AIRA
AMERICAN IMMUNIZATION REGISTRY ASSOCIATION

IIS Insights Shared at AIRA's August 2021 National Meeting

COVID-19 Interim Debrief Summary

AUGUST 2022

Table of Contents

Introduction

In August 2021, the American Immunization Registry Association (AIRA) convened its hybrid 2021 National Meeting in Portland, Oregon, with some participants meeting onsite and others attending virtually. AIRA moderated a COVID-19 interim debrief plenary on the first day of the meeting to provide a platform for immunization information systems (IIS) staff, immunization program staff, and the technical implementers who support them to share experiences, document lessons learned, and discuss ongoing plans for pandemic response. *This summary was generated after the meeting to document and share lessons learned at that point in time.*

Several noteworthy themes related to challenges, opportunities, and recommendations emerged from participant conversations. Those themes are highlighted briefly in this section and are described in more detail throughout the report.

Challenges with communication were common and included addressing the flow of information to and from various levels of government to immunization programs, providers, and the general public. Participants agreed that improving communications at the federal, state, and jurisdictional levels was needed. Further, understanding the unique strengths and limitations of IIS data and communicating those to decision makers was a shared challenge among many.

Managing the increase in provider enrollment and onboarding was also a frequently cited challenge; participants recommended a consistent, national approach to provider enrollment. With regard to mass vaccination clinics, using a wide range of tools and approaches to support vaccination scheduling arose as a major challenge; participants recommended a standardized national approach to vaccination scheduling.

Achieving high data quality in the IIS—and the need for a standardized approach to addressing common data quality issues and capturing required data fields—rose to the top of the list of participant challenges. Responding to a new and demanding level of data reporting not previously experienced by jurisdictions was also a considerable challenge.

Additional themes surfaced as opportunities and recommendations, including using public-facing immunization dashboards and data visualizations to share relevant and timely immunization information with a variety of stakeholders. It was noted that resources and guidance (from CDC and vendors) are needed on how to best use and maintain mass vaccination scheduling systems for future vaccination efforts. In addition, strategies are needed for supporting the large increase in IIS users, the volume of data submitted to IIS, and the volume of queries requesting IIS data. For future response efforts, earlier access to data specifications and provider agreement tools from CDC is needed, along with collectively identifying the best tools for addressing future pandemics.

The goals of this summary are to document and share the meeting participants' experiences and recommendations with the broader IIS community and to inform the ongoing COVID-19 response and future mass vaccination efforts. Recognizing that the

COVID-19 response is continuing, this summary is considered an interim debrief on the vaccination response.

Methods

A total of 468 individuals participated in AIRA's 2021 National Meeting, including 187 in-person attendees and 281 virtual attendees. Thirty IIS jurisdictions were represented in person. The 2021 meeting also included representation from the IIS implementer, vendor, electronic health record (EHR), and industry communities. This interim COVID-19 debrief session was limited to in-person attendees, including 144 participants representing 45 organizations and 23 IIS jurisdictions. Participants were divided across 20 roundtables. Each table was assigned a moderator to guide the discussion and a note taker to capture the conversation using a standardized data collection template. The following six topics were discussed with 10 minutes allotted per topic.

- **Communication:** What were your successes in communication with your partners and stakeholders during COVID-19, including communication with your governors, leadership, etc.? What would you do differently next time?
- **Provider enrollment:** What were the strengths in how your jurisdiction managed provider enrollment? What would you do differently next time?
- **Scheduling for mass vaccinations:** How was appointment scheduling managed in your jurisdiction? Any lessons learned?
- **Managing increased volume:** What adjustments did your jurisdiction make to manage the increased volume of submissions and queries for COVID-19? What work is still underway?
- **Data reporting to the Centers for Disease Control and Prevention (CDC):** What is working well regarding data reporting to CDC? What could be improved upon next time, either within your jurisdiction or within CDC's applications?
- **COVID-19 modules:** How is your jurisdiction planning to manage any new COVID-19 modules going forward?

While IIS data quality was not specifically called out as a designated topic for roundtable discussions, it surfaced as an important topic throughout many of the conversations. This was not surprising, given that data quality has implications for most of the discussion topic areas, especially provider enrollment, managing increased volume, and data reporting to CDC.

