Data Modernization Tactical Guide:

Building, Equipping, and Sustaining a Data Modernization Workforce

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Contents

Introduction

The purpose of this document is to detail key strategies and tactics for **building, equipping, and sustaining a data modernization workforce** within a state, tribal, local, or territorial (STLT) public health agency. This document is intended for Data Modernization (DM) Directors and other agency leadership who will be implementing data modernization.

This Tactical Guide is part of a multi-part series on data modernization for STLT agencies.

1. Data Modernization Primer: Guide for State and Territorial Health Officials
2. Data Modernization Tactical Guide: Planning Data Modernization Activities
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Each agency is approaching data modernization with their own unique set of structures, resources, strengths, and challenges. These documents are not designed to prescribe a "one-size-fits-all" approach. They serve as a guide rather than a set of stringent instructions to follow. Each agency will follow different routes, but all are traveling to the same destination—a stronger public health ecosystem that allows for data-driven decision making to promote population health for all.

Overview

In order to promote successful data modernization efforts, public health agencies must invest in workforce development. Workforce development refers to "a range of strategies, initiatives, and educational activities that aim to enhance the skills and competencies of staff at an organization" (Generation). A well-equipped public health workforce will help agencies deliver real-time, high-quality information on public health threats. Having this timely access to quality data will in turn help public health professionals to solve problems proactively and reduce the harm caused by problems that do occur.

Primary areas of workforce development include upskilling, training, recruitment, and retention. Looking at workforce development from the lens of data modernization, this guide focuses on the following steps:

1. Identifying key areas of a data modernization workforce
2. Building workforce competency
3. Developing candidates
4. Hiring and retaining informatics and data science workforce

In addition to these steps, agencies may consider establishing an Informatics and Data Modernization Unit within their agency. This optional step is a unique approach to aligning responsibilities for data modernization that some agencies have found works well for them. More information on what this might look like will be covered in the last section of this guide.

Identifying Key Areas of a Data Modernization Workforce

Public health agencies need to build a robust workforce with knowledge in a variety of areas as a vital piece of the data modernization journey. Every agency is different, and agencies across the country may not have the exact same titles or ability to hire certain roles. The table below focuses on key workforce areas of data modernization, key responsibilities that fall into these areas, and potential roles for each. While this list is not exhaustive, it is meant to provide an idea of who might be a good fit to lead these areas of work. It is ultimately up to each agency to determine what will work best for them and how they should be organized. For example, some of the below workforce areas may be covered by a single role, while others may benefit from a group or committee that will lead efforts in the area. DM Leadership should communicate with all department leads within the agency to determine which responsibilities will be managed within a department or program area and which will require a more enterprise-wide approach.

Table 1: Identifying Key Areas of a Data Modernization Workforce

Key Workforce Areas	Key Responsibilities	Potential Roles
Executive Leadership	Endorse and secure resources for projects, approve budgets, direct strategy.	Commissioner, Deputy Commissioner, Chief Medical Officer, Executive Director
Data Modernization Accountability	Provide guidance and vision, monitor and review DMI Plans, help to resolve any risks or issues.	DM Director, DM Lead, DM Steering Committee
Data Governance	Develop and implement policies for data access, data quality, data privacy and usage, data sharing, and data retention.	Chief Data Officer, Data Governance Office, Data Trustee, Data Stewards
Information Technology	Assist in the implementation, operation, and maintenance of systems, applications, and tools. Handle cybersecurity, IT governance, and tech procurement.	Chief Information Officer, IT Analyst, IT Specialist, Cloud Architect, Systems Administrators, Application Developer

Table 1: Identifying Key Areas of a Data Modernization Workforce (Continued)

Key Workforce Areas	Key Responsibilities	Potential Roles
Informatics	Gather and structure health data in ways useful to decision-makers, establish informatics framework, implement, and support information systems, maintain surveillance systems.	Informatics Lead, Informatics Analyst/ Specialist, Health Scientist
Knowledge Management	Capture, organize, and share critical knowledge and information across the organization.	These responsibilities may not be covered by a specific role, but rather be done as part of each program area's activities (e.g., having a point person for public health data onboarding, clinical data onboarding, etc.)
Data Analytics, Visualization, and Reporting	Derive insights from patterns and correlations in data and use it to make better decisions, ensure quality data is available to those who need it when they need it.	Data Analyst, Data Scientist, Program Analyst
Data End Users	Apply data to carry out public health functions.	Epidemiologists and Program Subject Matter Experts
Partnerships	Identify opportunities to collaborate with private partners, academic institutions, community-based organizations, and other public health agencies.	These responsibilities may not be covered by a specific role, but rather be done as part of each program area's activities (e.g., having a point person for reaching out to academic institutions).

