



HEALTH SYSTEMS CONSIDERATIONS FOR THE ADAPTATION AND REDESIGN OF ROUTINE IMMUNIZATION SERVICES DURING AND BEYOND THE COVID-19 PANDEMIC

Findings from a qualitative assessment in Mozambique

MOMENTUM works alongside governments, local and international private and civil society organizations, and other stakeholders to accelerate improvements in maternal, newborn, and child health services. Building on existing evidence and experience implementing global health programs and interventions, we help foster new ideas, partnerships, and approaches and strengthen the resiliency of health systems.

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ABBREVIATIONS

CHW	community health worker
DDH	district directorate of health
EPI	Expanded Program on Immunization
HF	health facility
IPC	infection prevention and control
KII	key informant interview
MOH	ministry of health
PDH	provincial directorate of health
PPE	personal protective equipment
RI	routine immunization

EXECUTIVE SUMMARY

With decreased demand for routine immunization (RI) and other essential health services in many low- and middle-income countries early in the COVID-19 pandemic,^{1,2} it was essential to design delivery models that mitigated service disruptions—including the potential reduced demand for services—in the short-term and contributed to more equitable immunization coverage in the long-term.³ While these adjustments to RI focused on disruptions at the time, they can be used to adapt, reorganize, and redesign services to make them safer, more client-centered, and equitable.

In 2023, the MOMENTUM Routine Immunization Transformation and Equity (the project) conducted a qualitative study in Mozambique’s Zambezia and Nampula Provinces and Maputo City to assess which if any changes to immunization and other health services were caused by the COVID-19 pandemic and vaccine introduction, why they happened, and their implications for the broader health system.

The study collected qualitative data through in-depth, in-person semi-structured key informant interviews (KIIs) with people who support RI and other primary health services at the provincial, district, and health facility (HF) levels. KIIs were conducted across all relevant levels of the system to document service adaptations—both on-going and those that were implemented and discontinued.

Key adaptations to the delivery of RI services:

- Due to strict social-distancing requirements, HFs were instructed to conduct services outside the medical office whenever possible. HFs with outdoor physical spaces were able to comply, while those lacking such spaces continued to provide services indoors to one patient at a time.
- In Nampula, due to the scarcity of space and the need to reduce the length of client visits, facilities adopted a one-stop system that grouped four clinical services: RI, healthy child consultation, sick child consultation, and nutrition. This not only reduced visitor time in the HF, but also availed clinical space previously designated for sick child consultations for a COVID-19 ward.
- Guidance during the emergency phase was to suspend all planned outreach vaccination by mobile brigades due to the risk of COVID-19 infection. This made it impossible to reach vulnerable populations for vaccination because RI was provided at the HF only. With the introduction of the COVID-19 vaccine, the mobile brigades resumed. Children were identified using registration books and through home visits by community health workers.
- HFs had to restructure their workforce and services to cope with the emergency and prioritize COVID-19 response activities. In Maputo City, mitigation measures included hiring retired health workers on a temporary basis and recruiting volunteer health students to support the mass vaccination campaigns in later stages of the pandemic. In addition, a large number of providers became ill and staff from other HFs and the provincial level were brought in to continue service delivery.
- During the emergency phase, electronic COVID-19 data reporting records were introduced and devices (tablets) were allocated to the district directorates of health (DDH) to aggregate and submit data to the national level in real time. This daily reporting brought challenges including late data reporting due to insufficient airtime on

¹ WHO. Second round of the national pulse survey on continuity of essential health services during the COVID-19 pandemic: January-March 2021. Interim report. 22 April 2021. <https://www.who.int/publications/i/item/WHO-2019-nCoV-EHS-continuity-survey-2021.1>

² PATH. Essential health services during and after COVID-19: A sprint analysis of disruptions and responses across six countries. PATH and Bill & Melinda Gates Foundation; 2020 Dec. <https://www.path.org/resources/essential-health-services-during-and-after-covid-19-sprint-analysis-disruptions-and-responses-across-six-countries/>

³ WHO and UNICEF warn of a decline in vaccinations during COVID-19. <https://www.who.int/news/item/15-07-2020-who-and-unicef-warn-of-a-decline-in-vaccinations-during-covid-19>

providers' phones; unstable mobile phone networks; and a lack of Android mobile phones among providers. The high frequency of reporting also created a challenge by increasing the volume of work assigned to immunization providers, who in addition to RI services were involved in the mobile vaccination brigades and daily COVID-19 case reporting. Because providers got no financial or in-kind incentive (e.g., airtime) to enable the use of SMS data reporting, they had to use their own money. The use of tablets at the DDH continued beyond the pandemic.

- Both Nampula and Zambezia experienced a shortage of some RI antigens during the introduction of the COVID-19 vaccine. Although the COVID-19 vaccines were quickly distributed to the vaccination campaign points, there were still storage constraints for RI vaccines despite its shortages in both the provinces and districts as they were not prepared to store the required quantity of both RI and COVID-19 vaccines.

This study documents the pandemic effects on primary health care service delivery in Mozambique, with special attention on RI, from the emergency phase to the introduction of the COVID-19 vaccine. It also documents innovations to strengthen RI service delivery and practices to apply to future RI and health systems shocks that emerged from the pandemic.

INTRODUCTION

MOMENTUM Routine Immunization Transformation and Equity (the project) applies best practices and explores innovations to increase equitable immunization coverage in USAID-supported countries. The project is USAID's flagship technical assistance mechanism for immunization in over 20 countries around the world. It builds countries' capacity to identify and overcome barriers to reaching zero-dose and under-immunized children and older populations with life-saving vaccines and other integrated health services, including rebuilding immunization systems adversely affected by the pandemic. It also supports COVID-19 vaccine rollout across countries with a wide range of circumstances and needs.

The COVID-19 pandemic required countries to make urgent adjustments to maintain routine immunization (RI) services. With decreased demand for RI and other essential health services in many low- and middle-income countries early in the pandemic,^{4,5} it was essential to design delivery models that mitigated service disruptions in the short-term and contributed to more equitable immunization coverage in the long-term.⁶ It is critical to contextually define and assess the health systems and resource implications of these adaptations and new models (e.g., financing requirements, human resources, infection prevention and control [IPC], social and behavior change, supply chain) to identify opportunities to strengthen RI service delivery and mitigate future health system shocks.

