Real-Time Monitoring Beyond the Big Catch-Up

Leveraging Big Catch-Up Experience to Strengthen Routine Immunization through Digital Solutions and Real-Time Monitoring

A Learning Brief

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Executive Summary

Launched in April 2023, the Big Catch-Up is a global initiative led by the World Health Organization, United Nations Children's Fund, and Gavi, the *Vaccine* Alliance to close immunization gaps caused by the COVID-19 pandemic, restore coverage levels, and strengthen national systems by integrating catch-up activities into routine immunization programs. The initiative focuses on reaching Zero-Dose and Under-Immunized children, particularly those aged 12 to 59 months, who missed routine vaccinations between 2019 and 2022.

This learning brief summarizes insights from country reports, webinars, and scoping calls, highlighting how countries adapted digital and paper-based immunization recording and reporting tools to support real-time monitoring - the continuous, near-instantaneous collection and use of data to inform decision-making - during the Big Catch-Up.

Digital solutions were applied across the Big Catch-Up program cycle, from planning and readiness assessments to recording doses administered with age stratification, monitoring coverage and making course corrections. Countries updated vaccination registers, tally sheets, and reporting tools to capture data on Big Catch-Up target age groups (12–23 and 24–59 months) and integrated these into their routine Health Management Information Systems. Coverage data were reviewed regularly through existing mechanisms, with reporting frequencies ranging from daily to monthly. As these systems were rolled out, countries faced a learning curve and made mid-program adaptations to address challenges such as limited infrastructure, delayed tool customization, training gaps, inaccurate denominators, and server reliability issues. In fragile and conflict-affected settings, insecurity, displacement, and poor connectivity further constrained digital monitoring efforts.

Key lessons include the importance of early planning for digital tool adaptation, leveraging existing systems where possible, strengthening interoperability with national platforms, and investing in subnational capacity for data use and informed decision-making. Broader, more systematic digital readiness assessments are also needed to complement programmatic planning.

Looking ahead, embedding real-time monitoring within routine immunization systems and designing digital solutions that are flexible, sustainable, and responsive will be critical to sustaining catch-up efforts and building more resilient health systems beyond the Big Catch-Up.

Acronyms

AEFI	Adverse Events Following Immunization
BCU	Big Catch-Up
BeSD	Behavioral and Social Determinants
CHW	Community Health Worker
CSB	Centre de Santé de Base (Basic Health Center)
DHIS2	District Health Information Software 2
DTP	Diphtheria, Tetanus, and Pertussis
eCHIS	Electronic Community Health Information System
EIR	Electronic Immunization Registry
eLMIS	Electronic Logistics Management Information System
EPI	Expanded Programme on Immunization
EPIMIS	Electronic Programmatic Immunization Management Information System
GIS	Geographic Information System
Gavi	Gavi, the Vaccine Alliance
HMIS	Health Management Information System
HBR	Home-Based Record
IA2030	Immunization Agenda 2030
LQAS	Lot Quality Assurance Sampling
M&E	Monitoring and Evaluation
ODK	Open Data Kit
PIRI	Periodic Intensification of Routine Immunization
PHC	Primary Health Care
RTM	Real-Time Monitoring
SIAs	Supplementary Immunization Activities
UN	United Nations
UNICEF	United Nations Children's Fund
UI	Under-Immunized
WHO	World Health Organization
WUENIC	WHO and UNICEF Estimates of National Immunization Coverage
ZD	Zero-Dose

Background

The Big Catch-Up Initiative

The 2022 World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Estimates of Immunization Coverage (WUENIC) reported over 25 million zero-dose (ZD) children — those who had not received any Diphtheria, Tetanus and Pertussis (DTP) vaccine by 12 months — and under-immunized (UI) children — those who have not completed the recommended vaccination schedule. This represents an increase of 2 million from 2020 and 6 million from 2019, reflecting the cumulative impact of coverage declines during 2020, 2021, and 2022, when the COVID-19 pandemic and concurrent crises disrupted essential health services and deepened existing system gaps.[1],[2]

Launched in April 2023, the Big Catch-Up (BCU) is a global initiative led by WHO, UNICEF, Gavi, the Vaccine Alliance and partners. Its goal is to reach children who missed vaccinations, restore immunization coverage following disruptions caused by the COVID-19 pandemic and strengthen health systems towards the Immunization Agenda 2030 (IA2030) goals.[3],[4] The BCU pursues three interconnected objectives:

- Catch up on missed vaccinations: prioritize children who missed routine immunizations between 2020-2022, including those classified as ZD and UI since 2019.
- Restore immunization programs: rebuild coverage levels to meet or exceed pre-pandemic benchmarks.
- Strengthen health systems: embed immunization delivery within the broader primary health care (PHC) framework to accelerate progress toward the IA2030 goals.

Immunization Agenda 2030 goals: Effective, efficient and resilient immunization services are accessible to all people as an essential part of primary health care and thereby contribute to universal health coverage

Approaches to the Big Catch-Up

The BCU supports 35 countries where immunization coverage has stagnated or declined.[5] Implementation is tailored to each country context, drawing on a combination of high-impact service delivery strategies such as:

- Periodic Intensification of Routine Immunization (PIRI): short-term campaigns such as Child Health Days and Vaccination Weeks to boost coverage.
- Catch-Up via routine services: integrating catch-up vaccinations into existing immunization sessions.
- Supplementary Immunization Activities (SIAs): targeted campaigns to reach children missed by routine systems for supplementary doses (e.g., polio or measles) while also identifying children eligible for catch-up doses (e.g., Penta and others) and referring them for catch-up vaccination.
- Reducing Missed Opportunities for Vaccination: systematically checking immunization status at every health encounter.
- School-based integration: checking vaccination status and delivering vaccinations in schools and childcare centers.

These approaches are reinforced by strong multi-stakeholder coordination,

1 https://data.unicef.org/wp-content/uploads/2016/07/progress-challenges_wuenic2021.pdf
2 https://www.who.int/news/item/15-07-2022-covid-19-pandemic-fuels-largest-continued-backslide-in-vaccinations-in-three-decades
3 https://www.who.int/publications/i/item/9789240075511
4 https://www.who.int/teams/immunization-vaccines-and-biologicals/strategies/ia2030
5 Afghanistan, Benin, Burkina Faso, Burundi, Cameroon, Central African Republic (CAR), Chad, Comoros, Côte d'Ivoire, Democratic Republic of the Congo (DR Congo), Ethiopia, The Gambia, Guinea, Guinea-Bissau, Kenya, Kyrgyzstan, Madagascar, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Nigeria, Pakistan, Solomon Islands, Somalia, South Sudan, Sudan, Syria, Tajikistan, Tanzania, Togo, Yemen, Zambia.

drawing on national and regional leadership, partner engagement, and global technical support.

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The Importance of Monitoring, Evaluation, and Learning for the Big Catch-Up

Monitoring the BCU is critical for tracking progress, ensuring accountability, and generating evidence for decision-making. Effective monitoring helps close immunization gaps, prevent outbreaks, and strengthen immunization services. To support this, WHO, UNICEF and other members of the IA2030 Data Strengthening and Use Working Group developed technical guidance to help Ministries of Health, national immunization programs, and country partners monitor both the BCU and the integration of catch-up into routine immunization systems. The monitoring and reporting guidance provides methodologies, standard definitions for catch-up groups, and readiness and system indicators to support planning, implementation, and reporting.[6]

As part of the BCU monitoring, countries were encouraged to adapt existing health information systems to enable continuous tracking, timely reporting, and evidence-based adjustments. Although many countries have started adapting their health information systems to capture catch-up vaccinations, most platforms still cannot reliably distinguish catch-up doses from on-schedule immunizations. Some countries have made partial updates, such as adding new age bands to paper registers, tally sheets, or digital data collection tools, but full system-wide adaptations remain limited.[7] As a result, coverage data continue to underrepresent children reached through catch-up activities, limiting visibility on who has been reached.

Real-time monitoring is the continuous tracking and assessment of health activities using digital technologies and tools. This enables health workers and program managers to make timely data-driven decisions. Common features of RTM include data collection and reporting, tracking and geolocation, dashboards, alerts and notifications, data integration and synchronization, feedback mechanism for health workers, and real-time analysis and decision support.

The Role of Real-Time Monitoring in the Big Catch-Up

In this context, real-time monitoring (RTM) plays a key role across the planning, implementation, and evaluation phases of immunization programming. By enabling the continuous collection and use of timely, disaggregated, and geolocated data, RTM empowers health workers and decision-makers to make more agile, evidence-based choices. RTM supports several stages of health campaigns and routine immunization, from identifying ZD and UI children and conducting readiness assessments to enabling mid-course adjustments and evaluation, helping deliver more responsive and equitable services. Its integration into the BCU highlights RTM's potential to not only improve catch-up efforts but also to strengthen routine immunization systems over the long term.

6 https://www.technet-21.org/en/resources/tool/gavi-big-catch-up-monitoring-form-and-guidance
7 https://verixiv.org/articles/2-123

Scope and Approach

This **Big Catch-Up Real-Time Monitoring Learning Brief** consolidates lessons on how BCU-implementing countries have adapted and used RTM tools to support the planning, delivery and monitoring of BCU activities. It covers the period from September 2024 to June 2025 and is based on a desk review of country plans, technical reports, and documented experiences, complemented by scoping calls, regional working group discussions, and inputs from the BCU Task Team.[8] Where possible, insights were validated with country implementers. Compiled in June–July 2025, this brief summarizes key use cases, RTM implementation strategies, and lessons learned, and provides recommendations to strengthen the use of RTM and digital solutions in both catch-up efforts and broader immunization programs. While this document offers a high-level synthesis of available evidence across countries, detailed case studies are being developed to capture context-specific lessons and help tailor digital strategies to national needs.

Although not officially supported through direct BCU funding, Uganda is included in this brief because it implemented significant catch-up activities aligned with BCU objectives, similar to the other 35 countries directly supported by Gavi under the BCU initiative during the same period.

