

Analysis of COVID-19 Vaccination Intra Action Review Reports

July 2022

Copyright © 2022 MM Global Health Consulting

All rights reserved. No part of this report may be reproduced or used in any manner without the prior written permission of the copyright owner. To request permissions, contact the publisher at info@mmglobalhealth.org



CONFIDENTIALITY DISCLAIMER

The mini c-PIE reports are the propriety information of the individual countries and have been shared in confidence for this analysis.

This report should not be re-circulated without explicit consent.

Table of Contents

Acknowledgements	4
Acronyms	5
Executive Summary	6
Introduction	9
Aim of This Report	10
Objectives	10
Methodology	11
Scope of Analysis	11
Key Findings	13
Planning, Coordination, Financing & Service Delivery	16
Regulatory Preparedness	20
Supply Chain & Waste Management	20
Human Resource Capacity	23
Vaccine Demand & Acceptance	25
Vaccine Safety Monitoring & Response	28
Data & Monitoring	31
LIMITATIONS OF THE ANALYSIS	34
Lessons & Insights	36

Acknowledgements

This work was commissioned by the World Health Organization (WHO) to document the learnings from the early phase of implementation of the COVID-19 vaccination response. MMGH Consulting gratefully acknowledges the Member States who shared the reports of their Intra Action Reviews for analysis and the staff of WHO Geneva and the Regional Offices for their careful review and feedback on the contents of this document. MMGH Consulting also acknowledges the support provided by Janet Michel for the review and coding of the country IAR reports and in the analysis and drafting of this report.

Acronyms

AEFI	Adverse Events Following Immunisation
AFR	African Region
AMC	Advance Market Commitment
AMR	Region of the Americas
AVAREF	African Vaccine Regulators Forum
BOL	Bolivia, Plurinational State of
BTN	Bhutan
BWA	Botswana
COD	Congo, the Democratic Republic of
CoX	Country X
DHIS	District Health Information Software
EMR	Eastern Mediterranean Region
EPI	Expanded Program on Immunisation
EUL	Emergency Use Listing
FDA	Food and Drug Administration
GHA	Ghana
GMB	The Gambia
GNB	Guinea-Bissau
HPV	Human Papillomavirus
IAR	Intra Action Review
ICC	Interagency Coordination Committee
ICT	Information and Communications Technology
LAO	Lao People's Democratic Republic
LMIS	Logistics Management Information Systems
MMGH	MMGH Consulting
MOZ	Mozambique
NDVP	National Deployment and Vaccination Plan
NITAG	National Immunisation Technical Advisory Group
NRA	National Regulatory Authority
PIE	Post-Introduction Evaluation
SAE	Serious Adverse Events
SEAR	South-East Asian Region
SOM	Somalia
SSD	South Sudan
SYR	Syrian Arab Republic
TWG	Technical Working Group
UCC	Ultra-Cold Chain
UGA	Uganda
WHO	World Health Organization
WPR	Western Pacific Region
ZMB	Zambia

Executive Summary

Background: A country COVID-19 Intra Action Review (IAR) refers to an activity conducted by a country to provide an opportunity to share experiences and collectively analyse the ongoing in-country COVID-19 response by identifying challenges and best practices. The World Health Organization (WHO) developed and promoted the use of the IAR process in response to the need early in the COVID-19 pandemic to evaluate the various pillars of the COVID-19 response, including the vaccination pillar. The IAR for the vaccination pillar was often conducted independently of the other pillars, and tools and templates specific to the vaccination pillar were developed. Technical support was provided to countries to conduct the review. The IARs for the vaccination pillar were also referred to as mini COVID-19 vaccine post introduction evaluations (mini c-PIEs) and were generally conducted a few months after the initiation of vaccination in a country, though the timing of the evaluation varied.

Countries prepared reports summarising the findings of the mini c-PIE using a template provided by WHO. The reports from a representative sample of countries were reviewed with the aim of documenting the countries' collective experience during the initial rollout of COVID-19 vaccines, to identify good practices, challenges, and lessons that may be used to inform the scaling up of the ongoing COVID-19 vaccination response and enhance preparedness for future pandemic and epidemic vaccination response.

This report complements the WHO global analysis of COVID-19 IAR, which analysed IAR report findings from all 13 public health response pillars, including the vaccination pillar.

Methods: The mini c-PIE reports of 15 low- and middle-income countries (LMICs) from five of the six WHO regions were included in the review. They were selected based on availability, willingness to share, and to provide maximum possible cross-regional representation. The reports were analysed with the aid of the MAXQDA20™ software using a hybrid approach of inductive and deductive thematic analysis. The thematic areas reflected the National Deployment and Vaccination Plan (NDVP) categories i.e., planning, coordination, financing & service delivery; regulatory preparedness; supply chain & waste management; human resource capacity; vaccine acceptance & demand; vaccine safety monitoring & response; and monitoring & evaluation. The areas of planning, coordination, financing, and service delivery were merged into a single thematic area given the closely inter-connected nature of these areas.

Findings: The key enablers and challenges in each of the thematic areas are summarised in this review. Below is a very succinct summary. However, it should be read in conjunction with the Key Findings section of the report to fully understand the context and nature of the factors identified under each thematic area. In several instances, certain issues that were reported as having worked well were also considered as challenges, suggesting that certain aspects could have been implemented better in order to optimise their impact.

Planning, coordination, financing & service delivery

Enablers: Fully financed NDVP, clear governance structures and coordination, selection of priority groups for vaccination, robust district-level micro plans.

Constraints: Funding shortfalls, limited political engagement, evolving situation & timelines, issues with accessing and disbursing funds, lack of micro plans, service delivery challenges, competing vaccination priorities.

Data & monitoring

Enablers: Effective use of digital tools, timely training & feedback.

Constraints: Lack of trained staff, connectivity issues, availability of digital tools, and lack of technical help with IT solutions.

Vaccine safety monitoring & response

Enablers: Existence of surveillance systems & committees, adequate AEFI reporting & mgmt., timely risk comms.

Constraints: Low-quality systems, inadequate resources for investigation, and management of serious adverse events, lack of timely risk communications, knowledge gaps, lack of coordination between the regulatory authority and immunization programmes.

Regulatory

Enabler: Ability to obtain all the relevant documents for timely regulatory approval

Supply chain & waste management

Enablers: Timely SC planning, multi-level storage capacity, varied transport options, trained personnel, closely monitored stock levels, centralized waste mgmt. process.

Constraints: Lack of functional cold chain equip, transport shortages, stock levels not updated, limited waste mgmt. capacity, distribution plans not shared, deployment of multiple vaccines, human resource-related constraints.

Human resource capacity

Enablers: Trained staff, virtual or mixed training sessions to overcome travel restrictions, attention paid to staff well-being.

Constraints: High staff turnover, access to training, work overload, unpaid remuneration, and diminished health worker motivation.

Vaccine demand & acceptance

Enablers: Involvement of political and community leaders and professional societies, proactive engagement and social listening, enhancing health worker comms skills, strong partnerships

Constraints: Misinformation, low investment in community engagement, restriction of vaccination to priority groups, health worker hesitancy, and need for additional behavioural studies



There were several limitations to the analysis. Since the sole data source for the review was the country-prepared reports, this limited the ability to determine links, enablers and root causes underlying the best practices and challenges. The primary objective of the evaluation was to enable the country to reflect on what worked well and did not during the initial phases of the vaccine rollout. The reports only briefly summarised the outcomes and did not capture the details discussed over several days. In addition, in some reports the same issue was mentioned as both an enabler and a challenge with inadequate detail to determine which aspects worked well and which did not. Hence, it was not often possible to determine the root causes of success or failure. Furthermore, since these reports were compiled at the national levels, what was reported might not fully represent the situation at the sub-national levels.