The World Health Organization's (WHO) interim guidance early in the pandemic to maintain RI services during COVID-19 focused on:

- Sustaining delivery with enhanced safety protocols such as continuing with fixed-site delivery with proper IPC and social distancing, avoiding campaign-based models, and making strategic use of outreach activities including prioritizing outreach to catchment populations vulnerable to COVID-19 and other vaccine-preventable diseases.
- Intermittently interrupting and resuming RI services based on the epidemiologic situation of COVID-19 and/or availability of resources in a given location, including tracking gaps within catchment area during service interruptions and providing catch-up immunization as soon as safely possible.
- Identifying innovative models to continue RI services at local levels safely.⁷

According to the WHO's second round of the national pulse survey on continuity of essential health services (January–March 2021), more than one-third of countries reported disruptions to immunization services—both routine facility-based (34 percent) and outreach-based services (39 percent).⁸ Countries also reported how adaptations for RI and other essential health services were implemented. Selected data from the two rounds of the surveys are shown in Figure 2.

⁴ WHO. Second round of the national pulse survey on continuity of essential health services during the COVID-19 pandemic: January–March 2021. Interim report. 22 April 2021. <https://www.who.int/publications/i/item/WHO-2019-nCoV-EHS-continuity-survey-2021.1>

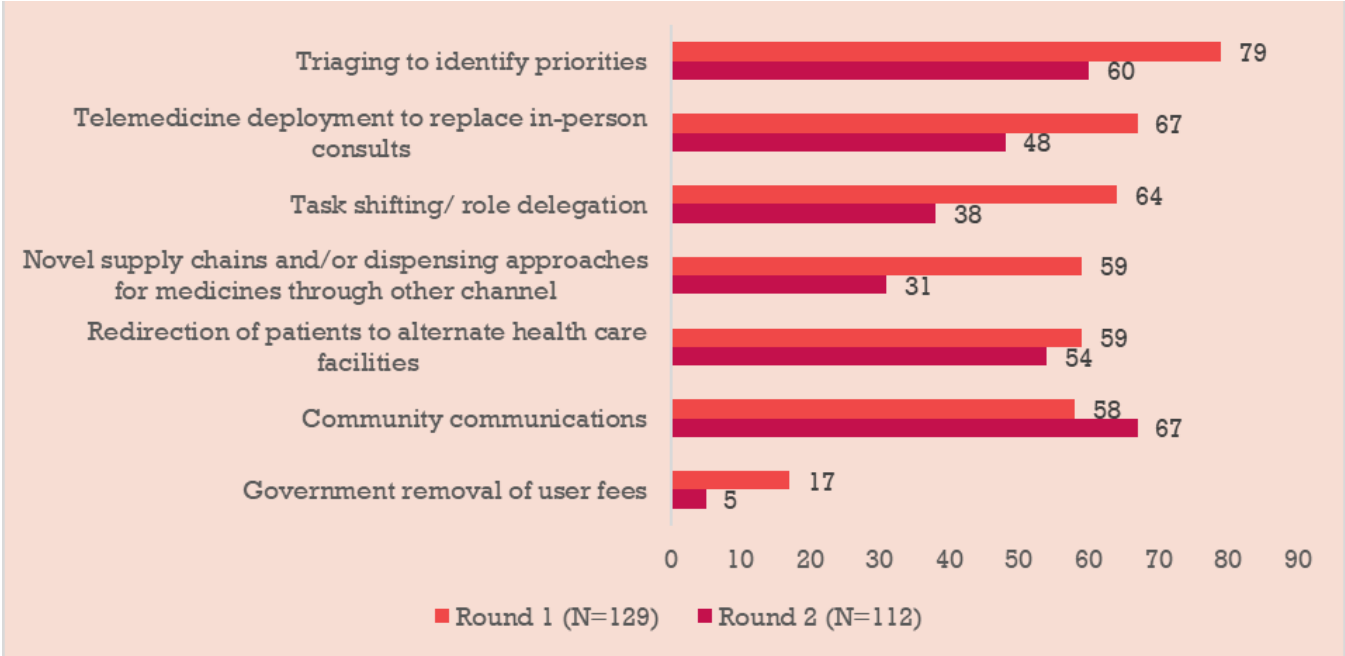
⁵ PATH. Essential health services during and after COVID-19: A sprint analysis of disruptions and responses across six countries. PATH and Bill & Melinda Gates Foundation; 2020 Dec. <https://www.path.org/resources/essential-health-services-during-and-after-covid-19-sprint-analysis-disruptions-and-responses-across-six-countries/>

⁶ WHO and UNICEF warn of a decline in vaccinations during COVID-19. <https://www.who.int/news/item/15-07-2020-who-and-unicef-warn-of-a-decline-in-vaccinations-during-covid-19>

⁷ WHO. Maintaining essential health services: operational guidance for the COVID-19 context: interim guidance, 1 June 2020. https://www.who.int/publications/i/item/WHO-2019-nCoV-essential_health_services-2020.2

⁸ Second round of the national pulse survey on continuity of essential health services during the COVID-19 pandemic: January–March 2021. Interim Report. 22 April 2021. <https://www.who.int/publications/i/item/WHO-2019-nCoV-EHS-continuity-survey-2021.1>

Figure 2. Approaches for Overcoming Service Disruptions: Comparisons of Surveyed Countries



The experiences across essential services highlighted the need for increased coordination of health systems functions to support implementation.^{9,10,11} Table 1 summarizes a range of potential interim and longer-term service adaptations that had relevance for RI services.

