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Key Considerations for Global Public Health Data Modernization: Lessons from Modernizing the Hepatitis C Program Data Analytics System in the Country of Georgia

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Timely and accurate data are essential for preventing disease transmission, program monitoring, and making data-informed public health decisions towards global health

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protection. Hepatitis C affects about 58 million people globally, and an estimated 150,000 persons live with the infection in Georgia.[1] Public health programs like Hepatitis C elimination face several challenges with data access for disease surveillance and response, and the COVID-19 pandemic exposed more of these challenges.[2] Issues around siloed data systems, poor data quality, data availability, and capacity for data integration, interpretation, and aggregation continue to impact public health response efforts globally.

Public health data modernization involves building better and more resilient information systems to quickly detect, prevent and respond to public health threats. Modernization seeks to improve situational awareness among public health decision makers and provide access to the right data at the right time to inform public health response strategies. Public health data modernization can help address some of challenges faced during the COVID-19 pandemic by supporting initiatives that break down data silos, improve data completeness, and timely access to data for decision making.

The United States Centers for Disease Control and Prevention (CDC), with funding through the 2021 U.S. American Rescue Plan Act (ARPA), is responding to the global health data modernization needs in line with the broader CDC global health strategy. CDC is working with other country governments to strengthen global outbreak response, pandemic preparedness, and surveillance through improved data timeliness, availability, completeness and use for public health decision making. CDC's effort to address global health data needs is oriented around 2 key strategic initiatives: the Data Modernization Initiative (DMI) and the Global Digital Health Strategy (GDHS). The DMI aims to enable CDC to get better, faster, and actionable data for decision-making at all levels of public health by improving processes and governance structures, and also modernizing the public health data infrastructure.[3] The GDHS articulates actionable strategies that facilitates the availability and use of data in health systems through a fundamental change in how digital health is implemented both within the United States and globally.[4] These CDC strategies build on the foundations that have been laid by many country governments, and other bilateral and multilateral organizations.

The National Health Strategy of Georgia (2022–2030)[5] has seven strategic goals that demonstrate the national vision for the health sector. Two goals from the strategy target improving public health data use and surveillance by strengthening the health care management information system (goal 5) and strengthening the public health system to improve preparedness and response to public health risks (goal 7). These goals intend to enhance the national digital health architecture, improve the quality of data exchange, and strengthen surveillance systems. Some key activities already underway include aligning the national data protection regulation with the European Union standards,[6] implementing several health information systems at multiple levels of the health sector, lab capacity development, and developing early warning systems.

The Georgia National Center for Disease Control and Public Health (NCDC), through a cooperative agreement with CDC, is implementing a three-phased project to modernize its data management processes for the hepatitis C elimination program.[7] The goal of the project is to improve the program's data management approaches though automated data integration

and analytics processes. Phase 1 of the project, completed in April 2023, implemented a proof-of-concept as described in the section below. Phase 2 is currently piloting the proof-of-concept, while phase 3 of the project will transition these modernized processes into production.

The Proof of Concept

The Georgia hepatitis C elimination program utilizes two major data sources: a screening registry (a MongoDB database) and a treatment database (Microsoft SQL server). The data from these two information systems needed to be integrated to effectively monitor program performance and progress. However, the data integration and linkage were done through a process external to in-country program resources due to insufficiency in both human resources capacity and technology infrastructure. The proof-of-concept automated the data management life cycle processes with the intent to develop a platform the national program can adopt for its routine data use needs. Features of the proof-of-concept included functionalities such as data pre-processing, data transformation, record linkage and data storage. The solution was implemented using a suite of solutions as described in Table 1.

This project assembles the right infrastructure that allows the hepatitis C elimination program data to be analyzed by key health equity metrics including gender, age, and region.

We present below, key lessons learned from completing the proof-of-concept implementation as key consideration towards modernizing the public health data infrastructure to support global health protection.