Conclusions: The results of this evaluation provide useful lessons and insights from the early phases of the COVID-19 vaccine rollout, with a few important caveats. While the lessons may provide useful insights that can inform the continuing vaccine rollout, the contextual changes that would have occurred during the intervening period since the reviews were conducted should be considered. Though the findings are presented under various thematic areas, there is strong inter-connectedness between the different thematic areas. Strong and committed political leadership was important in establishing strong governance structures, enabling inter-sectoral collaboration, and securing resources, all of which affected every thematic area. In addition, by leading by example, political and community leaders were able to build trust and improve vaccine uptake.

Several challenges were not specific to the COVID-19 vaccine rollout but reflected health system weaknesses in the country. Lessons from the H1N1 pandemic response in 2009 do not seem to have been applied since many LMICs continued to have difficulties in identifying the prioritised target groups,

which were the same for both pandemic influenza and COVID-19. The COVID-19 vaccination response would have greatly benefited if pandemic influenza National Vaccination Deployment Plans been updated, and adequate steps taken to prepare for pandemic influenza vaccination.

Finally, several countries used innovative approaches to improve vaccine rollout such as the use of mobile applications for pre-registration of clients, or the use of drones to deploy vaccines to remote areas. It will be important to document the impact of these innovative approaches to inform and optimize their use for pandemic and emergency preparedness as well as for routine vaccination.

Introduction

WHO promoted the use of Intra Action Reviews (IARs) to periodically review the various components (pillars) of the COVID-19 pandemic response¹. The purpose of this report is to summarise the good practices, enablers, and challenges during the early phases of the COVID-19 vaccine rollout and document the lessons identified to date, as indicated by the country IAR reports. The report also aims to promote cross-learnings and inform the policy and strategy changes and the technical assistance requirements of LMICs to scale up and optimize vaccine implementation.

A country COVID-19 IAR refers to an activity conducted by a country to provide an opportunity to share experiences and collectively analyse the ongoing in-country COVID-19 response by identifying challenges and best practices. It is a country-led, facilitated process conducted during the COVID-19 outbreak, bringing together a group of COVID-19 responders with knowledge of the public health response pillars under review. Standardised tools and templates were provided to conduct the IARs and WHO provided technical support to conduct the reviews. Since vaccination was an important component of the COVID-19 pandemic response, there was a conscious effort to promote a focused review on this pillar. Benefits of focused review versus a comprehensive multi-pillar review are explained in an addendum to the IAR guidance published in April 2021². Tools were developed to evaluate the vaccine pillar of the COVID-19 pandemic response, including a database for trigger questions to facilitate a discussion and templates for notetaking and for preparing a final report³. WHO supported the conduct of IARs of the vaccine pillar, also referred to as the mini COVID-19 vaccine post-introduction evaluations (mini c-PIEs), in LMICs. Reports from these evaluations were prepared using the standard template and shared with WHO.

This report synthesises and summarises the findings of a representative set of mini c-PIE reports. It complements a WHO global analysis of COVID-19 IAR, which analysed IAR report findings from all 13 public health response pillars, including the vaccination pillar. The WHO global analysis took a different angle by documenting how governments globally leveraged existing systems and resources, innovated new solutions and strategized their response when faced with common challenges experienced by all countries during the pandemic. In addition, the WHO report also examined countries' perspectives on how the COVID-19 IAR was customised to fit their needs, as well as the value and impact of the IAR process on the COVID-19 response and beyond. In the WHO report it is also clearly mentioned that the solutions identified in one country might not always apply to another country, given each country's unique contexts and settings. Therefore, individual strategies taken by respective countries should be

¹ Tool 12. Conducting effective online COVID-19 intra-action reviews during the pandemic - <https://www.who.int/publications/i/item/conducting-effective-online-covid-19-intra-action-reviews-during-the-pandemic>

² Guidance for conducting a country COVID-19 intra-action review (IAR): Addendum 1 - 28 April 2021 <https://www.who.int/publications/i/item/WHO-2019-nCoV-Country-IAR-add.1-2021.1>

³ Evaluation of COVID-19 vaccine introduction - <https://www.who.int/tools/covid-19-vaccine-introduction-toolkit/#Evaluation%20of%20COVID-19%20vaccine%20introduction>

used more as a reference or to inspire new ideas rather than be misinterpreted as formal guidance endorsed or recommended by WHO.

AIM OF THIS REPORT

Document the countries' collective experience during the initial rollout of COVID-19 vaccines, to identify good practices, challenges, and lessons that may be used to inform the scaling up of the ongoing COVID-19 vaccination response and enhance preparedness for future pandemic and epidemic vaccination response.

OBJECTIVES

To review the reports of the mini c-PIEs conducted during the early phases of the COVID-19 vaccination rollout to:

- Compile the good practices, enablers, and challenges during the early phase of the COVID-19 vaccine rollout.
- Document the lessons learned from the COVID-19 vaccination rollout efforts to date, in order to inform actions required to improve the implementation of COVID-19 vaccination.

Methodology

SCOPE OF ANALYSIS

The authors conducted a qualitative analysis of 15 complete mini c-PIE reports that were available for review with the aid of the MAXQDA20™ software. These mini c-PIEs were conducted between April and December 2021.

Qualitative research enables examination of the “why” and “how” of research questions and can provide additional understanding and insights often not available with quantitative methods. A hybrid approach of inductive and deductive thematic analysis was undertaken. A template approach for the deductive analysis was used whereby a reference codebook was developed to analyse what did or did not work in each of the eight pillars of the mini c-PIE framework (thematic areas) i.e., the enablers and challenges. The thematic areas reflected the National Deployment and Vaccination Plan (NDVP) categories i.e., planning, coordination, financing & service delivery; regulatory preparedness; supply chain & waste management; human resource capacity; vaccine acceptance & demand; vaccine safety monitoring & response; and monitoring & evaluation. Since planning, coordination, financing, and service delivery were closely interconnected, they were merged into a single thematic area. To note, the report extracts classified as “challenges” were those that countries felt did not work or impeded implementation, whilst those classified as “enablers” provide insights into what countries deemed as good or best practice and facilitated implementation.

Inductive codes were assigned to segments where new themes emerged. The deductive and inductive coding in MAXQDA20™ was undertaken by an experienced qualitative researcher. During the process of reviewing and coding the mini c-PIE reports, several discussions were held between the coder and the advisory team to clarify unclear concepts, definitions and reported experiences. Alongside the coder, the interpretive phase was conducted by the MMGH project team who had provided technical assistance to LMICs in conducting the mini c-PIEs.

The reports included in the review were selected based on availability, the willingness of countries to share, and to provide maximum possible representation from the various WHO regions. Reports from the

following countries were analysed: The African Region: Botswana (BWA), the Democratic Republic of Congo (COD), Ghana (GHA), the Gambia (GMB), Guinea-Bissau (GNB), Mozambique (MOZ), South Sudan (SSD), Uganda (UGA) and Zambia (ZMB). The Region of the Americas: The Plurinational State of Bolivia (BOL) and Country X⁴ (CoX). The Eastern Mediterranean Region: Somalia (SOM) and the Syrian Arab Republic (SYR). The Southeast Asia Region: Bhutan (BTN). The Western Pacific Region: Lao People's Democratic Republic (LAO).

The reports largely followed the standardized mini c-PIE reporting template developed by WHO except for LAO where a detailed slide presentation was used for the analysis.