Notes from each table were analyzed to identify the most common themes that surfaced during the roundtable discussions. These initial findings were shared with in-person and

virtual attendees as part of the closing plenary.[1] Following the meeting, a second reviewer assessed the notes to validate the initial key themes informing this summary.

When possible, comments were attributed to member organizations, which are shared in the jurisdiction or member spotlights found throughout this document. These spotlights help share lessons learned and the innovative work being done by IIS jurisdictions and the broader public health community. During the debrief, participants who wished to speak "off the record" were instructed to state this to the session note taker; in these circumstances, no attribution was recorded.

The information summarized is limited by several factors, most significantly that the findings reflect only the experiences of a convenience sample of jurisdictions attending the meeting in person and that the sentiments shared represent a snapshot in time (i.e., August 2021). Additionally, the sessions were limited on time and topics, and some aspects, such as vaccine ordering and inventory, were not covered.

Background and Context

The COVID-19 pandemic placed an unprecedented amount of work and demand for data on IIS jurisdictions and state and local immunization programs. From January 2020 when the first case of the 2019 novel coronavirus was confirmed in the United States, to December 2020, when the Advisory Committee on Immunization Practices (ACIP) recommended the first COVID-19 vaccine for use in the United States,[2] to today's expanded ACIP recommendations for additional age groups and booster doses, IIS jurisdictions and their public health partners have had to launch their own community and state-specific pandemic responses and quickly adapt to changing demands.

To contextualize this report, below are key milestones, specific to immunization programs and the IIS community. These milestones illuminate the flexibility IIS programs needed in order to adjust to a frequently changing pandemic response. Programs had to incorporate new vaccine rollout recommendations while responding to near-constant media inquiries and collaborating with a variety of stakeholders to ensure equitable vaccine distribution and administration in their communities. See Appendix A: Key Recommendations and Publications for links to more information.

- **February 2020:** United States declares the coronavirus outbreak a public health emergency.
- **March 2020:** WHO declares COVID-19 a pandemic.

[1] AIRA 2021 National Meeting: Closing Plenary. August 5, 2021. https://repository.immregistries.org/resource/aira-2021-national-meeting-closing-plenary/from/type:national-meeting-presentations

[2] American Journal of Managed Care (AJMC). A Timeline of COVID-19 Developments in 2020. January 1, 2021. https://www.ajmc.com/view/a-timeline-of-covid19-developments-in-2020

- **May 2020:** AIRA publishes and promotes strategies and activities to increase IIS readiness for COVID-19 vaccines.[3]
- **June 2020:** Through Operation Warp Speed, the US Department of Health and Human Services (HHS), announces COVID-19 vaccines will be provided by the federal government at no cost to recipients.
- **October 2020:** CDC releases COVID-19 vaccination operations guidance with key sections for jurisdictions to address; COVID-19 Data Use Agreement (DUA) for data sharing between CDC and jurisdictions is released.
- **December 2020:** ACIP publishes COVID-19 vaccine recommendations for allocating initial supplies and for Pfizer-BioNTech and Moderna doses[4]; jurisdictions begin reporting to CDC COVID-19 vaccination doses administered.
- **January 2021:** CDC announces COVID-19 Supplemental Funding supported through the Coronavirus Response and Relief Supplemental Appropriations Act; IIS jurisdictions to submit workplan outlining how funds will be used to support COVID-19 vaccination activities.[5]
- **February 2021:** AIRA convenes a set of community webinars[6] to strategize and provide support for COVID-19 vaccination supplemental workplan applications.
- **March 2021:** ACIP publishes COVID-19 vaccine recommendations for Janssen (Johnson & Johnson) doses.[4]
- **April 2021:** States report seeing drop in demand for COVID-19 vaccines; ACIP publishes a report on blood clots that can result from the Janssen COVID-19 vaccine.
- **May 2021:** Vaccination rates differ significantly across regions of the country; ACIP publishes interim recommendations for use of Pfizer-BioNTech COVID-19 vaccine in adolescents.
- **July 2021:** ACIP publishes report summarizing myocarditis among mRNA COVID-19 vaccine recipients.
- **August 2021:** AIRA hosts in-person and virtual National Meeting—attendees provide insight on COVID-19 vaccination efforts during roundtable breakout session; ACIP publishes report summarizing adverse events among adult recipients of COVID-19 vaccines.