Why This Learning Brief Matters

The BCU has provided a valuable opportunity to observe how countries adapt RTM approaches and digital health systems – whether through rapid innovation, practical workarounds, or existing platforms — to include older children and ensure catch-up doses are accurately counted. These brief captures practical lessons and examples of how RTM and country Health Management Information Systems (HMIS) adaptations supported BCU implementation, offering insights to inform:

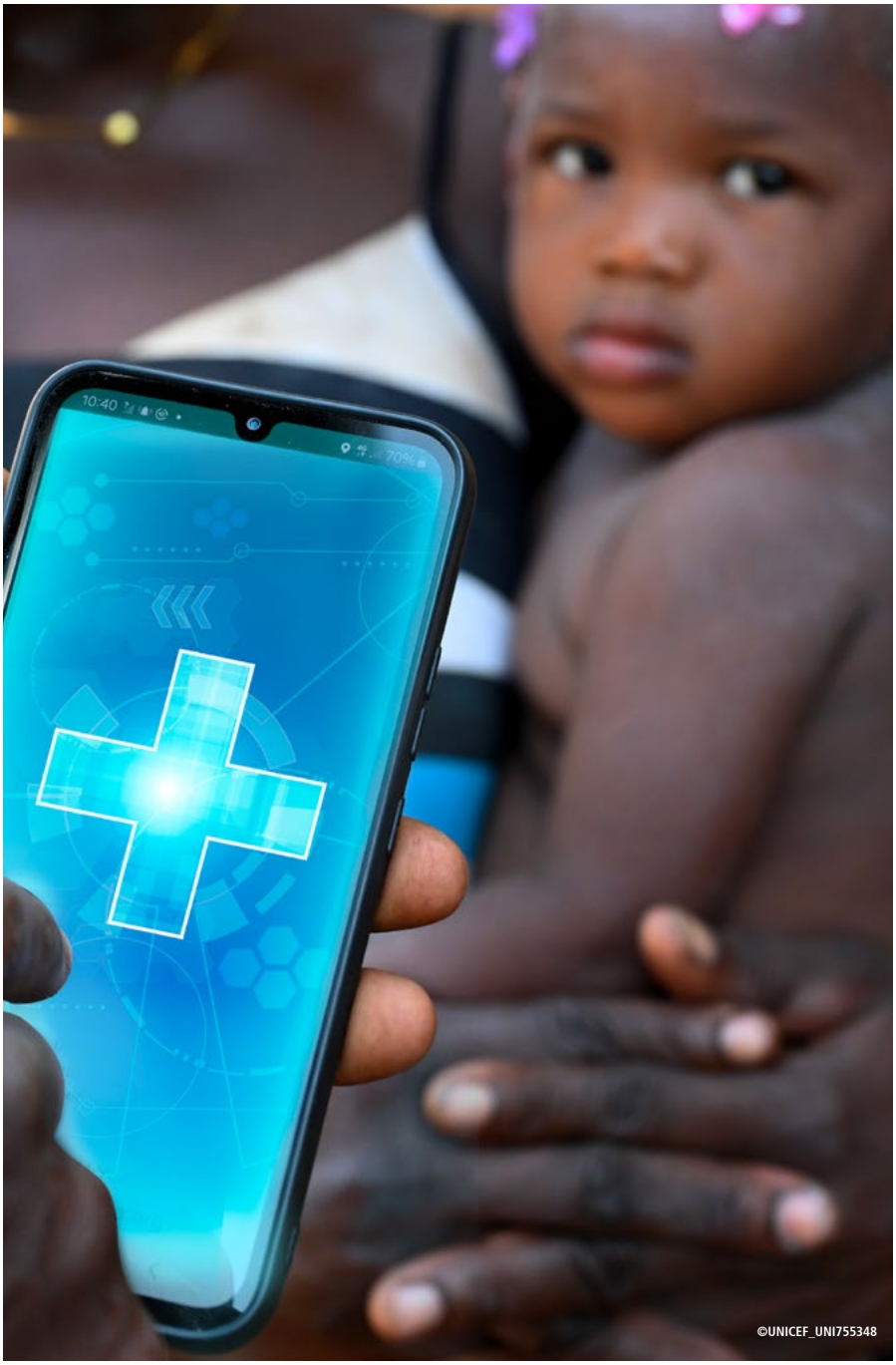
- Future digitalization efforts beyond the BCU.
- Integration of catch-up vaccination monitoring into routine health systems, ensuring that data on delayed doses administered to older children are continuously captured.
- Broader health system strengthening and digital transformation efforts aligned with IA2030 goals.

By sharing what has worked and where gaps remain, this brief aims to help countries, partners, and global stakeholders refine their digital strategies to build more responsive and resilient immunization programs.

8 The Big Catch-Up Task Team, composed of Gavi, WHO, and UNICEF, is responsible for coordinating the overall implementation of the BCU initiative. It plays a central role in ensuring that the initiative functions as intended facilitating program coordination across partners and levels, managing global program risks, and ensuring alignment of technical guidance, monitoring, and partner support for countries.

Applying Real-Time Monitoring Across the Big Catch-Up Program Cycle

RTM tools have significant potential to strengthen the planning, implementation, and evaluation of immunization programs. By generating timely, actionable data, RTM enables more responsive, targeted, and accountable service delivery — particularly in dynamic or under-resourced contexts.[9]



To illustrate how countries applied RTM in the BCU, this brief is organized around a BCU RTM framework previously shared with countries to guide RTM planning. The framework groups activities into three stages of the program cycle: (1) Planning, (2) Implementation, and (3) Evaluation. Each stage includes activities tailored to BCU objectives, from identifying ZD and UI children to preparing frontline workers to tracking vaccine delivery in real time to analyzing post-PIRI data. As countries applied RTM across the BCU program cycle, valuable lessons emerged, highlighting both the potential of real-time data to drive responsive immunization efforts and the challenges of adapting tools and systems for this purpose.

Together, these stages provide the foundation for a sustainable RTM approach that extends beyond the BCU, embedding catch-up vaccination tracking into routine systems and strengthening long-term program resilience. Table 1 summarizes the digital solutions applied at each stage of the BCU program cycle.

The following sections are structured around the three BCU program lifecycle stages: Planning, Implementation, and Evaluation. For each stage, the brief explores how countries have responded to key programmatic and monitoring needs, adapted RTM tools, and used digital solutions to improve data-driven decision making.

9 https://www.gavi.org/sites/default/files/evaluations/Planning-Implementing-RTM-Approaches-Strengthen-Vaccination-Campaigns.pdf

Big Catch-Up Real-Time Monitoring Framework

Planning	Implementation	Evaluation
Lays the groundwork for effective RTM approaches within BCU efforts.	Deploys RTM to support field operations and enable adaptive management.	Uses RTM data to assess performance and inform future planning.
Conduct a digital landscape and use case assessment • Review the national digital health ecosystem to identify tools, infrastructure, and gaps. • Define the RTM use case for tracking catch-up doses among eligible children aged 12-59 months (e.g., ZD and UI mapping or enumeration).	**Deploy RTM tools for frontline use** • Use mobile apps, tablets, or other digital tools to collect real-time data on vaccine delivery, stock levels, session performance, Adverse Events Following Immunization, reasons for non-vaccination, and outreach coverage.	**Conduct assessments** • Carry out post-implementation reviews (e.g., coverage surveys or other field assessments using Lot Quality Assurance Sampling, Rapid Convenience Monitoring or rapid assessments) to evaluate the quality of implementation, coverage achieved, Behavioral and Social Determinants indicators, and areas for improvement. Use RTM-generated data to validate findings, triangulate with other data sources, and identify gaps in program reach and equity.
Strengthen and digitize macro and microplanning processes • Integrate existing administrative data and digital tools into planning processes to improve target setting, team allocation, and resource distribution. • Use digital platforms that allow for real-time updates based on evolving field conditions or data inputs (e.g., ZD and UI mapping, population estimates, social mobilization, stock forecasting and distribution, and team performance), where feasible.	**Conduct supportive supervision** • Use RTM-enabled tools to conduct supervisory visits, record observations, and issue real-time feedback to vaccination teams.	**Document learning and adaptations** • Capture how RTM data is used to identify implementation gaps, document challenges and adaptations in digital solution deployment. Extract lessons to inform broader immunization and PHC strategies.
Clarify BCU-specific data requirements and update collection tools and workflows • Determine what data is needed to track delayed or missed vaccinations, such as age breakdowns (e.g., 12–23 months, 24–59 months), gender, geographic disaggregation, and defaulter history. • Revise vaccination registers, tally sheets, and home-based records to enable accurate recording of delayed doses. • Select or customize existing digital tools (e.g., mobile apps, Geographic Information System platforms and dashboards) to support real-time tracking and visualization.	**Enable real-time adjustments through dashboards** • Set up dynamic dashboards to visualize progress toward daily and overall targets in order to identify gaps that require corrective action.	**Plan and implement RTM improvements** • Identify and prioritize RTM implementation challenges, and define the enabling factors needed to resolve them and sustain progress. • Gather emerging requirements aligned with evolving program goals, and coordinate adaptations to RTM tools and supporting systems, including infrastructure, capacity building, ownership, accountability, and governance, to ensure effective implementation and long-term sustainability.
Capacity building • Train national and subnational staff, including vaccinators, immunization focal points, planners and data officers, on revised tools and processes, ensuring readiness for rollout.		
Monitor readiness activities • Use RTM to monitor the rollout of training, social mobilization, and microplanning activities, ensuring timely completion and feedback loops for continuous improvement.		