⁴ Formal approval to name the country is still pending

Key Findings

This section summarises the areas that countries reported as having worked (enablers) and those that did not work (challenges). The findings are organised according to seven thematic areas that closely match the pillars in the NDVPs. It is to be noted that **the enablers and challenges were not mutually exclusive but are, in fact, quite interconnected** as is apparent when one reads the individual thematic area findings. The reports indicate that while several factors enabled vaccine rollout, their effectiveness or impact was impeded by several challenges. The reports mainly included the plans, strategies or actions that worked well or did not work well. Though some mini c-PIE reports may not have specifically stated whether some plans, strategies or actions did or did not work well, we assume that this does not imply that they were not employed. While the mini c-PIE reports did list the actions that each country would take in response to the findings, these were very context-specific and not analysed in detail, though it was evident that the conduct of the mini c-PIE did provide insights and lessons that informed future actions. The reports do not, however, provide information on whether, or the extent to which, the recommended future actions were implemented and what the impact was.

The heatmap below presents the *challenges* and *enablers* in the seven thematic areas. It indicates the number of instances where the thematic area was mentioned as an enabler or challenge in the country's vaccination response to COVID-19. The colours are presented as a gradient: green is the least frequently mentioned, gradually increasing over to yellow, with orange/red indicating the most frequently mentioned issues in the respective reports, whether as an enabler or as a challenge.

For example, across all countries, planning, coordination, financing & service delivery is mentioned most frequently as both a challenge and an enabling factor. Whilst UGA, ZMB, and MOZ considered this thematic area as a challenge; BWA, GHA and BOL considered it to be an enabling factor. Similarly, regulatory preparedness was least frequently cited as either a challenge or enabling factor.

The heatmap may include some double counting; consequently, it should be viewed as a rough indication of the frequency of enablers or challenges per country, rather than the extent of the problem within a country.

	BWA	COD	GHA	GMB	AFR GNB	MOZ	SSD	UGA	ZMB	SEAR BTN	WPR LAO	EMR SOM SYR		AMR BOL CoX	
CONSTRAINT															
Planning, Coordination, Financing & Service Delivery	12	16	8	14	11	27	16	53	31	9	23	15	23	25	4
Regulatory Preparedness	1	0	0	3	1	0	0	5	0	0	1	0	0	0	0
Supply Chain & Waste Management	3	0	5	5	2	4	0	12	1	1	11	0	4	6	2
Human Resource Capacity	3	6	2	3	0	3	0	9	5	1	6	0	10	4	10
Vaccine Demand & Acceptance	3	3	6	11	3	6	9	22	7	1	8	7	6	2	0
Vaccine Safety Monitoring & Response	4	7	5	14	0	4	4	21	8	2	13	1	2	2	1
Data & Monitoring	13	2	12	6	6	5	3	10	11	3	6	2	2	8	0
ENABLER															
Planning, Coordination, Financing & Service Delivery	30	9	31	10	8	11	9	8	12	13	16	4	10	34	6
Regulatory Preparedness	2	0	0	3	1	0	0	1	1	0	5	1	0	7	0
Supply Chain & Waste Management	2	4	4	5	0	1	0	1	4	3	6	1	3	12	6
Human Resource Capacity	3	0	2	3	0	2	0	2	6	0	3	2	4	4	8
Vaccine Demand & Acceptance	3	5	13	8	3	4	3	7	9	7	10	2	3	14	0
Vaccine Safety Monitoring & Response	7	7	10	7	1	1	4	1	3	6	7	2	6	14	6
Data & Monitoring	2	1	7	2	2	4	0	1	8	7	6	1	3	9	1

Legend

Green less frequently mentioned; red most frequently mentioned



Table 1. Frequency of what worked (enabler) and did not work (challenge) in each thematic area

WHO Regions: AFR= Africa, AMR= the Americas, EMR=Eastern Mediterranean, SEAR=Southeast Asia, WPR=Western Pacific

Country ISO Alpha-3 codes: BOL (Bolivia, Plurinational State of); BTN (Bhutan); BWA (Botswana); COD (Congo, the Democratic Republic of); CoX (Country X); GHA (Ghana); GMB (The Gambia); GNB (Guinea-Bissau); LAO (Lao People’s Democratic Republic); MOZ (Mozambique); SOM (Somalia); SSD (South Sudan) SYR (Syrian Arab Republic); UGA (Uganda); ZMB (Zambia);

**PLANNING,
COORDINATION,
FINANCING &
SERVICE DELIVERY**

All countries reported developing a NDVP for COVID-19 vaccination based on the WHO guidance. For countries that benefited from the COVAX Advance Market Commitment (AMC) supply of vaccines, this was a requirement, and the quality of the plans was assessed by the respective Regional Review Committees before vaccine doses were allocated. However, the mere presence of a plan did not guarantee country readiness and optimal rollout of vaccination and several enabling and constraining factors were reported in the mini c-PIE reports.

Enabler: Financed NDVP Plan, with identified sources of funding and fund monitoring mechanisms

All countries had developed and costed their NDVPs, though the methods for estimating cost and for budgeting varied in their robustness. BTN and ZMB reported conducting simulation exercises and used the outcomes to improve their operational plans.

Several countries reported that their NDVP was fully funded through domestic resources, grants or loans from the World Bank, international agencies, or from development partners and the pooling of resources from different sources (BOL, BWA, GMB, GHA, SYR).

A few countries reported having put monitoring of funds in place to ensure proper utilisation (BOL, SOM). The Ministerial Office in BOL helped to mobilise resources to implement the vaccination plan and implemented an austerity policy to optimize the use of funds.

Enabler: Establishment of clear governance and coordination structures, with coordinated partner & stakeholder support

Several countries reported that the establishment of governance and coordination structures enabled vaccine implementation. Clear national structures such as a National Task Force or Technical Working Group (TWG) enabled oversight and coordination of vaccine rollout (BTN, BOL, BWA, GMB, GHA, GNB, LAO, MOZ, SSD, ZMB).

Regular meetings among the national, provincial, and district level management groups were reported as having facilitated vaccine implementation (BTN, BWA, GHA, LAO, MOZ, UGA). Such meetings enabled identification of technical assistance and financing needs at the subnational levels and ensured that the resources were allocated and distributed.

"Appointed liaison officers for all the districts as a constant communication and technical link between national and implementing districts". - BWA

"Scheduling vaccination for the indigenous population, representing different nations or native indigenous and rural populations, who live in areas that are difficult to access, with communication and intercultural barriers." – BOL

Coordination of partner and stakeholder support was another enabling factor noted in several reports (LAO, GHA, MOZ). In COD and BWA, private sector health providers were involved in service delivery.

Enabler: Selection of priority groups for vaccination at the outset

Several countries reported that the identification of priority groups to be targeted for vaccination based on the advice of their respective National Immunisation Technical Advisory Groups (NITAGs) enabled planning (BWA, BOL, COD, GMB, GHA, LAO).

In COD, provinces were prioritised for vaccination, based on risk and to ensure equity.

The phased approach to vaccination, starting with the highest risk groups, facilitated planning, allocation of resources, and logistical support to reach these target groups (COD, MOZ, SYR, UGA).

Enabler: Development of district-level micro plans and vaccination strategies, aligned with NDVP

The development of district micro plans (that mapped the target populations, vaccination sites, and vaccination strategies) enabled allocation of adequate supply of vaccines and human resources, and improved service delivery in some countries (LAO, UGA).

Vaccination sites were established at different locations such as correctional facilities, military health zones, mining sites, police camps, and COVID-19 treatment centres. Outreach sessions and mobile teams were used to enable easy access to vaccination (BTN, BOL, BWA, COD, GHA, MOZ, SYR)

Challenge: Un-funded NDVPs, lack of operational funds, incomplete budgets, and fund disbursement challenges

"Lack of budgeting for procurement of waste management supplies" – MOZ

The lack of a costed NDVP with identified funding hampered the process for mobilising resources for the various components of the COVID-19 vaccination response in ZMB. Even though NDVPs were costed, and budgets developed, funds to cover operational costs were often not adequate (BOL, COD, GMB, GNB, LAO, SOM, UGA). Consequently, planned activities could not be optimally conducted or conducted within the desired timelines. The constant re-adjustment of target groups and vaccination strategies affected the budgets. In addition, several items were not adequately budgeted for (BOL, BWA, GHA, MOZ, SSD, ZMB).