⁹ WHO. Second round of the national pulse survey on continuity of essential health services during the COVID-19 pandemic: January–March 2021. Interim report. 22 April 2021. <https://www.who.int/publications/i/item/WHO-2019-nCoV-EHS-continuity-survey-2021.1>

¹⁰ WHO and UNICEF warn of a decline in vaccinations during COVID-19. <https://www.who.int/news/item/15-07-2020-who-and-unicef-warn-of-a-decline-in-vaccinations-during-covid-19>

¹¹ World Health Organization Regional Office for the Western Pacific. Routine immunization services during the COVID-19 pandemic. 2020 Apr 24. <https://apps.who.int/iris/handle/10665/331925>

Table 1. Potential Service Delivery Adaptations for RI During COVID-19¹²

Category	Adaptation	Definition/Example
Service reconfiguration	Integrate at point of care	Coordinating the delivery of multiple services to optimize the delivery of both preventative and curative care, improve patient experience, and reduce the risk of multiple health facility visits (e.g., delivering all maternal and child health services at a single appointment for a mother instead of separate visits).
	Extend service hours	Offering services outside the 'normal' service window time (e.g., weekend, evenings) to avoid overcrowding and increase access/convenience for clients.
	Appointment scheduling	Scheduling clients at specific times to avoid overcrowding and using automated messaging to send reminders to patients' mobile phones.
	Home-based visits	Health care workers or community health workers (CHWs) visit clients at home (e.g., promote immunization, provide other types of preventive and curative routine care).
	Task shifting (to a lower level of care)	Shifting the responsibility of certain aspects of health care to a lower level of care where appropriate (e.g., CHWs or community-based delivery of immunization services) to make more efficient use of the available human resources.
	Prioritize high-risk or vulnerable populations	Give precedence to the provision of services to high-risk or vulnerable populations to protect those likely to be more negatively impacted than the general population.
	Adjust outreach or mobile services	Reorganize services to mitigate risk of COVID-19 transmission (e.g., hold RI sessions outdoors).
Demand creation	Intensify community outreach to generate service demand	Use radio, TV, SMS, and interpersonal communication to inform and encourage patients to get health care services.
Incentives and recognition	Offer incentives and/or financial support for providers	Offer financial or non-financial incentives (e.g., trainings, certificates, or distinguishing clothing) to motivate and prevent burnout among providers and CHWs (e.g., financial support to facilitate travel to hard-to-reach areas or missed communities).
Private sector engagement	Expand service availability through private providers	Contract private providers to offer RI services to reduce overcrowding in public facilities, particularly in urban and hard-to-reach places. Mitigate barriers to RI provision and reporting among hard-to-reach populations.

¹² Adapted from PATH. (2020). Essential health services during and after COVID-19: A sprint analysis of disruptions and responses across six countries. PATH and Bill & Melinda Gates Foundation. <https://www.path.org/resources/essential-health-services-during-and-after-covid-19-sprint-analysis-disruptions-and-responses-across-six-countries/>

While most national guidelines and policies examined during this study’s desk review contained recommendations on maintaining adaptations to essential health service delivery—including RI—only a subset included guidance on the health systems building block(s) needed to operationalize service delivery. For each of the adaptations in Table 1, there are considerable implications on systems-level resources and behavioral interventions needed to support implementation. For example, shifting to appointment scheduling may involve information and/or technological requirements for booking and reminding patients of appointments, and require behavioral changes among health workers and clients. Similarly, intensified community outreach services may require financial incentives to motivate overstretched health workers to travel to underserved communities.

In 2023, the project conducted a qualitative study in Mozambique’s Zambezia and Nampula Provinces and Maputo City to assess which if any changes to immunization and other health services were caused by the COVID-19 pandemic and vaccine introduction, why they happened, and their implications for the broader health system.

MOZAMBIQUE CONTEXT

The first reported case of COVID-19 in Mozambique was on March 22, 2020. In that same month, policymakers, as in many countries, were trying to find a way to continue essential services such as immunization while preventing virus spread among providers and the rest of the population.

In April 2020, an Expanded Program on Immunization (EPI) circular was disseminated within the country with the following guidance:

- Restructure facility-based vaccination services to minimize transmission.
- Integrate vaccinations into well-child visits to reduce missed opportunities.
- Use community radio shows to convey information on the continuing need for child immunization and the new health system approach to EPI provision.
- Suspend immunization outreach (mobile brigades, community campaigns) and offer immunization services in health facilities (HF) only.

In June 2020, the WHO issued *Maintaining essential health services: Operational guidance for the COVID-19 context*. The next circular in Mozambique was distributed in February 2021 and included further guidance on mitigation measures.¹³ It advised health programs to resume provision of essential health services, including immunization outreach.

In March 2021, Mozambique launched its COVID-19 National Deployment and Vaccination Plan, and on March 8, the first batch of 384,000 COVID-19 vaccine doses arrived in Maputo from the COVAX Global Vaccine Initiative.¹⁴

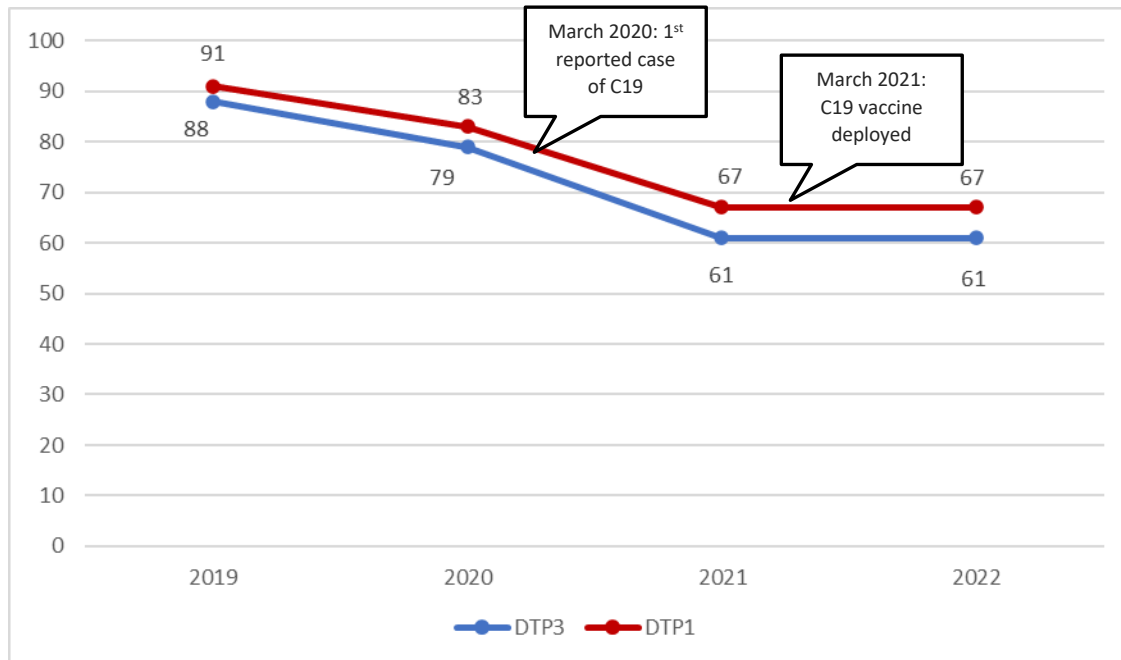
Graph 1 shows selected indicators for RI coverage in Mozambique from 2019 - 2022. During 2021-2022, when high levels of COVID-19 vaccination were achieved, there was a substantial drop in RI coverage in children. In 2021 and 2022, cumulative, fully vaccinated COVID-19 vaccine coverage was 19% and 57% respectively.¹⁵

