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Foundational Guidance for Minimum Functionality to Improve Visibility and Access to Information from Acknowledgment Messages

Introduction

There is a need for clear, aggregate immunization-specific acknowledgment (ACK) reports containing descriptions understandable to both technical and non-technical individuals. The Health Level Seven (HL7) immunization messaging standard includes an acknowledgment message that is sent back to the sending system after receiving an immunization update message. However, due to the large volume of messages that may be generated, these cannot be reviewed in real time, nor do they always reach the most appropriate actor in the interoperability process. For this reason, aggregate reports may also support the communication needs and actions necessary for ensuring accurate message exchange. Aggregate reports provide significant information to identify patterns of errors that lend themselves to systematic changes in workflow, software coding, and configuration. The effort requires a multi-actor approach, and the guidance outlined below provides example aggregate reports that could be designed by a clinical software (typically electronic health record systems) developer, an immunization information system (IIS), a health information exchange (HIE), or a health information system analyst. Such reports could support drill-down capabilities as needed and could inform system-wide mitigation strategies to correct errors and to prevent further errors for subsequent immunization message submissions. Alternatively, software developers could provide access to and the ability to extract individual ACK data that would allow analysts to develop reports. To prepare vaccination provider organizations to handle ACK message data, the [Immunization Integration Program \(IIP\)](#) Acknowledgments Workgroup developed the guidance detailed below to improve visibility and access to information from acknowledgment messages.

Understanding the Issue

An IIS may communicate three different severity levels of issues (all three are technically referred to as “errors”): Information, Warnings, or Errors (fatal errors) in ACK messages. The least severe issues are called Information and the next are called Warnings. When issues with severity levels of Information or Warning are communicated from the IIS, the issues should be reviewed by the sender but do not result in data being rejected by the IIS.

The most common errors occur when critical data (required by the IIS) are illogical, conflicting, invalid or missing, such as patient’s name, date of birth, vaccine product, lot number or expiration date. There are a variety of reasons errors like these occur. Examples include: data was not collected at registration, the EHR was not configured properly, and a data entry error occurred when data was entered into the EHR by a member of the clinical team, or the IIS has not yet updated its configuration. According to [guidance released by the American Immunization Registry](#)

[Association \(AIRA\)](#), when fatal errors occur and are communicated from the IIS to the provider organization, the expectation is that the error is reviewed, and after a correction is made, data is resubmitted. If this does not occur, the error could be repeated for other patients, and patient records with errors may not be complete in the IIS. This can impact patient care when the same patient seeks care at other provider organizations that rely upon data from the IIS to build a vaccination history. Without finding a patient's full immunization history, a clinician may administer unneeded or improperly spaced vaccines and waste limited resources. Schools and other entities also rely upon records from the IIS. If data is submitted accurately, completely and timely to the IIS, providers administering vaccinations can spend less time fulfilling requests for immunization records and more time on patient care.

To better understand the potential impact that rejected vaccine submissions can have upon the immunization ecosystem, the workgroup gathered one month of ACK data (January or June 2020 specifically, with the intent of avoiding low-patient volume from the move to telehealth operations) from eight different sources. Of the more than 72 million acknowledgment messages collected, 0.8% (576,000) messages indicated full or partial data rejection. To understand the bigger picture, consider that if the same rate were applied to the more than 105 million of COVID-19 vaccines reported as administered in the United States during the 90 days of its vaccination efforts, more than 852,000 doses may not have been recorded in a timely manner in an IIS (105,703,501 doses reported 12/13/2021 - 03/13/2021: $(105,703,501 / (100\% - 0.8\%)) = 852,448$). This can undermine confidence in data reported by public health authorities, lead to healthcare providers incorrectly vaccinating patients in the future and waste valuable resources.

Provider organizations have the opportunity to make the IIS more complete, accurate and timely by regularly reviewing data volume and quality and designating team members to review ACK data received from an IIS in a report format. If report functionality is not available, developers could enhance health information and technology software to allow users to extract ACK data to generate their own reports. These recommended capabilities could be incorporated into IIS, EHR, pharmacy data systems, HIE and third-party health IT applications. Regardless of which actors create aggregate reports, they should summarize the number of messages that contain fatal errors along with descriptions and locations of issues. IIS expects senders to correct issues that led to fatal errors and resubmit corrected data. The information contained within ACK fatal error reports can help inform clinicians and healthcare administrators about what happens to their patients' data after it is sent to an IIS. These reports must also be made available to administrators of health IT systems to allow them to investigate issues and prevent them from occurring in the future. The suggestions within the guidance below are not meant to be viewed as prescriptive software requirements to summarize fatal errors.

