Linking Electronic Medical Record Systems with Immunization Information Systems

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March 2010

Overview

State Immunization Information Systems (IIS) are increasing their efforts to establish interfaces with Electronic Medical Record (EMR) systems. This white paper presents STC's experience establishing these electronic links. This "how to" and practical approach summarizes lessons learned and suggests a step-by-step protocol to create a successful and sustainable exchange. This document illustrates how electronic links support the HL7 standard and emerging meaningful use metrics. This paper recommends additional EMR data fields that if exchanged would add value to the IIS user community.

Background

Nearly eighteen years ago, the Centers for Disease Control and Prevention (CDC) established a national objective to develop population-based tracking systems that captured children's immunization histories, and has continued to update these goals through the Healthy People objectives.[1] The original goal was to increase coverage rates for vaccine preventable diseases in target populations. Key objectives were for physicians to access immunization records for all patients and for immunization programs to use the data to monitor the effectiveness of their initiatives to increase immunization rates.

From 1995-2000 standards were established for data, security, policies, and operations. There were few interfaces and links between registries and other health data systems. The exception being some states established connections to birth data contained in Vital Record Systems. This allowed data for new born babies to be established in these population-based systems prior to their first well-child visit. Between 1988 and 2001, Arizona, Georgia, and Wisconsin became early adopters of these types of electronic data links.[2] Today nearly 80% of the 53 state and city immunization registries support exchanges of data from vital records to immunization systems.[3]

This opened the door to utilize electronic health information from other key third-party sources. Electronic data collection initiatives expanded to immunization specific encounter data contained in provider Practice Management Systems,[4] claims data from Medicaid and other third party health insurers.

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[1] Healthy People 2010 Objective #1-32; http://www.healthypeople.gov/

[2]   State Immunization Information systems and Public Opinion: A Case for Georgia; State and Local Government Review: Vol. 30, No. 3 (Fall 1998): 194-204; http://www2.gsu.edu/~padgds/Streib%20Immunization%20and%20Public%20Opinion.pdf

[3]   Centers for Disease Control and Prevention, 2008 Immunization Information System annual report; http://www2a.cdc.gov/nip/registry/IISAR/IISAR_DATA_2008.xls

[4] All Kids Count, Documentation of Immunization from Billing Data and Chart Abstract: Implications for a Large Health System Reporting Billing Data to a State Immunization Registry,

This next generation of electronic data sharing consisted of one-way data transfers from these systems into the IIS. While these data were the best available at the time, data quality varied as administrative data entry staff were not trained to identify immunization data errors on billing and claims data.

On December 30, 2009, the Centers for Medicare and Medicaid Services (CMS) proposed rules to implement the provisions of the American Recovery and Reinvestment Act of 2009 that provide incentive payments to providers for the meaningful use of certified EMR technology. Meaningful use is defined as "the use of health information technology to improve health care quality, efficiency, and patient safety." The primary intent of meaningful use is to establish and measure health outcomes so that the overall health of the public or a target population is improved. As it applies to the certification of EMRs this translates to the electronic exchange of immunization data.[5] Electronic exchange of meaningful use immunization data to affect these outcomes is optimally enabled through the incorporation of data and messaging standards.

The HL7 Standard and Health Information Exchange

Health Level Seven (HL7)[6] is an accredited, nationally-recognized standard for electronic data exchange for clinical and administrative messages in healthcare environments. According to the "Implementation Guide for Immunization Data Transactions", HL7 was created in 1987 for use within hospital settings, and is the CDC's standard for exchanging immunization messages. [7] This is currently done using Version 2.3.1 of the Health Level Seven Standard Protocol. [8] This document is maintained by the Committee on Immunization Registry Standards for Electronic Transactions (CIRSET)[9] which is incorporated under the American Immunization Registry Association (AIRA).[10]

The CDC HL7 implementation guide defines two kinds of communications: query and update.[11] A query is a solicited request for a patient's demographic and vaccination history. An update is an unsolicited message sent which contains patient demographic and vaccination data. There are four combinations of an HL7 message illustrated in figure 1, extracted from the CDC HL7 Implementation Guide (pg. 4)[12]

- Vaccine query – VXQ
- Vaccine query response indicating multiple patients were located and no records returned - VXX
- Vaccine query response indicating patient located and a returned record - VXR
- Vaccine update to a vaccination record, demographic and/or immunization - VXU

http://www.allkidscount.org/iz/ppoint/kallenbach/abstract.html

[5] Federal Register, January 13, 2010 (Volume 75, Number 8); http://edocket.access.gpo.gov/2010/E9-31217.htm

[6] Health Level Seven, www.hl7.org

[7] CIRSET. Transport of immunization HL7 transactions over the Internet using secure HTTP, version 1.0, http://www.cirset.org.