Government contribution to operational costs was reportedly low in some countries, increasing dependency on external resources (COD).

"However, the protocols involved in the release of the funds made it difficult to access the funds. Consequently, the NDVP planned activities were not adhered to during COVID-19 vaccination" – GMB.

Even when funds were available, countries reported that the procedures for the release and disbursement of funds made it difficult to access the funds in a timely manner at the lowest implementation levels (BOL, GMB, GNB, LAO, SOM, SYR, UGA). The delayed release of funds affected all aspects of vaccine delivery and led to delayed remuneration of health workers, affecting their motivation.

Some of these delays in allocation and disbursement of funds were related to issues outside the control of the Ministries of Health, as evidenced in BOL where the suspension of the mayors' and governors' budgets in the pre- and post-election period made it difficult to start the vaccination process.

Lack of, or partial compliance, with subnational responsibilities in financing the vaccination activities also reportedly affected the vaccine rollout in BOL.

"We observed multiple reporting lines for the planning and coordination pillar (e.g., to Strategic meeting, NITAG, IMT, NTF, TCC & ICC); and our planning and coordination did not properly engage the private sector, VHT, and community leaders and these have negatively affected uptake of COVID-19 vaccination roll-out" - UGA

Challenge: Limited stakeholder engagement, poor collaboration within governance structures and inadequate communication

In some countries, not all stakeholders were involved in planning and coordination and there was poor collaboration between the groups coordinating the different pillars of the COVID-19 response (COD, UGA). Weak coordination and collaboration across COVID-19 vaccination partners was reported in other countries (GNB, MOZ, ZMB).

Inadequate communication between the national and subnational levels was reported in COD, whereas in UGA, lack of engagement of the subnational levels in developing budgets was reported.

Challenge: Changing / evolving situation and short timelines

Bureaucratic procedures often led to delays, for example, in securing the signed indemnity agreements to permit the allocation and shipment of vaccines.

The rapidly evolving pandemic, erratic vaccine supply and changing policy recommendations also affected operations (BTN, GMB, LAO, UGA). For example, the receipt of vaccines with very short shelf-life, uncertain shipment timing, and short timelines for training health workers on the vaccine product that was allocated and shipped were issues that negatively affected the implementation of vaccination plans.

Challenge: Service delivery challenges

Two countries reported that no micro plans existed at the subnational levels (COD, ZMB). Even where plans were available, the reports

"Frequent changes in the directives and from different sources (PMO, MoH, Districts) on COVID-19 vaccination has confused people at the grass root level and as well as the vaccinators in the field" - BTN

suggested that planning was not optimal. In UGA the lack of a “functional” micro plan was noted as a challenge.

The definition and estimation of the prioritised target population was a challenge reported in UGA. In other countries, adherence to vaccination of the prioritised target groups was weak (BWA, MOZ, SYR).

In some countries, the private facilities were not involved in service delivery, which was a missed opportunity to scale up vaccination more rapidly (COD, GMB, UGA). In others, inadequate number of vaccination sites in certain districts were reported (COD, LAO, SOM, UGA). In COD, there were no strategies to reach special populations such as refugees, internally displaced persons, and populations living in certain crowded environments such as correctional facilities, military camps and homes for the aged; though vaccination sites were established in a few correctional facilities and military zones this was not available throughout the country. Vaccination of people with mobility issues was expensive and resource-intensive and negatively affected the delivery of other routine health services (BTN).

Planning and coordination committees in a few countries did not fully engage with the private sector providers, village health teams, and community leaders which affected vaccine rollout (GMB, UGA).

The opening hours of the vaccination sites were not convenient for city populations in BOL, impeding vaccine uptake; whilst COVID-19 travel restrictions also impeded service delivery in LAO. The multiple vaccine types available and population preferences for certain products created service delivery challenges in SYR.

Specific vaccination sites selected to exclusively provide a specific vaccine or dose (e.g., some sites only provided 1st dose exclusively while others provided 2nd dose exclusively in the case of Astra Zeneca) posed challenges in access to vaccines. Second doses administered away from initially planned outreach/mobile sites resulted in hesitancy in ZMB.

Weak monitoring of vaccination at the central and provincial levels was reported in a few countries (MOZ, SOM). For example, the planned end-of-day reviews to assess performance were not fully implemented and/or outcomes were not reported back to the central level.

Challenge: Competing vaccination priorities

Competing priorities also impeded the optimal implementation of COVID-19 vaccination plans in several countries (BOL, GMB, SOM, UGA),

e.g., response to circulating vaccine derived poliovirus (cVDPV) in environmental samples in UGA, and HPV vaccine introduction in GMB.

REGULATORY PREPAREDNESS

"WHO issued a guidance document for manufacturers "Points to consider for manufacturers of COVID19 vaccines" which assisted respective applicants and evaluators on critical aspects that had to be submitted for products to be considered for emergency use listing (EUL)" - BWA

Regulatory approval was a pre-requisite for the procurement and deployment of COVID-19 vaccines. For vaccines obtained through the COVAX facility, vaccine doses were only shipped to the countries after confirmation that the country had in place regulatory authorisation, usually an Emergency Use Authorisation from the National Regulatory Authority (NRA). WHO had provided guidance on expedited regulatory approval, including reliance on WHO Emergency Use Listing (WHO EUL). Countries in Africa also received support through the African Vaccine Regulators Forum (AVAREF). Approval for import of the vaccines was an additional requirement.

Enablers

Most countries were able to secure timely regulatory approval and import authorisation. Existing policies and best practices for assessment of products during public health emergencies enabled countries to secure timely approval.

The flexibility of the regulatory frameworks on an exceptional basis, without compromising the scrutiny of the vaccines, was reported as an enabler in BOL.

The availability of WHO guidance facilitated the process as illustrated in the quote (left).

Challenges

Few countries reported any major challenges with securing regulatory approval or import licenses for the vaccines. However, BWA did report that they faced some challenges since the WHO assessment reports were not available for sharing at the time their NRA was conducting the regulatory approval.

SUPPLY CHAIN & WASTE MANAGEMENT

The capacity to store and transport vaccines, monitor and manage stock at all administrative levels, and to safely dispose waste including the safe disposal of personal protective equipment, was critical to the success of the COVID-19 vaccine rollout. Several factors facilitated the availability of the right quantities of vaccine stored and transported at the right temperatures at all levels up to the vaccination points.

Enabler: Proper and timely supply chain planning

Proper and timely supply chain planning, operational support, and the provision of guidelines enabled the safe and timely deployment of vaccines and other supplies, and waste disposal (COD, CoX). Planning and coordination also enabled timely clearance processes from the point of arrival into the country to enable speedy deployment of vaccines (BOL, GHA, ZMB).

Choosing vaccines based on the storage temperature requirements and the vial size was important and enabled the appropriate storage and transport of vaccines in GMB.

Enabler: Adequate and multi-country level storage capacity

Adequate capacity to store vaccines at all levels was reported in several countries (BOL, COD, GMB, MOZ, SYR, ZMB).

Updated cold chain inventories ensured that there was adequate cold chain capacity at all levels in BOL, whilst adequate planning enabled the timely acquisition of ultra-cold chain equipment (UCC), refrigerated trucks, and other cold chain equipment for the optimal storage and transport of vaccines in CoX.

