Recommendations for addressing systemic root causes of data backlogs

Findings based on root cause analysis of COVID-19 vaccination data backlogs in Senegal, Kenya, and Tanzania

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Today's agenda

Background and methodology of analysis across three countries

Root causes of data backlogs and recommendations

Summary and Q&A

The Background and Methodology

Overview of the root cause analysis and purpose of this deck

- In September to December 2022, Digital Square conducted a root cause analysis in Kenya, Senegal, and Tanzania to:

  - Identify possible underlying systemic challenges across four dimensions (technology, infrastructure, guidance/processes, and human resources) that contributed to data backlogs related to COVID-19 vaccinations.

  - Draw lessons to understand whether the data backlog is unique to COVID-19 immunization processes or whether there are opportunities to learn from and address these challenges across routine and other immunization platforms.

- This deck provides the lessons, root causes, and recommendations for country stakeholders who want to prevent or address data backlogs to other large-scale data collection efforts.

- The findings and recommendations included in this report were those found to be consistent across the three countries and with generalizable applicability to other data collection efforts.

We collected data in Kenya, Senegal and Tanzania

- Estimated the size of data backlogs by triangulating secondary data sources (stock data, aggregate reporting).

- Sampled subnational administrative areas for primary data collection (in partnership with MOH, based on estimated size of data backlogs).

- Conducted subnational data collection at health facilities (observations and interviews with health care workers and data entry clerks). See table at right.

- Conducted national level technical assessment focused on system configurations and performance issues (system testing and interviews with MOH & ICT).

Country	Region/county	Interview types / Number of facilities / # of respondents?	Urban/rural	Type of facility
Kenya	Busia County Homabay County Kajiado County Kakamega County Kilifi County Laikipia County	50 health facilities respondents	Urban: 42% Semi-urban: 6% Rural: 52%	Dispensaries and clinic: 38% Hospitals (primary and secondary): 30% Primary health care facility: 24% Comprehensive teaching and referral: 8%
Senegal	Kédougou Region	6 health facilities respondents	Urban: 50% Rural: 50%	General high volume: 100%
Tanzania	Dar es Salaam Region Dodoma Region Rukwa Region Songwe Region	67 health facilities respondents *In Tanzania, we also conducted interviews with 13 Council Health Management Team / Regional Health Management Team respondents*	Urban: 49% Rural: 51%	Hospitals: 21% Health centers: 33% Dispensaries: 46%

We analyzed data as follows:

- Summary statistics for quantitative data from facility observations and surveys.
- Qualitative analysis (Dedoose) from facility observations and interviews.
- Participatory RCA process (Miro) with study team.
- Root causes categorized by people, process, technology, or infrastructure.
- Recommendations generated by the study team based on results, digital health expertise, and knowledge of local context.

The root causes and recommendations are applicable to other large-scale data backlogs

- The rapid introduction and scaling of COVID-19 vaccination campaigns for large target populations in such a short period of time created a large and prominent data backlog. While many of the root causes that are noted in the following slides likely existed pre-pandemic, the urgency to act, paired with the massive volumes of patients and data pushed systems to their limits and created sizable data backlogs.

- After reviewing the findings across all three countries, we determined that the root causes and recommendations are applicable to electronic health management information systems and other large-scale data collection efforts. The findings could potentially be generalizable regardless of the speed, population, or level of data that is being collected.

- Addressing the root causes by implementing these recommendations will enable more efficient implementation of Electronic health management information management systems.

Lessons learned from COVID-19 immunizations could be relevant to other Electronic Health Management Information System efforts including:

Short-term and/or high-volume data surges as part of an emergency/ rapid response or campaign
(e.g., immunization or mass drug campaigns, new vaccine rollout, contact tracing)

- Rapid implementation
- General or sub-population
- Individual and aggregate level data

Routine individual patient-level data systems
(e.g., HIV, malaria, immunizations data)

- Routine/on-going
- Sub-populations for some (HIV), general for other patient level (e.g., OPD)
- Individual-level data

Aggregate data for health sector monitoring
(e.g., HIV, malaria, community data)

- Routine/on-going
- General and sub-populations

The Root Cause of Data Backlog

Six root causes of data backlogs

Category	Root causes
Technology – Software and Hardware solutions	System slowdowns, freezes, or crashes
	Insufficient device availability and functionality
Infrastructure – Digital solutions enablers	Lack of reliable internet access and data bundles
Guidance & processes	Lack of SOPs for service delivery and data management
	Incongruence between processes, data fields, and formats of paper tools and digital systems
Human resources	Staff shortage, large workload, and lack of motivation