Table 1: Digitization Use Cases for Supporting Big Catch-Up Real-Time Monitoring

Stage	Use Cases	RTM tool	Countries
Planning			
	Conduct a digital landscape and use case assessment	/	/
	Strengthen and digitize macro and microplanning processes	DHIS2, Digital maps, Excel, IASO, ODK	Burundi, Cameroon, Ethiopia, The Gambia, Madagascar, Mali, Mozambique, Uganda, Zambia
	Clarify BCU-specific data requirements and update data collection tools and workflows	DHIS2, IASO, KoboCollect, ODK, Talkwalker	Afghanistan, Burundi, Cameroon, Mali, Madagascar, Mozambique, Nigeria, Somalia, Tanzania, Zambia
	Capacity building	Microsoft Teams, WhatsApp	Comoros, The Gambia, Kyrgyzstan, Madagascar, Nigeria
	Monitor readiness activities	Excel, Google Sheets	Afghanistan, Nigeria
Implementation			
	Deploy RTM tools for frontline use	DHIS2, Google Sheets, KoboCollect, IASO, ODK	Burundi, Cameroon, Comoros, Ethiopia, Madagascar, Somalia, Sudan, Zambia
	Conduct supportive supervision	EPIMIS Mobile App, KoboCollect, ODK	Afghanistan, Burundi, Ethiopia, Mozambique, Pakistan
	Enable real-time adjustments through dashboards	DHIS2, Google Sheets, Microsoft Teams, Power BI	Cameroon, Madagascar, Mali, Mozambique
Evaluation			
	Conduct assessments	ODK, Power BI	Madagascar
	Document learning and adaptations	Reviews supported by data from various RTM tools	Afghanistan, Burkina Faso, Burundi, Central African Republic, Democratic Republic of Congo, Ethiopia, The Gambia, Kenya, Madagascar, Mali, Mozambique, Myanmar, Nepal, Pakistan, Somalia, South Sudan, Sudan, Syria, Tanzania, Uganda, Zambia
	Plan and implement RTM improvements	DHIS2, IASO, KoboCollect, ODK	Afghanistan, Burundi, Cameroon, Cote d'Ivoire, Ethiopia, The Gambia, Kyrgyzstan, Madagascar, Mozambique, Myanmar, Nepal, Pakistan, Somalia, Syria, Tanzania, Uganda, Zambia

Planning Stage

A critical first step in BCU planning was estimating the number of ZD and UI children and assessing vaccine needs. Countries used a mix of existing data sources and digital tools to set targets and prioritize areas for catch-up activities. These sources included administrative data and census estimates, WUENIC and United Nations (UN) estimates of surviving infants, routine health data from platforms such as District Health Information Software 2 (DHIS2), and equity assessments to identify underserved or high-risk communities.

In some settings, countries applied digital tools, such as mobile data collection apps and geospatial mapping platforms, to conduct community headcounts and refine target population estimates (e.g., Mozambique). These efforts supported better stratification of districts based on zero-dose burden, access barriers including insecurity and remoteness, and past immunization performance, allowing for more targeted BCU planning. In most countries, this target-setting process was part of ongoing efforts to maintain up-to-date immunization data and occurred before BCU implementation. As a result, there are limited examples of RTM tools being used specifically for target setting in the BCU context. Instead, RTM was applied mainly for planning operational activities and monitoring implementation.

The following sections highlight how countries applied digital approaches within the planning stage to strengthen the foundations for effective BCU implementation.

Conduct a Digital Landscape and Use Case Assessment

Conducting a digital landscape assessment and defining RTM use cases are critical first steps to help countries select the most appropriate tools for their context. In practice, however, most countries did not conduct a systematic assessment of their digital health ecosystem as part of BCU planning. Instead, competing priorities and tight timelines meant that decisions were usually based on familiarity with existing platforms, their use in past campaigns, or availability of in-country support. As a result, most countries simply extended the use of familiar tools to cover the older age groups targeted by BCU (12–23 months and 24–59 months) and adjusted workflows to track catch-up vaccinations. While this pragmatic approach enabled faster deployment, it also meant missed opportunities to optimize tool selection, strengthen interoperability, and improve system design.

Strengthen and Digitize Macro and Microplanning Processes

To translate BCU targets into actionable plans, countries strengthened their macro- and microplanning processes and, where feasible, integrated digital tools to better prioritize geographic areas and population groups. They integrated administrative data, routine health information systems, and, where available, digital platforms to map ZD and UI burden, identify high-risk districts, and guide campaign and routine immunization strategies.

Macro-level Prioritization Using Administrative and Routine Data

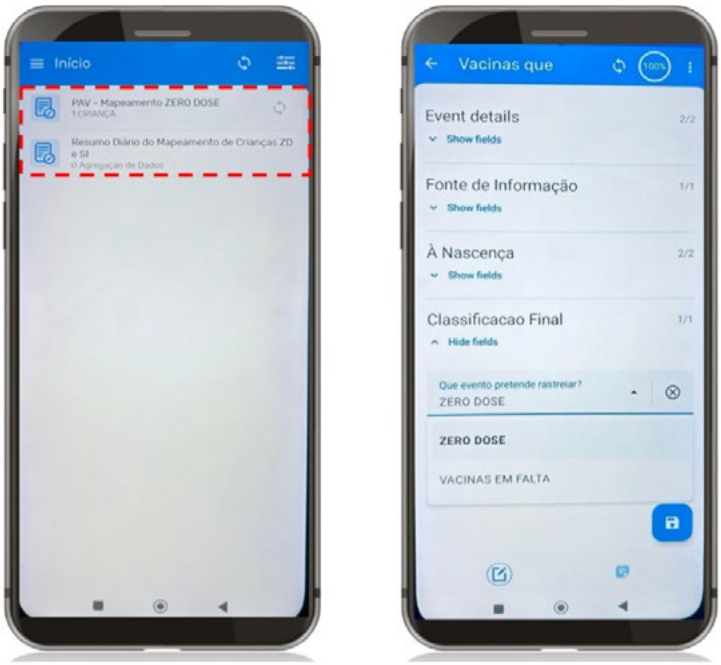
In **Cameroon**, the national immunization team used DHIS2 administrative data to prioritize areas based on number of ZD and UI children, recent measles outbreaks, and other contextual risks. Districts were categorized into 38 high-ZD districts, 56 with recent measles epidemics, and 8 with other risk factors. Additional categories included 7 insecure/conflict zones, 12 disadvantaged urban areas (slums), 20 hard-to-reach areas, and 4 other urban districts. Based on this analysis, the Cameroon national immunization team planned three rounds of vaccination campaigns to address a five-year backlog, while intensifying routine immunization in fragile and insecure areas.

The Expanded Programme on Immunization (EPI) team in **Madagascar** triangulated administrative data (unvaccinated children aged 0–11 months) with WUENIC 2022 estimates to calculate ZD children aged 12-59 months (2019-2022). Prioritization focused on the 56 out of 114 districts that accounted for over 60% of ZD children. In 2025, an adapted DHIS2 BCU module was deployed, excluding children already reached and incorporating the 2024 birth cohort, with results cross-referenced with Lot Quality Assurance Sampling (LQAS).[10] This process identified 35 additional

10 https://docs.dhis2.org/en/implement/health/immunization/immunization-epi-big-catch-up/design.html#imm-bcu-design https://docs.dhis2.org/en/implement/health/immunization/immunization-epi-big-catch-up/design.html#imm-bcu-design

high-priority districts, bringing the total districts targeted for BCU activities to 91.

Figure 1: DHIS2 Tracker entry form used for community mapping of zero-dose and under-immunized children in Mozambique.



Geographic Information System-based Approaches to Enhance Microplanning

Building on these national-level prioritization efforts, several countries applied geographic information system (GIS)-based approaches to refine microplanning, enabling more precise, location-specific team allocation and resource distribution.

In **Ethiopia**, the Ministry of Health and partners used Open Data Kit (ODK) to conduct community-level headcounts of ZD and UI children, integrated with interventions such as insecticide-treated net distribution, and polio and measles campaigns. The approach benefitted from smartphone availability, and prior health worker experience with the electronic Community Health Information Systems (eCHIS). The headcounts provided granular data for planning and decision-making in supported areas, though challenges included inconsistent ZD definitions, training gaps, community resistance, and limited funding in non-Gavi supported districts. Ongoing follow-up and troubleshooting support were crucial, as some areas also struggled to use collected data effectively for planning and decision-making.

In **The Gambia**, the Ministry of Health and partners analyzed regional administrative data to determine ZD and UI targets. Digitized catchment area maps at the facility level were also available to help locate settlements. However, cross border vaccination, and the absence of updated facility-level microplans may have limited the effectiveness of these approaches.

In **Mozambique**, the EPI team conducted both paper-based and digital mapping of ZD and UI children. DHIS2 was piloted in five provinces to support Community Health Workers (CHWs) identify and geo-reference ZD and UI children (0–23 months and 24–59 months). Mapping data was used to determine optimal locations for vaccination distribution sites, inform budget adjustments, and guide the allocation of human resources. The pilot demonstrated the value of geo-referenced, individual-level data for planning and implementation. However, challenges such as limited coverage, gaps in training, insufficient devices, and poor internet connectivity underscored the need for stronger infrastructure and capacity building to support broader scale-up. Paper-based headcounts, in contrast, were less effective in pinpointing the locations of missing children. There was a wide discrepancy between BCU estimates generated using DHIS2 data and mapping results, which questioned the quality of mapping.[11]

The EPI team in **Zambia** conducted GIS-based microplanning in 116 districts, leveraging geospatial data to support enumeration, and model the optimal placement of outreach and sites, building on previous GIS investments.

Leveraging Existing Campaigns to Advance Big Catch-Up Goals

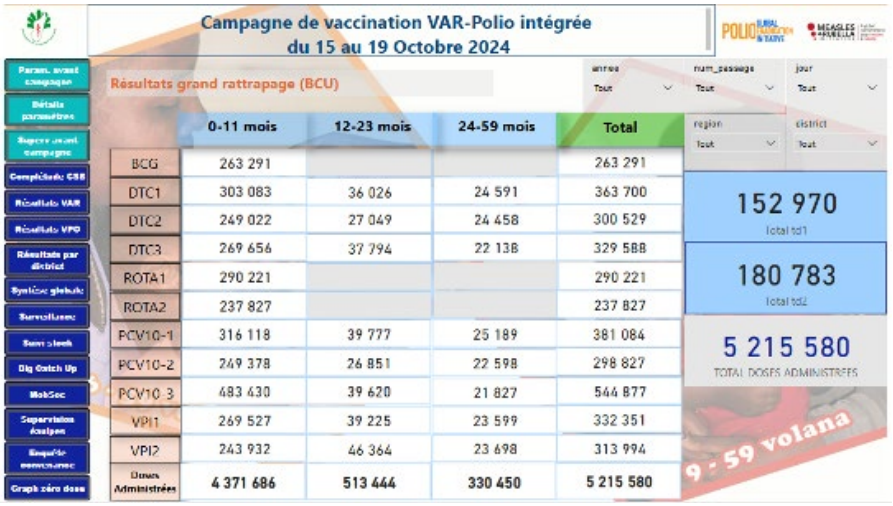
In some countries, existing vaccination campaigns were leveraged to support BCU efforts, expanding reach and

11 https://dhis2.org/zero-dose-mozambique/

improving efficiency by using established delivery platforms.