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[3] American Immunization Registry Association (AIRA). Tips for IIS: Preparing for a COVID-19 Vaccine. https://repository.immregistries.org/files/resources/5eb1694a0c8ce/aira_preparing_for_covid-19_one-sheet_v2.pdf

[4] CDC. COVID-19 ACIP Vaccine Recommendations. https://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/covid-19.html

[5] AIRA. Potential COVID-19 Vaccination Supplemental Funding Activities. February 2021. https://repository.immregistries.org/files/resources/601d7b7f87e1c/potential_covid-19_vaccination_supplemental_funding_activities-0.pdf.

[6] AIRA. Strategy & Support for Your COVID-19 Vaccination Supplemental Funding Application. February 2021. https://repository.immregistries.org/resource/strategy-support-for-your-covid-19-vaccination-supplemental-funding-application/

- **September 2021:** ACIP publishes recommendations for use of Pfizer-BioNTech COVID-19 vaccine in adolescents.
- **November 2021:** ACIP publishes interim recommendations for primary and booster doses of COVID-19 vaccines and recommendations for use of Pfizer-BioNTech COVID-19 vaccine in children.

Findings

This summary report mentions some of the tools and programs utilized by state health departments and the broader health care community to bring COVID-19 vaccines to the public. These tools supported efforts to enroll vaccinating providers, recommend vaccines to target populations, schedule vaccination appointments, store and administer vaccines, and document doses administered. Tools and terms are briefly described through the subsequent sections; see Appendix B: Glossary of Terms and Abbreviations for more detailed definitions and context.

The following sections summarize the successes and challenges which emerged for each of the six discussion topics.

Communication

Successes

Jurisdictions were required to quickly establish new internal, external, public, and private partnerships to coordinate response efforts and communicate effectively across diverse stakeholders. Stakeholders ranged from new and traditional providers to community members, the media, state governors, coalitions, new vaccination partners, and others across their respective states.

Example Communication Tools

- Email listservs, Health Alert Networks (HAN)[7]
- Emergency operations/ incident command structure[7]
- Basecamp, Teams, Webex, Zoom[7]
- Custom apps (these apps were developed by Louisiana, Mississippi, and New Mexico)
- Data request portal
- Dashboards

To support communication efforts, many jurisdictions established regular and frequent (in many cases daily) internal and external meetings (e.g., with providers, local public health departments, and partners), and also implemented new tools and channels of communication[7] to streamline efforts and prioritize and manage the large volume of requests for information and data. Making data available through public dashboards was instrumental in communicating the data to various audiences as well as supporting decision-making. Educational webinars and office hours were offered to providers to assist

[7] Appendix B: Glossary of Terms and Abbreviations

with various aspects of the response, including provider enrollment, inventory management, reporting to IIS, and more.

> "Communication and transparency are the most important aspects of leading a successful response."
> – Participant Quote

Challenges

Common challenges cited by participants centered on a few key themes, including the need for more timely guidance, flow of information, addressing data limitations and expectations, and provider communications. As IIS waited for guidance from the CDC and local leadership, many delayed working on necessary enhancements or developed enhancements and processes without the level of information they needed to ensure they would meet forthcoming requirements of the vaccination campaign. At the jurisdiction level, multiple programs were frustrated because they were not included earlier in the planning that was taking place at various leadership levels, such as the governors' offices. IIS also had to adapt to new directions of information flow among public health leadership, state governors' offices, state legislatures, and immunization programs, which at times led to conflicting messages from different sources and confusion over decision-making.

IIS also faced exceedingly high expectations related to data. Various stakeholders expected data and responses to their questions about data immediately. IIS worked to prioritize, track, and triage requests and communicate effectively about data limitations that arose because of expectations for real-time access to data. The public attention and scrutiny directed at IIS and immunization programs underscored a need to work with communications experts on media training for the immunization and IIS community and the importance of consistent messaging.

Jurisdiction Spotlight

Kentucky established a data request portal to assign levels of urgency for various types of requests from all stakeholders including the governor's office. The portal tracks the types of reports being generated and by whom. This enables Kentucky to reuse or adapt past reports rather than duplicate the work.

Immunization programs and IIS had to dedicate significant resources to communicate with providers with varying levels of IIS familiarity and computer skills. The rapid pace at which information changed throughout both the planning and response meant priorities shifted and messaging needed to be adapted, compounding the communication challenges.

