Office of the National Coordinator for Health Information Technology

Program Evaluation for the Strengthening the Technical Advancement and Readiness of Public Health via Health Information Exchange (STAR HIE) – Cooperative Agreement Program

AUGUST 30, 2023
FINAL REPORT

Prepared for:
U.S. Department of Health and Human Services
Office of the National Coordinator for Health IT
330 C Street SW Rm 1200
Washington, DC 20201

Prepared by:
UCSF
Center for Clinical Informatics and Improvement Research
10 Koret Way, 3rd Floor
San Francisco, CA 94131

Evaluation Lead: Julia Adler-Milstein, PhD
Evaluation Team: Sarah Rosenthal, Jake Joseph

Table of Contents

STAR HIE Program Overview

In August 2020, the Office of the National Coordinator for Health Information Technology (ONC) announced the Strengthening the Technical Advancement & Readiness of Public Health via Health Information Exchange Program (Program). The Program was a $5 million cooperative agreement program designed to strengthen and expand the ability of health information exchanges (HIEs) to support public health agencies' (PHAs) response efforts to public health emergencies and pandemics such as Coronavirus Disease 2019 (COVID-19).[1]

The key objectives of the Program were to build innovative health information exchange (HIE) services that benefit PHAs and to improve the HIE services available to support communities disproportionately impacted by the COVID-19 pandemic.[1] In September 2020, ONC awarded 2.5 million dollars to the following five recipients: Contexture (formerly Health Current Arizona), Georgia Health Information Network (GaHIN), HealthShare Exchange of Southeastern Pennsylvania (HSX), Kansas Health Information Network (KONZA), and Texas Health Services Authority (THSA).[2]

On January 19, 2021, ONC announced another 2.5-million-dollar supplemental funding opportunity specifically focused on increasing data sharing between HIEs and immunization information systems and was awarded to seventeen HIEs (including four of the five original recipients).[3] This evaluation focuses on the five recipients of the original funding and their original scopes of work.

The Program leveraged the unique capabilities and characteristics of HIEs as entities that hold an extensive amount of clinical data that is often not accessible by PHAs. Further, HIEs are well-positioned to produce unique insights on a community's longitudinal health and specific trends, particularly within disadvantaged populations through combining clinical and demographic data. The Program sought to better align HIEs and PHAs to leverage these capabilities to provide critical data to illuminate disparities in COVID-19 outbreaks, identify gaps in response efforts, and support knowledge generation around the epidemiology of diseases like COVID-19. In addition to serving as hubs for rich data from varied sources, HIEs make strong partners for PHAs because they typically operate as state, local, or regional entities with a strong understanding of and experience with local health care environments and are able to actively support electronic data reporting in particular electronic lab reporting (ELR) and electronic case reporting (eCR)) to PHAs and improve data quality.[1]

Summary of Program Activities by Recipient

Contexture (formerly Health Current), Arizona

Contexture (Health Current) worked to strengthen existing state-level HIE infrastructure in Arizona with a goal of improving the public health response to the COVID-19 pandemic and other emerging public health threats.

Their original scope had two main objectives: The first was to improve the timeliness, accuracy, and completeness of hospital reporting of situational awareness data (e.g., facility hospitalization metrics, personal protective equipment (PPE) inventories, and ventilator inventory and utilization). With this information, the Arizona Department of Health Services would be able to efficiently direct healthcare resources to facilities, providers, and geographic regions in greatest need. The second objective of this project was to reduce hospital and health system reporting burden, by utilizing the HIE as a data intermediary to allow hospitals to reallocate those resources. Contexture (Health Current) engaged six pilot hospitals for this project but quickly realized the complexity of this type of reporting. Upon learning that most information could not be extracted automatically from systems (i.e., a person would have to enter information manually into a system regardless), Contexture (Health Current) decided to pivot as the original scope would not adequately address their goals of improving situational awareness reporting or reducing reporting burden.

The new scope of work supported public heath response coordination at the state-level by engaging in Master Person Index (MPI) planning for the state of Arizona. They convened a planning collaborative with two state-level PHAs – the Arizona Department of Health Services and Arizona's Medicaid agency, the Arizona Health Care Cost Containment System. Under the structure of the Program, Contexture (Health Current) provided their expertise to address the state's need for a single repository of user data to be able to coordinate social services, conduct contact tracing, and match people across disparate systems. Once implemented, this technical infrastructure will improve state agencies' access to more varied and complete sources of health and social data to improve resource allocation and to bolster public health response efforts.

Georgia Health Information Network, Georgia

GaHIN is Georgia's designated entity that serves as the nexus for health information exchange across the entire state of Georgia. GaHIN directly connects four service area regional HIEs, five of the largest health systems in the state, the eHealth Exchange, four Care Management Organizations, and five state agencies including the Departments of Public Health (DPH) and the Department of Community Health (DCH).

The State of Georgia established a COVID-19 Registry to report patient encounters and lab results to the DPH and the DCH. GaHIN utilized two methods to increase and enhance data to populate the registry. The first was to increase the reporting from underrepresented populations – namely, by connecting Veterans Administration clinics, state correctional facilities, and rural hospitals. The second was to enrich ELR by combining lab results with patient demographic and clinical data from across GaHIN's broad network. In May 2022, they began offering eCR for COVID-19 cases as well as other reportable diseases as defined by the Georgia DPH to improve public health surveillance for the COVID-19 pandemic and potential future public health emergencies.

HealthShare Exchange of Southeastern Pennsylvania, Pennsylvania

HSX is the Delaware Valley's HIE covering Pennsylvania, New Jersey, and Delaware with over 16,000 providers participating in this network and exchanging data on more than 12 million patients. HSX worked with their local PHAs (Pennsylvania Department of Health, Montgomery County Office of Public Health, and Philadelphia Department of Public Health) to identify gaps in reporting and recruited new participants based on local PHA guidance.

HSX established services that benefit PHAs' pandemic response efforts and that support communities disproportionately impacted by COVID-19. First, to improve the current surveillance system, HSX partnered with Temple University as a pilot hospital to increase timely COVID-19-related ELR data feeds to PHAs. They worked with the Philadelphia Department of Public Health to identify gaps in reporting and, as a result, increased onboarding of facilities to ELR. HSX also aimed to increase eCR participation in the region to the Centers for Disease Control and Prevention AIMS platform. Using their Master Person Index (MPI) to improve the completeness of COVID-19-related data, HSX produced and sent indexed panel-based extractions with vaccine status (e.g., full, partial, unknown), co-morbidity risk scores, race/ethnicity data, and mobility impairment data. Lastly, HSX developed a COVID-19 registry for its participants' reporting of COVID-19 test results and case data. HSX extracts data from this registry to create reports for their three PHA partners.

Kansas Health Information Network dba KONZA, Kansas

KONZA is a private health information network based in Kansas that connects healthcare providers, patients, and health plans in several different healthcare markets within and outside Kansas to organize healthcare data into information that drives healthcare transformation. The KONZA team identified two critical priority activities that support the delivery of COVID-19 data quickly and effectively to PHAs and ensure healthcare providers have the medical information to provide safe and effective care.

First, to reduce the inaccuracies and burden of manual reporting, the KONZA team developed the TRANSLATE product (Translate Ambulatory Electronic Lab Reporting) to reduce ambulatory physician burden in reporting in-office COVID-19 lab results. The product works with three EHR products (Athenahealth, NextGen, and Qvera) to map EHR Health Level 7 (HL7®) feeds to electronically reportable lab results.[4] They enhance this lab data with existing HIE data to improve accuracy and reduce the burden of manual reporting. They provide this service for participants in five states: Kansas, Connecticut, Missouri, Mississippi, and Texas.

Second, KONZA adapted an alerting platform to provide real-time COVID-19 diagnosis data to the Kansas Department of Health and Environment (KDHE). KDHE requested additional information (demographics, contact information, diagnosis, test results, vaccinations, and characteristics) be added to the platform to create a COVID-19 Registry that provides a longitudinal view of a patients' COVID-19 care. KONZA continued reporting to this registry until it was sun-setted in April 2022.

Texas Health Services Authority, Texas

THSA, in partnership with c3HIE (a regional HIE covering multiple regions in Texas), a pilot hospital, and Audacious Inquiry (Ai), leveraged their collective expertise to demonstrate how HIE services can better support PHAs and hospitals as they executed state and federal reporting requirements for the COVID-19 response. Specifically, the partnership conducted a proof-of-concept pilot to demonstrate real-time, automated exchange of hospital capacity and other situational awareness data through APIs using HL7® Fast Healthcare Interoperability Resources (FHIR®).[5]

The current reporting system for situational awareness data in Texas is largely manual as it requires an individual from each participating hospital or health care organization to populate these databases daily. To improve existing statewide health care situational awareness capabilities and reporting processes, THSA and its partners used the HL7® FHIR® Situation Awareness for Novel Epidemic Response (SANER) Implementation Guide that has been developed under The SANER Project.[6] THSA and its partners applied this framework in a pilot hospital, Parkland Memorial Hospital, to standardize the reportable data elements (personal protective equipment, ventilators, and hospital capacity) and develop methods to automatedly extract them from underlying hospital data systems. The end goal is to enable public health authorities and response agencies in Texas to view these data in real-time via a dashboard and reports.

Goals of the STAR HIE Program Evaluation

The Center for Clinical Informatics and Improvement Research at the University of California, San Francisco was engaged to conduct interim and summative evaluations of the original five recipients of the STAR HIE Program. The interim evaluation report was completed on September 30, 2022 and reflected insights from the first year of program activities. The summative evaluation captured insights from the final year of program activities. This report combines content from the interim and summative evaluations to reflect the totality of learnings across both evaluations. The specific goals of the evaluation reports are to assess: (1) the effectiveness of the Program's initiatives with a specific focus on the level of implementation of planned activities; (2) the Program's impact on relationships between HIEs and their PHA partners; (3) methods to alleviate reporting burden for PHAs; (4) sustainability, replicability, and lessons learned for all recipients within the cooperative agreement; and (5) successes and challenges associated with meeting programmatic milestones. The Program evaluation results serve to guide future investments and efforts to advance HIE for public health use cases across policymakers, HIE networks, PHAs, and other health system stakeholders.

Evaluation Methods

Conceptual Framework Development

The evaluation approach was guided by an overall conceptual framework that reflected the distinct, interrelated domains of activity to advance HIE for public health. The framework addressed broad ecosystem drivers (top level) and how they impacted the resulting HIE infrastructure, processes, and outcomes (Figure 1). In the context of the STAR HIE Program, efforts focused on advancing the breadth and depth of structural capabilities in the form of exchange and data services that benefitted public health registries and PHAs. In some cases, these efforts were pursued via advancing upstream ecosystem drivers. Further, the evaluation sought to assess how organizational processes were impacted by advances in structural capabilities as these process changes are essential to produce improved outcomes, whether directly addressed by program efforts or not.