During polio SIAs, the EPI program in **Madagascar** mapped ZD and UI children aged 0–11 months and vaccinated children aged 12–59 months. A mix of strategies was applied, including routine immunization services, PIRIs, and integrated measles and polio vaccination campaigns. This combination of approaches helped advance progress toward BCU targets, while leveraging existing campaigns to expand reach.

Figure 2: ODK-based dashboard used for BCU and Polio Integrated Campaigns in Madagascar.



Reliance on Paper-based Tools Where Digital Platforms Were Not Feasible

Despite progress with digital tools in many settings, some countries continued to rely on paper-based methods, reflecting infrastructure constraints and the need for simple approaches in remote or resource-limited areas.

In **Burundi**, health workers conducted household visits and reviewed birth registrations, home-based records (HBRs), and vaccination registers to identify children, sensitized families on the importance of vaccination, and referred children to nearby facilities. In **Mali**, immunization teams carried out targeted enumeration in internally displaced communities and gold-mining areas to locate ZD and UI children at risk of being missed. In **Tanzania** and **Uganda**, CHWs used paper forms during house-to-house visits to identify missed children and support enumeration of BCU targets, and both Ministries of Health are now exploring ways to integrate digital tools into future efforts.

Figure 3: EPI supportive supervision checklist used in Afghanistan that includes 10 questions specific to catch-up.

#	Questions
1	How many children between the age of 24-59 months received Penta 1 in the last completed calendar month?
2	How many children between the age of 24-59 months received Penta 3 in the last completed calendar month?
3	How many children between the age of 24-59 months received IPV1 in the last completed calendar month?
4	How many children between the age of 24-59 months received IPV2 in the last completed calendar month?
5	How many children between the age of 24-59 months received Measles 1 in the last completed calendar month?
6	How many children between the age of 24-59 months received Measles 2 in the last completed calendar month?
7	Has this HF microplan been revised for the Big Catch-up?
8	How many Big catch-up vaccinators have been hired?
9	Have the vaccinators received big catch-up training?
10	Is updated big catch-up IEC material such as posters, flip charts and banners available at this health facility?

Clarify Big Catch-Up Specific Data Requirements and Update Collection Tools and Workflows

To support RTM of BCU activities, immunization programs adapted paper-based tools and digital systems to capture data for older children in the BCU target age groups, particularly those aged 24–59 months who are typically not tracked by routine immunization systems. These adaptations improved the recording of catch-up doses and aligned BCU data collection with existing health information systems, enabling more accurate monitoring and reporting of catch-up efforts.

In **Afghanistan**, the immunization program revised the immunization schedule to include BCU target age groups. Updated vaccine cards, HBRs and tally sheets were printed and distributed to health facilities. To strengthen quality assurance efforts for service delivery, BCU-specific questions were also added to the digital supportive supervision tool. These adaptations ensured that

catch-up doses for older children were systematically recorded and that service quality could be monitored through both paper-based tools and digital supervision mechanisms.

In **Burundi**, **Madagascar**, **Mozambique**, **Nigeria** and **Somalia**, the EPI teams updated vaccination registers, tally sheets, and digital forms to capture data for BCU target age groups (12–23 and 24–59 months). In some contexts, DHIS2 was customized for age-disaggregated reporting for BCU activities, while in other contexts, adjustments were implemented retrospectively. In **Somalia**, the EPI team also adapted ODK forms for supportive supervision, while in **Nigeria** the Federal Ministry of Health revised tally sheets and digital forms to capture catch-up doses and reasons for non-vaccination. These adaptations enabled more detailed reporting on older age groups and reasons for missed vaccinations. However, in some countries, adjustments were rolled out retrospectively, limiting their usefulness for RTM.

In **Cameroon**, the immunization program team updated tally sheets and reporting forms to include BCU target age groups and sex-disaggregated data. Reporting also shifted from aggregate to event-based capture using mobile apps such as IASO WEB and Cameroon Collect, which enabled collection of geolocation data after immunization sessions. These updates improved the granularity of BCU data, allowing real-time event-based reporting and mapping of service delivery. This enhanced visibility into where and when vaccinations occurred, strengthening both monitoring and accountability.

Figure 4: Somalia's EPI's tally sheet revised to include reporting for age groups of 12-23 months and 24-59 months.

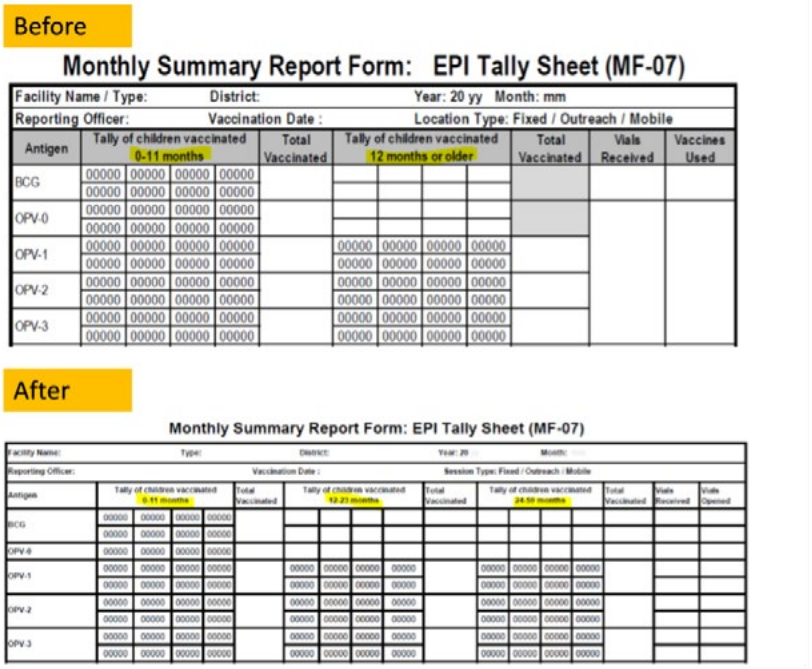
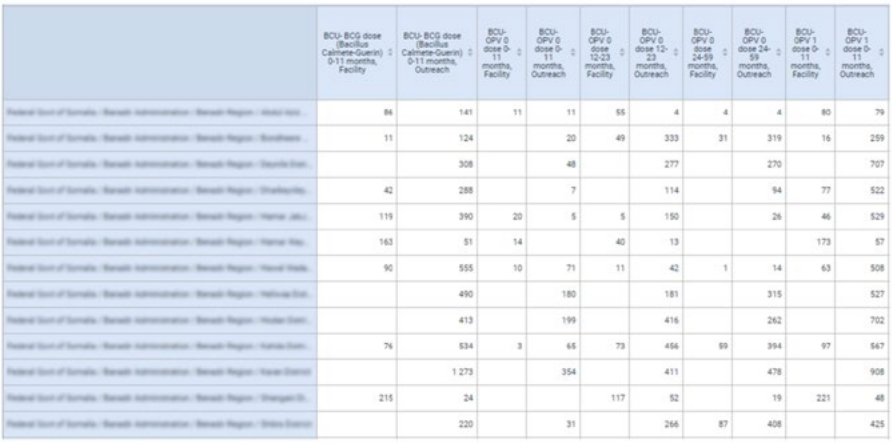


Figure 5: Somalia's DHIS2 report after the customization for BCU aggregate reporting.



During the first BCU PIRI round, the **Tanzania** EPI team used Google Sheets as an interim solution to track doses. Subsequently, updated tally sheets and defaulter tracing books were introduced, and the Afya Campaign System was customized to capture BCU data. Work is ongoing to integrate BCU data elements into the national DHIS2 routine immunization platform. Using Google Sheets enabled immediate tracking during the first PIRI round. However, it quickly highlighted the importance of adapting routine digital systems like DHIS2 and Tanzania Immunization Registry for sustainability.

The **Zambia** immunization program team customized a DHIS2 Tracker data entry form to enable real-time, patient-level data collection, capturing each child's age and administered vaccine doses and supporting defaulter tracking. An ODK-based supportive supervision checklist was also introduced to assess BCU service delivery at health facilities. However, due to data entry backlogs in the DHIS2 Tracker, an interim solution using Google Sheets was applied to monitor aggregate coverage. These adaptations allowed for BCU data monitoring. However, the concurrent use of both DHIS2 and Google Sheets underscored the need to address system bottlenecks for implementing digital systems at scale.

Beyond adapting service-delivery tools, several countries also leveraged RTM platforms to monitor behavioral and social determinants (BeSD) of vaccination uptake. These efforts aimed to understand reasons for non-vaccination, identify and address circulating rumors, and inform communication and awareness approaches for the BCU.[12] In several cases, countries integrated RTM tools directly into their BeSD activities, enabling more timely insight and action.

In **Mali**, women leaders' groups, inspired by the country polio program, were mobilized to identify ZD and UI children, support community sensitization, and guide families to vaccination sites. WhatsApp was used for real-time learning, training, and coordination, contributing to overall improved coverage.

In **Mozambique**, the EPI team combined ZD and UI mapping with a BeSD survey across four provinces. Findings pointed to education levels, parental age, safety perceptions, and gender dynamics as the main barriers to vaccination uptake. Social sensitization approaches were recommended, and digital tools were used to analyze results.

In **Nigeria**, a digital tool (Talkwalker) was deployed to monitor rumors and misinformation, enabling targeted responses to address myths and misconceptions.

Figure 6: Health workers trained on the use of a one-page visual algorithm designed to simplify catch-up vaccination planning in Kyrgyzstan. The tool was disseminated through in-person training and instructional videos shared via WhatsApp.