In UGA, a nationwide assessment of the cold chain storage capacity and weekly temperature monitoring and reporting from the districts ensured that there was adequate capacity and temperature management.

Enabler: Use of varied transport options to reach remote areas

Helicopters were used in BTN and drones in GHA to ship vaccines to remote areas with poor road connectivity; while in BOL, a strategic alliance with Boliviana de Aviacion (the flag carrier airline of Bolivia wholly owned by the national government) and the National Police enabled vaccine distribution and security.

Enabler: Trained personnel

The availability of trained personnel to manage vaccines and supplies was another enabler reported by countries, particularly BOL and GMB.

Enabler: Closely monitored stock levels

Monitoring and redistribution of supplies between regions and health facilities reduced wastage of vaccines in GMB and LAO.

BTN reported using their Logistics Management Information Systems (LMIS) for real time gathering and analysis of data.

Enabler: Centralized waste management process

In LAO, the engagement of a private waste management company at the central level facilitated timely disposal of waste.

Challenge: Distribution plans not widely shared

In UGA, the vaccine distribution plans were not shared with all stakeholders at the district level and most districts had not developed distribution plans as recommended by the national level. Furthermore, the need to increase vaccine uptake led to an increase in vaccination sites which were not initially planned and led to logistical challenges.

Challenge: Deployment of multiple vaccine products

The multiplicity of products with different presentations, storage requirements, and shelf-lives, and uncertainty about which product would be available at what time made it very challenging to ensure proper storage and stock management (BOL, LAO, GMB, SYR). As a result, despite the availability of adequate human resources and cold chain capacity, stock reporting, vaccine management and handling were challenging.

Challenge: Lack of functional cold chain equipment

The lack of equipment at the subnational levels limited the country capacity to use vaccines that required UCC. It took several months for additional cold chain equipment to become available (GHA, SYR).

The lack of availability of electricity at the lower administrative levels created high dependency on solar direct drive refrigerators, creating challenges (SYR).

Poor documentation of functional and non-functional cold chain equipment was reported in UGA.

Challenge: Transport shortages

Transport shortages particularly in hard-to-reach areas was a challenge reported in BWA, while in GHA the unavailability of refrigerated vans at the regional level and inadequate funding caused transportation challenges.

Inadequate fuel for vaccine deliveries was reported in GMB.

UGA reported the absence of temperature monitoring during transportation from the district level to the vaccination sites, leading to suboptimal reporting of temperature excursions.

Challenge: Stock levels not updated on a timely basis

Several countries in the African region reported challenges in monitoring and managing stock levels. In UGA, daily updates on vaccine utilisation and stock levels were not available to inform operational decisions. In ZMB, the electronic LMIS had not been rolled out to the service delivery

points leading to challenges with stock management and visibility, and in GMB while there were adequate human resources, stock reporting and management was reported to be a challenge.

Challenge: Human resources-related challenges

In UGA, the district cold chain training was poorly attended and resulted in information gaps and suboptimal practices while in BOL and BWA, insufficient manpower was a challenge.

Challenge: Limited waste management capacity

The capacity for waste management was an issue reported by several countries, including lack of waste management facilities in some regions (GMB, GHA, LAO, MOZ), and insufficient information on waste management at the vaccination sites (LAO, UGA). In UGA, while waste management guidelines were developed, they were not disseminated, and training was not implemented resulting in gaps in waste management practices.

**HUMAN RESOURCE
CAPACITY**

Adequate numbers of trained and motivated health workers are key to a successful vaccine rollout. The health workers may need special training, especially when surge capacity requires drawing in health workers who are not normally involved in vaccination. Going forward, as vaccine supplies improve and there is a need to accelerate vaccine delivery, having an adequate, motivated health workforce will be critical. As with the other thematic areas, several enablers and challenges were reported by countries in their reports.

Enabler: Availability of adequately trained human resources

"The Zambia COVID-19 Vaccination Pillar heightened surge capacity through the utilization of newly graduated Health Care Workers and support staff who served as volunteers as well as secondment of staff from partner organizations. This helped to improve the Human Resources component of the response". - ZMB

Several countries reported that the availability of adequate human resources in the early phases of the vaccine rollout enabled vaccine management (BOL, BWA, CoX, GMB, GHA, LAO, MOZ, SOM, SYR, ZMB). In LAO, health workers who were initially hired for other aspects of the COVID-19 response were reassigned to support vaccination as vaccine supplies became available. In CoX, health workers were hired using varying processes and efforts were made to assign permanent positions to temporary staff. In SOM, human resources in existing health facilities were supplemented with additional surge capacity from the private sector and non-governmental organisations. In SYR, health workers were redistributed according to needs.

In MOZ and BOL, those without a health background were hired to carry out pre-registration and to support data entry and reporting, allowing the health workers to focus on vaccination. ZMB also reported mobilising surge capacity using different modalities as stated in the quote from the report (left).

Enabler: Provision of timely virtual training sessions

Health workers and community mobilisers were rapidly trained (GMB, LAO). Many countries reported having conducted training using virtual training platforms (BOL, BWA, GHA, LAO, UGA, ZMB), while others used the more conventional in-person and cascade training (CoX, SOM). In CoX, simulation exercises were used to supplement training and used digital media and virtual platforms for the timely dissemination of updates.

In GHA, the availability of electronic conferencing facilities and personal electronic devices facilitated rapid training at low cost, whilst in SYR, funds were made available to meet the expansion of training as needs arose.

Enabler: Ensuring the well-being of staff

In addition to providing training, CoX reported taking additional measures to ensure the well-being of their staff and maintain motivation including the provision of health insurance to cover for any illness, and a good working environment, e.g., food boxes, air-conditioned cabins, and relaxing music. Staff were also remunerated for extra hours of work.

Challenge: Lack of adequately trained human resources, high staff turnover and inadequate supportive supervision

In COD, inadequate numbers of health staff at all sites was reported. Though there was a gradual increase of health staff at all administrative

levels, not all staff needs were fully covered in some countries (BWA, CoX, SYR). A high staff turnover was reported in SYR, and several countries reported inadequate supportive supervision of the front-line health workers.

Challenge: Difficulties in accessing training sessions

*"...poor knowledge of health workers in implementation resulted in missed population and absence of functional micro plan in use because of their inability to take part in virtual trainings"
- UGA*

The instability or lack of access to internet services affected participation in the virtual training in several countries (GHA, LAO, MOZ, ZMB). The lack of personal contact impeded the provision of practical training, addressing doubts about vaccines or vaccination in LAO, and securing the undivided attention of the participants in GHA. In UGA, some of the health workers were unable to participate in the virtual training which was held before they were on-boarded. In ZMB, the quality of the virtual training was of variable quality whilst in UGA, deficiencies in training were evident in gaps in knowledge, missed populations and absence of a functional micro plan.

Challenge: Diminished health worker motivation

In GMB and SYR, health worker motivation was reportedly low because of non-payment of allowances. Delays in transfer of incentives or the low level of the incentive for health workers at the subnational level affected motivation in LAO. Health workers in SYR were reportedly overwhelmed with multiple tasks that affected their motivation.

In UGA, the lack of operational funds in the initial phases of vaccine rollout reportedly dampened the morale of health workers, whilst CoX reported not having trained staff to provide psychological support to health personnel to address stress and fatigue and mitigate the risks of programmatic errors.

VACCINE DEMAND & ACCEPTANCE

Community acceptance and demand for COVID-19 vaccine was an important contributor to the uptake of vaccines in most countries, including in the LMICs where the mini c-PIEs were conducted. The review of the mini c-PIE reports indicated several enablers and challenges related to vaccine acceptance and demand that affected vaccine uptake.