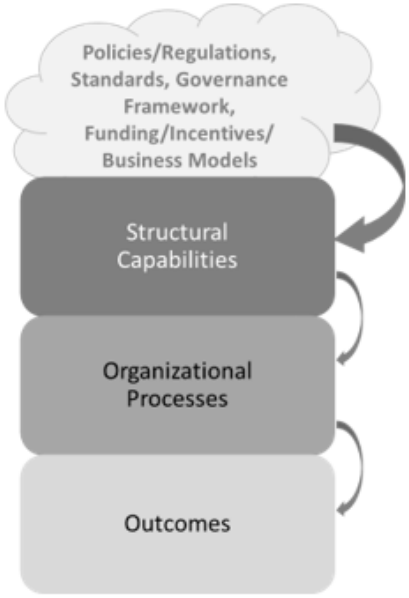

Figure 1. The Donabedian Framework

To operationalize this framework to support the evaluation, we captured, for each recipient, information about the current state of relevant ecosystem factors, structural capabilities, processes, and outcomes. We then characterized the logic model for which changes, at each level, they undertook with program funding and the resulting impacts in the form of infrastructure expansion, process improvements, and outcomes. These logic models were derived from reviewing proposal documents, deliverables tied to Project milestones, artifacts generated to support progress towards project milestones, and additional contextual information as needed. We then vetted logic models with recipients and any contracted partners as well as ONC to confirm our understanding of planned activities and intended impacts.

We found that recipients focused on enhancing capabilities in an array of domains relevant to COVID-19, such as (1) tracking and disseminating real-time hospital volumes and resource utilization; (2) serving as a single, unified source of lab testing data for the state's COVID-19 management effort; and (3) analyzing COVID-19 testing volume and result trends by ZIP code or census block along with disparities in testing, positive diagnoses, and fatalities. While diverse, we found there to be similarities in the logic models across recipients that enabled us to develop a common evaluation approach.

This framework allowed us to tailor evaluation activities to each recipient's goals while ensuring that we addressed broad ecosystem drivers across the Program. Given the level of customization, our results reflect the extent to which each recipient made progress against what they set out to accomplish under the Program rather than a "one size fits all" approach that would have allowed comparisons across recipients.

Conceptual Framework Implementation

In order to quantitatively assess progress made under the Program, we worked with each recipient to develop a set of direct and/or proxy measures that they could report. Final submissions of measures were submitted within three months of recipients closing out their program period. Table 1 shows which recipients submitted each measure type. Unless explicitly noted, all measures reflect progress made directly under the Program using associated funds.

Quantitative Measure Type	Contexture (Health Current)	GaHIN	HSX	KONZA	THSA
New Participants			✓		
New Data Feeds			✓		
ELR Volume			✓	✓	
eCR Volume		✓			
COVID-19 Registry Volume		✓	✓	✓	
Data Completeness				✓	
Close-Out Date:	3/30/23	12/31/23	9/30/23	3/30/23	3/30/23
Notes on Data:	No quantitative data associated with project activities.		Quantitative data reported through 7/31/23 to accommodate evaluation timeline.		Quantitative data unavailable at time of evaluation.

Table 1. *Quantitative Measures of Program Progress.*

To complement quantitative measures of progress, we conducted qualitative interviews that captured a breadth of perspectives from each recipient (including the recipient organization, technical vendor, public health partner(s), and participants). For the first round of interviews that informed the interim evaluation, we conducted a total of 27 interviews that included 29 interviewees. For the summative interviews, we confirmed with the lead at each recipient organization whether to engage the same individuals. While there were some minor changes to the interview participants, we largely interviewed the same set of individuals. Interviewees were contacted via email, and 30–60-minute Zoom interviews were scheduled. In total, we conducted a somewhat larger set of interviews (29) that included 36 interviewees. Table 2 provides more detail on how many summative interviews were conducted, when they were conducted, and the types of stakeholders interviewed by recipient.

Recipient	Number of Interviews Completed (Interviewees)	Dates Interviews Were Conducted	Types of Stakeholders Interviewed
GAHIN	6 (7)	February – March 2023	Recipient, technical vendor, PHA, supporting HIE, participant
Contexture (Health Current)	4 (4)	March – April 2023	Recipient, PHAs
KONZA	7 (9)	May 2023	Recipient, technical vendor, participant, PHA
THSA	7 (7)	June – July 2023	Recipient, technical vendors, supporting HIE, PHA, pilot site
HSX	5 (9)	June – July 2023	Recipient, pilot sites, PHAs

Table 2. *Overview of Summative Evaluation Interviews.*

For both interim and summative rounds of interviews, the semi-structured interview guides were developed using an implementation science framework (Consolidated Framework for Implementation Research or CFIR).[7] A synthesis of several evidence-based implementation frameworks, the CFIR is comprised of a set of constructs designed to guide theory development and empirical verification of which practices work, where and why, across different contexts. The CFIR model is organized around five core domains: the outer setting (events happening outside an organization that influence change); the inner setting (specific characteristics of the organization itself, including social norms); intervention characteristics (adaptability, complexity, stakeholders' perceptions of evidence strength); implementation process (planning and evaluation activities, the involvement of internal and external champions); and individuals within the organizations (their knowledge and beliefs, readiness for change). The CFIR also considers the multiple, interacting domains that factor into successful implementation. This framework served as the basis for both interview guides which assessed the breadth and depth of Program activities, had customized questions based on each recipient's set of activities, and identified barriers and facilitators along the CFIR domains.

The interim interview guide focused on identifying the status of activities under the Program mid-way through implementation, how each furthered recipients' targeted goals, and associated successes and challenges (Appendix A). For the summative interviews, we organized the interview guide (Appendix B) around the following list of focal areas developed in collaboration with ONC based on topics emerging from the interim evaluation:

- Sustainability of Program activities
- Development of long-term HIE-PHA relationships and the value proposition for HIE-PHA relationships
- Impact of state and local policies on the health information sharing between HIEs and PHAs (e.g., shifting reporting requirements, data sharing restrictions)
- Usability of ELR and eCR data by PHAs
- Comparative value and breadth of data required for ELR and eCR
- Level of, and factors shaping, reporting burden reduction
- Master Person Index value proposition
- Unique challenges reporting VA data
- Specific policy recommendations for SANER standards
- Identification and impact of information blocking

We used both deductive and inductive qualitative analysis processes to analyze interview transcripts, first guided deductively by the CFIR framework constructs and then using an interview matrix to inductively identify key themes that both capture common learnings across recipients and highlight differences, drawing on both interim and summative transcripts. Each theme draws on findings from multiple recipients in order to provide generalizable insights for future initiatives that promote HIE for public health use cases. However, given the variation in Program activities and implementation approaches, not all five recipients necessarily contributed to each theme. For some themes, we extracted illustrative quotes to provide more detail.

Results from Measures of Program Progress

Expanded Participation: New Participants- HSX-

HSX increased the number of participants across facility types with notable growth in one type of facility, post-acute care organizations (Figure 2). Prior to the Program, HSX achieved high levels of participation among hospitals and health systems. Thus, under the Program, HSX in collaboration with their PHA partners identifed long-term care facilities as key stakeholders to onboard as new participants to boost COVID-19 test result reporting. Of the 222 facilities HSX onboarded over this three year span of the Program, 152 were post-acute care organizations. This rapid level of growth was able to be achieved because HSX targeted a post-acute care EHR vendor hub (Point Click Care), allowing HSX to establish a single connection that covered many facilities. Other increases in the number of participants included hospitals, ambulatory practices, and urgent care clinics (31, 19, and 12, respectively). HSX also recruited participants from traditionally less-connected settings: Federally Qualified Health Centers (5), home health organizations (2), and behavioral health organizations (1).

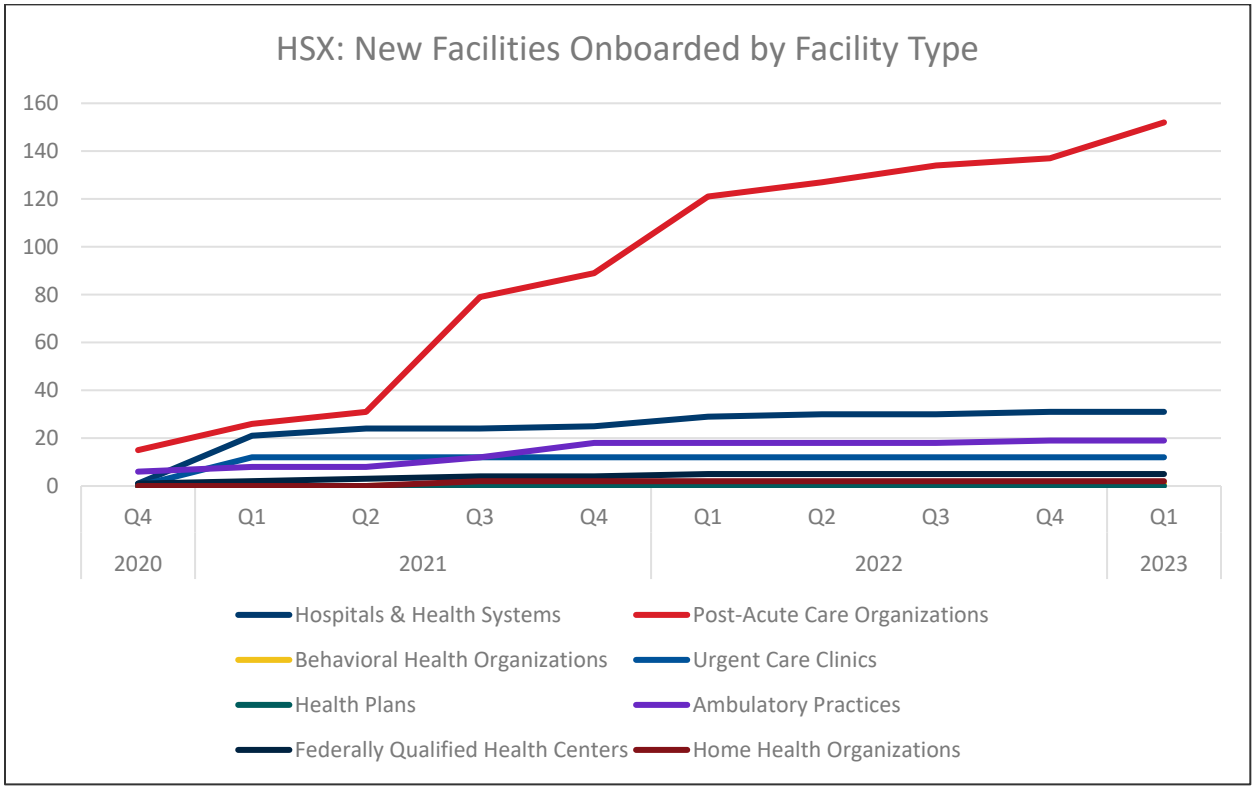

Figure 2. *HSX Number of New Facilities Onboarded by Facility Type due to the Program. From Q4 2020 to Q1 2023.*