Building Workforce Competency

A large part of data modernization is about developing a public health workforce with the latest skills in data science and informatics. As new data information systems and tools are developed, public health staff will need to stay up to date on these advancements and learn how to utilize these tools. Additionally, upskilling workforce can be a good alternative or supplement to hiring new staff. "Upskilling" refers to improving an individual's skillset in order to make them more effective in their role, accomplished through employee development with education or additional training.

Assessing current workforce competency in the different areas of data modernization (see Table 1) will help identify priorities for workforce development. Workforce competencies describe knowledge, skills, or behaviors required to complete a job or task. Table 2 illustrates an example of a workforce competency assessment for the area of data analytics, visualization, and reporting.

Table 2: Representative Output of a Workforce Competency Assessment

- ***No Gap***: *A gap does not exist in this competency.*
- ***Training/Learning and Development Gap:*** *A gap exists in this competency that can be resolved with training/learning and development.*
- ***Staffing/Capacity Gap:*** *A gap exists in this competency that can be resolved by hiring additional staff.*

Data Analytics, Visualization, and Reporting	
Competency Milestones	**Type of Gap**
Ability to—through the application of various tools—use both predictive and prescriptive statistical methods, qualitative methods, and geospatial methods to interpret and summarize data.	Training/Learning and Development Gap
Ability to use exploratory data analysis approaches to identify general patterns and possible anomalies in the data.	No Gap
Ability to develop data science and analytical models by applying relevant testing and model validation techniques and developing methods to extract knowledge from structured and unstructured data.	Staffing/Capacity Gap
Ability to create, modify, and test computer code, forms, and script to ensure operability of applications.	Staffing/Capacity Gap
Ability to program language to develop and write computer programs to store, locate, and retrieve specific documents, data, and information.	Training/Learning and Development Gap
Ability to design, implement, and support the organization's data assets to ensure effective collection, storage, backups, and retrieval.	No Gap
Ability to analyze user needs to recommend software solutions and designs.	No Gap
Ability to maintain and ensure efficient performance of the technologies that make data accessible.	Staffing/Capacity Gap
Ability to contribute to root cause analysis of data issues and helps the organization identify business processes and technical improvements that contribute to higher-quality data.	No Gap
Ability to design and showcase visual representations of data findings via visualization tools to ensure understanding of core users to facilitate decision-making.	Training/Learning and Development Gap
Ability to formulate action-oriented recommendations for appropriate audiences (e.g., scientific colleagues, constituents, partners, and the public) for adoption.	Training/Learning and Development Gap

Once DM leaders evaluate workforce competencies, the team can focus on developing training plans and strategies to address existing gaps. This may include upskilling (see Table 3 below) or recruiting new staff (see the Hiring and Retaining Informatics and Data Analytics Workforce Section). Public health agencies should define skills for all roles they plan to include in their data modernization workforce. It is important to note that some skill building will vary depending on the types of systems or platforms your agency uses (e.g., Google Cloud versus Amazon Web Services (AWS)). Be sure to investigate if any of the systems or services your agency uses offer trainings to users. The table below highlights a few resources currently available to public health agencies to build skills within their workforce to sustain data modernization efforts. Note that the table is not exhaustive of all DMI workforce areas.