[8] Centers for Disease Control and Prevention, National Immunization Program, Immunization Registry Support Branch, "Implementation Guide for Immunization Data Transactions using Version 2.3.1 of the Health Level Seven (HL7) Standard Protocol: Implementation Guide Version 2.1," September 2002, http://www.cdc.gov/nip/registry/hl7/hl7guide.pdf

[9] Committee on Immunization Registry Standards for Electronic Transactions (CIRSET), http://www.cirset.org

[10] American Immunization Registry Association, http://www.imminformation systems.org

[11] Health Level Seven, www.hl7.org

[12] CDC HL7 implementation guide: p4; http://www.cdc.gov/vaccines/programs/iis/stds/downloads/hl7guide.pdf
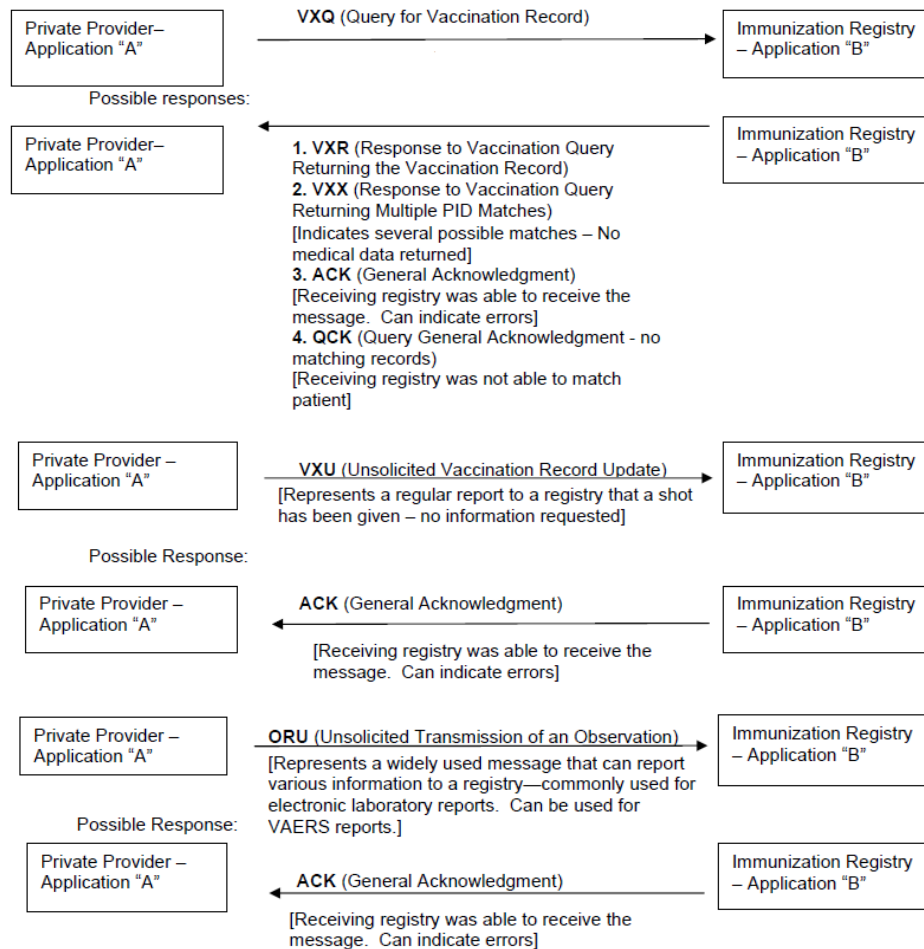
Figure 1 Immunization Data Transaction Messages

In 2004 these standards were used to support efforts to exchange immunization data with bordering states. Washington, Arizona, and Idaho participated in a pilot study which demonstrated that data-sharing between states using the standards for HL7 messages was both cost-effective and efficient. In a specific event-based situation, all states were linked to the Louisiana IIS to access patient records after Hurricane Katrina, some of which were accomplished using HL7 connections.