Provider enrollment

Successes

The COVID-19 vaccination response has been a massive undertaking. IIS enrolled an unprecedented number of new providers. The increase in provider enrollment was due to the requirement for providers to enter all administered COVID-19 vaccine doses into the IIS and the large influx of formerly non-vaccinating providers who requested to become COVID-19 vaccination providers. For example, as of late July 2021, Louisiana enrolled more than 2,400 COVID-19 providers in 22 weeks,[8] equating to four times their annual Vaccines for Children (VFC) provider enrollment.

Member Spotlight

The STChealth consortium introduced electronic signatures to streamline the onboarding process. They also created a "fast pass" to help expedite enrollment and shorten the time frames for pharmacies.

Jurisdictions tailored strategies to expand to new types of providers for the COVID-19 vaccination program and to ensure equitable access to vaccine. Many states implemented new, web-based enrollment tools to support their provider enrollment processes, including REDCap, web-based surveys, and PrepMod, to name a few.[9] These tools helped to digitize the enrollment process and reduce the burden of completing paper-based provider enrollment forms. Alongside these tools, many IIS expedited their processes for onboarding providers for IIS reporting and access. Programs hired new staff to meet onboarding demands and to support provider training. In Texas, staff increased from 12 to 50 individuals to support the COVID-19 response. Hiring and training of new staff took time, and some programs faced onboarding backlogs until they were able to ramp up staff to catch up.

Challenges

IIS excelled in enrolling a record number of COVID-19 vaccination providers in a short amount of time. The speed at which they onboarded these new providers led to data quality issues, however, and required increased staffing capacity to manually correct and clean data. Common examples included inconsistencies between facility and organization names, duplication of providers, and providers facing challenges with the number of requested fields. This resulted in the need for IIS staff to follow up and validate information.

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[8] AIRA 2021 National Meeting: Plenary: Important Initiatives. August 4, 2021. https://repository.immregistries.org/resource/aira-2021-national-meeting-plenary-important-initiatives/from/type:national-meeting-presentations

[9] Appendix B: Glossary of Terms and Abbreviations

Some states preferred the strategy of enrolling all providers at once (e.g., North Dakota) while others chose a phased approach to make the effort more manageable. Some providers expressed frustration related to the length of time between enrollment and their eligibility for receiving vaccine. This resulted in a notable number of providers that enrolled but dropped out of the program by the time they could receive vaccine. Other providers enrolled only to vaccinate their own staff; jurisdictions faced challenges vetting these sites as valid COVID-19 vaccination providers.

Jurisdiction Spotlight

Louisiana noted that it was a lot of work to enroll providers who only wanted to vaccinate their own small staff. A key lesson learned is to be more selective and consider recommending those providers send their staff to a mass vaccination site.

Participants expressed a desire to have a more centralized, consistent, national approach to provider enrollment in the future, as well as earlier access to data specifications and provider vaccine agreement tools. This would help to eliminate the need for each jurisdiction to develop its own solution.

Mass vaccination scheduling

Prior to the COVID-19 pandemic, mass vaccination scheduling was not a prioritized functionality for most IIS. Jurisdictions used a wide range of tools and approaches with varying levels of success and satisfaction to support COVID-19 vaccination scheduling. With a lack of standards related to scheduling and a need for IIS to vet and develop solutions quickly, multiple scheduling systems were used across states. These ranged from in-house and external solutions (e.g., PrepMod, Real Time Solutions used in New Mexico) to CDC's Vaccine Administration Management System (VAMS).[10] What's more, multiple scheduling systems were often used *within* states. For example, if an immunization program adopted PrepMod, some counties and providers chose to use it while others did not.

Lesson Learned

Many health systems and providers preferred to use their own scheduling systems, though some hesitated to add records for immunized non-patients into their EHR system, due to the impact on denominator and quality improvement initiatives.

Overall, a key theme among participants was that many providers and health systems preferred to (and did) use their own scheduling and EHR systems. Of note, there were exceptions to this, as some providers did not want records for non-patients in their systems for various reasons (e.g., impact on patient population denominator and quality initiatives). Before the availability of VaccineFinder[11] (a website that integrated vaccine availability by ZIP code and interacted

[10] Appendix B: Glossary of Terms and Abbreviations

[11] Appendix B: Glossary of Terms and Abbreviations

with scheduling systems), several jurisdictions largely left the role of scheduling to providers. These jurisdictions supported the public in locating COVID-19 vaccination providers through means such as call-in hotlines and online maps/listings. Addressing public confusion related to where and how to access vaccine was a greater challenge during the earliest phases of the response when there was limited vaccine supply. Call-in hotlines were helpful for populations less comfortable using online tools, such as the elderly.