¹³ Plotkin, M.K., Williams, K.M., Mbinda, A. et al. Keeping essential reproductive, maternal and child health services available during COVID-19 in Kenya, Mozambique, Uganda and Zimbabwe: analysis of early-pandemic policy guidelines. *BMC Public Health* 22, 577 (2022). <https://doi.org/10.1186/s12889-022-12851-4>

¹⁴ Mozambique receives first COVAX COVID-19 vaccines. https://www.eeas.europa.eu/eeas/mozambique-receives-first-covax-covid-19-vaccines_en.

¹⁵ Our World in Data: Mozambique: Coronavirus Pandemic Country Profile. <https://ourworldindata.org/covid-vaccinations>

Graph 1. Mozambique's DTP1 and DTP3 Percent Coverage 2019–2022



Source: WUENIC¹⁶

METHODOLOGY

Through qualitative methods, this study assessed which if any changes to immunization and other health services were caused by the COVID-19 pandemic and vaccine introduction, why they happened, and their implications for the broader health system. Specifically, the objectives of this study were the following:

- Identify adaptations to continue delivery of RI and other essential health services during the pandemic emergency and the introduction of the COVID-19 vaccine.
- Assess the systemic implications of these adaptations and how they were considered during design and implementation.
- Understand the contextual factors that facilitated implementation of these service adaptations.
- Examine ways in which challenges prevented some adaptations from being partially or fully implemented and/or scaled.
- Determine if policy changes were instituted to permit key adaptations.
- Understand resource requirements (financial, human, and material) needed to implement adaptations.

¹⁶ Mozambique: WHO and UNICEF estimates of immunization coverage: 2022 revision. https://cdn.who.int/media/docs/default-source/country-profiles/immunization/2023-country-profiles/immunization_moz_2023.pdf?sfvrsn=f18339b9_3&download=true

Data Collection

This study collected qualitative data through in-depth face-to-face semi-structured KIIs at the provincial, district, and HF levels to obtain information from a variety of people in the health sector who support RI and other primary health services (see Annex for KII questions). KIIs were conducted across all relevant levels of the system to ascertain service adaptations that are on-going as well as those that were implemented and discontinued. Qualitative data were collected from September to October 2023.

This study was conducted in Zambezia, Nampula, and Maputo Provinces. The selection of these three provinces was purposeful due to the project’s presence and previous work done in the country. The selection of the health facilities within each province included in this assessment was done in consultation with the local authorities. In Mozambique, all health facilities are classified as Type II and may or may not offer inpatient services. Given the distinct characteristics of the rural and urban areas, in each district of Zambezia and Nampula Provinces, one rural and one urban facility was assessed. Urban facilities at the district level serve as referral centers. They are located at the district sede, or "headquarters," and are typically better equipped and offer a broader spectrum of health services. Maputo was selected because it had the highest number of COVID-19 cases in the country. In Maputo City, there are only two rural health facilities. However, due to time constraints and accessibility challenges, the study team decided not to include these two rural facilities and instead focused solely on urban facilities.

The selection of the facilities listed in Table 2 was done in conjunction with the local provincial authorities.

Table 2. Facility Locations and Types

Province	District	Type
Zambezia	Molumbo*	Urban
		Rural
	Pebane	Urban
		Rural
Nampula	Muecate*	Urban
		Rural
	Meconta	Urban
		Rural
Maputo	Kamubukwane	Urban
		Urban
		Urban
		Urban
	Catembe	Peri-urban*
		Peri-urban
		Peri-urban
		Peri-urban

*Note: Within Maputo City, there are only two rural HFs; most are in urban and peri-urban areas. Due to logistical constraints in reaching the rural facilities, data were collected in peri-urban facilities.

Health care workers providing RI services and administrative support in the selected provinces were asked to take part in the study. Table 3 shows the job titles of participants engaged at the various study levels.

Table 3. Key Informants at Provincial, District, and Health Facility Levels

Provincial	<ul style="list-style-type: none"> • Head of Public Health Department/senior staff, Ministry of Health (MOH) • EPI manager • Logistics manager
District	<ul style="list-style-type: none"> • EPI managers/chief medical officer • Monitoring and evaluation managers • Medical managers
Health Facility	<ul style="list-style-type: none"> • Manager • RI focal person • Community engagement officers

The interview guides were structured to ask questions based on the cadre and job function of the stakeholder. All interviews were undertaken on a one-to-one basis, and in Portuguese. Interviews lasted 20–60 minutes depending on the availability of the key informant. Consent forms were signed before the interviews.

The interviews were audio-recorded, after signed informed consent from the participants. Audio recordings were securely stored in an access-restricted folder on Google Drive. In some cases, participants were unwilling to be audio recorded; in these instances, transcripts were based solely on note-taking.

Interview locations were selected to make interviewees comfortable. In some cases, due to a lack of available space in the health care facilities, other health workers came into the room during interviews, causing interruptions. Interviews conducted during peak service times had to be shortened to avoid service disruption.

At the completion of each interview, a verbatim transcript was developed based on the notes taken and supplemented by the recording. Audio recordings were reviewed against the transcripts. The final Word documents, in Portuguese and English, were then uploaded to Google Drive for coding.