Expanded Participation: New Data Feeds - HSX

HSX advanced ELR and eCR by expanding the number of facilities with varied types of data feeds implemented, from which data could be parsed to populate lab reports and case reports to send to PHAs. HSX furthered public health reporting by onboarding both existing participants to new data feeds and new facilities to their organization. They successfully increased the number of participants with ADT and CCD feeds, particularly among post-acute care organizations (201 post-acute care organizations and 191 facilities, respectively as seen in **Figure 3**). HSX onboarded 16 facilities newly submitting lab messages. While this was a small number of facilities, HSX was able to receive a large volume of lab data because these connections included Labcorp and Quest Diagnostics.[8,9]

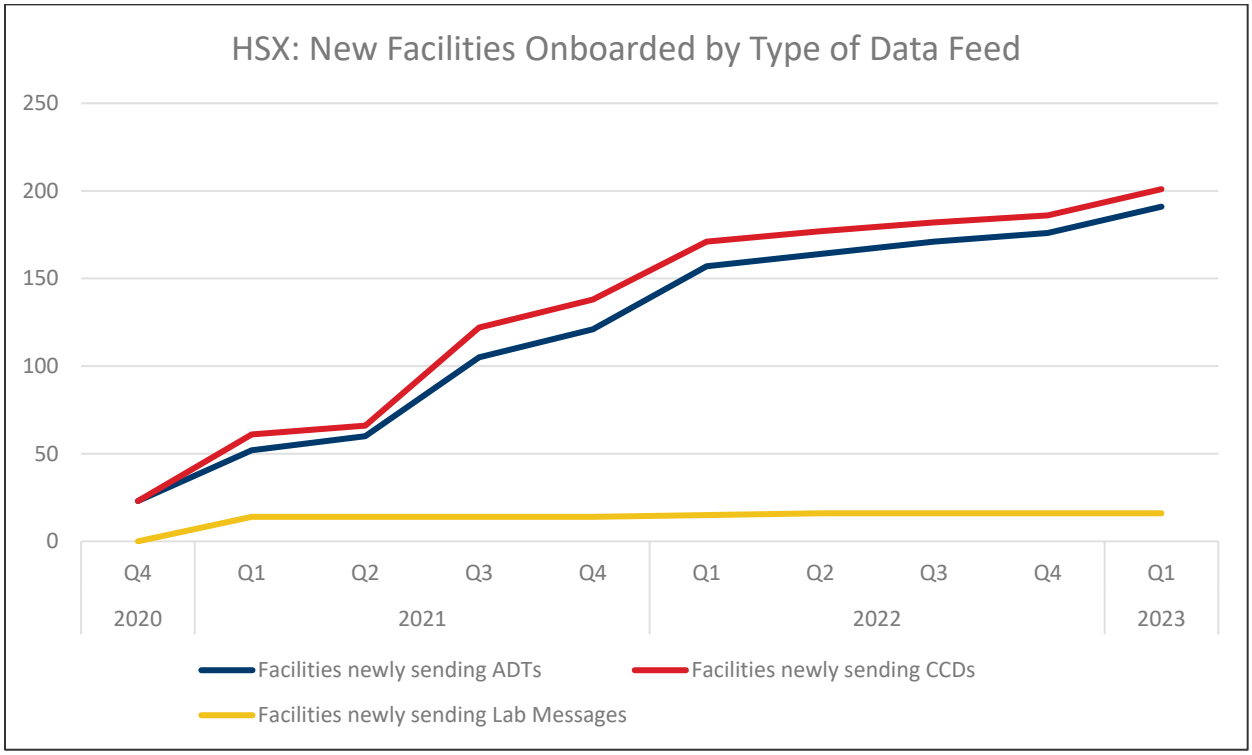

Figure 3. *HSX Number of Facilities Onboarded by Type of Data Feed due to the Program. From Q4 2020 to Q3 2023.*

Electronic Lab Reporting (ELR) Volume - KONZA

KONZA connected five ambulatory clinics to ELR during the Program period, which allowed them to increase ELR volume for COVID-19 test results. ELRs were sent to the Kansas Department of Health and Environment (KDHE) from the five Kansas clinics through KONZA's ELR TRANSLATE product (**Figure 4** shows connections for all facilities that were set up during the Program period: **Figure 5.** shows ELR volume by participating facilities). Patterns of ELR volumes largely tracked spikes in cases and spikes in testing that are evident from November to January and from June to August in 2022. The same spike in ELR volume in late 2021 is not reflected in late 2022, an indication of reduced testing volumes and public health messaging around COVID-19 testing. Differences between COVID-19 cases and testing volume reflect those facilities reduced COVID-19 testing over time.

Figure 4. *Electronic Lab Reporting Volume to Kansas Department of Health and Environment (KDHE) from Five Ambulatory Clinics by Facility due to the Program. From July 2021 to March 2023.*

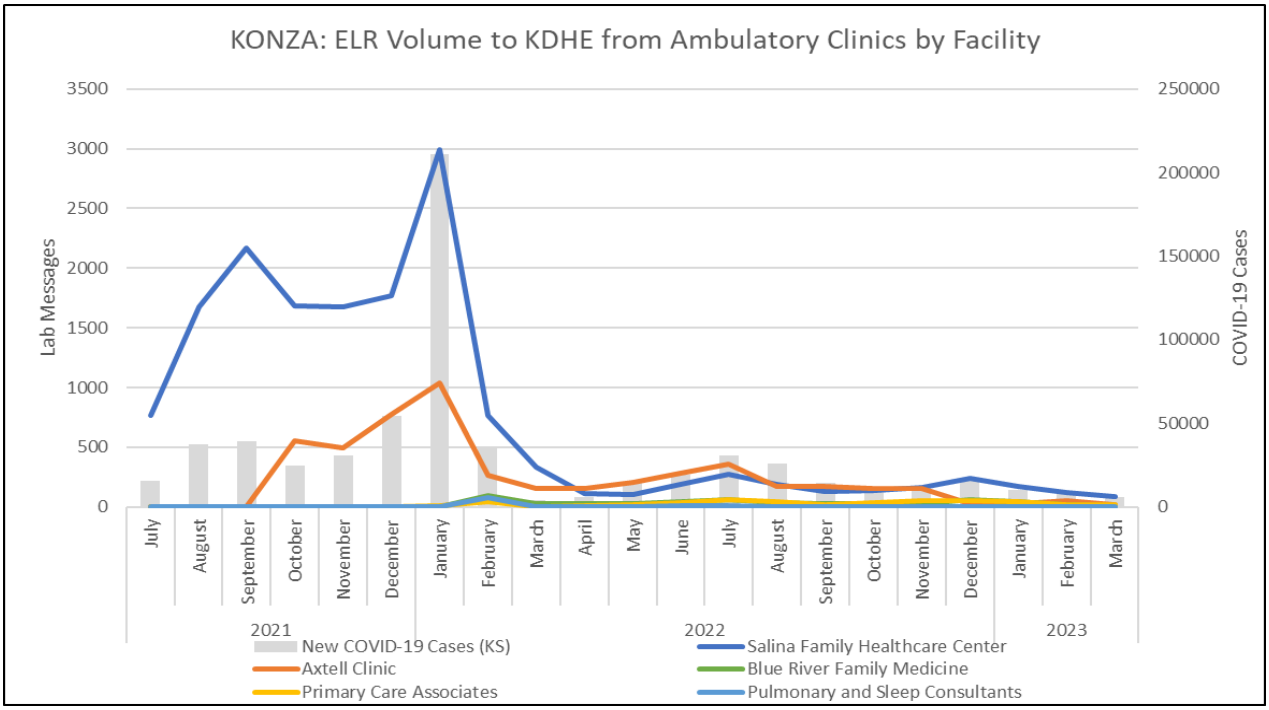

Figure 5. *Electronic Lab Reporting Volume by Facility to KDHE from Five Ambulatory Clinics by Facility due to the Program. From July 2021 to March 2023.*

Similarly, through expanded data feeds, HSX was able to increase ELR volume for COVID-19 test results. HSX reported ELR messages sent on behalf of the seven facilities reporting to the Philadelphia Department of Public Health (PDPH) via HSX. Patterns of ELR volumes largely track spikes in cases and spikes in testing that are evident from November to January and from March to May **(Figure 6)**.