Capacity Building

Digital tools offer significant potential to enhance training through remote learning, progress tracking, curriculum design, and reuse of content. During the BCU, most countries opted for practical, familiar platforms such as Microsoft Teams rather than adopting more advanced eLearning systems. Examples of capacity-building efforts include:

In **The Gambia**, the Ministry of Health used eLearning approaches to remotely train health workers on BCU data management increasing data accessibility for health workers at subnational levels.

In **Comoros** and **Madagascar**, virtual training sessions were conducted via Microsoft Teams, focusing on BCU dose management and vaccine handling and administration. In **Nigeria**, refresher trainings through Microsoft Teams reinforced revised paper workflows and updated electronic reporting tools before PIRI rollout.

12 https://www.who.int/publications/i/item/9789240049680

In some contexts, simple tools were developed to support health worker decision-making: with UNICEF support, the **Kyrgyzstan** Republican Center for Immunoprophylaxis developed a one-page visual algorithm to simplify catch-up vaccination planning. Nurses were trained to independently determine catch-up schedules without waiting for epidemiologist guidance during child visits. To ensure usability, the algorithm was placed under glass tabletops for easy reference, and rulers were used to help cross-check the maximum eligible age for each vaccine dose. In-person training was provided on how to use the tool. Recognizing that staff turnover could limit the tool's impact (as flagged in a prior readiness assessment) the training team also developed a short instructional video, distributed via the WhatsApp groups routinely used by healthcare workers. The algorithm supported independent decision-making by nurses, and health workers welcomed the video as a practical resource for onboarding new staff.[13]

Figure 7: UNICEF-supported Big Catch-Up Real-Time Monitoring Readiness Checklist.

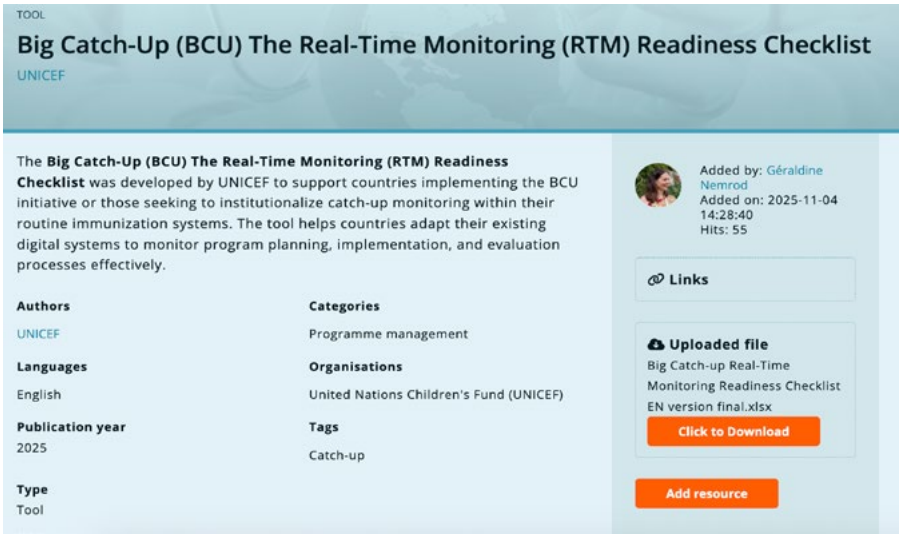
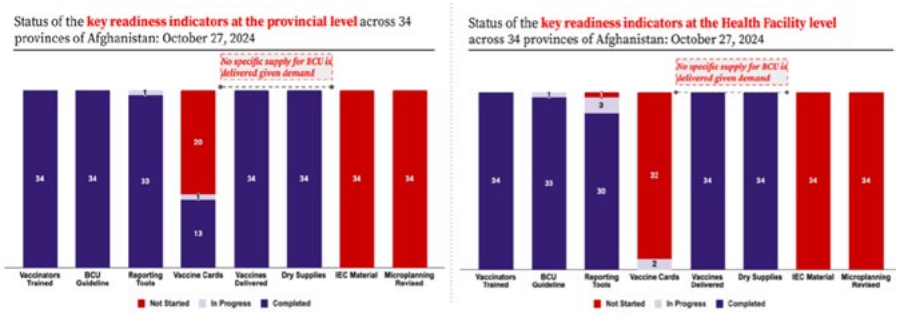


Figure 8: Digitally supported rapid readiness assessments in Afghanistan identified priority areas requiring support ahead of BCU implementation.



Monitor Readiness Activities

The BCU Task Team developed standardized readiness assessment guidelines to help countries evaluate preparedness for BCU implementation. UNICEF also developed complementary digital readiness assessment tools, giving countries practical ways to assess both operational and digital readiness.[14]

In **Afghanistan**, national and subnational immunization teams conducted readiness assessments across all 34 provinces using phone interviews and in-person surveys. Assessments covered vaccine stock availability, completion of health worker training, and access to reporting tools. Approximately 5,000 vaccinators across 2,700 health facilities were trained on the BCU strategy. Data were consolidated and analyzed in Excel dashboards, enabling real-time monitoring of provincial preparedness. This assessment identified key gaps, including 20 health facilities without vaccination cards, incomplete distribution of Information, Education, and Communication materials, and pending microplanning activities. While the country recognized the importance of revising vaccine supply forecasts to incorporate BCU targets, like many countries, it did not differentiate between routine immunization and BCU-specific supply needs.

In **Nigeria**, readiness checklists were deployed via ODK to all 36 States, enabling real-time tracking of key indicators such as vaccine stocks, trained staff, and reporting form availability. Data were automatically compiled in a Google Sheets dashboard. This enabled real-time tracking of readiness indicators across all states.

13 https://knowledge.unicef.org/resource/complexity-clarity-preparing-integrated-catch-vaccination-usability-tested-job-aid
14 https://www.technet-21.org/en/resources/tool/big-cacth-up-bcu-the-real-time-monitoring-rtm-readiness-checklist

Implementation Stage

During implementation, immunization programs used RTM tools to capture and report BCU coverage data, with data review frequencies ranging from daily monitoring in some cases to monthly validations in others. BCU-specific indicators were integrated into supportive supervision checklists, strengthening oversight and accountability at subnational levels. Although most countries did not distinguish between BCU and routine doses within supply chain systems, some applied existing digital tools to guide vaccine stock distribution and reconciliation.

This section highlights how RTM approaches were applied during implementation to support data-driven decision-making and strengthen the operational management of BCU activities.

Deploy Real-Time Monitoring Tools for Frontline Use

BCU implementing countries used a range of digital platforms to track vaccination coverage, monitor progress, and guide adaptive management activities. Data were collected at health facility and district levels and reviewed at varying intervals. The examples below illustrate how countries applied digital tools to strengthen vaccination coverage monitoring:

In **Burundi**, BCU PIRI was implemented across 49 districts in December 2024. Health facility data were entered into DHIS2 within three days of vaccination to support timely validation and rapid follow-up. After the campaign, catch-up doses were integrated into routine immunization services, with the same digital forms used for data entry. Routine BCU data are now entered monthly (between the 5th and 10th), validated later in the month (25th–28th), and reviewed in monthly sessions led by District Medical Officers using DHIS2 dashboards for antigen-level analysis.

In **Cameroon**, the EPI team and partners adapted the IASO tool to monitor vaccination coverage among children aged 12–59 months. Data were disaggregated by age, sex, and location, allowing health officers to track PIRI performance in real time. The system enabled immediate adjustments in low-coverage areas, such as reallocating resources or adapting outreach strategies.

In **Comoros**, health teams began introducing real-time reporting tools by making ODK available at the district and service levels, though implementation was still in early stages. Health facilities were also tasked with reviewing child vaccination records and extracting overdue data from DHIS2 to compile and share with the regional level. These efforts improved the visibility on vaccination coverage.

The **Ethiopia** Ministry of Health and partners deployed Google Sheets to support real-time coverage monitoring during BCU campaigns. Health workers collected vaccination data daily, which was reviewed at multiple levels to identify low-coverage areas and guide corrective actions. RTM helped guide corrective action during campaigns, but challenges included fragmented data entry across multiple Google Sheets, limited training of data officers, and weak data flow between health facility and district levels.

During the initial phase of BCU implementation, the **Madagascar** EPI team used ODK and Power BI dashboard to track progress of PIRI activities. However, due to reporting

Figure 9: ODK-based Power BI dashboard showing coverage indicators for 12-23 months and 24-59 months old children in Madagascar.

	0 à 11 mois	12 à 23 mois	24 à 59 mois	Total
BCG	20474			20474
VPO 0	9029			9029
VPO 1	25433	7 450	5 487	38 370
VPO 2	21 558	5 470	3 143	30 171
VPO 3	22 534	7 341	4 384	34 259
VPI 1	22 444	7 555	4 750	34 749
VPI 2	19 557	9451	5 517	34 525
DTC-1	24 513	7 353	5407	37 273
DTC-2	21 519	5 314	5 402	32 235
DTC-3	22 610	7 401	4 413	34 424
PCV10-1	24 398	7 239	5 273	36 910
PCV10-2	21 620	5 310	4 936	34 132
PCV10-3	22 315	7 288	4 370	33 973
ROTA 1	24 635			24 635
ROTA 2	21 623			21 623
VAR 1	20 987	10 581	6 194	37 762
VAR 2		23 219	15 563	38 782
Total	345 249	110 972	74 839	531 060

Table 2: Expanded Programme on Immunization and Big Catch-Up Data Review Instances in Madagascar

Administrative Level	Frequency	Activity
Central Level	Monthly	Review of routine immunization and BCU data
	Bi-monthly	EPI Task Force meetings
	Bi-annual	Sharing of feedback documents from the central level
Regional Level	Bi-annual	EPI data review meetings
District Level	Quarterly	Data review meetings
Health Facility	Monthly	Grouping of CHWs for data discussions

gaps and server outages, the EPI program transitioned BCU reporting to their national DHIS2 instance. Health facility staff complete paper-based BCU summary forms, and data are entered in DHIS2 by district data managers for subnational and national review. At the national level, BCU data is reviewed during the monthly BCU review meetings and bi-monthly EPI taskforce meetings. At subnational level, data is discussed monthly during facility-level meetings and quarterly during district-level meetings. Persistent challenges limiting the impact of RTM data use include data quality issues, limited capacity building, poor connectivity at health facilities, and health workers perception of reporting as a burden.

