National Support for Case Investigation and Contact Tracing

Digital Tools Adopted by Public Health Agencies to Support COVID-19 Case Investigation and Contact Tracing, United States, 2020-2021

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Abstract

During the COVID-19 pandemic, public health agencies implemented an array of technologies and digital tools to support case investigation and contact tracing. Beginning in May 2020, the Association of State and Territorial Health Officials compiled information on digital tools used by its membership, which comprises 59 chief health officials from each of the 50 states, 5 US territories, 3 freely associated states, and the District of Columbia. This information was presented online through a publicly available technology and digital tools inventory. We describe the national landscape of digital tools implemented by public health agencies to support functions of the COVID-19 response from May 2020 through May 2021. We also discuss how public health officials and their informatics leadership referenced the information about the digital tools implemented by their peers to guide and refine their own implementation plans. We used a consensus-based approach through monthly discussions with partners to group digital tools into 5 categories: surveillance systems, case investigation, proximity technology/exposure notification, contact tracing, and symptom tracking/monitoring. The most commonly used tools included the National Electronic Disease Surveillance System Base System (NBS), Sara Alert, REDCap, and Maven. Some tools such as NBS, Sara Alert, REDCap, Salesforce, and Microsoft Dynamics were repurposed or adapted for > 1 category. Having access to the publicly available technology and digital tools inventory provided public health officials and their informatics leadership with information on what tools other public health agencies were using and aided in decision making as they considered repurposing existing tools or adopting new ones.

Keywords

COVID-19, digital tools, contact tracing, case investigation, public health

Case investigation and contact tracing are pillars of communicable disease control and prevention. These key public health interventions can be labor intensive and time-consuming. To facilitate scaling up case investigation and contact tracing during the COVID-19 pandemic and support traditional workflows, public health agencies implemented an array of technologies. These digital tools aimed to increase the speed, completeness, and efficiency of case investigation and contact tracing.

In May 2020, the Association of State and Territorial Health Officials (ASTHO), a national nonprofit organization representing public health officials in the 50 states, 5 US territories (American Samoa, Guam, Northern Mariana Islands, Puerto Rico, and US Virgin Islands), 3 freely associated states (Republic of the Marshall Islands, Palau, and the Federated States of Micronesia), and the District of Columbia, began formally tracking public health agency adoption and implementation of technologies and digital tools to support the COVID-19 response.

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Purpose

This case study presents the digital tool categories that expanded or emerged to support COVID-19–related workflows during May 2020–May 2021. The purpose of collecting anecdotal feedback from public health agency staff was to enumerate the digital tools used, strengthen situational awareness, and support decision making when considering tools to adopt. In addition, this information provides a foundation for future evaluation of the utility of these digital tools with the purpose of enhancing traditional case investigation and contact tracing workflows.

Methods

ASTHO worked with partners from the Centers for Disease Control and Prevention (CDC), the National Association of County and City Health Officials (NACCHO), the Council of State and Territorial Epidemiologists (CSTE), and the National Governors Association to compile information on the digital tools used by the 59 jurisdictions. A STHO gathered information on digital tools by collecting data from public health agency websites on their use of digital tools and technologies for COVID-19, validating information with state and territorial health agencies during regular convenings, comparing information with what CDC partners collected through regular discussions with public health agency staff, and conducting a formal data call through email outreach and several virtual convenings of A STHO’s Informatics Directors Peer Network. Response rates varied but remained consistent throughout the validation process from May 2020 through May 2021 to include validation of the information from at least 52 states and territories. The data call focused on which digital tools public health agencies were using for their COVID-19 response and for what purpose. A STHO used this information to categorize the tools and provide additional details about how they work within a health agency setting.

This information was curated into a technology and digital tools inventory on a publicly available website that organized the digital tools into 5 categories: surveillance systems, case investigation, proximity technology/exposure notification, contact tracing, and symptom tracking/monitoring. To reach consensus on how to categorize and share information about the digital tools used to support COVID-19 response efforts, A STHO held monthly calls with national partners during May–September 2020. After September 2020, A STHO continued to collect information about digital tool use as various state and territorial public health agencies reached out to A STHO to validate new information on the products they had adopted or discontinued. These subsequent updates were made on a monthly basis.