Although state-to-state immunization system record exchange is critical to provider knowledge of patient histories the immediate objective is to increase the data capture ability of an IIS by leveraging the current emphasis on meaningful use and expanding EMRs in physician's offices.

IIS and EMR Vendor Links

STC has identified a logical series of steps to investigate, test, and implement IIS and EMR links. Through experience this approach will help avoid unexpected barriers and increase the likelihood of success.

Step 1: Investigation Phase:
Interview the Provider
- Ensure the provider's practice will commit leadership staff to the process and will follow it to completion.

- Identify the technical and clinical staff who will be involved in the testing and implementation process.
- Hold an official kick-off meeting with the provider and IIS team to outline the process.
  - Describe data quality testing processes.
  - Estimate the anticipated length of time until the data exchange will go LIVE.
- Validate the current quantity of the immunization data in the EMR.
  - Identify length of time the practice has been using the EMR.
  - Identify where the immunization legacy data resides.
  - Establish how and if the legacy data will be migrated to the EMR.
  - Establish what immunization data has been documented in the application since the EMR was launched.
- Identify provider staff who will be accountable for completing file uploads - if a manual process is required.
- Clarify how patient confidentiality will be maintained throughout the testing process.
- Clarify how the IIS VFC accountability tools can continue to be used through the vaccine auto-decrementing functionality.

Interview the EMR Vendor
- Have the vendor demonstrate the application.
- Identify the lead technical staff person who will assist with the exchange and data testing.
- Identify how the user populates demographic and immunization fields. Note free text versus selection lists.
- Identify the mandatory fields in this area and review the data integrity checks.
- Identify all locations in the application where the user populates the same data.
- Provide the IIS data specifications to the EMR vendor.
  - Hold a conference call with the EMR technical staff to allow them to ask questions about the IIS application, the data exchange process and testing processes.
  - Review with the vendor the EMR's current and planed export data exchange formats; HL7, CSV.
- Establish the EMRs data exchange capabilities to send and receive data.
  - Identify for the send the fields that the IIS requires.
    - Establish which fields are mandatory and which are highly desirable.
  - If the EMR can receive data from the IIS, determine if this data be displayed in the patient record?
  - Identify if the EMR can send data natively via HTTPS to ensure patient data is transferred in a secure manner (for inbound interfaces).
  - Establish what triggers data to be exported from the EMR to an IIS.
    - Technical trigger - manually triggered or automatic feed
    - Data trigger - any change in patient data; updated demographic data only; new vaccination event; new vaccination entry; (administered or historical)
  - If the EMR can receive data from the IIS, determine the method used to de-duplicate vaccinations in the EMR application.
- Identify how the EMR manages patients who Opt Out of the IIS.
- Identify how the EMR manages patients who must Opt In, to (sign consent to allow data into a central system) an IIS.
- Identify how and if the EMR supports Vaccine for Children (VFC) status information.
  - At the vaccination level
  - At the patient level
  - Both

Step 2: Testing Phase

There are two testing phases within these projects: technical and data quality testing. It is important to avoid the assumption that if an EMR has the technical infrastructure in place to send data it does not have a bearing on the quality of data.

Technical Testing

This process requires data to be exported to the IIS; and it is recommended that after the initial test data set, live patient data is provided. The initial test data can be used to validate:
- The expected data electronically sent is available for review in the test environment.
- Data sent is in the correct message HL7 segment and format.

Whereas the actual patient records are necessary to validate and understand:
- Data adheres to validation criteria, if applicable, for example, no vaccinations prior to the patient's date of birth.
- The frequency that the data fields are populated and the triggers to send data.
- That patient data entered in multiple locations within the EMR is sent since it is possible to not capture all data if a single set of fields are being used.
- If patient consent is required for the IIS, ensure the EMR can filter data to allow only the consented patients through the interface.

It is recommended that the test files contain at least 250 test patient records allowing mock patient data testing to identify possible random technical transfer errors. Actual patient test files with less than 1,000 actual patients with immunization records are insufficient to validate the transfer of data to the IIS. Multiple test files are needed to ensure clean, accurate and complete data. Three to six test exchanges on average are usually required.