Enabler: Involvement of political, religious, and community leaders

Several countries that made COVID-19 vaccination a political priority seemed to have done well in this regard, particularly the involvement of the Heads of State and other political leaders who took the first

vaccination shots in public (BTN, BOL, GHA). Periodic public statements to the public from the political leadership were reported to have had a positive effect on vaccine acceptance and demand (BTN, LAO, UGA).

Several countries also used religious, community and opinion leaders to advocate for COVID-19 vaccination (LAO, SOM, ZMB).

Enabler: Use of professional societies, civil society organisations, and medical professionals

Medical professionals are a trusted source of information, and their engagement had a positive influence on vaccine acceptance.

The use of professional societies, civil society organisations and medical professionals outside the Ministry of Health was an enabling factor that was also reported (BOL, COD, ZMB),

UGA reported national level stakeholder engagement with the leadership of cultural and professional bodies to establish a pool of vaccine advocates and ambassadors.

Enabler: Use of a proactive communications and community engagement plan

Several countries reported having developed a communication and community engagement plan that contributed to improving vaccine demand and acceptance (BOL, GMB, LAO, MOZ, SSD, UGA, ZMB).

In GMB, the Directorate of Health Promotion and partner agencies embarked on intensive community engagement to create demand for the vaccine. Television clips and radio jingles were developed and aired and talk-shows conducted. In GMB, an “immunisation caravan” was employed to mobilise community members for the vaccination. The establishment of a toll-free help line to disseminate information was also reported to have had a positive effect on vaccine acceptance in the country.

GHA reported the development of a National Communication Blueprint for COVID-19 activities that improved demand and acceptance and provided policy direction to all levels of the health system. Regular meetings were held at the national, regional and district levels to facilitate the dissemination of information to key stakeholders and engage them in risk communication. A dashboard was established for the provision of real-time information to the public.

Several countries used evidence from studies on the Behavioural and Social Drivers of vaccine acceptance to inform the design of their plans and the development of appropriate messages (GNB, SSD, UGA, ZMB).

Enabler: Proactive engagement with the media

"Use of existing integrated community mobilization network (ICMN) in all states for sustained messaging to target audiences using the messaging developed in consultation with the Risk Communication and Community Engagement (RCCE), EPI and COVAX technical working groups". – SSD

Proactive engagement with the media was another strategy that was reported to have worked well in some countries in improving community demand and acceptance (BTN, BOL, BWA, SOM, ZMB). ZMB reported using multiple channels, including electronic, social, and print media to track, gather and disseminate information.

Enabler: Proactive social listening and management of misinformation

Proactive social listening and the timely management of misinformation was also reported as an enabler in several countries (BOL, BWA, COD, GHA, MOZ).

GHA reported the establishment of a misinformation and rumour management taskforce and in SOM the Minister of Health used social media platforms for technical briefings.

Enabler: Improving health workers' skills in communication and social mobilisation

BTN and SYR reported that training communication personnel and improving their skills was an enabling factor.

Enabler: Establishing strong partnerships

Establishing strong partnerships with international agencies, Civil Society Organisations, and Development partners enabled several countries to implement effective communications and demand creation strategies (BWA, GMB, GHA, UGA).

Challenge: Limited vaccine shelf-life, vaccine stockouts and requirement to provide indemnification

The requirement for countries to sign agreements releasing the vaccine manufacturers from indemnification resulted in reduced vaccine acceptance and demand in GMB. The absence of clear communications as to why such agreements were required created misperceptions about the quality of the vaccines that were developed and authorised within a very short timeframe.

The short shelf-life of vaccines and reports of vaccines having passed their expiry dates also raised concerns and fuelled hesitancy in some countries (GMB, GHA, LAO, MOZ). In addition, the stockout of vaccines was reported to have affected vaccine demand in UGA.

Challenge: Low investment in community engagement

In MOZ, low investment in community engagement and in social mobilisation was reported as a constraining factor.

Challenge: Misinformation and disinformation in the social media

The negative messages, misinformation, and disinformation in the social media reportedly decreased vaccine acceptance (BWA, LAO). While countries did take measures to monitor the social media messages and respond with positive messages, several countries reported the lack of capacity to keep up with the misinformation and respond in a timely manner.

"Restriction of vaccines to pre-determined priority groups created community concerns" – UGA

"Hesitancy of health workers, whom the community relies on as the most trusted source of health information. Their negative attitude and actions spoke millions of words." – UGA

Challenge: Restriction of vaccination to priority groups

The restriction of vaccination to pre-determined priority groups reportedly raised concerns about the safety of the vaccines and negatively impacted vaccine uptake in UGA.

Challenge: Health worker hesitancy

Noteworthy is vaccine hesitancy amongst health care workers, often the most trusted and influential persons in the community providing medical advice. This reticence among health workers seemed to have negatively and deeply impacted community acceptance as well as the planning, coordination, and service delivery components.

Challenge: Studies on Behavioural and Social Drivers of vaccination

While several countries reported using evidence from studies on the Behavioural and Social Drivers affecting vaccine uptake, at least one country (UGA) reported the need for additional operational research to address the multiple barriers to vaccine uptake.

VACCINE SAFETY MONITORING & RESPONSE

Since the available COVID-19 vaccines were developed within a short time frame with some of them using novel platforms, there were questions about the safety of these vaccines. Though the clinical trials generated safety information that supported the provision of Emergency Use Authorisation, there were inadequate data on rare adverse events and long-term safety. Hence, it was important to have robust surveillance for adverse events following immunisation (AEFI), investigate any serious adverse events (SAE), assess whether they were causally related to vaccination, and to implement robust risk communication plans to allay fears and maintain public trust. As with the other thematic areas, there were several areas where plans were formulated and implemented appropriately; however several challenges were also reported in the reports.

Enabler: Existence of surveillance systems and AEFI committees

Several areas reportedly worked well and enabled vaccine uptake. Among these, the existence of vaccine safety surveillance systems and AEFI committees at the national and regional level were identified as enablers by several countries (BTN, BWA, GMB, GNB, LAO, MOZ, ZMB).

"Agreements between public/private Universities and the Ministry of Health to carry out investigations" - BOL

A few countries reported having conducted refresher trainings of the AEFI committees which enabled investigation and causality assessment (BTN, BWA, GMB) and BOL reported engaging experts from universities to assist with investigation and causality assessment of SAEs.

Enabler: Adequate AEFI reporting

Training of health workers, the sensitisation of vaccine recipients and their relatives to report AEFI, and the use of electronic systems to capture safety data were enablers for ensuring adequate reporting of adverse events (BOL, GMB, SYR).

GHA and LAO reported using multiple channels for reporting safety issues. The establishment of a multi-disciplinary team at the national level and AEFI focal points at the subnational levels, standard operating procedures, and the use of digital tools reportedly enabled AEFI reporting and response in GNB.

Enabler: Well-run AEFI management

A few countries reported that suspected AEFI were well-managed at the health facility level (BTN, BOL, GMB).

Some countries reported the deployment of medical experts, including NITAG members, at the vaccination sites to manage any immediate serious AEFIs (BTN) or establishing agreements with universities to investigate and manage AEFI (BOL).

COD reported the provision of free treatment of cases of SAE in designated health facilities while in BOL the medical care of SAEs was covered by the Universal Health Insurance and short-term insurance through a ministerial resolution.

COD, GMB, and BOL reported that mass vaccination sites were complying with the standards established for AEFI management and care whilst SSD reported supplying AEFI kits to all health facilities to manage such events.

"Suspected AEFI case were well managed at health facilities" - GMB

Enabler: Timely risk communication

The publication of safety updates during each phase of vaccine deployment on the FDA website in GHA reportedly enhanced public confidence in vaccines.