ASTHO compiled a list of digital tools adopted by public health agencies and qualitative information on the characteristics of these tools. A STHO worked with its web development team to use Google Sheets and Google Data Studio to collect the information quickly and present it publicly. The information is presented on a publicly available website, and A STHO convened regular meetings to discuss updates. Final validation and approval of the categories under which each tool is listed came from partners’ engagement with their constituents and through A STHO’s validation process with its Informatics Directors Peer Network.

A STHO’s Informatics Directors Peer Network, which includes representation from 50 states and 2 territories and comprises epidemiologists and other senior public health officials who manage surveillance data, verified the data on product-based information through direct outreach from A STHO staff and during quarterly convenings of the network.

A STHO collected information on the features and functions of technologies and digital tools used to support COVID-19 case investigation and contact tracing. These tools were grouped into 5 categories developed through a consensus-based approach during monthly discussions with CDC, CSTE, and NACCHO. A STHO collected information that demonstrated that multiple tools could be used in the same jurisdiction and that a single tool could be used to support multiple functions.

Outcomes

The information captured in the A STHO technology and digital tools inventory displays the variety and volume of digital tools adopted by public health agencies. Several of the most commonly used tools in each category as of May 2021 include the National Electronic Disease Surveillance System (NEDSS) Base System (NBS), Sara Alert, REDCap, and Maven (Figure). Some tools (eg, NBS, Sara Alert, REDCap, Salesforce, Microsoft Dynamics custom solutions) were repurposed or adapted for >1 category.

Surveillance systems provide public health officials with a timely system for detecting, understanding, and monitoring health events. Surveillance data can detect changes in the usual level of illness or disease and can serve as an early warning system for public health concerns. For surveillance systems, public health agencies most often used the NBS, Maven, and custom surveillance systems.

Case investigation involves locating and interviewing people diagnosed with COVID-19 to ascertain their current health status and to facilitate access to resources or social supports to successfully isolate. During the interview, health officials also elicit information about close contacts to identify people recently exposed to SARS-CoV-2. Digital tools to support COVID-19 case investigation included an array of open- and closed-source case-management and customer-relationship management software that aimed to facilitate case data management and support coordination of follow-up services. The most used digital tools for case investigation were NBS and REDCap.

Proximity technology and exposure notification tools augment traditional contact tracing through rapid notification of individuals with potential SARS-CoV-2 exposure.
One approach uses Bluetooth-enabled technologies on smartphones. Individuals can choose to receive anonymous notifications of a potential exposure if their smartphone has been in close proximity to another smartphone of someone who is later confirmed as having COVID-19. This process uses deidentified data that contain no geospatial information, to protect the privacy of participants. A number of health jurisdictions used the Google/Apple exposure notification application programming interface to develop custom smartphone exposure notification applications (apps), while other jurisdictions used the Google/Apple EN Express, which did not require customization and was the most commonly used proximity technology/exposure notification tool.

Contact tracing is the process of locating, notifying, and interviewing those who have been exposed to people with COVID-19. The interview also ascertains current health status and identifies whether resources or social support may be needed for successful quarantine. COVID-19 contact tracing technologies included customized mobile app- and web-based tools and customer-relationship management software, which aim to enhance data management.
and coordination of follow-up services. The most commonly adopted tools to support contact tracing were the Salesforce Platform, REDCap, and NBS.

Symptom tracking and monitoring are tools for monitoring the health status of people who have been identified through case investigation and contact tracing until they have completed their isolation or quarantine period. To reduce public health agency staff time and resources associated with traditional outreach, tracking and monitoring occur via automated daily texts or telephone calls or online surveys. Commonly adopted symptom-tracking and -monitoring tools included Sara Alert, the Salesforce Platform, and Text Illness Monitoring.