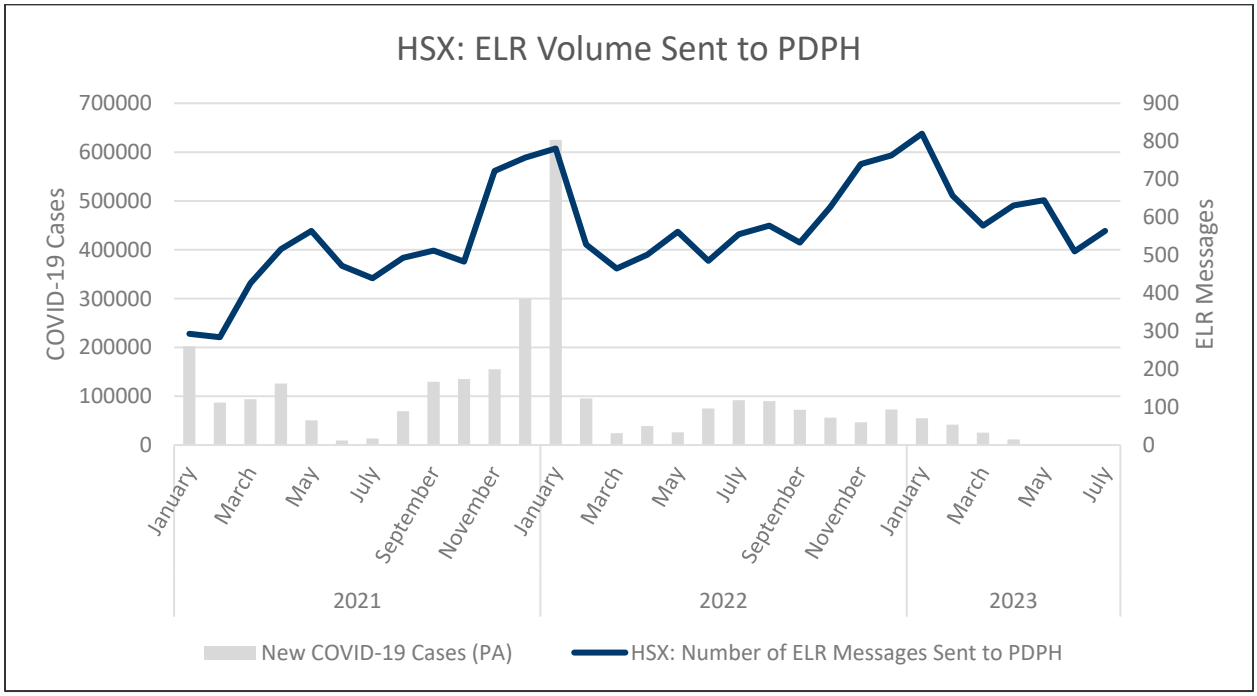

Figure 6. *HSX Electronic Lab Reporting Volume to Philadelphia Department of Public Health (PDPH) due to the Program. From January 2021 to July 2023. Note: The COVID-19 data from the Centers for Disease Control (CDC) ended in April 2023 when the public health emergency ended and cases stopped being reported.*

Electronic Case Reporting Volume - GaHIN

GaHIN onboarded a major regional health system for eCR in May 2022 in order to report COVID-19 cases as well as other reportable diseases to the Georgia Department of Public Health (DPH). From May 2022 to December 2022, 25,984 eCRs were submitted. For this health system, the trend in case reports largely follows the increase in COVID-19 cases in the first three months of reporting **(Figure 7)**.

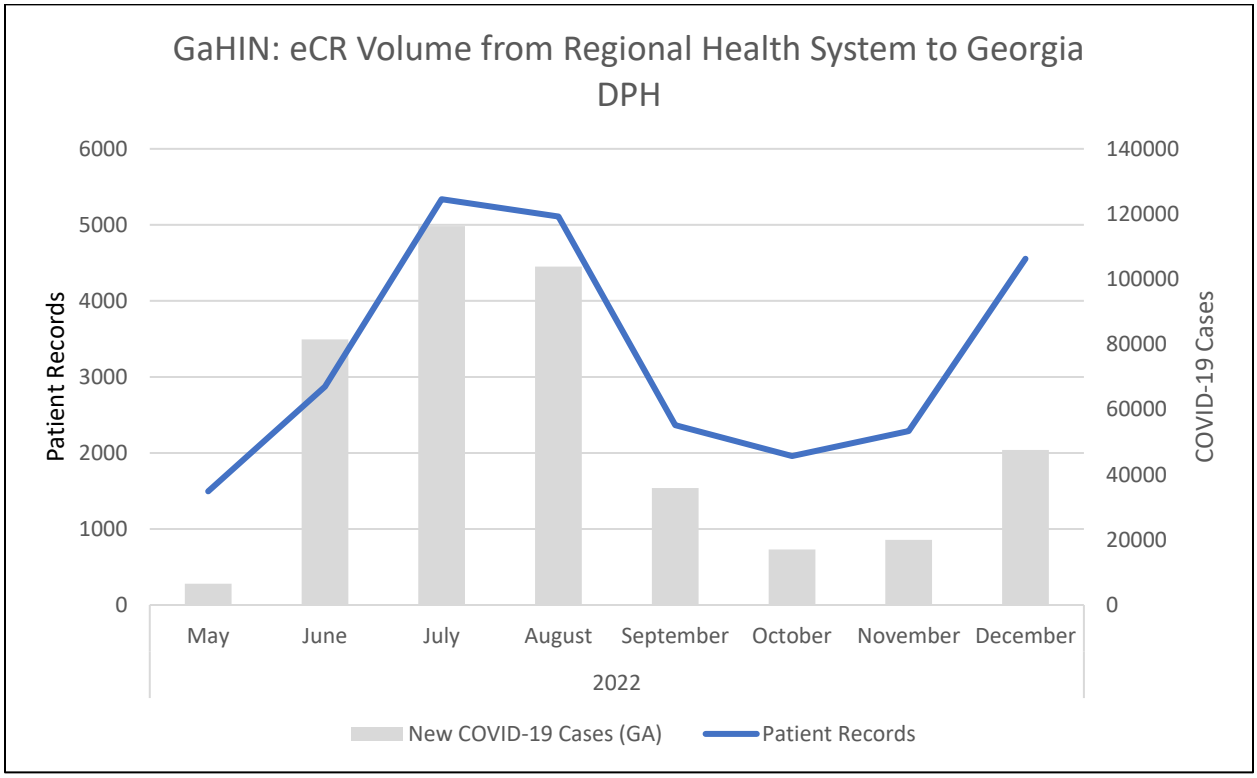

Figure 7. *Electronic Case Reporting Volume from Large Regional Health System to Georgia Department of Public Health due to the Program. From May to December 2022.*

COVID-19 Registry Volume - KONZA, HSX, and GaHIN

KONZA created a new data service to facilitate the submission of patient records to the KDHE COVID-19 Registry, which tracks only Kansas' patients **(Figure 8)**. Patient records were sent to the registry for both positive and negative COVID-19 test results, totaling 508,669 unique patients over a year and a half. The spike in March 2022 is due to the increase in testing volume during this pre-holiday (spring break) period. The registry was sun-setted in April 2022 at the request of the State, which has since switched to its own reporting structure using syndromic surveillance. Therefore, no new data after April 2022 was submitted for the Program evaluation.

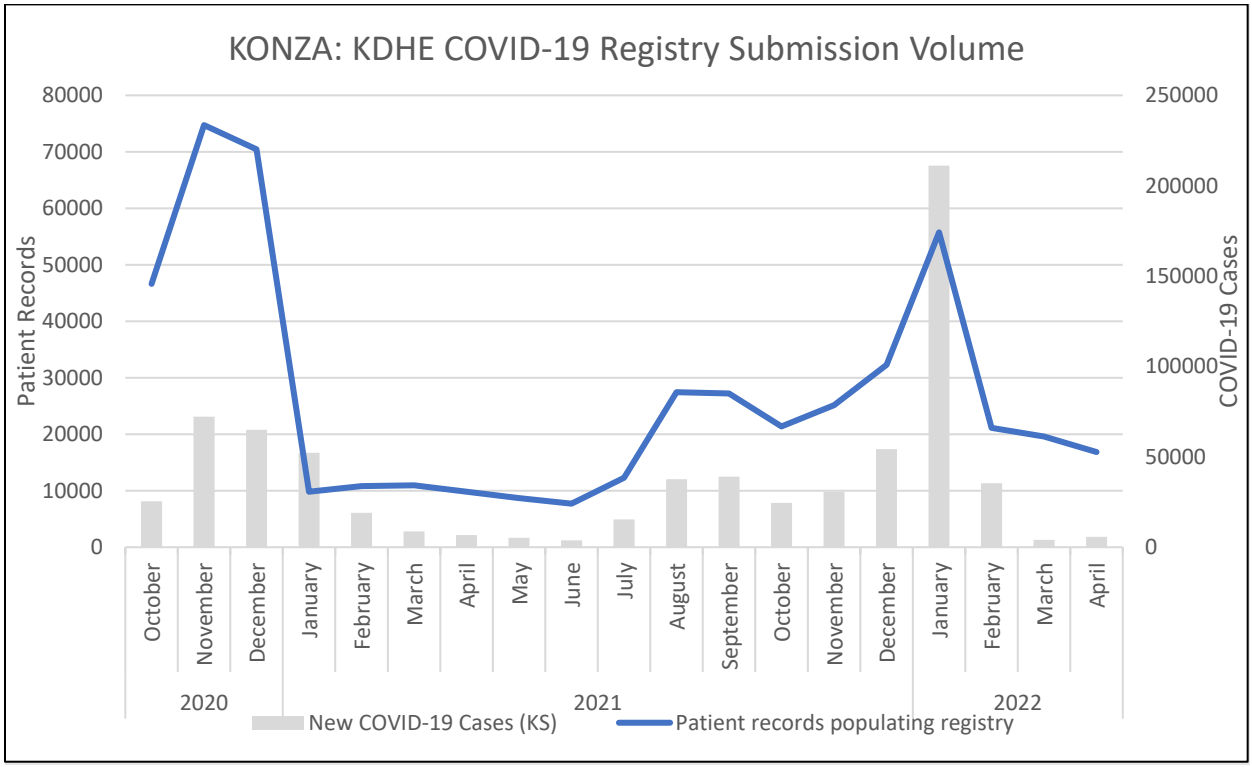

Figure 8. *KDHE COVID-19 Registry Submission Volume Facilitated by KONZA due to the Program. From October 2020 to April 2022.*

HSX submitted COVID-19 data to newly developed registries. HSX developed and operates their own COVID-19 registry that includes COVID-19 test results and patient records **(Figure 9)**. The Patient Records trendline captures unique patients added to the registry in the given month, whereas the COVID-19 Test Results trendline captures the total number of tests (i.e., there can be more than one test per patient). Cumulatively over the three-year reporting period, the registry captured 1,143,376 unique patients and 3,147,486 COVID-19 test results. PHA partners access these data through reports that HSX generates and sends to them.