Guidance

Generation, receipt and review of summary of ACK HL7 v2 messages prevent data rejection to ensure patient vaccination data is complete and timely. Data rejection can adversely impact patient care, healthcare delivery costs and accuracy of public health data. Clinicians may be unaware of the many potential failure points of the transmission of a patient's electronic vaccination record from their clinical software to an IIS. They may also be unaware of the potential volume of data rejection that can affect providers downstream who rely upon data from the IIS for clinical decision making.

An IIS is expected to return an acknowledgment message when a clinical software system interface submits an unsolicited vaccination update message (VXU). According to the [HL7 Version 2.5.1 Implementation Guide for Immunization Messaging, Release 1.5 2018 Update](#), an ACK message indicates if vaccination records were accepted, processed with errors (some errors are so severe, sometimes called fatal errors, this could mean partial or full rejection of a vaccination record), or rejected by the IIS due to unsupported data or “reasons unrelated to format or content.”

This guidance provides minimum functionality that must be incorporated into software applications to summarize fatal errors so users may access or create rejection reports. Such reports will allow users to become aware of and investigate the problem, to stop the problem from occurring in the future, and to plan for resubmission of corrected data. This guidance is helpful to key groups from public health, healthcare delivery, clinical software developers, health information exchanges and other third parties. Each partnering group can develop solutions to assist users in identifying and addressing errors from VXU submissions.

This guidance assumes readers have familiarized themselves with the [AIRA's “Guidance for HL7 Messages to Support Interoperability.”](#)

Scope

This document provides guidance to clinical software, IIS and third-party system developers who wish to 1) provide access to ACK data in the form of aggregate reports or 2) provide access to individual acknowledgment message data that can be extracted to allow users to create their own aggregate reports. The focus of this guidance is a report of acknowledgment messages that summarizes errors that cause patients' vaccination update messages to be rejected in whole or in part. Readers familiar with HL7 ACK messages will recognize this scenario as the acknowledgment code of “AE- application error” reported in MSA-1 in combination with one or more errors with a severity level of “E - Error” reported in ERR-4.

The examples below are intended to provide developers with ideas for implementing functionality and are not intended to be prescriptive or to be fully replicated. Additionally, examples provided are not intended to assign responsibility to a particular developer (i.e., IIS, clinical software, or third party). Each developer type's work will have a different level of impact depending on the capabilities and processes of interoperating systems. Users from healthcare facilities may find it helpful to have functionality that currently exists in an IIS be incorporated into their clinical software. Similarly, some clinical software functionality may be helpful to incorporate into an IIS. Some existing functionality within IIS that is currently only available to an IIS administrator could be expanded to IIS users within a provider organization. This way provider organizations are able to review their data quality without intervention by an IIS user.

Out of Scope

When designing this document, the workgroup intentionally avoided developing guidance that prescribes how to develop solutions. Instead, the intent of this guidance is to describe what could be done to improve acknowledgment handling rather than prescribe how to develop solutions. To produce timely information that may assist with COVID-19 vaccination reporting and provide solution developers with quick wins, this guidance has limited scope. Although some items listed below are not discussed in this guidance, there is recognition of their importance for future

guidance. The primary goal was to provide guidance to quickly and significantly reduce the volume of errors that lead to patient and immunization data rejection.

This document does not discuss summarizing errors with severity of Information (I) or Warning (W). While errors with a severity level of Warning or Information do not result in full data rejection (i.e., non-fatal) they do communicate important information that actors in healthcare delivery should review. For example, some IIS may communicate a warning that while the clinical system reported a certain vaccine code, the combination of the vaccine code and patient age may not be appropriate. This may be due to a system configuration or clinical mistake but is not so severe that the IIS will reject the vaccination record.

ACKs with an acknowledgment code of "application rejection" (MSA-1 is reported as "AR") indicate total data rejection from the originating message and must be carefully reviewed. These occur rarely and must be examined individually rather than in aggregate. ARs usually occur due to messages being incorrectly formatted, relate to technical configuration and do not relate to workflow or content. This guidance does not cover AR ACKs. Proactive attempts to avoid errors in reporting to an IIS should be employed by clinical software developers and clinicians where possible. However, these are outside the scope of this guidance. This guidance does not cover acknowledgment messages in response to queries, or generating, receiving or handling individual acknowledgment messages.