In some cases, the clinical practice will not have access to a technical specialist to support the generation of test files and the exchange if the EMR vendor does not assist. In some cases this is likely to be a cost to the practice. As such, the IIS team should have a support plan in place for both the technical effort and possible funding.

Data Quality Testing
This testing step validates the quality and quantity of immunization data in the EMR.
- Review accuracy of current CPT/CVX codes in the EMR.
  - Ensure combination vaccines can be documented. Warning some EMRs support only single antigens.
  - Ensure EMR supports documenting contraindication to or history of disease; Providers may document administration of vaccine to substitute for the ability to mark contraindications / history of disease.
- Review the vaccine codes for accuracy.
  - Ensure discontinued codes are not being used.
  - Ensure the EMR stored codes match what the provider is administering.
- Review what vaccination related fields are being populated and if they are being populated consistently, to include vaccinator, vaccine manufacturer, and vaccine lot number.
- Ensure vaccine codes are accurate; Warning the vaccine names the user sees in the EMR application may not match the underlying codes.
- If Opt In, consent to allow data into the IIS is needed, ensure consent field is being populated.
- Compare data in the electronic file against what the clinician sees in the EMR.
- Select 50+ random patients from the electronic file to compare the demographic and immunization data against what is viewable in the EMR.

- o Identify discrepancies.
  - ▪ Have the vendor correct technical malfunctions or change the application to support staff workflow/needs.
  - ▪ Have the vendor retrain clinical staff in the appropriate use of the EMR application so that documentation practices support the interface design.
- • Provide a clean test file to IIS to put in their test environment for loading and processing.
- • After IIS team accepts the test file, the physician's EMR is ready for LIVE data exchange.

Step 3: Implementation Phase
- • Ensure the provider understands their ongoing responsibilities for the data exchange.
- • Ensure data files are sent to the IIS on a regular basis.
  - o If data files are manually uploaded: Determine the frequency of the data uploads - daily (preferred) or weekly (acceptable). Assign two staff to complete the task one for a backup and replace assigned staff as needed when turnover occurs.
  - o If data files are automatically uploaded: Assign staff who will confirm successful data file transmission; Replace assigned staff as needed when turnover occurs.
- • Establish how the CPT/CVX codes in EMR application will be kept current.
- • Add/remove codes as new ones are established and others discontinued.
  - o Identify who will be responsible to keep codes current; the vendor, the provider.
- • Intermittent data quality checks should be a formal process.
- • If the EMR is receiving data from the IIS ensure that duplicate vaccines are not retained.
- • If sending data, ensure there are no errors in the transmission logs.
- • Formally certify a LIVE interface exists and is operational between EMR and IIS.

Historically, the main reason that private providers resist participation in IIS is due to the additional workload that manual or duplicated data entry creates. While providers appreciate the value of the IIS, they are entering the same dataset into the EMR as the IIS requires, and the sooner these electronic exchanges can be implemented the sooner value is established for the level of effort required.

Lessons Learned

The following are lessons learned and warnings. First and foremost, each data exchange is unique even with the same EMR application and/or version.

- • HL7 data exchange can give the IIS and the provider a false sense of security. It is important that the provider understand that transferred files are completely and accurately tested and that this process can be extremely time-consuming. No assumptions can be made in any phase of the process.

- • In some cases, changes made to the provider's application will cause the links to fail or some data to no longer be correct.

- • Each provider or provider group runs the EMR application on his or her own server. Configuration settings and changes to settings alone can cause the data exchange to fail.

- • EMR vaccine codes need to be kept current.

- • EMR vendor's CPT/CVX code updates vary by company and the frequency of update can impact accuracy.

  - o Updates may only occur when and if the provider deems necessary. EMR vendors may dispatch regular updates but providers are not required to update their systems.