The Federal Ministry of Health of **Somalia** customized DHIS2 for aggregate reporting of BCU doses. This enabled the capture of session-level data, which was reviewed through customized dashboards. BCU implementation was integrated with the national nutrition program, enabling shared resources and identification of UI children, particularly those with Severe or Moderate Acute Malnutrition. Integration with nutrition programming improved outreach and facilitated identification of UI children.

In Sudan, the Ministry of Health adopted an approach similar to the one adopted in Somalia, aligning immunization and nutrition programming to strengthen outreach and service delivery. This integration supported more coordinated delivery of services to reach UI children.

In **Zambia**, health facilities organized localized data review meetings, often involving community members to promote shared accountability for BCU performance. At the national level, the EPI monitoring and evaluation (M&E) subcommittee convened monthly review meetings for coordination and oversight. An individualized electronic vaccination registry was introduced to track catch-up doses, while daily Google Sheets reporting was maintained to provide timely aggregate data during registry backlogs. Localized and national review meetings strengthened accountability and coordination. The electronic registry

improved tracking of catch-up doses, while Google Sheets ensured timely monitoring despite delays in data entry.

Conduct Supportive Supervision

Supportive supervision is a key part of BCU implementation, helping to identify service delivery gaps and providing real-time feedback to frontline teams. Countries adapted or developed digital tools to standardize supervision checklists, track supervisory visits, and capture field observations, improving the timeliness and quality of corrective actions.

Immunization teams in **Afghanistan**, **Burundi** and **Pakistan** adapted digital tools for supportive supervision during the BCU, enabling supervisors to monitor field activities and provide real-time feedback. In **Mozambique**, supervisors used an existing electronic supervision tool to oversee campaign implementation. Digital tools improved oversight during campaigns and allowed quicker feedback to frontline workers. In **Ethiopia**, the EPI team and partners developed a supportive supervision checklist using ODK covering four administrative levels: health facility, woreda, zonal, and regional. This standardization improved data consistency and the quality of supervision feedback across the health system. In **Somalia**, the EPI team customized ODK forms for supportive supervision visits, enabling faster data aggregation than paper-based systems, though limited connectivity constrained real-time reporting in some areas.

Enable Real-Time Adjustments Through Dashboards

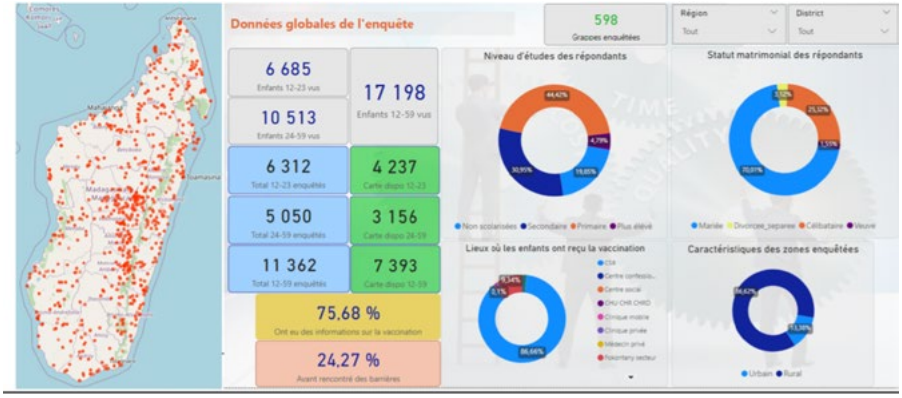
Real-time dashboards helped countries adjust operational plans during implementation, particularly for vaccine stock monitoring and distribution planning. Although most electronic supply systems did not differentiate between routine and BCU stock, some countries applied existing digital solutions to improve stock visibility during campaigns.

In **Cameroon**, the ProMeDeau tool was used to support monthly vaccine stock reconciliation across BCU PIRI rounds. In **Madagascar**, Google Sheets and the Stock Management Tool were used to forecast, distribute, and manage immunization inputs. The EPI team is also exploring the adaptation of ODK to digitize stock data reporting at the district level. In **Mali**, immunization teams used existing data and dashboards to simulate vaccine distribution needs and improve supply forecasting and stock allocation. In **Mozambique**, during the first BCU PIRI conducted in February 2024, a DHIS2 Tracker entry form was used for real-time reporting, enabling immediate data review and BCU implementation adjustments. RTM data enabled health workers to adapt their planned activities to visit missed children.

Evaluation Stage

In the evaluation phase, countries used RTM-generated data to assess BCU outcomes, identify operational gaps, and plan future rounds of catch-up activities. Digital tools supported coverage analysis, data reviews, and accountability processes at national and subnational levels. While formal evaluations such as coverage surveys and LQAS assessments were conducted in some contexts, most countries relied on routine data reviews and after-action discussions to support continuous learning and performance improvement.

Figure 10: Dashboard showing results of LQAS household assessments in Madagascar.



Conduct Assessments

In **Madagascar**, the Ministry of Health, with WHO and UNICEF support, coordinated a LQAS to assess immunization coverage and identify service delivery gaps. The district was subdivided into health zones (Zones de Santé), each linked to a Basic Health Center (*Centre de Santé de Base*, CSB). One village (fokontany) was randomly selected per CSB, and 19 children aged 12-59 months were surveyed in each village, prioritizing those aged 12-23 months. In total, 598 trained interviewers, 598 community mobilizers, and 284 supervisors participated. Data collection was digitized using ODK, with real-time visualization and coordination through Power BI dashboards. Feedback loops between field teams and central coordination units addressed challenges as they arose. Findings from the LQAS identified key barriers to immunization coverage, including vaccine stockouts, distance to vaccination sites, caregivers' competing priorities, and limited awareness of the importance of vaccination.

Document Learning and Adaptations

As countries reviewed data and reflected on BCU implementation through daily consultations, stakeholder discussions, and regional working group presentations, a range of operational and system-level challenges emerged. These lessons are crucial not only for improving future BCU rounds but also for strengthening routine immunization and RTM systems more broadly. While digital tools supported data capture, supervision, and planning, countries also faced constraints such as data quality issues, customization gaps, infrastructure barriers, and funding limitations. Addressing these challenges will be essential for targeted investments, system strengthening, and more strategic use of RTM tools beyond the BCU.[15]

The following key themes emerged during BCU implementation. They are grouped into:

1. BCU-specific challenges: directly linked to expanding immunization target age groups and integrating catch-up into routine immunization systems.
2. Broader digital health system challenges: generalizable to routine immunization and RTM more broadly.

Big Catch-Up-specific Challenges

Data Quality Gaps Affected Target Estimates and Defaulter Tracking

Inaccurate estimation of children eligible for catch-up vaccination was one of the most persistent challenges. In The **Gambia**, difficulty

15 https://doi.org/10.1016/S0140-6736(23)01587-8

in estimating subnational targets complicated performance monitoring. In **Mozambique**, the initial BCU ZD targets were revised mid-implementation following improved guidance, which revealed that some previously included birth cohorts had been mistakenly classified as eligible for the BCU doses. In **Afghanistan**, **Somalia**, **Sudan** and **Syria**, displacement, outdated health worker lists, and weak routine data systems hindered estimates of ZD and UI children. In **Uganda** reliance on static population estimates from the Bureau of Statistics, without accounting for refugee influxes, internal displacement, cross-border movement, or nomadic populations, led to inflated coverage figures in some areas.

Alongside denominator challenges, data inconsistencies also weakened BCU monitoring efforts. In **Ethiopia**, fragmented data entry across unlinked Google Sheets, limited training, and lack of dedicated data officers resulted in incomplete reporting and occasional data loss. In **Somalia**, reporting gaps through ODK caused delays in decision-making. In **Uganda**, incomplete child health registers hindered defaulter tracing, while in **Zambia**, missing facility reports prompted national M&E teams to intervene with remote troubleshooting.

Limited System Customization Delayed the Use of Digital Tools

Many countries planned to use existing digital platforms for BCU but could not complete customizations in time. In **Mozambique** and **Tanzania**, delays in updating DHIS2 and other tools forced reliance on spreadsheets and paper-based tracking, creating data gaps. In **Nepal**,

the DHIS2-based platform was not configured for antigen-specific reporting for the 24–59-month age group, limiting visibility of this priority BCU population. In **Tanzania**, paper-based monitoring forms were not updated for children over 2 years in the first PIRI round, and in **Mozambique**, global M&E guidance on expanding paper and digital monitoring tools for children aged 12–24 and 24–59 months not applied in the first round. In **Pakistan**, early BCU rounds used existing checklists not tailored to catch-up indicators. Though system customizations were underway, these gaps reduced the ability to monitor catch-up doses in real time, highlighting the importance of advance planning for digital tool adaptation.

Limited Adaptation of Real-Time Monitoring Tools Led to Reporting Gaps and Limited Data Use

Several platforms were not configured for BCU-specific indicators such as stock management, Adverse Events Following Immunization (AEFI) reporting, or expanded target age groups, which limited their ability to generate and use timely data for critical decision-making. In **Ethiopia** and **Myanmar**, gaps in AEFI reporting were present due to low engagement of surveillance officers and competing priorities. UNICEF's Thrive 360 report found that many countries' electronic Logistics Management Information Systems (eLMIS) were not adapted to capture BCU-specific data. This missed opportunity reflected competing programmatic priorities, budget constraints, and limited time to

adjust systems before implementation.[16]

Digital Monitoring Remained Limited in Conflict-Affected and Hard-to-Reach Areas

Even where digital tools were available, insecurity, displacement, and environmental challenges constrained RTM activities. In **Ethiopia**, digital headcounts of ZD and UI children in Amhara and Oromia were disrupted by violence, difficult terrain, and rains. In **Burkina Faso**, **Kenya**, **Madagascar** and **Mali**, insecurity and logistical barriers limited access to underserved communities. In **Madagascar**, law enforcement support was needed to deliver immunization services in insecure areas. In **South Sudan**, severe flooding postponed BCU activities, and in **Sudan**, displacement in insecure areas complicated outreach. In **Mali**, insecurity displaced immunization staff, further hindering program operations.