**Lessons Learned**

During the COVID-19 pandemic response, public health agencies increased the implementation of digital tools to maximize efficiencies in their workflows and manage high volumes of COVID-19 cases. In 2020, technology companies developed or adapted their digital tools to support various aspects of COVID-19 response within public health agencies. Public health officials fielded a high volume of inquiries from potential vendors. In addition, many vendors were new to public health and underwent a learning process as they tailored systems to meet growing COVID-19 case counts, while integrating new digital tools within existing public health workflows. ASTHO’s technology and digital tools inventory provided public health officials with situational awareness about the evolving technology landscape and the tools their peers were implementing in the face of similar challenges. Furthermore, feedback from public health officials suggests that existing tools were not suitable to support a pandemic of this scale, which prompted them to explore alternative digital tools and technologies.

Some digital tools were adopted across multiple categories. Feedback from ASTHO’s Informatics Directors Peer Network suggests that implementing a single tool across multiple categories generally results in a more integrated and efficient workflow. In addition, tools that were interoperable by design allowed for multiple data formats and files to be uploaded from existing public health information systems and other data sources, such as electronic health records, point-of-care clinical data, and laboratory reports. Public health officials and informatics leadership noted that having access to the publicly available ASTHO technology and digital tools inventory aided their decision making as they considered repurposing existing tools or adopting new digital tools. For example, a health agency considering adoption of a new tool can see other jurisdictions that are already using that tool, which facilitates information sharing across their peers about the benefits and challenges of that tool.

Because of the rapid pace with which these tools were piloted and adopted, a major challenge is the lack of standard measures and consistent definitions to evaluate their impact and efficiency. During convenings of the Informatics Directors Peer Network, public health agency staff expressed hesitation to adopt new digital tools because of a limited understanding of the time it would take to adopt a new digital tool, asked questions about how the tools would integrate with their contact tracing and case investigation workflow, and shared concerns about resources to support using tools and the limited evaluation of the tools’ efficacy. Because of these concerns, some public health agencies simultaneously adopted multiple tools for each category of their COVID-19 response efforts.

This study had several limitations. First, the effort to create the ASTHO technology and digital tools inventory took place in response to an urgent need identified by public health officials during a global pandemic. Therefore, the generalizability of this case study has not been fully explored. Second, while anecdotal experience about the utility of the technology and digital tools inventory was shared with national partners (e.g., during ASTHO’s Informatics Directors Peer Network meetings), a structured evaluation would have augmented our understanding of the utility and impact of ASTHO’s technology and digital tools inventory in enhancing cross-jurisdictional information sharing and decision making concerning digital tool implementation. Third, future qualitative analysis may help to characterize jurisdictional implementation experiences, benefits and constraints of specific tools, adaptations of existing versus newly adopted digital tools, synergistic impacts of implementing multiple tools, and alternative solutions pursued outside of the tools identified in this case study.

**Public Health Implications**

Digital tools to support COVID-19 case investigation and contact tracing emerged rapidly during the COVID-19 pandemic. By enumerating the tools available, ASTHO provided public health officials with information to supplement decision making related to their pandemic response. As a result, health agencies shared information with peers about how tools were being used in other parts of the country, which helped to guide and refine subsequent requests for proposals and implementation plans from vendors. Case investigation and contact tracing activities for other infectious diseases can benefit from standardized assessments or evaluation measures, seamless integration of new tools within the existing public health workflow, and interoperability of digital tools with other tools or data systems.

To our knowledge, this case study is the first published synthesis of digital tools to support COVID-19 case investigation and contact tracing. This summary may provide a foundation for continued efforts to evaluate the utility of these digital tools and their impact on case investigation and contact tracing performance. Given the influx of resources for COVID-19 data-driven response efforts and public health data modernization, laying the groundwork for systematic evaluation of these digital tools and technologies is critical in informing future public health practice and implementation.
Disclaimer
The findings and conclusions of this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention (CDC). Use of product names does not imply their endorsement.

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