LAO reported the development of a risk communication plan in case of SAEs.

Challenge: Low-quality safety surveillance and systems

AEFI committees were not available in SYR.

Poor awareness and lack of community sensitisation of adverse event reporting reduced the quality of safety surveillance.

Though a reporting system using the DHIS2 platform was established in UGA, the system was not used adequately. In BWA, there weren't enough AEFI reporting forms at many vaccination sites.

Delays in completing and reporting the results of causality assessment were also reported (MOZ, ZMB).

Lack of financial resources and insufficient preparations to fully implement the planned activities in safety monitoring were reported in some countries (BOL, GHA, GNB, ZMB). Though lack of financial resources was not explicitly mentioned in other reports, it is likely that this also affected the quality of safety surveillance in other countries and contributed to some of the challenges listed in this section.

"Inadequate AEFI surveillance" – The Gambia
"Limited active safety monitoring activities and incomplete investigation of serious AEFIs" – LAO

Though safety surveillance was in place, surveillance quality hampered the activities of the AEFI committees in some countries (GMB, LAO, UGA, ZMB), whilst other countries reported that there was no system for active surveillance and monitoring of Adverse Events of Special Interest.

Challenge: Human resource challenges & knowledge gaps

Despite training, several countries reported knowledge gaps among front-line workers that led to difficulties in responding to AEFI (GMB, GHA, UGA, ZMB) resulting in inadequate documentation and reporting of AEFI.

Health workers were reportedly overwhelmed by the different tasks assigned to them and could not cope with the reporting requirements (SYR, ZMB). Staff shortages affected safety monitoring in MOZ and apathy of health workers towards safety monitoring was reported in GHA.

Challenge: Inadequate resources to enable AEFI management

"The AEFI reporting rate was low compared to the expected numbers. Many adverse events were not reported, mainly because the initial message given to healthcare providers was to only report serious events since other events were expected. This was contrary to the initial plan of collecting all events since the vaccine is new and a lot is yet to be known" - UGA

A few countries reported non-availability of AEFI kits at all vaccination sites (BTN, LAO, ZMB).

Challenges in conducting complete laboratory and radiographic investigation of adverse events to enable causality assessment was noted in UGA. Financial resources were reportedly inadequate for complete investigation of SAEs in BOL.

Challenge: Risk communication

There was an absence of adequate risk communication in LAO where reports on the occurrence of blood clots following the Adenovirus vector vaccines led to hesitancy in accepting vaccines during the early phases of vaccination.

Challenge: Lack of coordination

Lack of coordination between the AEFI committee and the National Communication Committee was reported in GMB.

DATA & MONITORING

The availability of timely and reliable data is critical to monitoring operations, informing operational planning, and optimising the rollout of vaccination. Unlike routine programme monitoring, during a pandemic reliable data are ideally required daily. Furthermore, the target groups for COVID-19 vaccination are not the same as those targeted in routine vaccination programmes, creating additional challenges. Countries used innovative solutions and leveraged available digital platforms to permit timely reporting and use of data, but also faced several challenges which provide important lessons not only for vaccination during the pandemic but can also be applied to non-emergency situations in vaccination and other health programmes.

Countries took extraordinary steps to improve the timeliness of reporting. For example, GMB reported achieving and sustaining 100% weekly reporting of immunization data at the national level and providing feedback from the national to the regional and health facility levels.

"Use of Bhutan Vaccine System (BVS) -web-based real-time data and AEFI reporting system - was the game changer in tracking real-time data and AEFI cases, follow up and management including referrals" – BTN

"The use of electronic data collection and management tools (such as DHIS2 Tracker) as part of the Vaccination Programme was critical in the implementation, reporting and decision-making processes. The tools made it possible to have continued (daily) monitoring of the country's COVID-19 Vaccination Programme using a dashboard. The tools helped to track vaccination coverage and client-level data, making it possible to disaggregate data based on tiers, occupation, gender, and geographical location" – ZMB

Enabler: Effective use of digital tools

Several countries reported using digital platforms for data reporting, management, and analysis.

BTN established the Bhutan Vaccine System – an electronic registration system to register the eligible population, implement pre-screening questionnaires, record immunisation data, and enable real-time reporting of AEFI. BTN also provided dedicated IT specialists to support the vaccination teams and assist with maintaining the system.

LAO reported implementing electronic registries, monitoring dashboards, and using QR codes for verification of vaccination.

MOZ reported piloting an electronic pre-registration system and the creation of the SIS-COV platform for data monitoring.

BOL reported the use of a nominal record system for COVID-19 vaccines, which was user-friendly, allowed incorporation of all eligible cohorts and permitted offline registration. The system also permitted the generation of a vaccination certificate with a QR code.

In GHA, a functioning dashboard was established to monitor vaccine uptake. The country also established an electronic registry and the use of QR codes for verification of vaccination status.

In GNB, an Open Data Kit (ODK) tool⁵ was used for data collection, while ZMB reported the deployment and use of the DHIS-2 Tracker for data collection and management at all health facilities. This system allowed both online and offline data entry.

Enabler: Timely training and regular feedback

Training health workers in data collection and providing regular feedback on gaps in reporting was a reported good practice in many countries in efforts to improve data quality (BOL, COD, CoX, GMB, GHA, LAO, SOM, SYR, MOZ, ZMB). A variety of methods were used for training and feedback, including online and virtual platforms. ZMB also provided an ICT help desk to support users at all levels.

The availability of existing electronic health infrastructure and human resource capacity was reported as an enabler in GHA.

⁵ <https://opendatakit.org/>

Challenge: IT-related challenges in using electronic data systems

GMB reported that poor archiving of completed data forms and the lack of electronic data management systems were an intractable challenge. Furthermore, the non-inclusion of COVID-19 vaccines in the Vaccine Visibility System, presumably a logistics management information system, constrained their ability to track and manage their vaccine stocks, representing a missed opportunity.

Though most other countries did use digital platforms to varying extents, they too reported challenges.

Unstable internet connection and low bandwidth, especially at the subnational levels, was a common theme across most of the countries (BTN, BWA, GHA, LAO, MOZ, SYR, ZMB).

Several countries reported a shortage of data entry devices for registration and data entry (BOL, BWA, COD, GHA, LAO, UGA, ZMB).

Both the above issues slowed down the registration process and created backlogs and overcrowding at the vaccination sites. It also slowed down data cleaning, analysis and making information available on data dashboards.

The unstable internet connectivity also impeded health worker training on the use of the electronic tools.

The lack of pre-testing of digital tools, the constant updating of target populations, and low user ownership of the digital platforms was reported in MOZ, whilst frequent changes in the vaccination and recording processes was a challenge reported in BTN.

The vaccination databases were often not linked to the databases of cases and hospitalization, representing a missed opportunity to plan and implement interoperable systems that would have facilitated the measurement of vaccine effectiveness and impact.

Changes in the security of vaccination cards led to parallel systems with a mismatch of serial numbers in GHA (see left panel).

Challenge: Lack of trained staff to use and maintain the data systems

The challenges faced with the digital systems themselves were compounded by the lack of trained staff to use and maintain the data systems.

"The introduction of new vaccination cards with enhanced security features while the campaign had already started. This resulted in the mismatch of the serial numbers on the new cards that were issued and the electronic records in the database" - GHA

Several countries reported inadequate numbers of trained health workers who could collect and report data (GHA, LAO, MOZ, SYR, UGA). In LAO, the shortage of health workers necessitated the use of volunteers who had limited training and orientation. The training of staff was itself impeded because of poor internet connectivity to conduct virtual training. The low level of digital literacy in the community also impeded the use of digital devices to access services (BWA).