Align Policies and Regulations with Technology Adoption

As data technologies evolve, updates to the legal framework, policies and procedures around data security and data governance are required.[8] Modernization introduces new kinds of perspective around how to think of data privacy, security, new architectures and infrastructure.[9] With the rapid adoption of modern technologies across the globe, laws and regulations across multiple geographies including Georgia are taking on new dimensions, some of which are introducing new barriers to technology adoption.[10–12] Lessons from this project underscored how these regulations can impact technology adoption for data modernization. To address this, there needs to be greater understanding of technological options that establish and protect legal ownership. This understanding will help refocus the legal frameworks and policies on protecting data sovereignty through technical implementation rather than viewing this from the geographic lens. Doing this establishes the right environment for innovation and public health data modernization.

Develop Strategies for Modernizing the Workforce

Having a workforce with the right informatics and data skillsets to use current technologies are critical considerations for global public health data modernization.[13] Identifying the capacity development needs of the workforce and developing upskilling initiatives to address those are critical steps to modernization and digital transformation. Georgia partnered with other countries in the region, CDC, WHO regional office for Europe, and the University of

Washington to provide informatics and data science upskilling training called Informatics and Data Science for Health (IDASH), for key government personnel.[14] IDASH is aimed at preparing the public health workforce to use up-to-date technology approaches to detect, prevent and respond to future global public health threats. The trainees from the Georgian state agencies are applying the lessons from the program by leading the pilot implementation of the hepatitis C elimination program data modernization activities. This approach to informatics and data science workforce development, that interconnects trainings and capacity development activities, with tangible public health data modernization project, can be a useful model for other public health institutions looking to upskill its workforce.

Understand the Existing Technical Infrastructures but Consider the Future

Outcomes of technology modernization include systems that can seamlessly integrate data from multiple sources, and systems that use artificial intelligence to generate population specific insights. In modernizing the public health infrastructure, considerations should be made for how the technology might evolve.[8] To do this effectively, it is important to understand the current systems, assets, and deficiencies that can guide decisions on technology selection, migration strategies, and data storage and analytics considerations. This project went through a discovery process that established the current state of the hepatitis C data management processes, modeled the to-be process and developed high-level requirements to move from the current to the future state. In developing the future state, the project considered scalable approaches that allow ease of expansion to other public health conditions of interest.

Stepwise Implementation: From Proof-of-Concept, to Pilot, to Operation

It is often the case that public health institutions will identify more system modernization activities than they can immediately address. Implementation of large-scale public health data systems are complex and may include aspects such as data sources, health information exchange, analytics, and data processing systems. It is useful to take a phased approach with consideration for the available time, funding, technology, and human resources to support the work. Lessons from this project showed that adopting this approach allowed minimal disruption in service, opportunities to iterate and build back better, and manage change gradually.

Conclusion

Public health data modernization is a complex endeavor that requires balancing its strategic nature and defining practical projects to demonstrate meaningful progress. Data modernization involves setting all the necessary foundations to ensure that a technology solution, when deployed, can effectively and efficiently provide complete data in a timely manner to public health decision makers. We have laid out in this paper four key lessons that can guide public health institutions in beginning their journey to better, faster, and more reliable data for decision making. It is our goal that the considerations laid out in this paper will drive discussions and action, towards modernizing the public health data systems across

countries for global health security and equity, and to maximize the impact of digital health globally.

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Implications for Policy & Practice

- Public health data modernization is a necessary step towards readiness to detect, prevent and respond to public health threats.
- Modernization is not only deploying new tools and solutions, but involves all the other operational factors including policies, the right governance structures, human resource capacity, and technology infrastructure.
- Public health institutions should consider aligning projects with local regulations, develop upskilling strategies for its workforce, understand the existing technology infrastructure, and adopt incremental development strategies that will allow them to learn from small fast fails.

TABLE 1

Description of Solutions Used in Developing the Proof-of-Concept

Solution	Description	Use on the project
Azure Data Factory (ADF)	A cloud-based service for creating workflows and automating data movements and data transformation.	Data ingestion, data transformation and workflow automation.
Azure data lake (ADL)	A cloud-based storage solution that allows storing large amounts of data regardless of structure or formats.	Data storage.
Databricks	A cloud-based solution for developing analytics, data science and artificial intelligence solutions.	Data processing and analysis.
Microsoft Power BI	A business analytics solution that allows the creation of interactive reports and dashboards.	Data visualization and reporting.

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