Data Analysis

The analytical framework presented in Figure 3 is designed to help conceptualize the health system and behavioral adjustments needed to support implementation of service delivery adaptations. The framework is based on the WHO’s health systems building blocks with the addition of specific domains for community accountability and engagement. This addition of a community health building block recognizes the explicit role of community-level services and stakeholders as well as the particular community health needs necessary for the effective provision of

accessible quality health care services.¹⁷ The framework also highlights the need to identify adjustments required to implement the service delivery model based on the performance driver framework articulated by Chee et al. 2013.¹⁸

Each identified adaptation was mapped to one (or more) of the seven blocks. Each block has three domains under which required adaptations were assessed:

- **System inputs** – What requirements support the functionality of each system building block (e.g., new data registers, digital platforms, additional staff) to implement the new service model?
- **Policies, regulations, and/or organizational structures** – What broader contextual changes from a policy, protocol, etc. perspective are needed to enable implementation of the new service delivery strategy? At which systems level must these changes occur?
- **Behaviors** – How can the health system and communities support managers, health workers, community members, and caregivers adapt behaviors to foster desired changes? What behaviors need to be prioritized to test co-created solutions?

In addition to the different blocks and domains, **gender and equity** are important cross-cutting considerations for all service adaptation discussions.

Figure 3. Analytical Framework with Examples

Facility managers engage communities in planning and implementation of RI services.

	Inputs	Polices, Regulation, Organizational Structures	Behaviors	Cross cutting gender and equity considerations
Service Delivery	<ul style="list-style-type: none"> • Facility adjustments (e.g., outdoor clinics, hours) 	<ul style="list-style-type: none"> • IPC protocols/policies 	<ul style="list-style-type: none"> • Managers institute programs to fully immunize high risk/vulnerable populations 	
Workforce	<ul style="list-style-type: none"> • Revised staffing structures • Training on new models 	<ul style="list-style-type: none"> • Task-shifting policy • Supervision structures 	<ul style="list-style-type: none"> • Health workers adhere to new protocols 	
Information & technology	<ul style="list-style-type: none"> • Adjustments to data tools, registers, etc. 	<ul style="list-style-type: none"> • Scheduling infrastructure 	<ul style="list-style-type: none"> • Managers use data for decision making, including program adaptation. 	
Medical products & supply chain	<ul style="list-style-type: none"> • Increased PPE supplies and buffer stock 	<ul style="list-style-type: none"> • Supply and distribution strategies 	<ul style="list-style-type: none"> • Logistics personnel effectively execute revised distribution strategies. 	
Financing	<ul style="list-style-type: none"> • Health worker incentives 	<ul style="list-style-type: none"> • Incentive structure for health worker motivation 	<ul style="list-style-type: none"> • Policymakers allocate sufficient resources to support adaptations 	
Governance	<ul style="list-style-type: none"> • Redefinition of roles and responsibilities 	<ul style="list-style-type: none"> • Policy adaptations 	<ul style="list-style-type: none"> • MOH engages non-health sectors in routine immunization 	
Community	<ul style="list-style-type: none"> • Community communication and awareness creation 	<ul style="list-style-type: none"> • Accountability mechanisms (financial, social) 	<ul style="list-style-type: none"> • Facility managers engage communities in planning and implementation of RI services 	

¹⁷ Sacks E, Morrow M, Story WT, et al. Beyond the building blocks: integrating community roles into health systems frameworks to achieve health for all. *BMJ Global Health*. 2019. https://gh.bmj.com/content/3/Suppl_3/e001384.

¹⁸ Chee G, Pielemeier N, Lion A, Connor C. Why differentiating between health system support and health system strengthening is needed. *The International Journal of Health Planning and Management* [Internet]. 2013;28(1):85–94. <https://onlinelibrary.wiley.com/doi/abs/10.1002/hpm.2122>

Limitations

This study did not measure the efficacy of service adaptations. Therefore, our findings will not address the extent to which these adaptations contributed or did not contribute to improved immunization coverage or decreased incidence of COVID-19. It is focused on identifying and analyzing the processes, the changes themselves, and their implications.

An additional limitation of this study was the ability to identify which adaptations would continue in the longer term beyond the pandemic. In discussing adaptations to essential health service delivery, our findings identify those adaptations which were still in place at the time of data collection (September – October 2023) and indicate where key informants expressed an intention or desire for the adaptation to continue.

Limitations encountered during data collection related to availability of some identified key informants, challenges getting to some rural geographies, and the longer recall period for some respondents given the amount of time that had passed. Additionally, due to high turnover in some HFs in Nampula Province and Maputo City, some key informants were recently hired and unable to respond to all questions.

FINDINGS

Data collected and analyzed during the assessment resulted in the identification of several adaptations, and in some instances, innovation, in the delivery of immunization and other health services as a result of the COVID-19 pandemic and introduction of the COVID-19 vaccine. These findings are presented by health system building block.

Service Delivery

During the pandemic emergency phase, defined in Mozambique as the period from the onset of the pandemic in March 2020 to the introduction of the COVID-19 vaccine one year later, in March 2021, the MOH introduced strict physical-social distancing measures and instructed the provincial directorates of health (PDH) to ensure compliance with stay-at-home orders. As a result, there was a decrease in the number of people seeking clinical services, leading to a reduction in clinical activities for a short period of time. However, the sudden demand for emergency clinical services shifted priorities to the pandemic response. Importantly, there was no guidance to stop provision of any health service, and HFs were instructed to implement all pandemic guidelines in accordance with the local context and national protocols.

The district directorates of health (DDH) were also instructed to strictly enforce social distancing measures and prioritize emergencies over chronic patients, including prenatal consultations and screening adults and children, to avoid crowding in the facilities. As a result, the HFs had to make several adjustments including adapting infrastructure to accommodate two new points of care: triage for COVID-19 and a COVID-19 ward. This was a significant challenge. Some HFs adapted consultation rooms and others used tents from clinical partners for COVID-19 triage.

A general visitor ban was instituted in all HFs, and all patients were screened and triaged upon entry to ensure early identification of those with suspected COVID-19 infection. In the initial stage, there was a strict separation between the COVID-19 and non-COVID-19 wards. When PCR tests became widely available, health personnel involved in patient care were tested weekly.

HFs were instructed to take advantage of open and ventilated spaces for RI and maintain social distancing during all health services. HFs with outdoor physical spaces were able to comply with the first measure, while those lacking such spaces continued to provide the service in the medical offices, one patient at a time. Other challenges to making these accommodations:

- Most HFs reported having offices that were too small to operate with more than one technician, and social distancing requirements made it impossible to have two working simultaneously.
- Even HFs with existing outdoor spaces reported that they lacked overhead coverage and exposed people to sun and rain.
- Most HFs reported that the offices were unventilated and lacked windows.