Lack of funds for personnel providing supportive supervision, and problems enabling timely access to the IT helpdesks were also challenges that were reported.

LIMITATIONS OF THE ANALYSIS

By nature of being a secondary data source (reports), there were limits to the data analysis that could be conducted in this review in terms of determining links and root causes underlying the best practices and challenges. Mini c-PIE reports summarise the deliberations resulting from discussions between invited key stakeholders. Therefore, even if root cause analyses were conducted during the mini c-PIEs, the summary reports tended to be high level and focused on the recommendations to address challenges identified and did not document everything that was discussed. Hence, the reviewers could only assess what was reported, without the benefit of the content from the rich in-depth discussions held during the breakout and plenary sessions. Although stakeholders from subnational levels were included in many IARs, these reports were compiled at the national level and removed from the vaccination sites, what was reported might not be fully representative of the experiences at the subnational level and vaccination sites themselves.

Although the definition of “best practices” and “challenges” were provided in the IAR online training, the term “best practice” was used very loosely in the reports. Interpretation ranged from best practice meaning standard practice like having a vaccination plan, the existence of an AEFI committee, or having functional refrigerators; to more outstanding practices such as innovative approaches for distributing vaccines or delivering vaccines to special population groups.

A policy, operational strategy or implementation practice can have both intended and unintended effects. Some practices implemented were novel, for example the use of drones for distribution of vaccines and supplies. It was not possible to assess how these initiatives positively or negatively affected vaccine uptake and coverage.

Another limitation was that the data reflected the situation when the mini c-PIEs were conducted, ranging from 1 to 12 months (median 4

months) after the initiation of vaccination. During and following the review there would have been changes in policies, vaccine supply availability, financing and other elements that affect vaccine rollout.

All countries reported recommendations for actions to improve the vaccine rollout, but how useful these recommendations were, whether they were implemented, and their impact could not be assessed. Since the supply of vaccines was erratic during the initial phases and would have varied during the pre- and post-mini c-PIE periods, it was not possible to assess the impact of the evaluation of vaccine rollout based on changes in uptake rates alone, in the absence of further qualitative information on the changes in vaccine rollout.

Lessons & Insights

The results of this analysis provide useful lessons and insights from the early phase of the COVID-19 vaccine rollout. However, there are a few important caveats to remember when applying the lessons to other pandemic or outbreak situations.

These evaluations were carried out in the initial phases of the COVID-19 vaccine rollout, with the timeframe ranging from 1-to-12-month (median 4 months) after vaccine introduction. The vaccines had been developed and authorised at an unprecedented pace and their supply and availability at the time when these evaluations were conducted was erratic and uncertain. Several vaccines used novel platforms that had never been used before. The pandemic was in a state of evolution as were the policy recommendations on the use of the vaccines. Hence, there were legitimate concerns about the safety and effectiveness of the vaccines and uncertainty on the choice of product; recommendations on the use of the vaccines evolved as more information became available. All of these created dynamic operational challenges and affected the uptake of vaccination by communities. Hence, some of the lessons may not directly apply to the continuing vaccine rollout or even to future outbreaks or pandemics. On the other hand, some of the lessons may also apply to the routine delivery of vaccination and other health services.

While the findings have been organised under themes, as indicated earlier, they are not mutually exclusive. Instead, they appear to be strongly inter-connected. Without being repetitive in listing the many lessons that have emerged from the thematic analysis, this section aims to reflect on a few key influencers and inter-connected areas that merit attention.

Strong and continued political leadership

Strong political leadership impacted all phases of the vaccine rollout and was a critical factor for success. Strong political leadership enabled the establishment of strong governance structures, facilitated inter-sectoral collaboration, ensured adequate operational funding, simplified bureaucratic processes, and even contributed to building public trust in vaccination.

Planning, service delivery and vaccine uptake are strongly inter-connected

Each of these three areas, i.e., planning, service delivery and vaccine uptake, are strongly inter-connected. One of the lessons that emerged from the country reports is that if plans change continuously, it is difficult to allocate and distribute resources, conduct the appropriate micro planning, and ensure the quality of services. The quality of

services in turn affects the uptake of vaccines and influences community behaviour.

Instilling systems thinking into all aspects of planning is a critical component to successful implementation. The inter-relatedness of the different components of the health systems should be considered when developing operational plans.

One aspect that emerged from the country reports is that the prioritisation of specific groups for vaccination, while limiting access to others, created rumours and raised concerns about the safety of the vaccines, especially since the vaccines used novel technology platforms. This highlighted the need for strong timely communications and community engagement to explain the rationale for the prioritisation.

Health worker vaccine hesitancy that was observed during the COVID-19 pandemic was not unexpected. This dynamic was observed in the H1N1 influenza pandemic and is also an issue faced with seasonal influenza vaccination of health workers. Most LMICs do not implement seasonal influenza vaccination of health workers and may not have encountered such hesitancy before. Lessons learned from seasonal influenza vaccination of health workers could have been included in the guidance documents provided to LMICs, and applied in preparation both for COVID-19 vaccination and for preparedness for any pandemic since health workers are likely to always be a priority target for vaccination during any pandemic.

Systemic health system weaknesses need to be actively addressed

Many of the challenges that were faced by LMICs were not new and reflected existing health system weaknesses exacerbated by the pandemic. While innovations helped overcome a few of these systemic weaknesses, others persisted.

Not all countries had developed NDVPs to respond to the H1N1 pandemic, and very few of those that had NDVPs had updated them since the 2009 pandemic. Further, few countries had been conducting simulation exercises to assess and enhance preparedness or had plans in place to overcome systemic weaknesses, particularly for the surge capacity required for the pandemic response. The lack of such preparedness was evident from the challenges the countries faced during the current pandemic. For example, the priority targets for influenza and COVID-19 overlapped considerably, yet, most LMICs did not have proper estimates of the size of these target populations or

have contingency plans to reach these populations in case of a pandemic.

Financial and technical support for LMICs to enable them to overcome operational challenges did not reach them fast enough. Weaknesses in other sectors also constrained vaccine rollout. The most evident weakness was financial systems that were unable to mobilise, access and distribute funds in a timely manner.

While addressing systemic weaknesses will take time, contingency procedures to address emergency situations should be part of epidemic and pandemic preparedness planning.

Technology and innovations to be leveraged and utilised

In order to rapidly deploy vaccines at the scale required, innovations are necessary. The reasonably high level of access to digital tools, especially in the form of smartphones led to the adoption of such tools for facilitating vaccine rollout and monitoring progress. However, most countries reported several challenges that underlined the importance of proper planning, due attention to the design of the digital platforms, and the availability of the required infrastructure and training to optimize their use. Compared to the scale of vaccination and the investment in vaccines and supply chain systems, efforts to optimize and scale up the use of digital technologies was limited.

The impact of the use of these innovations in enabling vaccination should be carefully documented to inform decisions on their use, both during emergencies as well as in routine service delivery.

Greater dissemination of performance standards for digital solutions for immunisation, accompanied by investment in establishing and scaling up digital solutions, will not only facilitate the ongoing rollout of COVID-19 vaccines but can be utilised to strengthen routine immunisation data systems and play a pivotal role in achieving immunisation equity, and in the zero-dose agenda. The valuable lessons learned from the use of innovative digital solutions for the COVID-19 vaccine rollout should serve to ensure that similar solutions for routine immunisation are fit for purpose and sustainable in LMICs.

About MMGH

MM Global Health (MMGH) Consulting GmbH is an advisory firm supporting public and non-profit clients to translate scientific evidence, data and knowledge into strategies and actions directly impacting people's health. Our focus and expertise are centered on vaccine-preventable and neglected diseases.

<https://www.mmglobalhealth.org>