- - Updates may only come in new releases; Providers may not update to the newest release in a timely manner.
- EMR vaccine codes may not be correct.
- Discontinued vaccine codes may be used for administered vaccines.
- Users will find a way to record data in the EMR if the application does not support it. Two common examples:
  - Users select a Td when they are actually giving Tdap because this code is not in the EMR.
  - Users record that a Varicella vaccine was administered because they had no ability to document Chicken Pox history.
- Vaccine descriptions in EMR may be linked to the wrong vaccine code.
- Vaccine lists in the EMR are not comprehensive.
- HL7 data files may contain CPT codes, CVX codes, or both.
- All vaccines do not have both a CPT code and CVX code.
- Manual file uploads are subject to failure or interruption.
- Must have at least two staff members trained to complete the task.
- Staff changes or lack of ownership for data exchange put data uploads at risk.
- Data considered mandatory by the IIS may not be mandatory data fields in the EMR and as requirements increase on the IIS for data this data may not be in the EMRs.
- Some EMR fields are free text format which are highly subject to error especially when involving vaccine lot numbers.
- Not all EMRs contain Guardian information. Some have Next of Kin or Guarantor (person responsible for the bill) fields vs. Guardian information; Not all IIS will accept these fields in lieu of Guarantor. Guarantor contact information is highly desirable.
- EMRs may be fully integrated with provider billing. Changes to EMR vaccine codes may impact provider billing. Disrupted billing or erroneous billing puts the provider at legal and monetary risk.

Example Linkages with EMR Vendors

The following table summarizes established EMR IIS interfaces that STC has implemented. It includes the type of messaging export (as some are not yet using HL7), and identification if an exchange is bidirectional. Most EMR vendors are in multiple states. As such, contacting the local representatives and referencing existing exchanges should facilitate communication.

Table 1: Established State Interfaces

Iweb HL7 data exchange 3/15/10	Entry Date	TYPE of EXPORT			
		HL7	Real time	Batch	Bidirectional
Allscripts, Touchworks	June, 2007	x		x	x
Cerner Power Chart	Jan., 2009	x		x	
eClinical Works	Feb. 2007	x		x	Testing
EHS	Jan., 2007	x		x	
EHS/Care Revolution	Jan., 2007	x		x	
eMDs	Jan., 2009	x		x	
Encounter Pro	Aug. 2006				
Epic (Bi-directional)	Feb. 2007	x		x	x
Epic Systems/Epicare	Feb. 2007	x		x	Testing
EZ Healthcare, Inc.	June, 2009	x		x	
GE Centricity (Logician)	Aug. 2006	x		x	
GE Centricity (Titan)	Tested prototype	x	x		x
Greenway Medical/Prime Suite	Dec-09	Target 4/2010		x	
iMedica	Feb. 2010	x		x	
Integrated Healthware (now Nightingale)	Aug. 2006	x		x	
Logician	Aug. 2006	x		x	
Medinformatix	Jan., 2008	x		x	
MIE WebChart (Medical Informatics Engineering)	Aug. 2006	x	x		
MOST	Aug. 2006	x		x	
Mountainside	Aug. 2006	x		x	
NetSmart Technologies (Insight)	Dec. 2004	x	x		x
Next Gen EMR		x		x	
Next Gen Practice Management System	Oct., 2006	x	x		
Nightingale	June, 2009	x		x	x
Noteworthy EMR (formerly Megawest)	Testing				
Power Chart Office by Cerner	Aug. 2006	x	x		
Practice Fusion	Requesting testing	x		x	
Practice Partner	Jan., 2007	x		x	
RPMS (Indian Health Services)	Aug. 2006	x			x
Safeway Pharmacy (DTT)					
Sage Software (Intergy)	Tested prototype	x		x	
Sage Software (PCN Network)	Sept., 2005	x		x	
Visual Data/Office Practicum		x		x	
Web MD	Aug. 2006	x		x	

Recommendations for Enhanced EMR Data to Support IIS

As EMR vendors continue to evolve their application they will likely remain current with HL7 standards. STC recommends they support the recommended data set and procedures in the newly established HL7 V2.5.1 Implementation Guide: Immunization Messaging (revised December 2009). This guide has been reviewed and voted on by the HL7 committee on Public Health and Emergency Response (PHER).

Since few EMRs currently contain the necessary data elements to leverage all immunization system assets STC also recommends evolving the EMR data sets to include additional data. This additional data when shared with IIS will increase the value of the provider's EMR and facilitate health information exchange that ultimately impacts the quality of patient care. The following table lists common data elements that can be exchanged between EMRs and IIS today as well as recommendations for future additions.