> "Use proper software and equipment for scheduling; don't try to force a functionality that doesn't work; use software as it was designed."
>
> – Participant Quote

Regardless of solution, jurisdictions cited many issues with mass vaccination scheduling technology, including managing priority groups and waiting lists, supporting adequate capacity to handle the large volume of consumers accessing the scheduling system, and addressing several data quality issues related to patient matching and deduplication resulting from patients' entering their own information. Some mass vaccination site solutions were not fully integrated with the IIS, or the sites were using paper reporting, leading to data gaps and timing delays within the IIS and an ongoing need to reconcile information from these sites.

For successfully implemented mass vaccination scheduling solutions, jurisdictions are considering how to best use and maintain these solutions in the future. Significant resources were spent vetting and implementing solutions for the COVID-19 mass vaccination campaign, and IIS would welcome support and guidance from the CDC, vendors, and others to pool resources and identify the best tools in the future.

Managing increased volume

The majority of participants encountered challenges with IIS performance and had to make adjustments to handle the tremendous increase in volume of vaccination data flowing into and out of the IIS and the vast number of IIS users. Some of the common changes implemented, and in many cases still underway, include:

- Limiting queries (requests for data or information from the IIS) to after hours and/or pausing queries, particularly batch queries
- Implementing data mart/data warehouse[12] solutions by replicating the database to process queries externally (e.g., from large providers or insurers/health plans)
- Increasing staff capacity
- Prioritizing reports out of the IIS, including limits on who can access/pull reports and types of reports

As jurisdictions implemented processes and tools to scale up capacity, managing the increased volume has improved. These experiences highlight the need to carry out regular

[12] Appendix B: Glossary of Terms and Abbreviations

load testing to identify the levels at which systems will be negatively impacted by high data volume.

> "Load testing is KEY! IIS need to be scaled up to handle [an increased] amount of data."
>
> – Participant Quote

General enhancements to system architecture included expanding memory, upgrading servers, and migrating to a cloud. Those with cloud-based systems were in a better position to handle the increased volume but still faced performance challenges. A number of IIS returned to older processes for some high-volume data submission, such as using flat file formats, but in some cases, this exacerbated data quality issues related to deduplication, patient matching, and missing data. While many IIS staff were accustomed to resolving such errors, the volume of errors was difficult to stay ahead of, particularly with the tight reporting timeline expectations from CDC (see next section: "Data reporting to CDC"). Training capacity challenges surfaced because of the high number of new providers. In addition, traditional providers who were asked to submit new fields needed to be trained on data submission.

Data reporting to CDC

IIS jurisdictions have experienced a new level of requirements for data reporting to the public and partners, particularly at the federal level. By August 2021, most jurisdictions represented at the roundtable discussions had established a rhythm of reporting to CDC's Data Clearinghouse (DCH), but demands on providers and the IIS community have been heavy, leading to many data quality concerns.

IIS identified areas needing improvement through various steps of the reporting process, including establishing data use agreements (DUAs), receiving the COVID-19 vaccine Reporting Specifications (CVRS), and reporting to VaccineFinder and CDC's DCH.[13]

The most commonly cited concerns centered on data quality, staff burden, timeliness expectations, and guidance related to navigating new systems and data specifications. Providers are required to report within 24 hours of COVID-19 vaccine administration, and jurisdictions are expected to rapidly report these data to the CDC each day, including weekends and holidays. At the time of this interim debrief, the process for uploading data had not yet been automated and, instead, relied on IIS staff to perform manual tasks each day.