Table 3: Training Resources

Key Area	Training Title	Organization	Description
Informatics, Data Analytics, Visualization, and Reporting	An Introduction to GitHub	General Services Administration (GSA)	This training introduces GitHub in easy, practical steps to create, manage, and publish website content.
All	CDC TRAIN	Centers for Disease Control and Prevention (CDC)	CDC TRAIN provides access to more than 1,000 courses developed by CDC programs, grantees, and other funded partners. Search for courses using "informatics" or "public health informatics" to show available data science offerings.
Informatics, Data Analytics	Health Informatics Essentials: Data Governance, Management, and Analytics	American Medical Informatics Association	This training provides introduction to health informatics that helps participants demonstrate knowledge of concepts and skills needed to ensure data quality and analyze health data to support the processes and performance of healthcare and public health organizations.
All	Informatics Academy	Public Health Informatics Institute (PHII)	This workforce development program offers a range of e-courses that build informatics capacity across foundational areas in U.S. public health departments and global public health practice.
All	Data Science Team Training	Council of State and Territorial Epidemiologists (CSTE)	This on-the-job training program promotes data science upskilling at state, territorial, local, and tribal public health agencies.
Data Analytics and Visualization and Reporting	Tableau Learn and R	Tableau and R Studio	These companies provide options for online learning (often paid). Colleges and universities may also offer training opportunities on these tools.

While many public health agency staff are aware of the importance of learning and development, it can be difficult to prioritize. When staff are busy with the demands of their day-to-day work, it can be challenging to find time to complete trainings. To address this, leadership must provide the support or coverage needed so that staff have the time to complete their trainings. While it may be difficult to accommodate this in the moment, it will be worth it to have a more equipped workforce in the future especially for responding to new or re-emerging public health threats.

Candidate Development for Specific Roles

Once an agency has identified the true gaps that cannot be served by existing resources or upskilling efforts, the team can begin building specific candidate profiles. These profiles can be used for funding requests, grant submissions, and if resources are already available, developing plans to fill positions (see the Hiring and Retaining Informatics and Data Analytics Workforce section).

It is important to identify the types of skillsets the agency needs the most. Some informatics professionals may focus more on data analytics, while others have a more specialized skillset in Health Level 7 (HL7—global standards for the exchange of healthcare data) and other data standards, so it is important to be clear about what skillsets are critical when writing candidate profiles and job postings. Consider reaching out to national public health associations (e.g., ASTHO, NNPHI, PHAB, CSTE, etc.) for examples of job descriptions or informatics or data science job classes. These agencies may also be able to facilitate connections with other health agencies who may have already created these job profiles and are willing to share.

The samples below show information that can be included in candidate profiles for data analytics, visualization, and reporting. The entry-level requirements and responsibilities needed will also dictate qualifications in terms of terminal degree and years of experience. Finally, candidate profiles will be driven by the specific job duties.

Example candidate qualifications and duties:

Data Analyst

- May be responsible for using, developing, and interpreting databases to analyze public health data and trends for use in program and policy decision making.
- Will analyze data and draw conclusions as to what it means, developing reports that detail the conclusions developed from that data and can assist in the preparation of finding for publication in journals.
- Often build dashboards to communicate data using Tableau and data visualization software to create compelling communications.
- May conduct spatial analysis using ArcGIS.
- Often have a master's degree in epidemiology, biostatistics, statistics, a related field, or equivalent practical experience.
- Should have experience in data management and statistical analysis, complex data structures, and linkages between data sources.
- Will need experience with a statistical program (e.g., SAS, R, Stata, Python).

Data Scientist

- Will organize, assemble, and process raw data, apply appropriate analysis tools and prediction models, and communicate results clearly and succinctly.
- May be responsible for developing and implementing machine learning models to better manage and utilize data.
- Often have a degree in bioinformatics, computational biology, data science, or a related field.
- Will need programming experience in at least two programs including R, Python, and C++.
- May have familiarity with Unix/Linux system, bash or similar scripts, and high-performance computing clusters.
- Will conceptualize health problems and use state-of-the-art tools and techniques to analyze, design, and manage health-related data to produce valuable analytic insights.

Program Analyst

- May be responsible for planning, developing, monitoring, and evaluating programs administered by public health agencies.
- Often collect, review, and research data to make public health recommendations.
- Will need a degree in public health, epidemiology, health informatics, biostatistics, or a related field.
- Will need experience in making recommendations for changes based on findings and experience preparing reports and analyzing data.
- May use programming tools such as SAS and SQL and analyze data from a relational database.
- Must oversee and define data quality metrics, develop a plan, oversee, and perform the necessary analytics and prepare acceptable reports of findings.