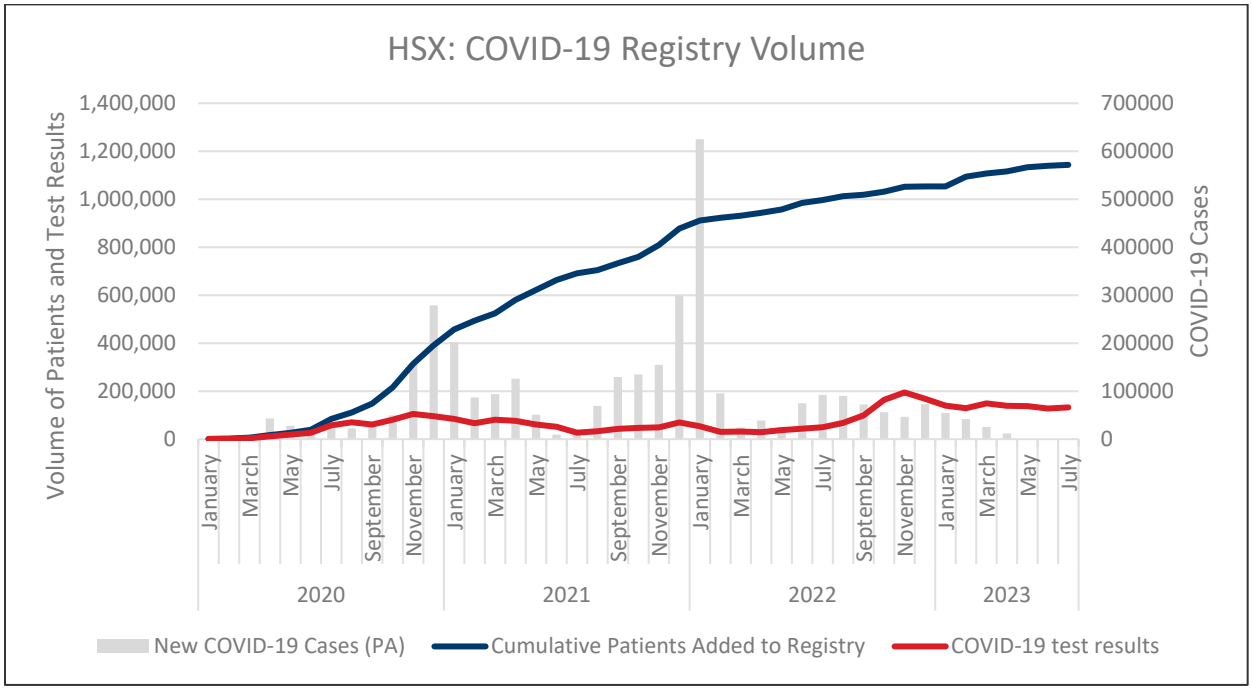

Figure 9. *COVID-19 Registry Volume under to the Program. From February 2020 to July 2023. Note: The COVID-19 data from the Centers for Disease Control (CDC) ends in April 2023 when the public health emergency ended and cases stopped being reported.*

GaHIN established the COVID-19 registry via an interagency agreement between the Georgia Departments of Public and Community Health. The registry assists researchers in identifying the most vulnerable populations in Georgia and understanding COVID-19 spread. GaHIN leveraged encounter and lab data from five participants—three health systems and two regional HIEs. Lab data includes only COVID-19 test results while encounter data includes both established COVID-19 cases and potential COVID-19-related diagnoses (e.g., cough, unspecified fever, respiratory illness). From January 2020 to December 2022, GaHIN populated the registry with a total of 1,382,084 patient records and test results **(Figure 10** shows overall volume of COVID-19 data; **Figure 11** shows COVID-19 data volume by participating facilities with whom GaHIN had established data feeds with under the Program.) One of the regional HIEs was onboarded in July 2022 including historical data back to October 2021 and includes correctional facilities; the other four were connected to GaHIN prior to the start of the Program and began reporting COVID-19-related data in August 2020 with historical data back to January 2020.

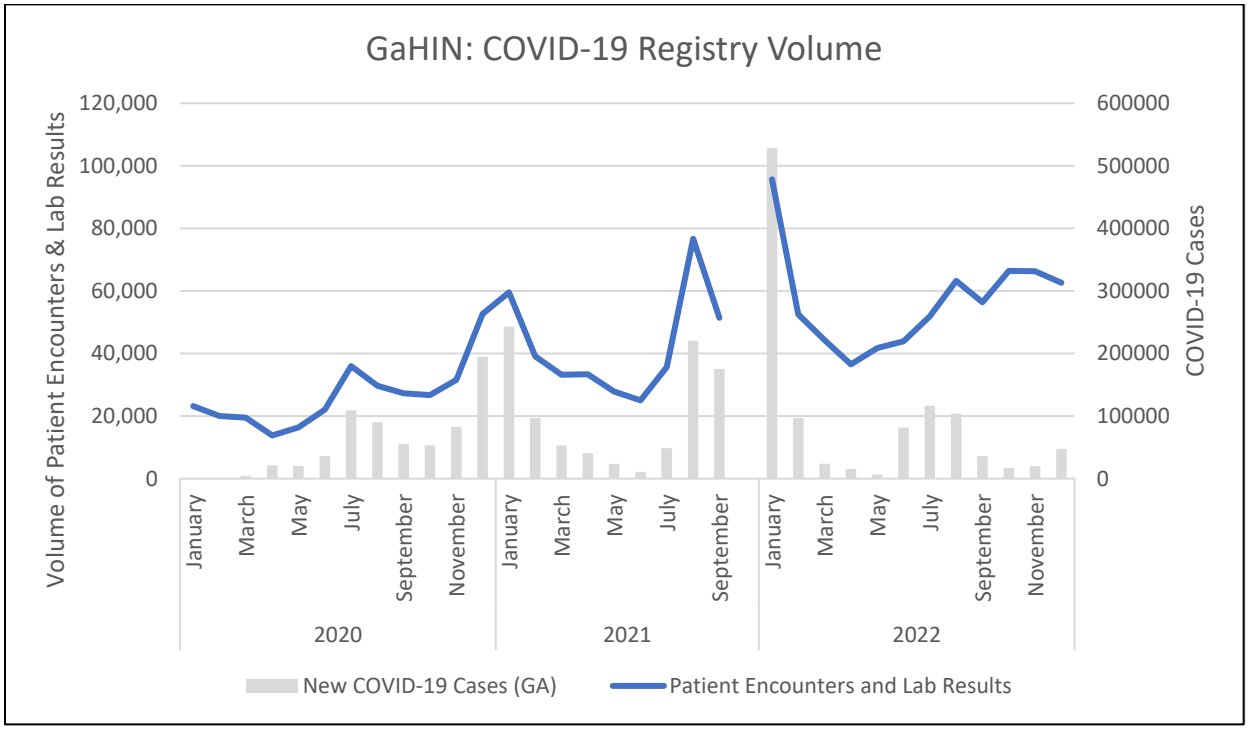

Figure 10. *COVID-19 Registry Volume Reported to Georgia Departments of Public and Community Health. From January 2020 to December 2022. Note: GaHIN reported data back to January 2020 per the request of their public health partners; Data not available October to December 2021 due to a system platform change.*

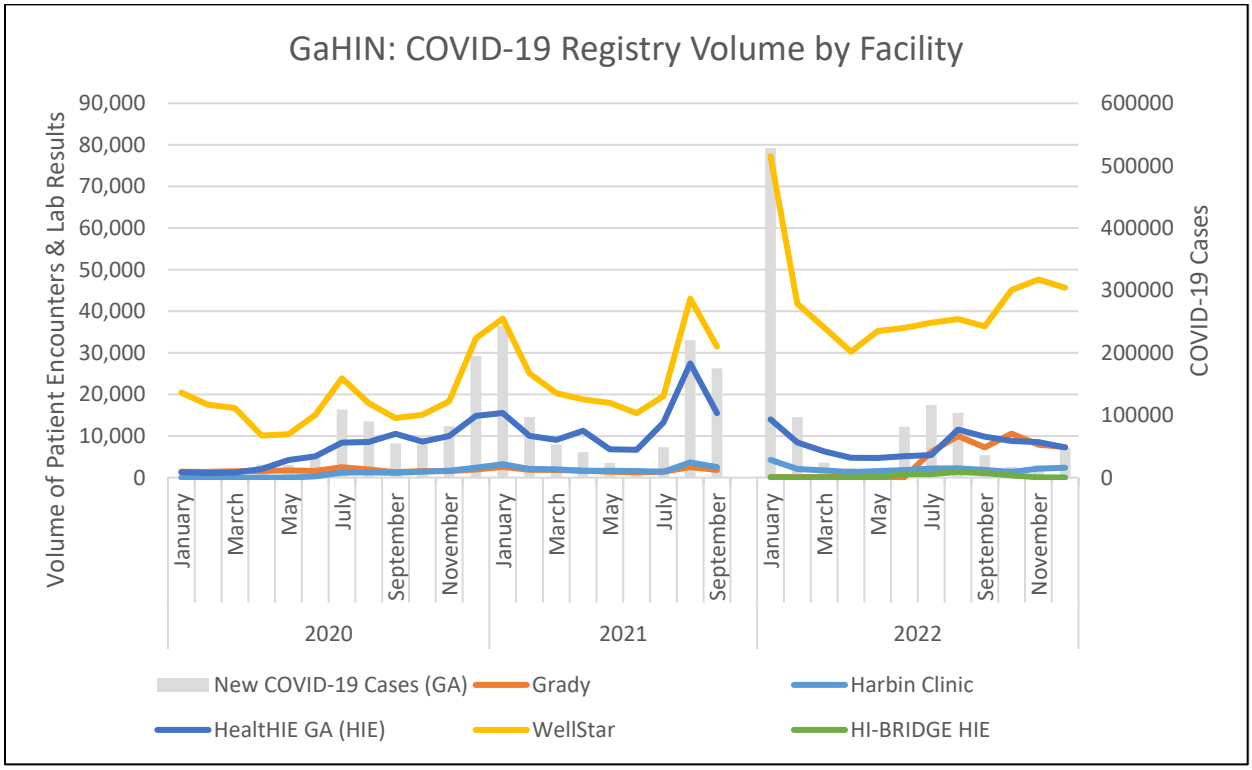

Figure 11. *COVID-19 Registry Volume by Facility. From January 2020 to December 2022. Note: Data not available October to December 2021 due to a system platform change.*

Data Completeness- KONZA

KONZA sought to combine data from multiple participants and PHAs to achieve improved completeness of race/ethnicity data associated with COVID-19 test data. In turn, this allowed for better understanding of COVID-19 testing and case volumes by race/ethnicity. They were able to improve completeness by 6.9 percentage points—starting at 92.8% and reaching 99.7% by the end of the reporting period (Figure 12).

