out of 10 non-immune people will catch measles if exposed to the virus [2]. The Government of Rwanda introduced in 2013 the MR combined vaccine as part of the country's efforts and goal to strengthen routine immunization and eliminate measles and rubella [3].
The MR vaccine is a combination of the measles and rubella vaccines, which are given together to provide protection against both diseases. The integration of the MR vaccine into the routine immunization program was intended to reach all infants and children under the age of five in Rwanda. Since 2014, when the MR2 was integrated into routine immunization, the coverage has been sustained according to DHIS2 data until the COVID-19 pandemic, when the MR2 vaccine coverage in Rwanda has declined from 93% in 2018 to 84% in 2022 (Figure 1) [4]. It was noticed that Measles cases in Rwanda increased from 94 cases in 2020 to 126 cases confirmed in 2021.

Studies conducted worldwide to evaluate the impact of the COVID-19 pandemic on routine immunization showed that during the initial

Potential Conflicts of Interest: No potential conflicts of interest disclosed by all authors. **Academic Integrity:** All authors confirm their substantial academic contributions to development of this manuscript as defined by the International Committee of Medical Journal Editors. **Originality:** All authors confirm this manuscript as an original piece of work, andconfirm that has not been published elsewhere. **Review:** All authors allow this manuscript to be peer-reviewed by independent reviewers in a double-blind review process. **Publisher:** Rwanda Health Communication Centre, KG 302st., Kigali-Rwanda. Print ISSN: 2663 - 4651; Online ISSN: 2663 - 4653. **Website:** https://rbc.gov.rw/publichealthbulletin/

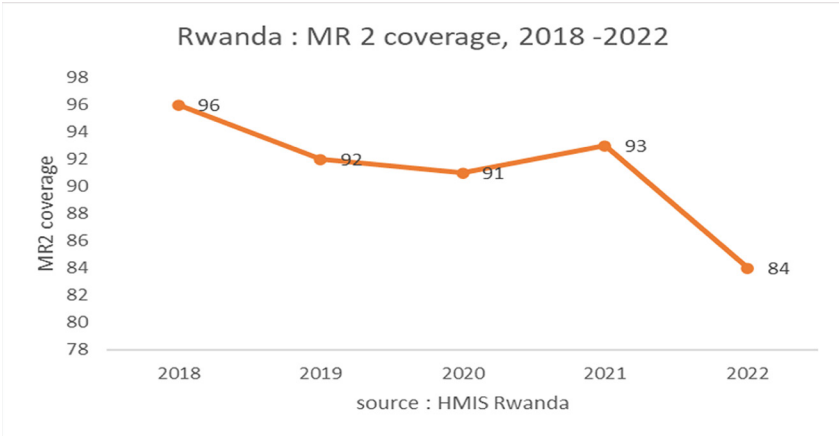

Figure 1: *MR2 Coverage from 2018-2022 (Source HMIS Rwanda)*

pandemic phase, there was a substantial reduction in all routine health services and a 70% reduction in routine immunization services [5,6]. During the COVID-19 pandemic, the unpreparedness of our health system, especially in protecting essential health services, led to an increased rate of unvaccinated children and measles-related cases [7]. Similarly, the COVID-19 pandemic disrupted healthcare services, including the MR2 vaccine routine in Rwanda. According to the Rwanda Biomedical Center (RBC) Epidemiology Department, there were 50 measles cases in 2019, 94 measles cases in 2020, 126 measles cases in 2021, and 93 measles cases in 2022. This was attributed to the decline in coverage in the previous years, from 93% in 2021 to 84% in 2022. National coverage of measles-containing vaccines never achieved its target to fully immunize at least 85% of children in 2022.

In a bid to counter this problem, there is a strong need to ensure the continuity of children's immunization through strategic intervention, such as recording all childbirths and improving the monitoring, tracking, and follow-up of children's immunization aged under 5 by leveraging digital technologies. This intervention will improve the readiness and efficiency of children under 5 years old in immunization programs.

POLICY OPTIONS

Status Quo: *Current Practices in Rwandan Hospitals*

What: To uphold the current practices in Rwandan children vaccination, including individual immunization e-tracker, which does not capture all ages of vaccination and complete information since birth and continue relying only on community health workers for vaccination follow-up and mass campaigns for tracking in the communities

Why: The status quo refers to the existing practices and procedures implemented in the child immunization program, serving as the benchmark against which alternative policy options can be evaluated. The limitations of existing methodologies underscore the necessity for enhanced strategies and actions to tackle the issue adequately.