IIS have been under significant pressure to report so quickly that their ability to clean data and correct errors has been limited. Additionally, some data do not match due to differences in the timing of reporting, duplicate reporting (e.g., provider sites reporting to both to CDC and IIS), and the reporting of data directly to CDC rather than to the IIS by providers from federal agencies (like the Veterans Health Administration), some pharmacies, and nursing homes. This has impacted data quality and resulted in issues with

[13] Appendix B: Glossary of Terms and Abbreviations

duplicate data, patient matching, and data discrepancies between the jurisdiction's data, data shown for the jurisdiction in Tiberius[14] (a reporting hub for vaccine distribution planning, tracking, modeling, and analysis), and national dashboards. To further complicate this, jurisdictions did not have the ability to fix errors in the CDC Data Clearinghouse for many months. They are now obtaining functionality to do so, but several participants indicated the update/delete process is cumbersome. The fixes have impacted state dashboards, resulting in the need to communicate changes in the data to various audiences who may not understand reasons for data inconsistencies.

Participants raised the need for additional improvements related to CDC guidance (e.g., being clear about what fields are needed), addressing legal hurdles (e.g., DUAs, limitations on reporting ZIP code or county level data for some rural states), orientation to new systems, data analytics capacity, reliance on standards and HL7 versus outdated processes, and interjurisdictional data exchange. Engaging the IIS community early in the planning process and involving IIS in all components of immunization data collection and reporting is essential to fostering collaboration and establishing an effective response.

COVID-19 modules

> "Keep the framework in place. Maintain infrastructure."
>
> – Participant Quote

Jurisdictions implemented a variety of new or enhanced modules and tools to support various aspects of the COVID-19 mass vaccination campaign, including provider enrollment/rapid entry, scheduling, vaccine ordering, inventory management and pre-booking, consumer access/vaccine credentialing, and reporting-related functionalities such as provider reports, batching, school roster reporting, and COVID-19 data dashboards.

Overwhelmingly, participants indicated they want to be able to maintain and adapt mass vaccination infrastructure and modules for all vaccines, not just COVID-19. It was noted that H1N1 modules were not kept up to date and had too many bugs to be useful for the current response. Ideally, IIS staff would like systems to offer flexibility and more customization to enable use for future pandemics.

Jurisdictions are looking for standards to guide development and evaluation of these tools in the future, as well as better integration between third-party systems and IIS. Examples could include more user-defined reporting and the ability for various stakeholders to access certain data to create their own visualizations. Some programs would like to leverage new infrastructure to support broader vaccination efforts such as for school and employee vaccination. Other jurisdictions were uncertain about the future of COVID-19 modules and enhancements in terms of sustainable funding, staffing, and capacity, as well as where these tools fit in programmatically (e.g., will COVID-19 become a part of routine immunization efforts).

[14] Appendix B: Glossary of Terms and Abbreviations

Recommendations for Next Steps

This interim report captures insights shared during AIRA's National Meeting, held in August 2021. As with any pandemic response, documenting experiences of the stakeholders involved will serve as an important tool for assessing needed changes to ongoing strategy and approaches as well as informing future response efforts. Common themes and key recommendations for next steps emerged for each of the six topics discussed. The recommendations are listed in the table below.

Table 1. COVID-19 roundtable topics and key recommendations

Topic	Key Recommendations
Communication	• Continue to utilize communication tools that facilitate and enhance communication with internal and external stakeholders. • Address the barriers to receiving timely guidance from CDC, flow of information among stakeholders, and consistent messages from various levels of government to immunization programs, stakeholders, and the general public. • Include immunization programs and IIS staff in pandemic planning efforts taking place at the local, state, and federal government leadership levels. • Develop tools and processes to handle a large influx of IIS data requests. • Set and communicate realistic expectations for data request responses. • Create and deploy strategies for communicating IIS data strengths and limitations to a variety of audiences. • Provide communication and media training for immunization programs.
Provider Enrollment	• Tailor enrollment strategies to address the specific needs of vaccination provider site types, including pharmacies, local health departments, private providers, community clinics, etc. • Use web-based tools to support and streamline provider enrollment and onboarding processes. • Use electronic signatures to digitize and expedite provider enrollment processes. • Expedite and automate processes to shorten the time frame for pharmacies and other providers to connect to IIS. • Decrease the length of time between provider enrollment and vaccine distribution. • Publish CDC data specifications earlier to allow for ample planning time and eliminate patchwork solutions.