Guidance for Immunization Data Receivers (Typically IIS)

Receivers of immunization data should make a summary report available for a submitting facility on a regular basis. Reports must span an appropriate time period—users must be able to view data frequently enough to be able to investigate and address errors and minimize the chance that a subsequent immunization event would occur before the error is resolved. Generating a report monthly may be too late and generating a report daily may not provide enough data volume to identify common recurring issues. If a facility is midsized, weekly reports may be appropriate. To provide maximum flexibility, users must be able to specify a custom timeframe and generate their own reports within the application. Comparing these reports over time will enable providers to examine rejection trends.

A report must contain valuable meta-information including: the organization, clinical facility or clinician that the report describes (not merely an ID number); the time period covered by the report; and the number of VXU messages received during the specified period. The report must break down the information further by indicating the number and percentage of VXU messages that generated at least one error with severity of "error" (data rejection, i.e., fatal error) reported in the fourth field of ERR segments.

VANDERBILT

Review Date: 7-Day Period Starting 20201207 Through 20201213

Number of VXU Messages Reviewed: **7413**

Response Type Breakdown (MSA-1):

AA: **1681** (22.67%)
 AE: **5732** (77.32%) --- **83** (1.448%) contained fatal errors and **5649** (98.55%) contained only warnings.
 AR: **0** (0%)

Fatal errors will be rejected by TennIIS and will not enter the system. See below for the type and frequency of common errors being submitted (Note: could be more than one error per VXU message).

ERROR LOCATION AND DESCRIPTION	MESSAGE COUNT	MESSAGE PERCENT
PID; SEGMENT SEQUENCE ERROR; LAST NAME REQUIRED - MESSAGE REJECTED	43	7.88
PID; SEGMENT SEQUENCE ERROR; FIRST NAME REQUIRED - MESSAGE REJECTED	42	7.69
PID^1^5-1; REQUIRED FIELD MISSING; PATIENT LAST NAME IS MISSING	42	7.69
PID^1^5-2; REQUIRED FIELD MISSING; PATIENT FIRST NAME IS MISSING	42	7.69
PID; SEGMENT SEQUENCE ERROR; PATIENT ADDRESS CITY IS MISSING - MESSAGE REJECTED	31	5.68
PID; SEGMENT SEQUENCE ERROR; PATIENT ADDRESS STATE IS MISSING - MESSAGE REJECTED	31	5.68
PID; SEGMENT SEQUENCE ERROR; PATIENT ADDRESS ZIP IS MISSING - MESSAGE REJECTED	31	5.68
PID^1^11-3; REQUIRED FIELD MISSING; PATIENT ADDRESS CITY IS MISSING	31	5.68
PID^1^11-4; REQUIRED FIELD MISSING; PATIENT ADDRESS STATE IS MISSING	31	5.68
PID^1^11-5; REQUIRED FIELD MISSING; PATIENT ADDRESS ZIP IS MISSING	31	5.68
PID; SEGMENT SEQUENCE ERROR; PATIENT ADDRESS STREET IS MISSING - MESSAGE REJECTED	30	5.49
PID^1^11-1; REQUIRED FIELD MISSING; PATIENT ADDRESS STREET IS MISSING	30	5.49
RXA; SEGMENT SEQUENCE ERROR; VACCINATION CVX CODE IS MISSING - MESSAGE REJECTED	22	4.03
RXA; SEGMENT SEQUENCE ERROR; VACCINATION NDC CODE IS MISSING - MESSAGE REJECTED	22	4.03
RXA^1^5-1; REQUIRED FIELD MISSING; VACCINATION CVX CODE IS MISSING	22	4.03
RXA^1^5-1; REQUIRED FIELD MISSING; VACCINATION NDC CODE IS MISSING	22	4.03
RXA; SEGMENT SEQUENCE ERROR; SUBSTANCE REFUSAL DATE IS UNWANTED - MESSAGE REJECTED	8	1.47
RXA; SEGMENT SEQUENCE ERROR; VACCINATION REFUSAL REASON IS UNWANTED - MESSAGE REJECTED	8	1.47
RXA^1^18; APPLICATION ERROR; VACCINATION REFUSAL REASON IS UNWANTED	8	1.47
RXA^1^3; APPLICATION ERROR; SUBSTANCE REFUSAL DATE IS UNWANTED	8	1.47
RXA; SEGMENT SEQUENCE ERROR; VACCINATION INFORMATION SOURCE IS MISSING - MESSAGE REJECTED	3	0.55