Increase system capacity and plan for troubleshooting

Findings about root causes	Recommendations
- Data reporting applications were slow to load, often stopped functioning, and required reboots or restarts of the application to function. - Root causes included insufficient server capacity issues, low quality or old devices, and slow Internet speeds. - System slowdowns or interruptions then limited when people were able to enter and access data.	**Short-term** ➤ Assess the device and network,[1] if this does not resolve issues, escalate issues to ICT to check system's server capacity. ➤ Perform routine system maintenance and bug fixes. **Medium & long-term** ➤ Determine and address causes of system slowdowns.[2] ➤ Anticipate and plan ahead for surges or high demands on the system. ➤ Ensure that each server meets the minimum requirements for the system and load capacity, which may require increasing server capacity with the purchase of new or extended servers. ➤ Migrate data to cloud-based system (as regulatory environment allows) so that the server capacity can be adjusted dependent on needs. ➤ Create protocols and invest in monitoring system so that people know when the system is down. ➤ Create budget line for sufficient server capacity and routine system maintenance.

[1] See resource on slide 18: "Facility Troubleshooting Flowchart"
[2] See troubleshooting guide – insert link

Provide sufficient functional devices and technical support

Findings about root causes	Recommendations
• Across facilities, there were not enough facility-owned devices provided. • When facility-owned devices were provided, they were often older and nonfunctional due to issues with computer viruses, device memory space, SIM cards, dead batteries, or faulty charging ports. • The lack of consistent access to functional devices resulted in slower data entry and the inability to enter data in real time, which contributed to the data backlog. • As a workaround, staff often used their personal devices which led to two problems: (1) data privacy issues and (2) financial burden on facility staff who were paying for their own data.	Short term ➢ Update or fix existing facility devices. ➢ Provide technical support to address functionality issues for facility devices, including updating to latest versions, providing antivirus software to current computers (desktop/laptop) and devices (phone/tablet), as relevant. Medium & long term ➢ Purchase new (better) devices for facilities with standardized software. ➢ Provide regular information technology maintenance services to keep devices functioning and updated with the latest versions of software, through either the creation or expansion of local tech support teams. ➢ Develop and circulate guidelines on what will help devices (whether facility-owned or personal) to function at its best. ➢ Develop and circulate standard operating procedures (SOPs) or guidelines for what applications are allowable on MOH-owned devices. ➢ Create budget line for devices and funding for data bundles (see recommendations on next slide).

Provide data bundles for internet access and include an option for offline data entry where necessary

Findings about root causes	Recommendations
• All three countries reported lack of available or reliable internet access as a significant barrier to timely data entry—these findings were relevant for both individual-level and aggregate data. • Many staff personally paid for these internet and data bundles to enter data into the system. • When the Internet was unavailable or inaccessible, there were delays in data entry and/or data had to be entered at a different location, where internet was available.	Short-term ➢ Provide funding for data bundles to access the Internet. ➢ Ensure the designated funding is distributed to facilities. Medium & long term ➢ In settings with limited internet connectivity, develop off-line system capabilities so data entry can occur regardless of Internet access. (Off-line systems will work for settings with aggregate data or individual-level data with unique identifiers). ➢ Orient end users to use the system off-line capabilities (once available) and then sync their data when internet connectivity is available. ➢ Work with telecommunication providers to negotiate cost of data bundles and Internet access. ➢ Create budget line for internet and/or data bundles.

Develop and implement SOPs for service delivery and data management

Findings about root causes	Recommendations
• Facilities lacked SOPs for both COVID-19 vaccination service delivery and data entry/ management. • The lack of SOPs, especially in terms of transferring data from paper tools to the digital system, impacted how quickly data were entered, and the lack of streamlined process added to the time facility staff needed to spend on data collection and entry, contributing to the data backlog.	**Short-term** ➤ Develop or review national SOPs and process guidelines for data entry and use of electronic systems. ➤ Provide routine training and mentorship to monitor and support dissemination, understanding and use of SOPs. ➤ When SOPs already exist, ensure that they are up-to-date and relevant staff are trained. **Medium & long term** ➤ For pandemic preparedness, create SOP templates that can be applied to a pandemic at an early stage. ➤ Disseminate SOPs to health facilities to ensure consistency in vaccination and reporting processes across all facilities. ➤ Identify who is responsible for maintaining and updating SOPs and guidance documents (e.g., a national governing body). ➤ Create budget line for developing/updating SOPs and incorporating into training & mentorship.

Ensure congruence between processes, data fields, and formats of paper tools and digital systems

Findings about root causes	Recommendations

• Format, questions and information collected on paper tools often did not align with information collected in the digital system.
 	
• Given the rapid roll-out of COVID-19 immunizations, paper-based COVID-19 data capture tools were not initially available at all vaccination sites. Staff used ad hoc paper tools that were at hand (e.g. routine immunization registers) or improvised paper tools. As a result, the format, information, and processes used to collect data on paper, did not align with the digital systems and processes.
 	
• When the digital system required mandatory data fields that were not in the ad hoc paper tools, people got stuck and were unsure how to proceed.
 	