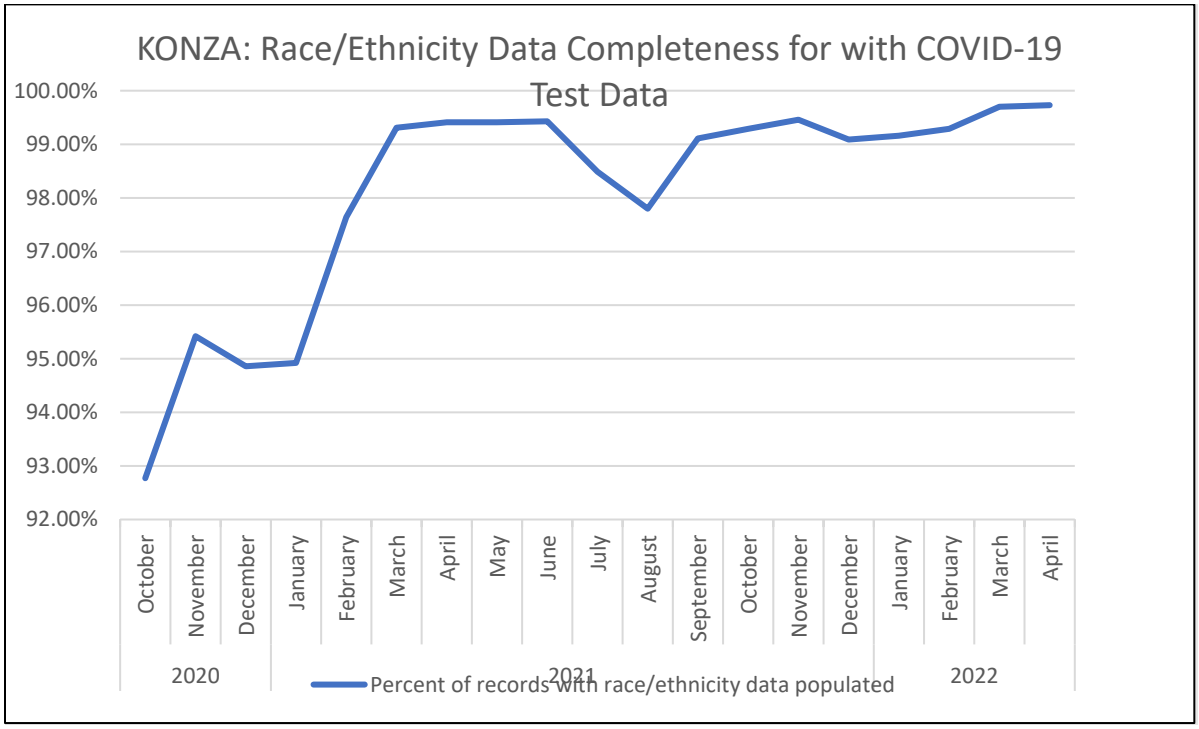

Figure 12. *Percent of Records with Race/Ethnicity Data. From October 2020 to April 2022.*

Results from Thematic Analysis

We identified five themes across the five recipients that capture the integrated set of interim and summative perspectives on the Program.

Theme 1: Successful HIE efforts under the Program included leveraging more complete patient data to bolster ELR and eCR. Novel technical approaches and reporting use cases also made progress but faced more substantial challenges.

Recipients were able to quickly mobilize existing data feeds to electronically report lab results and COVID-19 cases to PHAs. Due to the breadth of data held by HIEs, they were also able to improve completeness of ELRs and eCRs. In particular, new COVID-19-related feeds featured improved levels of completeness of race/ethnicity, co-morbidity, and other demographic data. KONZA consistently achieved more than 95% of patient records with race/ethnicity data. A PHA working with HSX data reported an 80% decrease (to less than 30%) in missingness for race/ethnicity data for eCR. Master Patient Indexes (MPIs) were also helpful in establishing registries. Taken together, more complete ELRs and eCRs and registries created a clearer picture of COVID-19 outbreaks and disproportionately impacted communities.

Relative to ELR and eCR, onboarding participants to capacity reporting proved more challenging – the key differentiator being the amount of work required to set up electronic reporting of situational awareness data (e.g., PPE, staffing, bed availability, ventilators). This more complex work was driven by four factors. First, HIEs, PHAs, and providers all had to reach a common understanding of how to measure each type of situational awareness data and lacked standards or even norms for such measures (e.g., how do you count a ventilator that is being repaired?). THSA used the SANER Implementation Guide to facilitate the development and understanding of these metrics. Second, situational awareness data was usually not stored in the EHR and there were often multiple sources (spanning from electronic systems to manual record keeping) of this data. One hospital reported that about 40% of the information they needed to report could not be pulled from the EHR and instead had to be counted manually or integrated from another system (e.g., staff scheduling software). Third, HIEs usually did not have experience working with connectivity to systems beyond EHRs, steepening the learning curve for understanding how to interface with such systems and then build the capability to automatically extract needed data (or establishing processes for manually entering data into a system that the HIE could connect to). Fourth, PHAs were unaccustomed to receiving situational awareness data and lacked established frameworks for how to leverage them. For example, given the dynamic nature of capacity measures, it was unclear how often PHAs should review them and how best to structure decision-making around them.

The heavy amount of upfront work for reporting situational awareness data was a key barrier to progress – especially amid high personnel turnover, technological difficulties, and competing priorities at provider organizations. In these instances, HIEs reported that it was more difficult to convey value when approaching new provider organization participants. Provider organizations that signed on attributed their ability to do so to having the resources (in particular, technical staff) to dedicate to the project; they felt the initial “switching costs” would return value in the long run, and the project aligned with their organizational mission around public health and data interoperability.

Another stream of work that proved more challenging than expected was incorporating novel technical approaches such as FHIR® and API-based reporting. Several recipients hoped to apply these to support public health reporting but found that they were insufficiently mature, thereby falling back on established methods. Specifically, barriers to implementing FHIR-based APIs were described as stemming from a combination of three factors. First, FHIR® standards were not sufficiently mature for public health use cases (e.g., the necessary FHIR® resources did not yet exist for situational awareness data including ventilator availability and staffing). Second, in cases where FHIR® standards did exist, they were not yet deployed in the EHR, such that the HIE could not use them. One pilot hospital described the need to update their EHR to support FHIR®, which could take 1-2 months – a long time in the midst of a pandemic. They also reported that obtaining and allocating the resources needed to train staff to support FHIR® was an obstacle to progress. Third, FHIR®- based APIs were perceived as a “nice to have” that got pushed down the list of priorities. Given the short time window to achieve Program goals, it didn’t feel worth incurring the uncertainty or risks of new standards and exchange methods relative to established ones. For example, technical vendors reported that they were ready to switch to FHIR® servers, but participants expressed security concerns around exposing FHIR® endpoints or prioritized other COVID-19-related efforts over technical updates. As another example, PHAs reported concerns about the reliability of and their capacity to support a novel exchange approach, especially during a pandemic. Overall, there was an expectation that FHIR®-based APIs would evolve to support public health reporting over a longer time horizon than the two-year Program period.

Theme 2: Reporting burden reduction remains salient for providers but has not been realized to the same extent on the PHA side.

For providers, HIE services provide a clear, meaningful reduction in public health reporting burden. They lower the amount of work needed to switch to electronic reporting methods by guiding providers through the process, interfacing with vendors and PHAs, and providing technical assistance as needed. HIEs reported that their pitch "resonated readily" with providers – both for existing participants being onboarded to electronic reporting methods and entirely new participants joining the HIE. Once electronic reporting is established for lab results and case data, providers can, at least in concept, stop manual processes and shift FTEs elsewhere.

However, there were some identified limitations. While not specific to HIE-facilitated ELR and eCR, provider organizations and PHAs expressed concerns about the reliability and completeness of electronic reporting methods. Providers felt responsible for any issues with reporting (in particular, successful transmission of reports), and neither HIEs nor PHAs had automated mechanisms in place to deliver positive confirmation reports as well as error reports to ease such concerns. PHAs expressed concern around the accuracy of reports as well as some challenges working with report content due to the lack of standards and adherence to standards. None of these issues impeded recipients' ability to make progress with ELR and eCR; instead, these concerns represented opportunities for further improving HIE offerings around ELR and eCR. Another limitation was the uneven technical capabilities between providers and PHAs. One health system automated situational awareness reporting to fulfill the state's requirements, but the PHA did not have a way to validate the electronic method. Therefore, the health system could not stop reporting manually and continues to maintain both methods.

For PHAs, HIE services do not lessen reporting burden to the same extent. Because HIEs represent only one of many sources of inbound data to PHAs, their impact is diluted by the myriad other ways that public health data is reported. One PHA stated that ELR from one HIE was "a drop in the ocean because we were getting COVID-19 data from everybody. We did appreciate it because it came consistently, came HL7®, and came automatically, so we didn't have to worry about data entry errors that are made when people enter data in through the portal." PHAs did express that HIEs offered other benefits – namely, onboarding coordination and technical assistance. HIEs demonstrated value by helping identify and connect providers to PHAs to promote reporting from previously disconnected regions or facility types. If issues arose, HIEs were also able to provide points of contact at each practice and technical support for troubleshooting. This reduced the work required from PHAs to contact facilities to fix reporting errors and instead allowed them to alert the HIE who could then resolve the issue.

Theme 3: There is no single optimal use case for how HIEs can best support public health reporting.

All projects under the Program were perceived as creating important value, yet none were described as transformative. PHAs expressed appreciation for the progress made under the Program, citing timeliness of reporting and data completeness (in particular, race and ethnicity data) as important advances. Yet, no single service stood out as essential or groundbreaking for pandemic response efforts. For example, PHAs did not have a strong position on the relative value of eCR compared to ELR, stating that reporting that came through HIEs was complete and easy to use but did not comprise enough of the total reports to have a major impact. When designing services to cater to public health needs, HIEs must still take on the challenging work of aligning stakeholders with differing incentives, complex regulations, and varied technical capabilities. This work is especially difficult when PHAs have barriers preventing investment in bi-directional exchange.

Specifically, HIEs often felt that they could deliver more valuable services if PHAs could share data back with the HIE to allow the HIE to have a more complete picture of data (e.g., COVID-19 immunization data to track vaccination rates and inform providers of potential gaps). However, PHAs reported being unable to share these data due to regulations intended to keep data secure and restrict the use of data to only the purpose for which it was collected. PHAs expressed that each request to send data to the HIE could incur risk for them. It was also perceived as difficult to maximize value and engagement in HIEs from PHAs when it is unclear who should fund these initiatives. Many PHAs voiced that public health data reporting represents a common good, so when forced to take a piecemeal approach to pay for these services, lines of communication became more fraught, and some potential benefits were sacrificed.

Theme 4: Ongoing sustainability is shaped by a broad array of factors that influence which services will continue and scale after the Program while others will be placed on hold until they may be needed in future public health emergencies.

The factors that influenced the future trajectory of service offerings started under the Program include (1) policies (e.g., state mandates for standards-based reporting, return of suspended HIPAA requirements), (2) funding, (3) scalability of solutions – particularly across EHR vendors, and (4) ongoing perception of urgency (i.e., ranging from none to ongoing related crises like natural disasters).