Image 1: Example Error Report Produced for a Provider Organization | Source: Tennessee Immunization Program, Tennessee Department of Health

The static report above was produced by the Tennessee Immunization Information System in Collaboration with Vanderbilt University Medical Center Department of Biomedical Informatics. It is provided weekly by email as a PDF to interested provider organizations. The report provides: a clearly identified facility by name (not an ID), the time period for the report, the number of total VXU messages processed, a breakdown indicating the number/percent of VXU messages resulting in ACKs indicating "AE- application error" reported in MSA-1 in combination with one or more errors with a severity level of "E - Error" reported in ERR-4, and the most frequent problems that need to be addressed first.

Due to the multitude of rejection reasons and limited resources of healthcare organizations (providers), an error report must identify the most frequent problems that need to be addressed first. This report must indicate the location (message segment and field) of an error in terms understandable to readers who have a basic comprehension of HL7 v2 messages but who may not recognize segment titles and field identifiers. Therefore, a report should provide a description of the segment and field. For example, instead of only indicating the error was found in "PID-11.3" the report should include a description of "Patient address - city (PID-11.3)."

IIS should consider their submitting facilities to determine how best to distribute these reports. Depending on the setting, some users may wish to receive a static report via email while others may wish to login to a portal and access multiple reports. Some users may wish to be able to drill down to message-level data and review trends that would not be possible in a static report. Error report functionality will have no value if users are not able to easily access their data.

IIS developers should consider developing functionality described for clinical and third-party software developers within this document.

Guidance for Immunization Data Senders (Typically EHRs and Other Clinical Software)

Immunization data sending systems (EHRs and other clinical software) have several options to assist users who want to know about their ACK data: to incorporate aggregate acknowledgment reporting functionality within the software, to support ACK data export or both. Software developers who do not intend to incorporate aggregate acknowledgment report functionality must be able to support data export functionality. This allows ACK messages received from an IIS to be downloaded in a common electronic format, including raw HL7, which can also be accessed by data analysts and/or third-party tools. The export functionality should allow the user to select a specified period and could have additional filtering capabilities.

HL7 Acknowledgement (ACK) Messages

Enter the selection criteria and click "Run Report" or click "Cancel" to return to the previous page.



Report Selection Criteria

Provider/Clinic : AART PROVIDER, AART CLINIC				Receiving Facility Code *	
SELECT A CLINIC BY TYPING PROVIDER, CLINIC, VFC PIN, OR CLINIC CODE				AART	
Sending Facility Code		Batch Log ID		Acknowledgement Code	
MODHSS -				<input type="checkbox"/> AA <input checked="" type="checkbox"/> AE <input type="checkbox"/> AR	
Patient		Message Text		Custom Acknowledgement Code	
				<input type="checkbox"/> AA <input type="checkbox"/> AI <input type="checkbox"/> AW <input type="checkbox"/> AE <input type="checkbox"/> AF <input type="checkbox"/> AR	
From Date	From Time	To Date	To Time		
01/11/2021	12:00 AM (HH:MM A/P)	01/11/2021	11:59 PM (HH:MM A/P)		
Output Type <input checked="" type="radio"/> EXTRACT - Delimiter: ,					
				Run Report Cancel	

Image 2: Example Data Extraction User Interface | Source: Envision Technology Partners

The image above is from a user interface that is incorporated into Envision Technology Partners' WebIZ (IIS product). Similar functionality allowing extracting for ad hoc analysis could be implemented by any of the three identified developers: clinical software, IIS or third parties. As currently implemented, the interface is available to IIS system administrators. The interface allows for the selection of ACK data that can be exported to allow a user to perform analysis and build reports. The user can specify a facility, filter by acknowledgment code, and specify a time period. The user may extract the data as delimited text and is able to select a delimiter of their preference.

For clinical software developers who intend to incorporate acknowledgment report functionality into their products, a summary report must share the functionality of reports described above in [Guidance for Immunization Data Receivers](#). Ideally, a software developer should be able to replicate a similar summary report that their customers received from an IIS. Clinical software has the opportunity to add value beyond what an IIS can do—namely, linkage to a patient's non-immunization data. A summary report should include drill-down functionality that allows navigation from a general error category to specific messages or patient demographic and immunization records that generated the error. Using the message control ID reported in MSA-2 for the VXU generating the error could facilitate identification and correction of the error and potential resubmission of the VXU message to the IIS. Users may also want to exclude messages from a report that have been corrected and resubmitted to avoid attempting to address issues that have already been resolved.