Hiring and Retaining Informatics and Data Analytics Workforce

Given the complexity and diversity of the public health field, it attracts individuals with a myriad of skill sets and backgrounds. There are several factors that could potentially make working in the public sector attractive to a potential candidate, including job security, benefits, or a desire to work in a field that contributes to the well-being of others. Even with such personal incentives, public health has long been understaffed in many technical fields. These include data science, computer science, analytics, software architecture, and web design.

For data modernization to be successful, it will require the recruitment and retention of skilled workers in the areas described in Table 1. Once approved to recruit to fill gaps identified in the competency assessment, DM Leadership should engage with their workforce team (human resources and/or offices of administration). They will help to establish and ensure a timely and equitable process for recruitment.

Agencies may experience challenges with attracting a qualified workforce to public health roles. Some of the barriers that exist include differing salaries and benefits in the public sector compared to the private sector, rules and regulations associated with state government, upward mobility within state government once hired, ability to offer continued training opportunities, and ability to retain talent. To overcome some of these barriers, DM Leadership and workforce teams will need to develop innovative strategies to find and recruit individuals suitable for roles. Below are sample strategies leaders may leverage in hiring and retention efforts:

Hiring and Retention Strategies

- Attend college hiring fairs.
- Hold events attracting data-savvy individuals such as “Datapalooza” events or Code-a-thons that will allow interaction with potential employees.
- Modify the hiring process to encourage rapid hiring for qualified individuals, such as granting authority to hire on the spot.
- Develop internships or fellowships to provide individuals experience working within the state systems with the potential to hire after successful completion of the time-bound opportunity.
- Partner with other nearby health officials and “pool” resources to work on efforts across public health agencies.
- Consider incentives for retention, such as tuition reimbursement, training opportunities, mentorship programs, and certifications.
- Demonstrate appreciation to staff by recognizing accomplishments.
- Consider Interagency Personnel Agreements, allowing individuals from the private sector to work within the public sector without losing their tenure or benefits while working for the public health agency.
- Review and update job classifications as needed to accurately reflect role responsibilities.
- Seek out graduates of specialty programs such as the Informatics Fellowship at CDC or other agencies.
- Leverage fellowship opportunities such as CSTE and APHL.

In some cases, it may be better to hire contractors to perform work rather than hiring full-time permanent staff. Outsourcing work to contractors can offer various advantages to agencies, including augmenting staff capacity and adding services supported by specialized vendors. The benefits of outside hiring include giving agencies quicker access to in-demand skills, reducing onboarding time, and possibly saving costs since many contractors are only engaged for a specified period of time. When planning hiring efforts for data modernization, DM Leadership should determine which areas of work will need full-time staff versus which areas may be better filled by contractors.

Establishing an Informatics and Data Modernization Unit

Establishing a formal Informatics and Data Modernization Unit can be a helpful strategy for building a broader data modernization workforce. This optional step is a unique approach to dividing responsibilities for data modernization that some agencies have found works well for them.

This unit would provide functional expertise and services to multiple program areas within an agency. Successful informatics teams are made up of individuals who have a broad knowledge of public health practice and are proficient in information technology. This includes expertise in health data standards, database design, data linking, and integration across health systems. This group can act as a liaison between public health program areas and the IT department to effectively communicate program area needs and help streamline projects. In many cases, informatics activities are already carried out by epidemiologists and other agency roles. Having an explicit Informatics and Data Modernization Unit would allow these agency members to focus on their primary responsibilities. The box below highlights representative activities a unit focused on informatics and data science may engage in.

Representative Informatics and Data Modernization Unit Activities

- Offer targeted support to program areas on the planning and design of public health information systems.
- Offer targeted support to program areas on the use of data standards to support interoperability.
- Manage all system upgrades, enhancements, and migrations.
- Create data extracts that can be utilized by epidemiologists across programs.
- Lead department-wide dashboard development efforts, developing visualizations and processes for automated data refreshes.
- Join public health association and/or CDC DMI and informatics work groups for learning and to drive agency priorities.
- Engage in procurement processes (developing requests for proposals or requests for information) for commercial off-the-shelf and modified off-the-shelf (COTS and MOTS), and other IT services that support public health systems.