Topic	Key Recommendations
	• Hire staff to meet onboarding demands, support call centers, address data quality, and support provider training. • Consider various provider enrollment strategies (e.g., all at once, phased approach). • Create a consistent, standardized process for provider enrollment that can be implemented nationwide.
Scheduling for Mass Vaccinations	• Create consistent, standardized approach to mass vaccination scheduling. • Support the public in locating vaccination clinics via call-in hotlines, online maps and listings, and the use of VaccineFinder.[15] • Use scheduling software as it was designed to be used; don't force functionalities that were not intended. • Ensure scheduling system can handle large volume of users. • Implement scheduling systems that can manage priority groups and waiting lists. • Address data-quality issues related to patients entering their own information in the scheduling system. • Address data gaps and timing delays due to paper reporting; automate processes for data exchange from the point of vaccination to the IIS. • Obtain guidance from CDC, vendors, and the IIS community on appropriate mass vaccination scheduling solutions for the future.

Managing Increased Data Volume	• Explore strategies to improve IIS performance and enhance IIS architecture, including memory, servers, and cloud migration.
	• Increase capacity to handle a surge in volume.
	  ○ Implement data mart/data warehouse solutions to avoid negative impacts to production.
	  ○ Limit queries to certain hours or pause queries.
	  ○ Increase staff capacity.
	  ○ Explore automation or expand processing capacity to address increase in needed reports.
	• Implement regular load testing.
	• Establish processes to train providers on data submission and required data fields.

[15] Appendix B: Glossary of Terms and Abbreviations

Topic	Key Recommendations
Data Reporting to CDC	• Obtain jurisdiction buy-in and input on the data fields required to be reported and the frequency of reporting. • Balance reporting frequency with data quality needs. • Allow jurisdictions the ability to fix data errors in a timely and efficient way. • Improve future data reporting through automation, a two-way flow of data submission and feedback, and a more user-friendly system for data submission.
COVID-19 Modules for Mass Vaccination Systems	• Use mass vaccination modules and IIS infrastructure improvements to support broader routine vaccination efforts. • Implement modules and systems which offer flexibility and customization. • Collaborate with CDC and state/local leadership to develop standards to guide the development of uniform capabilities for mass vaccination modules.

This summary is an effort to capture promising practices, challenges, and lessons learned from the IIS community based on the ongoing COVID-19 response. Future efforts will engage the full community to ensure their broader voice is included and documented. Other initiatives and planning efforts are underway to define the future of IIS ("IIS 3.0"). These efforts include a summary report from IIS 3.0 roundtable discussions held during AIRA's National Meeting, along with plans to continue community conversations regarding the future of IIS. Progress and lessons learned from COVID-19 will continue to inform IIS modernization and sustainability efforts into the future.

Appendix A: Key Recommendations and Publications

- "COVID-19 Vaccination Program Interim Operational Guidance: Jurisdiction Operations, Version 2.0"
- "Interim Jurisdiction COVID-19 Vaccination Playbook Draft Executive Summaries"
- "Interim Recommendation for Allocating Initial Supplies of COVID-19 Vaccine — United States, 2020" (12/3/21)
- "Interim Recommendation for Use of Pfizer-BioNTech COVID-19 Vaccine — United States, December 2020" (12/13/21)
- "Interim Recommendation for Use of Moderna COVID-19 Vaccine — United States, December 2020" (12/20/21)
- "Interim Recommendation for Use of Janssen COVID-19 Vaccine — United States, February 2021" (3/2/21)
- "Updated Recommendations from the Advisory Committee on Immunization Practices for Use of the Janssen (Johnson & Johnson) COVID-19 Vaccine After Reports of Thrombosis with Thrombocytopenia Syndrome Among Vaccine Recipients — United States, April 2021" (4/30/21)
- "Interim Recommendation for Use of Pfizer-BioNTech COVID-19 Vaccine in Adolescents Aged 12–15 Years — United States, May 2021" (5/14/21)
- "Use of mRNA COVID-19 Vaccine After Reports of Myocarditis Among Vaccine Recipients: Update from the Advisory Committee on Immunization Practices — United States, June 2021" (7/9/21)
- "Use of COVID-19 Vaccines After Reports of Adverse Events Among Adult Recipients of Janssen (Johnson & Johnson) and mRNA COVID-19 Vaccines (Pfizer-BioNTech and Moderna): Update from the Advisory Committee on Immunization Practices — United States, July 2021" (8/13/21)
- "Use of Pfizer-BioNTech COVID-19 Vaccine in Persons Aged ≥16 Years: Recommendations of the Advisory Committee on Immunization Practices — United States, September 2021" (9/24/21)
- "Interim Recommendations for Additional Primary and Booster Doses of COVID-19 Vaccines — United States, 2021" (11/5/21)
- "Use of Pfizer-BioNTech COVID-19 Vaccine in Children Aged 5–11 Years — United States, November 2021" (11/5/21)
- "Use of the Janssen (Johnson & Johnson) COVID-19 Vaccine: Updated Interim Recommendations from the Advisory Committee on Immunization Practices — United States, December 2021" (1/21/22)