Feasibility: Medium. The status quo requires no additional resources, as it represents the ongoing practices in Rwandan hospitals. However, it is not efficient because it does not record all ages of vaccination. Moreover, the follow-up and tracking of lost to immunization programs are not cost-effective, and campaigns rely more on the volunteerism of community health workers and donor funding. The consequences of maintaining the current practices will likely result in progressive loss, worsening of the immunization program, and an increase in measles-related hospitalization and mortality.

Policy Option 1: *Database Matching (CRVS & IMMUNIZATION TRACK, SMS Reminder)*

Routine measles vaccination is crucial for reducing measles deaths. The MR2 vaccine is safe, effective and inexpensive. One of the methods that can be used to increase measles vaccination and enhance tracking of children vaccinated is connecting/ integrating the Birth Registration System, such as Rwanda Civil Registration and Vital Statistics

(CRVS), and the individual immunization tracker system, and providing reminders through SMS to mobile phones of parents/carers about the vaccination schedules (Figure 2).

What: Rolling out Countrywide Matched CRVS system & immunization tracker and Providing SMS reminders to Children's parents to attend the immunization program and calendar.
Why: CRVS & immunization tracker, and the system have been working independently, though the matching has been tested and validated in certain health facilities. A unique Database with a unique identifier with complete parents' information will facilitate automated SMS reminders of all children born for monitoring and reaching vaccination targets.
Feasibility. High**:** Both systems already exist, and the matching has been piloted and validated in certain health facilities. Rolling out the matched System and adding automated SMS reminders for the immunization program aligns with Rwanda's ambitious eHealth strategic plan launched in 2009 and updated in 2016 [8]. Moreover, Rwanda gained experience from the COVID-19 vaccination tracking and SMS reminders, which were effective with a success rate of 99% [9].

Policy Option 2: *Integrating digitalized Rapid Convenience Monitoring in MR2 mass Vaccination program and Community health workers Performance Based Financing (PBF)*

Rwanda has demonstrated noteworthy advancements in the domain of routine vaccine coverage. Nevertheless, there are still obstacles that need to be overcome in order to attain and maintain high rates of vaccination coverage for all vaccinations, including the MR vaccine.

What: The aforementioned obstacles highlight a strong need for the Integration of digitalized Rapid Convenience Monitoring in the MR2 Vaccination campaign and Community Health Workers Performance-based financing (PBF).
Why: PBF, which is a pay-for-performance health system financing strategy in Rwanda [10], has been used in Rwanda since 2005 and has contributed significantly to achieving health-related Millennium Development Goals (MDGs) in Rwanda [11,12]. Rapid convenience monitoring (RCM) is a SIA monitoring technique that is specifically designed to locate children who have not been vaccinated, determine the reasons for their lack of vaccination, and implement appropriate measures to address this issue [13]. Integrating digitalized Rapid Convenience Monitoring in the MR2 Vaccination campaign and Community Health Workers Performance-based financing will facilitate real-time monitoring of vaccination campaign performance and enable timely corrective actions
Feasibility. High: Rwanda has standard operating procedures for the implementation of PBF, and it has been used at different levels of the Rwanda Health Sector. Customizing the Community health workers' PBF system in the MR2 mass vaccination campaign and integrating digitalized real-time