Before the pandemic, caregivers would arrive at the HF and present RI cards at the reception. Then, the immunization provider would call caregivers and babies in groups for vaccination. During COVID-19, mothers were asked to keep the RI cards with them and were called for vaccination individually.

In Nampula, due to the scarcity of space and the need to reduce the length of client visits, facilities adopted a one-stop system that grouped RI, healthy and sick child consultations, and nutrition services. This model had been conceptualized prior to the pandemic to reduce missed opportunities for vaccination, but the extent to which it had been implemented is unclear. Upon full implementation during the pandemic, it reduced visitor time and availed clinical space previously designated for sick child consultations for a COVID-19 ward. This model was implemented and ongoing in two larger health facilities visited during data collection, and they indicated an intention to continue using this model.

Guidance during the emergency phase was to suspend all planned vaccination mobile brigades due to the risk of COVID-19 infection. This made it impossible to reach vulnerable populations for vaccination because RI was provided at the HF only. With the introduction of the COVID-19 vaccine, the mobile brigades resumed. Children were identified using the registration book, and CHWs conducted an active search, disseminated messages on the value of RI, and corrected misinformation and anti-vaccine rumors. In Maputo City, TV and radio were also used to disseminate immunization information and generate demand.

Guidance on the implementation of rapid care flows for other clinical services, notably for patients with stable chronic conditions, included quarterly medication dispensing and spacing consultations to reduce crowding. Some facilities interrupted clinical services to avail offices and/or wards (e.g., adult and child triage, pediatrics, cough/TB room) for COVID-19 care. Mothers were asked to bring their own individual coverings for children to reduce infection transmission.

During the emergency phase, the provincial, district, and facility levels were unanimous in affirming that IPC was a key priority. National protocols were established and the MOH developed guidance on prevention and case management. IPC focal persons were established in each HF, and providers received on-the-job training and mentorship through a cascade model from the MOH to PDH to DDH and HFs.

Buckets of water were placed in front of the HF so that clients could wash their hands with soap and water before entering. Before receiving services, they were required to disinfect their hands with alcohol. The use of medical face masks was mandatory inside the HFs for all but children under 12. DDH were instructed to ensure the availability of disinfection products (alcohol gel), masks, gloves, soap, and protective clothing for providers.

After the emergency phase of the pandemic, adaptations including the use of masks by providers and patients, handwashing and when possible, open-space RI, continued. While rare in more rural settings, mask use was observed in HFs at the time of data collection. Funding to maintain masks and soap is needed.

When COVID-19 activities were prioritized, there was an increase in supervision visits from PDH and DDH to the HFs. This presented challenges because fuel and vehicles were limited and available vehicles were needed to transport people with COVID-19 and other emergencies including women who were about to give birth.

Workforce

The onset of the pandemic caused health workforce restructuring. A cadre was introduced to support the DDH RI team in managing vaccine and commodity logistics. During the emergency phase, the MOH advised that individuals with COVID-19, including health care providers, should be isolated for 10 days. Additionally, the MOH recommended that in areas with more than one health care provider, those staff should rotate to reduce contagion.

These measures decreased availability of health care providers, causing an overload of work on those who remained in the HFs. In Maputo City, several mitigation measures were implemented, including hiring retired health workers on a temporary basis and recruiting volunteer health students to support mass COVID-19 vaccination campaigns. Staff from less burdened HFs and the provincial level were reallocated so that HFs with shortages could continue service delivery.

When the COVID-19 vaccine was introduced, immunization providers' roles and responsibilities increased significantly. In addition to ensuring RI in HFs, they were the focal point for mobile COVID-19 vaccination units and responsible for awareness and demand generation and COVID-19 daily data reporting. At DDH level, the RI unit head and RI logistician performed the same functions.

During the emergency phase, all RI trainings were canceled. Only COVID-19 response trainings were provided, and these were mostly virtual. When the vaccine was introduced, in-person trainings gradually resumed. Nampula and Zambezia reported receiving virtual and in-service training on COVID-19 prevention, case management, vaccination, and reporting. Maputo City reported only receiving in-person training.

In the HFs visited, there was no official change in the hours of patient care. However, during the introduction of the vaccine, the provision of care took longer in HFs due to the reinforcement of IPC (hygiene, temperature measurement, and social distancing) and patient triage; reduced personnel due to illness; and the need to provide both RI and the COVID-19 vaccine. Therefore, providers often extended hours of care to meet patient needs. As several respondents noted, people came from far away to get health services. RI staff, with increased responsibilities due to COVID-19, started activities early in the morning to attend RI clients and later participated in mobile brigades.

Information & Technology

Record books for COVID-19 were introduced during the emergency phase, and daily data reports were sent from the HF to the DDH via SMS. At DDH level, data were entered into SISMA, the health information system. Later, electronic COVID-19 data reporting records were introduced, and tablets were allocated to the DDH for data aggregation and submission to the national level in real time. This system entailed challenges including late data reporting due to the insufficient airtime on providers' phones, unstable mobile phone networks, and a lack of Android mobile phones among providers. No financial or in-kind incentives (e.g., airtime) were given for use of SMS data reporting, so providers had to pay for it themselves which resulted in delays in data reporting due to the lack of airtime as well as placing an undue burden on providers.

Reporting frequency was also a challenge due to the increased work assigned to immunization providers, who in addition to RI services, were involved in mobile vaccination brigades and COVID-19 case daily reporting. For other health programs including RI, there was no change in data reporting frequency or collection tools. The RI data were reported daily in the registry book, followed by the preparation of daily and monthly summaries and quarterly reports. The one change was that HFs were instructed to send quarterly summaries to the DDH via SMS instead of delivering or mailing physical copies.

After the pandemic, paper-based quarterly RI reporting to the DDH resumed. However, interviewees in Nampula acknowledged the benefits of real-time coverage data for monitoring and programmatic decision-making.

Medical Products & Supply Chain

The introduction of the COVID-19 vaccine affected RI vaccine distribution, storage, and stock maintenance in Nampula and Zambezia Provinces. Their supply chain systems did not have the capacity to absorb the volume of COVID-19 vaccines received. As a result, the volume of RI vaccines in the supply chain was reduced and there was a shortage of some RI antigens, notably pentavalent and polio vaccines. Although the COVID-19 vaccines were quickly distributed to vaccination campaign points, the provinces and districts were unprepared to store large quantities of RI and COVID-19 vaccines.