Broader Immunization and Digital Health System Challenges

Weak Data Review and Use Limited the Real-Time Monitoring Impact

Real-time data are only valuable when they inform timely decisions, yet in several countries, weak data review processes limited managers' ability to respond to emerging gaps. In **Ethiopia**, subnational data reviews were constrained by poor internet connectivity, budget shortages, and weak leadership engagement, weakening accountability and delaying corrective action. In **Burundi**, the absence of a structured framework for analyzing routine immunization data, including governance, coordination, staff capacity, and systematic data review, reduced opportunities for evidence-based decision-making. The EPI team specifically noted the need to understand why areas with low vaccination coverage also have the fewest ZD children and no reported measles outbreaks. *WHO's handbook on the collection, use, and improvement of immunization data* remains a valuable resource for establishing such frameworks.[17] In **Uganda**, inadequate district-level data use impeded identification of service access and utilization gaps. Collectively, these weaknesses in data review and use undermined planning, decision-making, and resource mobilization for both catch-up and routine immunization.

16 https://eujournal.org/index.php/esj/article/view/18564
17 https://www.technet-21.org/en/resources/guidance/who-handbook-on-the-use-collection-and-improvement-of-immunization-data

Fragmented Systems and Poor Interoperability Created Data Backlogs

Countries experienced data backlogs due to the duplication of non-interoperable tools, reliance on retrospective data entry, inadequate reporting tools, and other contributing factors. In **Madagascar** and **Zambia**, campaign data had to be retroactively entered into DHIS2. In Zambia, delays in updating the Electronic Immunization Registry (EIR) led to the concurrent use of Google Sheets for daily reporting.

Infrastructure and Resource Constraints Hampered Real-Time Monitoring

Technical failures, connectivity issues, and device shortages disrupted RTM efforts in multiple settings. In **Ethiopia** and **Madagascar**, server downtimes and system failures interrupted ODK and DHIS2 use. In **Central African Republic**, **Democratic Republic of Congo** and **Ethiopia**, shortages of reporting tools, limited training, and budget constraints reduced efficiency. In **Mozambique**, limited smartphones forced paper-based headcounts, while in **Uganda**, shortages of data collection tools across districts, driven by large numbers of outreach teams, caused reporting gaps. In **Zambia**, limited access to mobile data bundles delayed electronic immunization registry updates, prolonging efforts to address data backlogs.

Funding Gaps Affected System Readiness and Continuity

Financial instability constrained system readiness in **Central African Republic**, as reported from readiness assessments that identified a 115 million CFA gap for data collection tools.[18] In **Kenya**, USAID funding gaps disrupted digital platforms during key BCU planning periods. In **Madagascar**, suspension of U.S. support raised sustainability concerns. In **Mozambique** a resource mapping exercise identified available and missing resources, helping to prioritize approaches and advocate for additional funds. These examples underscore how broader financial instability in the health sector – beyond BCU-specific funds — can impact the readiness and resilience of digital health systems.

Collectively, these challenges, spanning both BCU-specific monitoring and routine immunization systems, underscore the need for contingency planning. Priorities include developing offline-first data collection tools, strengthening community-level digital capacity, and building partnerships with humanitarian actors to sustain digital monitoring in fragile and conflict-affected settings.

Plan and Implement Real-Time Monitoring Improvements

As part of post-implementation reviews, immunization teams and partners worked together to identify key challenges and outline priorities for strengthening RTM systems. Countries prioritized system customizations and process improvements to address gaps identified during BCU implementation, particularly enhancing the capture of catch-up vaccination data, improving data use for decision-making, and reinforcing integration with routine immunization systems. Planned and ongoing digital solution enhancements efforts aim to move beyond one-time campaign monitoring toward continuous tracking of catch-up vaccination targets within routine systems. These improvements also contribute to building more resilient and sustainable real-time monitoring systems for immunization more broadly.

The table below summarizes key planned or ongoing digital solution enhancements and the enabling factors supporting these efforts.

18 As of Aug 5th, 2025, the CFA-USD exchange rate on https://oanda.com reports that 115 million CFA equals 202,854 USD.

Table 3: Planned Improvements to Real-Time Monitoring Tools Supporting Big Catch-Up and Routine Immunization Systems

Country	Planned Improvements
Afghanistan	• Customize DHIS2 to enable reporting on BCU target groups.
Burundi	• Establish a framework for validating coverage data at all levels, including data triangulation with birth records and campaign data, and conduct a socio-anthropological study on non-vaccination drivers. • Broader system improvements, including roll out of eLMIS (Medexis) in 10 districts (full rollout by end-2025), use RapidPro at the community level (though not yet capturing ZD), and continue deploying OpenClinic with DHIS2 integration.
Cameroon	• Integrate BCU data from IASO in the DHIS2 routine immunization system. • Strengthen health worker practices, ensure consistent vaccine availability, and address community concerns.
Côte d'Ivoire	• Expand the use of ODK for enumeration, replacing paper-based systems. • Continue monitoring children aged 24-59 months through routine services to deliver complementary doses.
Ethiopia	• Integrate BCU reporting into DHIS2, resolve ODK server issues affecting ZD and UI headcounts, and ensure adequate distribution of paper tools. • Hold regular review meetings, provide refresher orientations on digital and paper-based tools, and conduct rapid community surveys in completed catch-up areas.
The Gambia	• Strengthen bottom-up microplanning to generate more catch-up reliable target estimates.
Kyrgyzstan	• Complement the paper-based catch-up job-aid with a digital calculator and integrate it into the iEmdoo immunization registry.
Madagascar	• Integrate BCU coverage monitoring into the DHIS2 routine immunization system, transitioning from ODK to streamline data entry. • Develop automated alerts to flag underperforming areas.
Mozambique	• Implement the BCU module in DHIS2 for continuous catch-up monitoring. • Integrate ZD and catch-up mapping into the UpScale electronic community health platform (pilot planned for June–December 2025). • Use GIS mapping of ZD and UI children in upcoming polio campaigns. • Conduct a BCU coverage and equity assessment in DHIS2 and document RTM use.
Myanmar	• Improve AEFI case reporting. • Conduct rapid convenience monitoring with RTM to identify missed ZD and UI children. • Optimize outreach site placement to reach underserved communities.
Nepal	• Customize DHIS2 to support antigen-specific reporting for BCU target groups.
Pakistan	• Scale up use of the National EIR app for monthly registration and tracking of all eligible children. • Update vaccination records in real time using QR codes, with team assistants and vaccinators responsible for accurate data entry.
Somalia	• Analyze subnational vaccination coverage data to prioritize districts with the highest ZD burden.
Sudan	• Explore geospatial technologies to map and verify under-five population targets, addressing denominator challenges and improving planning accuracy.
Syria	• Strengthen defaulter tracing and introduce community notifications to remind caregivers of missed vaccinations.
Tanzania	• Finalize customization of Vaccine Information Management System for BCU and integrate it with DHIS2. • Add BCU indicators to CHW tools and defaulter tracing books (e.g., number and percentage under-fives missing doses for catch-up vaccination). • Train health workers to support RTM rollout.
Uganda	• Conduct a readiness assessment for an EIR to improve data quality and strengthen defaulter tracing.
Zambia	• Strengthen subnational data use through regular community-level review meetings. • Enable zonal leaders to use RTM data for performance monitoring, with supervisors supporting underperforming areas.

Spotlight: Strengthening Real-Time Monitoring for the Big Catch-Up in Pakistan

During the first BCU round, Pakistan faced challenges due to the absence of BCU-specific questions in monitoring checklists and limited access to digital reporting tools. To address this, the country's Federal Directorate of Immunization and WHO developed and rolled out a customized M&E checklist aligned with BCU needs. For the second BCU round in February 2025, a fully revised checklist was launched through a mobile app integrated into the Electronic Programmatic Immunization Management Information System (EPIMIS), enabling real-time reporting of catch-up vaccination activities. The rollout strategy included:

- Training provincial and district data managers on app installation and use.
- Prioritizing district-level adoption of the checklist.
- Ensuring district data managers create EPIMIS user accounts for field monitors.
- Providing technical support for app setup and use at district, tehsil, and union council levels.
- Delivering training on mobile reporting, dashboard data use, and troubleshooting.

This stepwise approach improved the accuracy and timeliness of BCU monitoring, supporting better decision-making at all levels of the immunization program.

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Distilling Lessons Learned

Country experiences from the BCU reveal that the success of RTM depends not only on technology but also on how well it is embedded in program design, implementation, and continuous learning. Lessons from across Planning, Implementation, and Evaluation stages point to critical enablers that can help other countries strengthen RTM for catch-up efforts and beyond.

Prioritize, Plan and Coordinate early

Countries that clearly defined the RTM use cases and prioritized areas with the largest ZD populations were better able to target efforts and avoid mid-course corrections. For example, **Cameroon**, **Madagascar**, **Mozambique**, and **Somalia** directed resources to underserved districts facing contextual barriers such as insecurity, urban density, or difficult geography. When planning happened early, aligned with context, and coordinated across government and partners at both central and subnational levels, implementation was smoother, and data quality was stronger.

Strong coordination between government and partners also helped align strategies, avoid duplication, and optimize resources. Multilevel engagement, including with subnational actors, improved ownership and responsiveness throughout the BCU implementation. Countries such as **Madagascar**, **Mozambique**, and **Tanzania**, which shifted pragmatically to routine systems when customizations were delayed, managed to adapt but faced challenges with data flow. By contrast, countries that aligned digital tools with national plans from the outset maintained more consistent reporting and oversight.

Build on Existing Systems and Capacities

Countries that leveraged existing digital infrastructure and in-country technical capacity experienced smoother and more sustainable adaptation of RTM tools for the BCU. In **Burundi** and **Somalia**, national and subnational immunization teams adapted their existing DHIS2 systems to track BCU, avoiding the need to deploy entirely new platforms. This minimized integration challenges and allowed countries to compare catch-up data with routine immunization performance, supporting more cohesive program monitoring.

Leveraging existing infrastructure such as tablets, servers, and mobile networks also reduced costs and enabled quicker scale-up. Technical teams within ministries of health and partner organizations played a critical role in supporting tool deployment, troubleshooting, and reducing the learning curve for frontline users.