Appendix B: Glossary of Terms and Abbreviations

Term	Definition	For More Information
Basecamp	A project management tool that encourages teams to work together, utilizing message boards, to-dos, schedules, documents, file storage, real-time group chat, and automatic check-in questions	https://basecamp.com/
COVID-19 Data Clearinghouse (DCH)	A data repository that receives case-level de-identified COVID-19 vaccination data from IIS, which are then used to populate the Immunization (IZ) Data Lake with data for analytics by CDC	www.cdc.gov/vaccines/covid-19/reporting/overview/IT-systems.html
COVID-19 Vaccine Reporting Specifications (CVRS)	A specification that defines the COVID-19 vaccination reporting requirements to CDC's COVID-19 DCH	www.cdc.gov/vaccines/covid-19/reporting/requirements/cvrs-v2.5.html
Data warehouse and data mart	A data warehouse is a highly structured repository where data are stored and managed until they are needed. A data warehouse or data lake is often separated from a production environment and serves as a replicated copy of production. A data mart is a highly structured repository where data are stored and managed until they are needed. Data marts isolate—or partition—a smaller set of data from a whole to provide easier data access for the end consumers, including data analysts.	https://www.talend.com/resources/what-is-data-mart/
Health Alert Network (HAN)	CDC and state health departments' primary method of sharing (via email alerts, RSS feeds, and web page updates) cleared information about urgent public health incidents with public information officers; federal, state, territorial, tribal, and local	https://emergency.cdc.gov/HAN/

Term	Definition	For More Information
	public health practitioners; clinicians; and public health laboratories	
Immunization (IZ) Data Lake	A cloud-hosted data repository to receive, store, manage, and analyze de-identified COVID-19 vaccination data. CDC, jurisdictions, federal agencies, and pharmacy partners use the IZ Data Lake to store and process administration, coverage, logistics, inventory, ordering, distribution, and provider data.	www.cdc.gov/vaccines/covid-19/reporting/overview/IT-systems.html
Microsoft Teams	A communication platform developed by Microsoft which allows users to chat, videoconference, store files, and integrate applications	www.microsoft.com/en-us/microsoft-teams/group-chat-software
PrepMod	An online clinic management and appointment scheduling system developed in Maryland to conduct mass vaccination/school-located clinics	Maryland Department of Health: COVID-19 Vaccination Plan Executive Summary www.cdc.gov/vaccines/covid-19/downloads/maryland-jurisdiction-executive-summary.pdf
Research Electronic Data Capture (REDCap)	A secure web application for building and managing online surveys and databases	www.project-redcap.org/
Tiberius	A COVID-19 vaccine distribution planning, tracking, modeling, and analysis application	www.cdc.gov/vaccines/covid-19/reporting/overview/IT-systems.html
Vaccine Administration Management System (VAMS)	VAMS is a secure, online tool developed by CDC to manage vaccine administration from the time the vaccine arrives at the clinic until it is administered	https://vams.cdc.gov/vaccineportal/s/login/?language=en_US&startURL=%2Fvaccineportal%2Fs%2F&ec=302
VaccineFinder	A website designed to help individuals find locations that offer COVID-19 vaccines. Supported by United States	www.vaccines.gov

Term	Definition	For More Information
	Department of Health and Human Services, CDC, and VaccineFinder from Boston Children's Hospital. VaccineFinder works with partners such as clinics, pharmacies, and health departments to provide accurate and up-to-date information about vaccination services by ZIP code.	
Webex	An enterprise solution developed by Cisco which allows users to videoconference, hold online meetings, screen share, and host webinars	www.webex.com/
Zoom	A video teleconferencing software program developed by Zoom Video Communications which allows users to meet, chat, talk on the phone, and host webinars and online events	https://zoom.us/