In Maputo City, RI logistics did not change, but the supply system was overwhelmed when COVID-19 vaccines arrived. Maputo City also reported a shortage of RI antigens, but there was a hesitancy to attribute these shortages solely to the introduction of the COVID-19 vaccine. Due to its proximity to the central medical store, vaccine delivery to HFs in Maputo City is relatively fast. To avoid storage capacity challenges, vaccines were distributed to the HFs every week.

Many respondents said that HFs had frequent shortages and unreliable personal protective equipment (PPE) sources. When PPE were unavailable, some health care providers refused to see clients, leaving some HFs unattended until PPE arrived. Other health care providers continued to see clients but used their own money to buy PPE. Some said they had to use the same masks for extended periods of time because new ones were unavailable. There were also reports of masks and protective aprons breaking.

Financing

The study examined the provision of financial incentives to health workers to support the delivery of health services and the sufficient allocation of resources from the provincial and district levels to support service delivery adaptations. No financial or other incentives were provided to support health workers' increased workload. However, as was the case before the pandemic, subsidies were provided during mobile RI brigade implementation. No incentives or compensation was provided for the use of mobile data or airtime. There was also no finding of resource allocation from the provincial or district level to support service delivery adaptations for COVID-19 treatment, response, or vaccination services.

Community

In Mozambique, CHWs are critical to the delivery of health care services and considered the most important link to the community. During the emergency phase, all community mobilization and service demand generation activities stopped, but CHWs continued to support health service delivery by mobilizing communities for vaccination, supporting the HF to organize patients according to the rapid care flow, reinforcing IPC measures, and weighing children. CSOs supported HFs by instructing clients to wash their hands with soap and water before entering and were trained to conduct sessions on ways to reduce COVID-19 spread and the importance of vaccination schedule compliance.

With the introduction of the COVID-19 vaccine and the relaxation of social distancing and isolation guidance, the health sector was directed to resume interactions with community leadership to reinforce the importance of health-seeking behaviors in general and vaccination in particular. During this phase and in close collaboration with the HFs, CHWs helped: 1) find children who missed vaccination via home visits; and 2) mobilize communities to adhere to vaccination schedules.

DISCUSSION

This study documents the pandemic's effects on primary health care service delivery—particularly RI—in Mozambique from the emergency phase through the introduction of the COVID-19 vaccine. A majority of HF

adaptations were expected (e.g., implementation of IPC measures, social distancing, triage, screening); these came with several consequences (e.g., reduced demand for and delivery of non-emergency health services, an overburdened health workforce, an overwhelmed vaccine supply chain).

However, the pandemic yielded opportunities and innovations to strengthen RI service delivery and practices to apply to RI and health system shocks. In Mozambique, HFs were granted autonomy to restructure health service delivery as they saw fit so long as they adhered to the national-level guidance. This enabled HFs the opportunity to consider how to improve integration and coordination among services within their own context. In Nampula, HFs used this opportunity to scale-up the innovative implementation of one-stop delivery of child health services, and key informants noted that for this adaptation, there was an intention to continue its implementation beyond the pandemic.

While the study findings highlighted the many challenges faced by the health system, it also found many adaptations that positively affected the response. For example, information and guidance was disseminated to all levels of the health system; in the context of a pandemic when guidance and knowledge is quickly evolving, it should not be underestimated how critically important the pathways of efficient and effective information dissemination become. Similarly, the required personnel and financial resources to conduct more supportive supervision visits to lower levels was prioritized. The findings also suggest that data and community health system components were critical to the pandemic's management. CHWs were critical to engaging with the community, sharing information, and increasing the delivery of essential health services during the pandemic. The use of SMS and tablets to support data reporting enabled monitoring of vaccination coverage with greater frequency than ever, as well as evidence-based decision-making and adaptation of programming to further strengthen service delivery. While the resources required to maintain this level of reporting (e.g., personnel time for data entry and financial resources to enable more frequent wireless, online data transfers) were not sustainable in the immediate aftermath of the pandemic, all levels of the health system saw the advantages of what could be possible with respect to reporting and data use should sufficient resources be available.

The pandemic placed considerable pressure on Mozambique's health system, as did many of the adaptations to manage the pandemic and sustain the delivery of essential health services. Most significant was the shortage of resources, including surge capacity among the health workforce, supply chain capacity, and critical IPC commodities. It is important to note that these shortages were experienced across a majority of countries and at the global level. Reflecting on these challenges and preparing for the inevitable next pandemic or shock to the health system is a critical step forward for Mozambique and all countries, for example considering how to sustain RI service delivery by identifying surge health worker capacity among retirees and students. Another critical challenge to be addressed was the limitation of the existing HF infrastructure to maintain social distancing and ensure open and ventilated spaces when providing health care services; this can be a key consideration when expanding HF infrastructure.

Additional learnings from the pandemic include the policy ripple effects that had unintended consequences and health system implications, such as providers having to use their own money to purchase IPC and airtime for data reporting. In terms of human resource management, task shifting seemed to be the immediate solution to both manage the impact and needs of the pandemic and maintain essential services, but most often, the unintended result was an expansion of HW tasks, which further increased the workload of HWs who were often stretched prior to the pandemic. The unintended consequences and health system implications of policies and adaptations to service delivery were disproportionately experienced by lower levels of the health system. While it was not a specific line of inquiry within this study, it does imply that broader consultation of stakeholders at all levels of the health system is necessary to identify these potential implications, such as undue financial or workload burden, prior to instituting policy guidance.

This study documents health system challenges at provincial, district, and facility levels during the pandemic, including limited ability to comply with national clinical and operational guidance. In early 2020, the MOH released guidance based on global knowledge available at the time, and this study illuminates the experience of implementing this guidance at the front lines of the health system in Mozambique. The global health community should continue to share lessons and good practices so we can apply them to large and small, temporary and long-term shocks to the health system and the delivery of services. Additionally, there is a need to further landscape adaptations at a global level and examine the efficacy and consequences of adaptations to further strengthen the preparation and response to future pandemics and better identify activities that could be sustainable without large influxes of resources.