Engage Communities in Zero-Dose and Under-Immunized Identification

Community-level systems and actors were critical for identifying ZD and UI children. In **Ethiopia** and **Mozambique**, existing community health information systems supported mapping exercises that improved identification of missed children and informed catch-up strategies. In **Madagascar**, **Mozambique**, and **Pakistan**, ongoing polio campaigns and social mobilizer networks were leveraged to identify ZD and UI children, with house-to-house polio vaccination visits used for digital mapping and documenting reasons for non-vaccination. In **Pakistan**, recommendations emphasized strengthening social mobilizers' role in door-to-door outreach and referrals. In **Tanzania** and **Uganda**, CHWs registered households 2-3 weeks prior to the start of catch-up activities, generating actionable data and targeted plans for microplanning and outreach

Invest in Subnational Data Quality and Use

Improving subnational data quality and granularity was essential for tracking ZD children and defaulters. RTM tools exposed gaps and inconsistencies but only where quality baseline data existed. Dashboards alone proved insufficient; countries that built data-to-action capacity through regular review meetings and clear decision-making processes, such as **Pakistan**, were able to make mid-course corrections.

Plan for Systems Integration from the Start

Countries emphasized the need to integrate BCU and routine immunization

systems from the outset by aligning RTM tools with national HMIS. When this was delayed, retroactive data merging created backlogs and inconsistencies, as seen in **Madagascar**. By contrast, countries that linked catch-up with routine immunization systems were able to track cumulative progress, monitor missed children beyond the BCU timeline, and support transition to routine follow-up.

Prioritize Capacity Building and Supportive Supervision

Effective training, especially for subnational and frontline staff, was consistently cited as critical to RTM success. In **Zambia**, training for health workers, which covered both digital tools and BCU programmatic goals, improved uptake and use. Regular supportive supervision ensured correct tool use, and where supervision and feedback loops were strong, as in **Ethiopia**, RTM helped to drive continuous improvements in service delivery.

Establish Early Data Review Processes to Guide Mid-Course Corrections

Structured data reviews during implementation enabled countries to adjust strategies in real time. In **Pakistan**, early lessons from the first BCU round led to revised supervision tools and improvements in the next round. In **Sudan**, daily subnational review meetings supported rapid replanning in low-coverage areas, including deployment of alternative strategies.

Use Human-Centered Design to Ensure Tool Usability

Involving health workers in digital tool design led to more practical and user-friendly solutions. In **Kyrgyzstan**, a co-design process engaged health workers in developing and testing BCU job aids, with focus group feedback used to refine them. This approach reinforced the value of simple paper-based visual job aids, such as visual algorithms now used by nurses alongside the planned rollout of iEmdoo, the electronic immunization monitoring tool.

The BCU demonstrated that while RTM tools can expand the reach and responsiveness of immunization programs, their success depends on how well they are embedded in planning, existing systems, and continuous learning. Countries that prioritized contextual planning, built on existing systems, engaged communities, and invested in supervision and capacity building achieved the greatest progress. Yet gaps remain in systems integration, subnational data use, and digital readiness. These lessons build on existing guidance and best practices, offering a practical roadmap for strengthening RTM as countries transition from catch-up efforts to sustainable routine immunization.[19]

19 https://www.immunizationagenda2030.org/resources/34-ia2030-data-action-framework

Limitations

The insights in this learning brief are primarily based on a desk review of country reports, presentations, and selected scoping calls with BCU implementers from September 2024 to June 2025. This approach provided a valuable snapshot of how countries leveraged RTM tools during the BCU but has several limitations.

First, the analysis was not drawn from a structured or comprehensive survey of all BCU-implementing countries. It reflects information available at the time of writing and deeper dives with a subset of countries that shared experiences more extensively. As such, it may not capture the full range of country practices, innovations, or challenges.

Second, the documentation reflects inputs primarily from national-level stakeholders and does not systematically include perspectives from subnational users, frontline health workers, or communities. These perspectives are essential to fully understand how RTM tools were implemented and used in practice. Ongoing BCU RTM case studies in selected countries are beginning to address this gap by capturing in-depth insights from subnational levels and end users.

Finally, the findings reflect a specific point in time. Some system and practice improvements may have occurred before or after the review period and are therefore not captured. Given that most efforts are ongoing, further learning will be needed to assess the sustainability of RTM adaptations and their integration into broader routine immunization and health system strengthening efforts.

Recommendations

Building on the lessons learned and acknowledging the limitations of this analysis, the following recommendations aim to guide countries and partners in enhancing the use of RTM for catch-up efforts and strengthening its integration within routine immunization systems.

1. Complement Program Readiness with Digital Readiness Assessments

Countries adopted the readiness checklist in BCU monitoring guidance, which includes two indicators for data monitoring. While these represent the minimum requirements for launching BCU activities, countries aiming to adopt RTM and digital tools for long-term use are encouraged to go further. Broader digital health readiness assessments can help evaluate overall preparedness, assess digital maturity, and guide the selection of appropriate tools. Training gaps and server infrastructure limitations seen during the BCU might have been mitigated through such a process. UNICEF has developed a BCU RTM readiness checklist that countries can adapt to identify improvement opportunities for RTM within the BCU and future immunization initiatives.

2. Transition from Spreadsheets to Scalable RTM Platforms

Spreadsheets such as Google Sheets provide initial flexibility but have limitations in data synchronization, security, and scalability. Countries like **Ethiopia** and **Tanzania**, which used spreadsheets during BCU implementation, reported challenges managing multiple sheets created at different levels. To address this, countries should prioritize transferring data into their HMIS and adopt structured, scalable platforms for long-term use.[20]

3. Prioritize Health Worker Capacity Building and Continuous Learning

Health worker training remains a critical enabler for RTM success. Countries should prioritize hands-on training on both paper-based and digital tools and strengthen understanding of data quality and use. With frequent staff turnover, training of trainers, eLearning modules, recorded training sessions, and decision-support features can support continuity. Countries with mature digital ecosystems could digitize paper-based job aids, such as catch-up algorithms, to provide frontline health workers with intuitive, vaccine-specific guidance. Capacity building should also extend to program managers and decision-makers to strengthen their ability to interpret and act on RTM data. Resources such as *UNICEF's Using Real-Time Monitoring to Strengthen Health Campaigns* e-learning course[21] can help equip leaders with these skills.

4. Broaden RTM Use Beyond Coverage Monitoring

RTM tools were often used narrowly to track immunization coverage, while other areas such as stock management and safety monitoring were under-addressed. For example, eLMIS platforms were not adapted for BCU-specific vaccine stock tracking and several countries reported gaps in AEFI reporting. Future programs should adopt a holistic RTM approach, identifying indicators across the full program life cycle — including planning, service delivery, safety monitoring, supply chain, and community engagement — and configure digital tools to capture these areas comprehensively. This will ensure that RTM supports both coverage monitoring and overall program quality and sustainability.

20 WHO, UNICEF and CHAI. Digital Tool Selection Guidebook for Health Campaigns. UNICEF 2025.
21 https://agora.unicef.org/course/info.php?id=58785

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5. Implement Evidence-Based Improvements

Planned improvements should be anchored in clear prioritization of challenges, a solid understanding of country context, and evidence-based selection of solutions. While adapting routine digital systems has laid a strong foundation for monitoring BCU activities, gaps identified during implementation point to the need for broader system investments. These include strengthening digital governance, upgrading infrastructure, enhancing interoperability, and building local capacity to sustain use of RTM tools. Aligning improvements with national digital health architecture ensures consistency and long-term value. Countries can also draw on resources such as UNICEF's Digital Tool Selection Guidebook for Health Campaigns to systematically match solutions to program needs and national strategies, avoiding fragmented or short-lived investments.[22]

6. Address Limitations of Planned Improvements

Countries should assess the limitations of proposed solutions before committing investments. For example, while EIRs can improve defaulter tracking, they often miss children born outside of health facilities. Countries planning EIR deployment should explore integrations with eCHIS or electronic Civil Registration and Vital Statistics platforms to increase inclusivity, particularly for ZD and UI tracking. Resources such as the *Digital Adaptation Kit for Immunization* provide standards-based guidance and interoperability templates to support these integrations and build more comprehensive EIRs.[23]

22 https://www.unicef.org/digitalimpact/reports/digital-tool-selection-guidebook-health-campaigns
23 https://www.who.int/publications/i/item/9789240099456

Conclusions

The BCU created a valuable opportunity for countries to advance their digital health maturity by adapting existing systems to meet new program demands. Country experiences highlight encouraging progress but also show that digital transformation in immunization remains a work in progress. Digital tools were often used reactively to meet immediate program needs rather than as part of long-term system planning. In some cases, despite leveraging existing digital systems, there were gaps in countries' ability to quickly customize tools for BCU RTM, and the adopted interim solutions caused backlogs. Persistent challenges including fragmented tools, limited interoperability, and incomplete integration with national health information systems constrained the ability to track ZD and UI children, strengthen defaulter follow-up, and monitor catch-up coverage in real time. Some countries also faced infrastructure and capacity limitations that slowed implementation. These issues are not unique to the BCU and reflect broader gaps in digital health system readiness and sustainability.

Looking ahead, stronger alignment is needed between programmatic priorities and digital health system strengthening efforts. Countries can build on BCU experiences by:

- Planning for digital readiness from the outset of immunization and health initiatives, ensuring data systems can meet evolving needs.
- Investing in local capacity to manage and customize digital tools as part of ongoing system strengthening efforts, not only campaign preparations.
- Integrating digital solutions into national health information systems to improve sustainability and avoid parallel systems.
- Strengthening data quality and use practices at all levels of the health system so that real-time data leads to timely decisions and actions.

Strengthening RTM in immunization offers benefits beyond campaigns, contributing to better data use, more responsive service delivery, and greater health system resilience. Lessons from the BCU provide practical insights to guide future efforts in making digital tools work for immunization and broader health goals.

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Digital Health and Information Systems
United Nations Children's Fund (UNICEF)
3 United Nations Plaza New York,
NY 10017, USA
www.unicef.org

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