• These inconsistencies required additional time to complete unnecessary questions or, in some instances, went back to try to find missing data.
	➢ Clarify accountability for decisions and alignment in data collection & entry processes, paper tools and digital systems.
	
	➢ Engage relevant stakeholders to review data needs, define processes and align tools & systems.
	
	   • This review should identify priority data elements to be collected, drop extraneous data fields, and inform the design of paper tools and digital systems so they are streamlined and aligned.
	
	   • In an emergency setting where tools and processes must be rapidly introduced, this review may occur after data collection begins and can inform re-design of tools/systems.
	
	   • When ad hoc paper tools have been developed, replace them with specifically designed paper tools as early as possible and ensure the tools are distributed to relevant health workers
	
	   • In the longer term and as resources permit, update the digital systems and/or revise paper tools to align with actual processes.
	
	➢ Create budget line and make time for system reviews and resulting updates.

Hire surge support and motivate and support end users to use the digital system

Findings about root causes	Recommendations

• All three countries referenced staff shortages, large workloads, and lack of motivation as factors contributing to the data backlog.
 	
• HCWs expressed concerns that COVID-19 service delivery and reporting was adding to their already high workload. This workload challenge was particularly true for large outreach campaigns.
 	
• HCWs reported a lack of motivation in part due to high workload and low (or no) compensation. In Tanzania, HCWs were supposed to receive additional compensation for outreach and campaigns, but that had not happened. In Senegal, HCWs were on strike due to inadequate compensation.
 	
• When HCWs had limited bandwidth and lack motivation, they deprioritized data entry, greatly adding to the data backlog.
	Short-term
	
	➤ When faced with a significant data backlog, hire temporary data entry clerks to provide time-limited support in emergency settings or campaigns.
	
	➤ Create a budget line to support short-term data clerks.
	
	Medium & long term
	
	➤ Design data collection and management processes to add value for end users (e.g., via time savings, decision support, streamlined processes). These non-financial incentives can motivate users to use the system.
	
	➤ Ensure end users are supported to use the system, e.g.:
	  ➤ Cover the cost of data bundles for internet access.
	  ➤ Evaluate and adjust staffing (e.g., admin staff, data entry clerks, IT staff) so that HCWs spend less time troubleshooting and more motivated to use the system.
	  ➤ Provide training and supportive supervision for HCWs on data collection systems.
	
	➤ Ensure HCWs are paid on-time.
	
	➤ For outreach and campaigns, add a budget line to provide additional compensation to HCWs and/or additional data entry surge support.
	
	➤ Review data tools and omit unnecessary fields to reduce burden on staff (see recommendations on slide 13).

Summary

Summary of the six recommendations

Category	Recommendations
Technology	Increase system capacity and plan for troubleshooting
	Provide sufficient functional devices and technical support
Infrastructure	Provide data bundles for internet access and include an option for offline data entry where necessary
Guidance & processes	Develop and implement SOPs for service delivery and data management
	Ensure congruence between processes, data fields, and formats of paper tools and digital systems
Human resources	Hire surge support and motivate and support end users to use the digital system

Across these recommendations, there are a few over-arching lessons that we captured:

Use an intentional and coordinated approach

Where possible, there should be an intentional approach to design and introduce a new digital system. This intentional approach will require clear governance and accountability, engagement of many stakeholders, identification of essential data elements/processes, and consideration for the enabling environment. We encourage the leadership to streamline data fields whenever possible and ensure alignment amongst the processes, SOPs, data collection tools, and digital systems.

Iterate as needed

We recognize that in emergency settings, like the Covid-19 pandemic, there are tradeoffs between rapidly introducing a system to meet urgent needs versus taking the time for the upfront intentional design. However, once you get something up and running, within a few months, it is important to pause, review and re-design for sustainability.

Proactively address needs of health workforce

To ensure that the health workforce engages productively, provide sufficient support (e.g., training, SOPs), infrastructure (data bundles, devices), and incentives. There are many ways to incentivize staff to view and utilize digital systems as an integral part of their jobs, these may include simplifying workflows, sharing data back with staff, and demonstrating how digital systems can make their jobs easier.

Ensure sufficient funding

Preventing data backlogs will require funding for line items including server capacity, data bundles for internet access, devices, training, system reviews & redesign, and staffing (e.g., IT staff, data entry clerks).

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Appendix: Facility troubleshooting flowchart

- **Facility flowchart preconditions are as follows**: To support troubleshooting on issues reported by facilities, it is necessary to validate that the DHIS2 Tracker hosting environment is configured for performance at scale, as well as see that server monitoring software is running to further investigate issues corresponding with the same date and time. Ideally, the individuals on-site at the facility have the hosting support team's contact phone number to explore server-side conditions when they need to "escalate to support."

- Figure 1 provides a flowchart/decision tree of steps a user can use to identify local application and network challenges.