Once an agency has decided to stand up an Informatics and Data Modernization unit, there are a variety of ways to proceed. A good place to start is by determining which agency staff are currently performing informatics or data science work. Review workforce competency assessments (see Table 2) and any current state DMI assessments. An agency will also need to decide which key areas of DMI (see Table 1) will reside within the new unit versus which will be accomplished by other departments.

Once staff have been identified, consider creating a community of practice or workgroup for these staff to begin sharing ideas and collaborating on projects. Transitioning this group to a more formally-defined unit within an agency will require significant internal investment and leadership support. For example, many of the previous responsibilities of the workgroup members will need to be realigned so that members can focus on the informatics and data science work full time. DM Leadership will also need to identify someone to serve as the lead for this group. This person would be responsible for realigning efforts, ensuring continuity of support from leadership, defining the goals and objectives of the unit, and working with groups outside of the unit who are also supporting DMI such as governance workgroups. Finally, leadership should provide opportunities for members to grow and expand their skillsets, such as offering trainings and supporting conference attendance. Doing so will encourage participation in the group and help to solidify membership in the Informatics and Data Modernization unit as a formal entity within the agency.

State Spotlight: Missouri Bureau of Data Modernization and Interoperability (BDMI)

In 2022, Missouri DPH created a Bureau of Data Modernization and Interoperability (BDMI) that focuses on modernizing and integrating data systems within the agency. The BDMI is comprised of staff that were previously working in areas including epidemiology, data analytics, and informatics. DPH leadership identified the need for the BDMI after noticing that program areas were juggling so many data requests that maintaining and upgrading systems became an afterthought. Having a dedicated bureau to manage these systems meant that staff would be free to focus on their day-to-day work and have the up-to-date systems that they needed.

Missouri DPH shared that defining system management as the primary responsibility of the BDMI has been instrumental to the bureau's success. The BDMI team began by working with disease surveillance systems, including migrating the agency's syndromic surveillance system. The team then took lessons learned from these experiences and began to define a standardized process for system upgrade and migration across the agency. Now, the bureau serves as a resource for all program areas to leverage, even if they are new to data modernization. The bureau also offers support on non-technical aspects of system upgrade and migration such as project management, developing a business case, and more.

Key Takeaways

- Key workforce areas for data modernization include executive leadership, data modernization accountability, data governance, information technology, informatics, knowledge management, data analytics, visualization, and reporting, data end users, and partnerships. DM Leadership team should identify which roles within the agency will cover each of these areas.
- Assessing workforce competencies can help identify existing gaps in skills. Upskilling workforce can be a good alternative or supplement to hiring new staff.
- Once gaps have been identified, DM Leadership team can create specific candidate profiles for needed positions. These profiles can be used for funding requests, grant submissions, and if resources are already available, developing plans to fill positions.
- Hiring and retaining workforce in technical fields such as data science, computer science, analytics, software architecture, and web design will be critical to the success of agency data modernization efforts.
- Establishing an enterprise-wide Informatics and Data Modernization Unit can help streamline and improve data modernization projects. Successful informatics teams are made up of individuals that have a broad knowledge of public health practice and are proficient in information technology.

Additional Resources

Topic	Resources
Data Modernization	• CDC's Data Modernization Initiative • CDC Public Health Data Interoperability • CDC LDX Strategy • CDC Public Health Data Strategy • Federal Data Strategy • PHII Data Modernization Planning Toolkit • Stories: Surveillance and Data in Action • Trusted Exchange Framework and Common Agreement (TEFCA) • ASTHO DMI 101 for Health Agency Leaders
Fellowship Opportunities	• CSTE • APHL
Training Resources	• An Introduction to GitHub • CDC TRAIN • Health Informatics Essentials: Data Governance, Management, and Analytics • Informatics Academy • Data Science Team Training

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