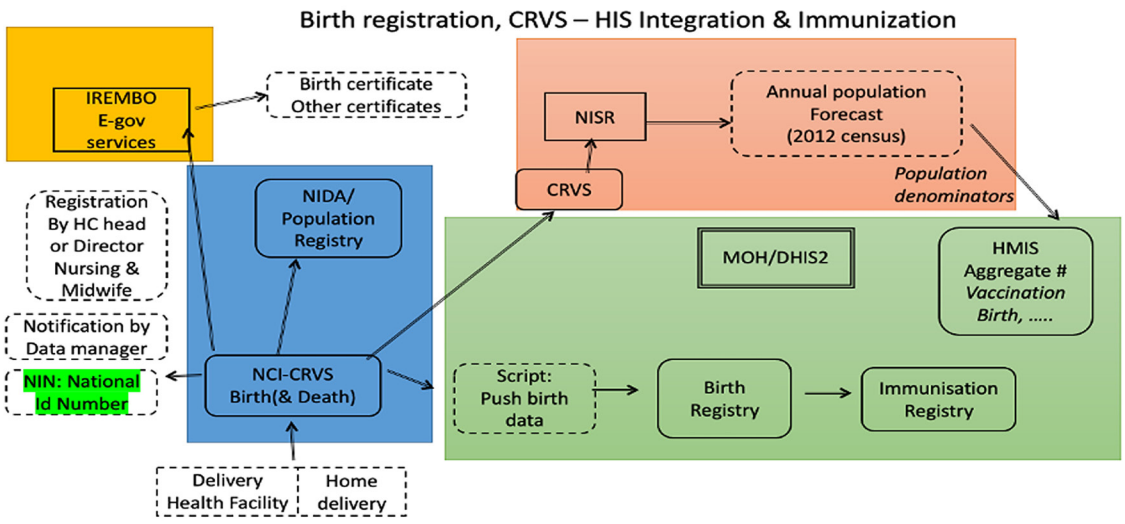

Figure 2: *Diagram showing the integration of Rwanda's CRVS and EIR systems (Source DHIS-Rwanda)*

Table 1: *Economic Evaluation of Policy Options*

	Status Quo	CRVS/Immunization Track	RCM- PBF-CHWs
Cost of intervention	$35,765,293.4	$62,953,728.8	$64,157,259.3
Incremental Cost		$27,188,435.4	$28,391,965.9
Effects	794784.3	1778613.7	1794395.9
Incremental Effects		983829.4	999611.6
ICER		$27.6	$28.4
Political feasibility	Medium	High	High
Operational feasibility	Medium	Medium	Medium

CRVS: Civil Registration and Vital Statistics; RCM: Rapid convenience monitoring; PBF: Community Health Workers; PBF: Performance-Based Financing

monitoring of vaccination campaign performance can have ripple effects, as it has been shown to be effective in Nepal [14]. It also aligns with the Government of Rwanda's digital health strategic plan [8].

The economic evaluation of measles and rubella intervention policies in Rwanda highlights three distinct strategies (Table 1): (i) maintaining the Status Quo, (ii) integrating the CRVS with an Immunization Tracker, and (iii) digitalized Rapid Convenience Monitoring in MR2 Vaccination campaign and Community Health Workers Performance-based financing (PBF-CHWs). The Status Quo requires the least investment at $35,765,293.4, yet its impact, gauged by its effects, is significantly lower at 794,784.3. The CRVS/Immunization Tracker integration, with an investment of $62,953,728.8, promises a substantial effectiveness leap to 1,778,613.7, enjoying a politically high feasibility.

Meanwhile, the Integration of RCM PBF-CHWs strategy, the most expensive at $64,157,259.3, yields the highest effects at 1,794,395.9. However, the added benefits of PBF-CHWs over the CRVS method come at an incremental cost of $28,391,965.9 for an incremental effect of 999,611.6, resulting in an Incremental Cost-Effectiveness Ratio (ICER) of $28.4 (Table 1). Thus, both advanced strategies are politically favorable, but their operational feasibility stands at a moderate level, underlining the need for a comprehensive review before endorsing either option.

RECOMMENDATIONS AND NEXT STEPS

Rwanda plans to roll out a nationwide matched CRVS system and immunization tracker and provide SMS reminders to children's parents to attend immunization programs.

To roll out the system: (i) high-level buy-in from the government and key stakeholders should be secured, a feasibility assessment should be conducted; (ii) the Validated System should be integrated with automated SMS reminders and piloted in certain health facilities to test its functionality and identify any areas for improvement. Once the pilot is successful, the rollout should be scaled up to all health facilities nationwide. Finally, (iii) partnering with mobile network operators is essential to provide SMS reminders at scale.

The integration of digitalized Rapid Convenience Monitoring (RCM) in the Measles-Rubella (MR2) Vaccination campaign and Community Health Workers (CHWs) Performance-Based Financing (PBF) in Rwanda requires the following: (i) assessing the current vaccination campaign and CHWs PBF systems; (ii) customizing the CHWs PBF system for the MR2 mass vaccination campaign; (iii) integrating digitalized RCM in the vaccination campaign, train CHWs on the use of digitalized RCM and the updated PBF system; and (iv) establishing a feedback mechanism for CHWs, monitor and evaluate the impact of the integrated system, and scale up the integrated system to other vaccination campaigns.

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