First, the lack of aligned reporting requirements across federal, state and local levels impedes providers' and PHAs' motivation to invest in establishing permanent reporting infrastructure. Moreover, poorly aligned reporting requirements between states limit HIEs' ability to scale these services as they have to navigate a new reporting landscape and reconfigure technical components for each new set of reporting requirements. While full harmonization is likely an unrealistic goal, some states are enacting policy to homogenize the reporting landscape both to allow already developed services to scale more easily and to prompt the development of new offerings that provide long-term solutions to reporting burden. For example, legislation passed in Texas directs the state PHA to identify current processes for and barriers to standardized, regular reporting of electronic laboratory, hospital capacity, and immunization administration data. The state agency will also collaborate with reporting entities on best practices to ensure consistency across state, regional, and local levels.[10] This policy creates a path to standardization that allows both THSA and providers to pursue investments in automating these types of reporting. On the other hand, in states that have not made reporting requirements permanent, providers conveyed more hesitancy to invest in electronic reporting services.

Second, PHAs felt that their ability to engage with Program activities was hampered by lack of funding, such that they could not take full advantage of the capabilities that HIEs were building. For example, one PHA reported that they lacked the staff to parse and aggregate the increased volume of lab results that the HIE could provide. While there was an influx of funding during the COVID-19 pandemic to support the public health response, PHAs expressed the need for less specified funds that could be used to update and integrate IT infrastructure to allow capabilities brought online during the pandemic to continue and be built upon. Since the public health emergency has ended, in some states funding has been dramatically cut back and so there is a sense that there is not the ability to continue paying to participate in the HIE (Table 3).

Perspective	Quotes
City PHA	"It's silly because these things seemed to have worked well and given us a lot of bangs for the minimal amount of buck that we used, but no one is noticing that and it's interesting. It's the same thing from the vaccine registry perspective. There [are] going to be significant cuts to the vaccine registry… and it was one of the few systems that worked during this pandemic. It's just a mind-boggling place for both HIEs and us to be. Beyond a few years, it's a shame if we can't sustain it"
County PHA	"At this point, we're not even using [the HIE]. Once the grant period ended, we decided not to continue that because we couldn't justify the cost."
	"In some ways, I feel like PHAs are 20 years behind because we've been historically underfunded for a variety of reasons, especially with technological tools. I think we're getting there, but we need some more handholding… We need to conceptualize the use of [more advanced data systems] and see it being used in health departments. It's a very important tool for us and we would have lots of ways to benefit from it, but we are not able to make that jump. Even those that are able to are tied down with so many other projects. We have multiple county systems in place. It seems like an opportunity for someone to have a public health-specific way to connect and utilize it."
State PHA	"Public health agencies have to keep running. So when financial constraints hit, they stop thinking about the big picture and just [think] about how to keep [their agencies] running internally."

Table 3. *Quotes from PHAs on navigating financial constraints with respect to IT investments. Note: Quotes were lightly edited for clarity.*

Third, scaling electronic reporting methods can be heavily dependent on the EHR landscape among an HIE's participants. In several cases, reporting functionality that was built under the Program was limited to participants with specific EHR vendors (both to limit complexity for the HIE and also because not all vendors had the interest or the technical maturity to engage in the needed work on the EHR side). For example, KONZA developed a product for COVID-19 test results that extracts lab data, maps it to a standard, and reports it to PHAs. They developed this product to work with Athena EHRs initially, scaled to two other EHRs, and are now continuing to scale to other EHR developers that are prevalent among their participants. But it is unlikely that they will invest in scaling to the full range of vendors given the lack of economies of scale.

Some electronic reporting methods, specifically eCR and situational awareness reporting using SANER, necessitate EHRs being updated to a version that has the technical capacity to support them. These upgrades are costly and may take several months to implement, impacting many aspects of the provider organization and therefore are rarely dictated by public health reporting needs. However, multiple health systems engaging with HIEs under the Program reported good experiences with support from their EHR vendor. For example, one EHR vendor offered a "checklist" of actions to be able to support automated extraction of EHR data for public health reporting. The checklist provided a clear set of tasks to help minimize the management burden associated with the technical lift for reporting. Yet, financial barriers and competing priorities within a health system still served as limitations to widespread adoption of eCR certification and FHIR® capabilities, making it difficult to reliably scale these types of reporting.

Fourth, perceived need and urgency influence which programs and services will be placed on hold versus expanded. For example, KONZA's ELR product will continue to be used for COVID-19 reporting but will not be expanded until public health officials identify new reportable lab tests and conditions. On the other hand, the state of Texas passed a bill that mandates capacity reporting in perpetuity to improve preparedness for public health disasters,[11] which has prompted THSA to explore options to scale their services to alleviate providers' burden from manual reporting of these measures.

Theme 5: The STAR HIE Program meaningfully altered the trajectory of the relationships between PHAs and HIEs.

By providing funding and incentives for PHAs and HIEs to closely collaborate and advance shared goals, the STAR HIE Program markedly strengthened relationships between HIEs and PHAs. The Program structure required recipients to have a PHA "sign on" as part of their application, creating buy-in from the beginning. Most recipients already had long-standing relationships with their public health partners, but the pandemic provided an opportunity for recipients and PHAs to prioritize public health use cases and undertake a more significant set of joint efforts, fostering closer working relationships – a sentiment expressed both by the HIEs and the PHAs (Table 4 and Table 5, respectively).

Perspective	Quotes
HIE	"State agencies came to the table in a way that they have not historically. And it really is thanks to the ONC STAR HIE Program."
	"The [STAR HIE] Program served as the catalyst for building the bridge between HIE and public health partners."
	"[Our HIE] has always had a strong relationship with [our PHA] and their support. And they want more to continue. I think this was probably a way to say that the governor has also recognized [our HIE] by reaching out to say, 'What can be done to help providers?' So, it certainly helped to raise the profile and raise the confidence in [our HIE]."
	"I really did not speak the same language as the public health personnel at the public health agencies, either local or state. And [for] what seemed to me to be pretty straightforward things…we were making little to no progress – and if anything, I was probably alienating them. We hired… someone that came from public health on our staff because we were meeting at the state level, and we didn't seem to be able to communicate well. [That employee] came in and is able to speak "public health" and knows how to frame those conversations – so that public health officials can hear it within the public health constraints they have."
	"The ONC STAR HIE Program opportunity offered us a significant tactical advantage. [It allowed us] to clear that money barrier and say, 'Look we are going to bring a financial investment to the table to move this forward.' It really helped to have a project structure and a timeline. It can't just be an ongoing discussion. Here are specific things we're going to do. We're going to have an end result deliverable, and here's the timeframe."

Table 4. *Quotes from HIE perspectives on how the STAR HIE Program strengthened their relationship with PHAs. Note: Quotes were lightly edited for clarity.*

PHA	"Our ELR program at the beginning of the pandemic, we were still setting up. We didn't have many facilities onboarded, but that changed once COVID-19 broke out. I don't know that we used [the HIE] much before the pandemic because we weren't massively onboarding people. But COVID-19 changed everything, [and the HIE did help during the pandemic]. But as we have a new normal after the pandemic, they are certainly [more on the radar as] a resource that to be considered."
	"Having the STAR HIE Program opportunity has fueled a lot of relationship building with [the HIE], and we have tapped them for new projects we'd like to do with respect to eCR"
	"As far as the communication, we do have established meetings in place for each of the registry programs that we work with. And pretty much keep an open communication as needed, even outside of our meetings. So, I think we have a good rapport there as far as reaching out in the event there's a need that someone needs information… We initiate a lot of the communication for providers or outreach in regard to the programs with [the HIE]. So, we just try to keep that line of communication open… in hopes that we can streamline some of the processes and make some of the work efforts a little more seamless."

Table 5. *Quotes from PHA perspectives on how the STAR HIE Program strengthened their relationship with HIEs. Note: Quotes were lightly edited for clarity.*

In many cases, PHAs gained a new understanding of HIE capabilities and offerings. One of the specific long-term implications was a "flip" in the dynamic from HIEs seeking out PHAs as partners and participants to PHAs approaching HIEs with proposals for new projects. For example, many PHAs recognized value in electronic reporting methods for COVID-19 and are hoping to expand those same mechanisms to other reportable conditions. As another example, GaHIN is partnering with their respective PHAs to improve the completeness and exchange of social determinants of health data in the wake of the inequities highlighted by COVID-19.

For all awardees, PHAs and HIEs are interacting more regularly (often in standing meetings that started during the pandemic and have continued), which allows them to have a detailed awareness of evolving priorities, needs, and capabilities. By coordinating and collaborating more, they expressed confidence that they would be ready to partner when the next opportunity arises.

Conclusion

The summative evaluation of the STAR HIE Program offers insight into the opportunities for HIEs to support PHAs' efforts against the backdrop of the COVID-19 pandemic as well as broader guidance for future programs to advance HIE for public health use cases. Over the past decade, there has been substantial investment in the technical infrastructure, national and local policy, governance, and business practices that facilitate the delivery of HIE services. However, prior to the COVID-19 pandemic, HIEs, PHAs, and other key stakeholders did not have an urgent need to leverage HIE capabilities to meet public health needs.

COVID-19 made it clear that timely, accurate, complete sources of data in geographic regions are critical to understand testing volume, case volume, and situational awareness. Given that the Program sought to seed five diverse HIE efforts, make progress in HIE-supported public health reporting, and learn from their experiences, **the evaluation suggests that it fulfilled its overall objectives**. HIEs were able to fill key gaps, demonstrating value in varied ways but most importantly strengthening their relationship with PHAs. The complex nature of the associated work signals that the long-term benefits of the STAR HIE Program lie largely in the relationship- and capacity-building effort. Indeed, perhaps the most encouraging results are that the activities accomplished under the Program have laid a foundation for ongoing future bidirectional HIE-PHA collaborations on a broader set of public health needs. These lessons from the STAR HIE Program can guide other HIEs, PHAs, and policymakers on how to better leverage existing HIE capabilities to advance public health as well as focus efforts to address ongoing challenges.