ANNEX: DATA COLLECTION TOOLS

Below are the English translations (from Portuguese) of the KII questions for each of the three levels – provincial, district, and health facility.

Key Questions for Stakeholders at the Provincial level	
1	What is your role and what are your core responsibilities in RI service delivery at this level?
2	<p>What type of policy guidance or circular or directive was instituted during the pandemic and after the introduction of COVID vaccine to guide reorganization of services to continue RI?</p> <ol style="list-style-type: none"> What were the key adaptations required and how will you categorize them? Can you describe the kind of support that was provided to health workers to guide reorganization of services and to implement these adaptations?
3	<p>What was your role in implementing the policy guidelines/circular/directive in coordinating some of these adaptations at the various levels?</p> <ol style="list-style-type: none"> Can you describe some of the factors that made these adaptations and reorganization of services easy? Can you highlight and describe some of the challenges that you encountered during the process? What steps did you take or would you recommend to address these challenges?
4	How would you describe the changes in other services apart from routine immunization such as family planning and other MNCH services?
5	<p>Are these policy guidelines /directive/circulars to guide these adaptations and reorganization of services temporary or permanent?</p> <ol style="list-style-type: none"> Are there plans in place to scale up some of these adaptations? Highlight some of the proposed plans or those that are already in place.
6	<p>What are some of the ways the implementation of this policy/circular/directive were monitored to ensure compliance?</p> <ol style="list-style-type: none"> What alternatives were included in the policy/circular/directive where implementation was not feasible?
7	What are some of your recommendations to improve RI services going forward?
6	<p>What strategies are in place to provide additional support to health workers at the health facility level to improve RI and other health services during the pandemic?</p> <ol style="list-style-type: none"> What are some of your recommendations to improve RI services going forward?

Key Questions for Health Workers at the District Level

1	What is your role and what are your core responsibilities in RI service delivery at this level?
2	<p>How did the service reorganization/ adaptation affect your regular monitoring and supportive supervisory activities at the health facility level?</p> <ul style="list-style-type: none"> a. Describe some of the changes to your data collection methods and tools to support reorganization of services? b. What are some of the innovative strategies that were put in place to reorganize monitoring and supervision?
3	<p>How has the service adaptation during the pandemic and after COVID vaccine affected the training of service providers at the health facility level?</p> <ul style="list-style-type: none"> a. What strategies were put in place to reorganize RI training and revise training materials? b. What additional knowledge and skills did the training take into consideration based on the pandemic and after the introduction of the COVID vaccine?
4	<p>How were you able to monitor the implementation of the policy guidance/directive/circular that was handed down from the higher level?</p> <ul style="list-style-type: none"> a. Describe some of the challenges encountered in the process of implementation and monitoring? b. How did this policy impact the implementation of other health services apart from RI?
5	What were some of the innovative strategies that were not in the policy guidelines/circular/directive that were implemented to ensure continuation of services?
6	<p>What strategies are in place to provide additional support to health workers at the health facility level to improve RI and other health services during the pandemic?</p> <ul style="list-style-type: none"> a. What are some of your recommendations to improve RI services going forward?

Key Questions for Health Workers at the Health Facility Level	
1	What is your role and what are your core responsibilities in RI service delivery at this level?
2	<p>How have the services you provide including routine immunization changed since the introduction of the COVID-19 vaccine?</p> <ol style="list-style-type: none"> a. Highlight some of the changes that have come about in infection prevention and control b. How did these changes affect the uptake of routine immunization? c. How were RI services carried out in underserved communities during the pandemic and since the introduction of COVID vaccine? d. Highlight some of the strategies used in targeting these groups during the pandemic e. Highlight other key adaptations that were carried out to continue RI services during the pandemic.
3	<p>What type of policy guidance did you receive from the ministry regarding reorganization of services?</p> <ol style="list-style-type: none"> a. What did the policy guidance say? (High level summary) b. What kind of clarification did you seek after receiving the policy if you did?
4	<p>How did you implement this policy guidance at the health facility level?</p> <ol style="list-style-type: none"> a. What kind of capacity strengthening activity was conducted to implement this policy and to help reorganize services? b. What were the changes in the implementation of this policy over time?
5	<p>What were some of the barriers and challenges you experienced in the process of reorganizing RI services since COVID vaccine introduction?</p> <ol style="list-style-type: none"> a. How did you navigate some of these challenges? b. Highlight some of the support you received to address some of these challenges c. What additional support did you require but was not available?
6	<p>What were the implications of these policy changes and RI service re-organization in the following domains?</p> <ol style="list-style-type: none"> I. Financial resources <ol style="list-style-type: none"> a. How did these changes impact financial resources during the service adaptation? b. How did the changes affect cash flow for immunization outreach logistics? c. Were there additional incentives given and what type of incentives were given? II. Human resources <ol style="list-style-type: none"> a. How did these changes impact human resources particularly those providing RI services? b. How has it impacted the way that RI service providers utilize their time after COVID vaccine was introduced? c. How did the adaptation affect other health providers supporting non-RI services such as family planning, and other services? III. Logistics, materials, and vaccine supplies <ol style="list-style-type: none"> a. How did the COVID -19 pandemic and the introduction of COVID-19 impact vaccine supply, storage, and other immunization logistics?

	<p>b. How did these changes, particularly workers' shifts affect the supply and use of medical consumables such as PPE, face masks, and other materials?</p> <p>IV. Information technology</p> <p>a. How did these adaptations affect the way RI data is managed and reported?</p> <p>b. How have the adaptations affected the way data is used for planning for RI since the pandemic and COVID vaccine introduction?</p> <p>V. Demand creation and service utilization</p> <p>a. How has demand creation for RI and other services been affected since the introduction of COVID vaccine?</p> <p>b. How has it affected RI and other services such as family planning, treatment of childhood illnesses, and other services?</p>
7	<p>How did this adaptation affect how other services were organized and used (i.e. family planning, management of other childhood illnesses, and other services)?</p> <p>a. MNCH services</p>
8	<p>a. What are some of the innovative adaptations that you would have undertaken but were not in the policy guidelines?</p> <p>b. How would these innovations have positively impacted RI and other services?</p> <p>c. What are some of your recommendations to improve RI services going forward?</p>