Table 2: Common and Recommended Future Data Exchange Elements

Data Category	Data Elements	Common in EMRs today	Recommended data for exchange when available
Patient Information	Patient Identification Number	x	
	Patient Name	x	
	Patient Date of Birth	x	
	Patient Physical Address	x	
	Patient Address City	x	
	Patient Address State	x	
	Patient Address Zip Code	x	
	Patient Phone Number	x	
	Patient Email Address		x
	Patient Social Security Number	x	
	How patient qualifies for VFC: American Indian / Alaska Native, Medicaid, Uninsured, Ineligible		x
	Patient Ethnicity	x	
	Patient Gender	x	
	Patient Guardian First Name	x	
	Patient Guardian Last Name	x	
	Patient Guardian Physical Address		x
	Patient Guardian Address State		x
	Patient Guardian Address Zip Code		x
	Patient Guardian Phone Number		x
	Patient Guardian Email Address		x
	Patient's Mother's Maiden First Name		x
	Patient's Mother's Maiden Last Name		x
	Patient's Guardian's cell phone number		x
	Patient has Opted out of IIS		x
Vaccination Information	Vaccine Manufacturer Name	x	
	Vaccine Manufacturer Code		x
	Vaccine Name	x	
	Vaccine Expiration Date	x	
	Vaccine Lot Number	x	
	Indicator if vaccine is VFC or if privately purchased.		x
	Indicator if vaccination is administered or historical		x
	Vaccination administration route	x	
	Vaccination administration site	x	
	Vaccination dose volume		x
	Deleted vaccinations		x
	History of disease (specify related vaccine)		x
	Contraindication to vaccine (specify which vaccine)		x
Facility Information	**Facility identification number**		x
	Facility Name	x	
Provider Information	**Provider Unique Identification number**		x
	Provider First Name		
	Provider Last Name	x	
		x	
Patient / Guardian Consents	**Yes / No Indicator**		x
Decision Support Data	Vaccine Forecasting (to EMR)	x	
	When Shots coming due and overdue	x	
	Why shots are invalid		x
	Accelerated schedule variant		x
	Which shots valid and when invalid, reason why		x
	Accelerated schedule variant		x

Data Category	Data Elements	Common in EMRs today	Recommended data for exchange when available
	Reciprocal messages **Sends vaccinations in IIS back to EMR** **Flag for Contraindication**		x x

Overwhelmingly, providers not only want to send data to the IIS, but also want to receive any additional immunization data back into their EMR that might reside in the IIS on their patients. Providers want a single source to view their patient's complete immunization record and they prefer that source to be their own EMR.

Third party payer incentives are frequently tied to immunization compliance rates. Data exchange with IIS gives the provider missing immunizations which routinely improves the coverage rate for their patient population. STC recommends EMRs consider providing the following functionality which currently exists in most state IIS for optimal data exchange. This additional data and functionality adds value to the EMR solution.

Table 3: Optimal EMR Patient Immunization Record Functionality

Functionality	Common in EMRs today	Occasionally seen in EMR	Recommended Enhancements to EMRs
1. Real time or near real time updates		x	
2. Automatic data send process		x	
3. HL7 messaging	x		
4. Send data to IIS from EMR	x		
5. Receive data from IIS		x	
6. Display data received from IIS in EMR immunization grid			x
7. Deduplicate vaccinations received from IIS			x
8. Receive contraindications to vaccines and display in EMR			x
9. Support online vaccine ordering in IIS			x
10. Manage vaccine deletions so that they are not included in data sent to IIS			x x
11. Differentiate vaccinations received from IIS in EMR vaccination record		x	

Summary

Electronic health information exchange will expand rapidly in the next 2-3 years. Funding is readily available for EMR purchases and enhancement to facilitate this exchange. As providers participate in local and regional Health Information Exchange (HIE) efforts the common request will be sharing of immunization data across this environment. Public health informatics has the opportunity to leverage these data exchanges to not only capture immunization data from new sources but also to secure funding and undertake data exchange projects with EMRs and HIEs. The IIS initiatives that began over a decade ago have established strong HIT frameworks that support these efforts. The IIS community has positioned themselves to be a leading driver to support certification of EMRs for meaningful use. As a result they are positioned to directly increase the data capture capabilities and facilitate the two way exchange of patient data, thus finally moving toward the original goals of sharable immunization records between providers that was established in the early 90s.

Lessons learned such as those highlighted in this document can support the provider's effort to positively impact their patient's health outcomes while assisting the IIS to achieve their public health goals. The ultimate benefit is derived by the user, the patient, the patient's family, and the community at large through the use of quality data.