References

1) HealthIT.gov. Strengthening the Technical Advancement and Readiness of Public Health via Health Information Exchange Program (STAR HIE Program). Published September 30, 2020. https://www.healthit.gov/topic/onc-funding-opportunities/strengthening-technical-advancement-and-readiness-public-health
2) U.S. Department of Health & Human Services. HHS Announces Funding for Health Information Exchanges to Support Public Health Agencies – STAR HIE Program Funds Five Organizations to Improve Interoperability of Health Data. Published September 30, 2020. Accessed September 8, 2023. https://www.hhs.gov/about/news/2020/09/30/hhs-announces-funding-for-health-information-exchanges-to-support-public-health-agencies.html
3) U.S. Department of Health and Human Services. HHS Awards Funds to Expand Immunization Information Sharing Collaboration. HHS.gov. Published January 19, 2021. Accessed September 8, 2023. https://www.hhs.gov/about/news/2021/01/19/hhs-awards-funds-to-expand-immunization-sharing-collaboration.html
4) hl7.org. Health Level Seven International. Accessed September 8, 2023. https://www.hl7.org/
5) hl7.org/fhir/. Hl7 - FHIR v5.0.0. Accessed September 8, 2023. http://www.hl7.org/fhir/
6) HL7 International Public Health Workgroup. Situational Awareness for Novel Epidemic Response Implementation Guide. Published February 15, 2022. Accessed September 8, 2023. https://build.fhir.org/ig/HL7/fhir-saner/
7) Damschroder LJ, Lowery JC. Evaluation of a large-scale weight management program using the consolidated framework for implementation research (Cfir). *Implementation Science*. 2013;8(1):51. doi:10.1186/1748-5908-8-51
8) Labcorp | Global Life Sciences Leader in Lab Diagnostics & Drug Development. Accessed September 8, 2023. https://www.labcorp.com/
9) Home | Quest Diagnostics. Accessed September 8, 2023. https://www.questdiagnostics.com/
10) Texas Health and Human Services. Data Collection and Reporting Best Practices. Published online September 1, 2022. https://www.dshs.texas.gov/sites/default/files/legislative/2022-Reports/Data-Collection-Reporting-Best-Practices.pdf
11) Texas S.B. No. 984. Published online 2021. https://capitol.texas.gov/tlodocs/87R/billtext/pdf/SB00984F.pdf

Appendix A: ONC STAR HIE Program Interim Evaluation Interview Guide

Note: Questions and topics are tailored to each recipient and will be further adapted to the interviewee (e.g., asking participants about reporting burden reduction, asking PHAs about the usability of ELR data).

General STAR HIE Questions

1) Please describe your role and organization as it relates to the STAR HIE program.
2) What are your overall impressions of the STAR HIE program?
3) What are the goals, as you understand them, of the STAR HIE program?
4) Is the program on track to succeed in the original timeline laid out?
5) What are the strengths and challenges of the overall design of the program?
6) In terms of the role of **ONC,** are there specific areas that have gone especially well or could use improvement?
7) In terms of the role of **EMI**, are there specific areas that have gone especially well or could use improvement?
8) In terms of engagement with **other STAR HIE Program grantees**, are there specific areas that have gone especially well or could use improvement?
9) What are the biggest opportunities for the lessons learned from the program to influence broader HIE activities moving forward?

Specific Activities Questions

<u>All Recipients:</u>

1) Can you summarize the key activities of [HIE Name] under the STAR HIE Program?
2) What are the goals, as you understand them, of these activities?
3) In what stage of implementation are these activities?
    a. Overall, how do you think it's going?
        i. What has been harder than expected?
        ii. What has been easier than expected?
4) How has progress been measured and tracked? What is being tracked and how often?
5) What progress has been made with reporting data to your public health partners?
    a. What data are being reported? How so?
    b. Are there challenges with reporting the data? Technological challenges? Challenges with staffing or bandwidth?
6) What have been the essential factors that enabled or hindered progress?
    a. Which, if any, are unique to your setting, organization, etc. (e.g., maturity, size, technological approach)?

7) What kinds of changes or alterations will, or did you make to the activities? Were the changes largely reactive (based on challenges) or proactive (to make better progress towards goals)?
8) Have you been able to incorporate novel technical approaches such as FHIR APIs?
    a. If so, what has been successful or challenging about doing so?
    b. If not, why not?
9) What resources have you had to draw upon to make progress in the activities?
    a. Within your own organization?
    b. From other organizations?
10) Who are the key individuals or organizations that were needed to get on board with the activities?
    a. What efforts have been made to bring them on board? Were they successful?
11) To what extent does participation in the activities bring value to your organization?
    a. How is this initiative viewed within your organization?
    b. Are there any things that could have been done to increase this value?
12) Are there any barriers or obstacles to participation? For whom? Describe them.
    a. Within your organization?
    b. Outside your organization?
13) How essential are these activities to the broader goals and objectives of your organization?
14) How well do the activities fit with existing work processes and practices in your organization?
15) What kinds of incentives are there to help ensure that the implementation of the initiative is successful?
16) What kind of local, state, or national performance measures, policies, regulations, or guidelines influenced the decision to pursue these activities?

<u>KONZA, HSX, and GaHIN Questions:</u>

1) How has the expanded connectivity resulted in a reduction in provider reporting burden in the federal requirements for COVID-19 related data?
    a. How has reporting timeliness been affected?
    b. How has data completeness or accuracy been affected?
2) Can you describe who is using the COVID-19 Registry and the value of such use?
3) What are the components of “enriched” data that are planned or successfully being reported?

THSA Questions:

1) Please describe the experience with recruitment of pilot sites. What went well? What was challenging?
2) Please describe your experience working with the SANER Project's FHIR Implementation Guide. What went well? What was challenging?

Health Current Questions:

1) Please describe your original scope of work.
    a. What did you encounter that led you to pivot?
2) How did you decide on your new scope of work.
3) Please describe your new scope of work.
    a. What are the key objectives?
    b. What challenges do you anticipate with this project?

Appendix B: ONC STAR HIE Program Summative Evaluation Interview Guide

Note: Questions and topics are tailored to each recipient and will be further adapted to the interviewee (e.g., asking participants about reporting burden reduction, asking PHAs about the usability of ELR data).

General STAR HIE Program Questions

1) Please describe your role and organizational goals as it related to the objectives of the STAR HIE Program.
2) What are your overall impressions of the STAR HIE Program? Strengths and benefits? Challenges?
3) What were the major opportunities created or lessons learned from the STAR HIE Program?
4) How would you describe the overall value of the STAR HIE Program efforts?
    a. What would be different today in your service area had you not participated in the STAR HIE Program?
    b. On a scale of 1 to 5 (with one being little to no value added and 5 being significant value added), how would you rate the value of the STAR HIE Program?

Summative Interview Topics:

<u>All Recipients:</u>

- **Sustainability** of Program activities
    - What activities are you planning to continue beyond the period of performance and how will you sustain these efforts?
    - Looking back, are there different decisions/strategies you would have implemented to ensure ongoing sustainability or maintenance of programmatic efforts beyond the period of performance?
    - If involved in the sustainability plan, can you speak to the key factors that will shape success of the plan?
- Assessing reporting burden reduction
    - Have program activities alleviated or impacted reporting burden of public health information for *public health agencies*? If so, how? If not, why not?
        - Have there been attempts to quantify or measure reporting burden reduction for *public health agencies*? Please describe.
    - How have program activities alleviated or impacted reporting burden of public health information for *providers*?
        - Have there been attempts to quantify or measure reporting burden reduction for *providers*?
- Development of **long-term HIE-PHA relationships** and the value proposition for HIE-PHA relationships

  - How has the program impacted your relationship(s) with public health agencies?
  - How easy or difficult was it for the HIE to speak public health language and for public health to speak HIE language?
  - Were you able to influence or change policies to enable HIE and Public health bi-directional data sharing?
  - Were you able to establish or streamline DUAs to enable more public health data sharing with HIE?
  - Are there any specific "next projects" or "next steps, next levels of engagement" that you are working on with PHAs?
  - Given some of the common challenges facing HIE and PHA engagement (e.g., turnover, resources, competing priorities, lack of technical expertise), are there any specific strategies that could mitigate these challenges?

- Impact of **state and local policies** (including pre-existing regs, COVID-specific executive orders, etc.) on the sharing of health information between HIE and public health agencies (e.g., differing legal interpretations that inhibit HIE access to public health data, shifting reporting requirements, data sharing restrictions)
  - (If not addressed above): Were you able to influence or change policies to enable HIE and Public health bi-directional data sharing?
  - To what extent did these factors impact your ability to engage with public health and reduce public health burden during the COVID-19 response?
  - Are there any specific mitigation strategies, best practices, or bright spots that allowed you to overcome policy at the state and local level?
- As the urgency of COVID-19 recedes or as the federal public health emergency is declared over, how is that impacting your ability to continue to make progress on HIE for public health?
  - General issues – e.g., competing priorities
  - Specific issues – e.g., expiration of HIPAA waiver that allowed public health data reporting
- Presence and impact of **information blocking**
  - To what extent have you observed EHR vendors and/or health care providers engaging in behaviors that you believe may have prohibited you from sharing or receiving data and/or increasing data exchange?
    - If you have experienced practices that you believe may have prohibited you from sharing or receiving data and/or increasing data exchange, how often did you report the practices to ONC/HHS using the Report Information Blocking Portal?
  - In what form(s) have you observed or experienced *behaviors* that you believe may have impacted your health IT outcomes and/or your ability to share or receive data?

- To what extent have you observed the following types of healthcare providers engaging in *behaviors* that you believe may have prohibited you from sharing data and/or increasing data exchange?
  - Health Systems, Independent Hospitals, Independent physician or physician groups, or others

GaHIN, HSX, and KONZA:

- **Usability** of ELR and eCR data by PHAs – especially with standards-mapped data
  - To what extent are local codes used versus LOINC codes?
    - How does your HIE address the use of local codes?
    - Can these solutions be broadly applied or scaled to a larger level?
  - How did PHAs use this data? How did it impact their decision-making processes?

GaHIN and HSX:

- ELR vs. eCR – **comparative value** and breadth of data
  - Were there different challenges when implementing ELR vs. eCR? Please describe.
  - How did the types and breadth of data differ between ELR and eCR and what was the overall impact?
  - What is the relative value of each during a public health emergency for providers, HIEs, and PHAs?

GaHIN only:

- Were there unique challenges reporting **VA data?**
  - If so, how did you navigate these? What was successful?

THSA only:

- Specific policy recommendations for **SANER**
  - What resources were needed to implement SANER?
  - What were the most challenging implementation issues?
  - What actions aided your success in recruiting and setting up a pilot hospital for this type of work?
  - How would you characterize the value proposition of SANER?
  - How easily can you scale this type of reporting to other participants? What lessons were learned or what advice would you give to other organizations looking to implement SANER?

Health Current and HSX:

- **MPI** value proposition
    - Who benefits from an MPI?
    - What are the benefits of using an MPI and how is it used?
    - What are the specific public health use cases for an MPI?
    - How does an MPI impact public health burden downstream?
    - What resources are needed to set up, store, and maintain an MPI?

Health Current:

- Impact of change in executive order on immunization data
- Impact of change in state administration