Select date range of acknowledgement messages:

[June, 2020](#)
(slower)

[Aug 3-9](#)
[Aug 10-16](#)
[Aug 23-30](#)

[Sep 6-13](#)
[Sep 13-20](#)
[Sep 20-27](#)

[Sep 27-Oct 4](#)
[Oct 4-10](#)
[Oct 19-25](#)

[Oct 25-Nov 1](#)
[Nov 2-8](#)
[Nov 9-15](#)

[Nov 23-29](#)
[Dec 7-13](#)
[Dec 14-20](#)

[Dec 21-27](#)
[Dec 28-Jan 3](#)

Date	AE Messages	[E] Only (1)	[E] & [W] (2)	(1) and (2)	Rejected %	[W] Only	Total Errors	Total Warnings
2020-12-28	1338	4	18	22	1.64	1316	174	6920
2020-12-29	1165	5	17	22	1.89	1143	132	6003
2020-12-30	1844	0	19	19	1.03	1825	126	10148
2020-12-31	1440	7	10	17	1.18	1423	102	8654
2021-01-01	1091	0	14	14	1.28	1077	116	7559
2021-01-02	86	16	8	24	27.91	62	136	249
2021-01-03	1444	52	15	67	4.64	1377	312	7349
TOTALS	8408	84	101	185	2.20	8223	1098	46882

Image 3: Example Report Featuring Drill-down Capability Part 1 | Source: Stuart Weinberg, MD; Vanderbilt University Medical Center Department of Biomedical Informatics

The above example was provided by Vanderbilt University Medical Center informaticians. They extract ACK data from their EHR into text files and load into a simple web application. All ACKs with AE are summarized daily for a seven-day period. The user may select a new time period using the hyperlinks in the header. Message errors are summarized by E ("fatal" error) and W (warning) severity levels; errors with a severity of I (information) are excluded. Report users can see a trend over time—for example, in the table below, a low percentage of messages were rejected the first five days and increased on day six but dropped down on day seven. The user may click on a sum of E and W errors to examine the most common errors.

==> Most frequent errors for 24 messages from 2021-01-02 <==			
Total	Error Description	Location	User Message
16	SEGMENT SEQUENCE ERROR	RXA	vaccination ndc code is missing - Message Rejected
16	REQUIRED FIELD MISSING	RXA(1)-5.1	vaccination ndc code is missing
16	SEGMENT SEQUENCE ERROR	RXA	vaccination cvx code is missing - Message Rejected
16	REQUIRED FIELD MISSING	RXA(1)-5.1	vaccination cvx code is missing
6	SEGMENT SEQUENCE ERROR	PID	Last name required - Message Rejected
6	REQUIRED FIELD MISSING	PID(1)-5.1	patient last name is missing
6	REQUIRED FIELD MISSING	PID(1)-5.2	patient first name is missing
6	SEGMENT SEQUENCE ERROR	PID	First name required - Message Rejected
6	REQUIRED FIELD MISSING	PID(1)-11.5	patient address zip is missing
6	SEGMENT SEQUENCE ERROR	PID	patient address state is missing - Message Rejected
6	SEGMENT SEQUENCE ERROR	PID	patient address city is missing - Message Rejected
6	SEGMENT SEQUENCE ERROR	PID	patient address zip is missing - Message Rejected
6	REQUIRED FIELD MISSING	PID(1)-11.1	patient address street is missing
6	REQUIRED FIELD MISSING	PID(1)-11.4	patient address state is missing
6	REQUIRED FIELD MISSING	PID(1)-11.3	patient address city is missing
6	SEGMENT SEQUENCE ERROR	PID	patient address street is missing - Message Rejected

Image 4: Example Report Featuring Drill-down Capability Part 2 | Source: Stuart Weinberg, MD; Vanderbilt University Medical Center Department of Biomedical Informatics

A continuation from Image 3. The user now sees the most frequent errors and can click on the number of errors to see further detail.

[Back to Summary](#)

SEGMENT SEQUENCE ERROR|RXA|vaccination ndc code is missing - Message Rejected

1.	1227997	01/02/2021 SEGMENT SEQUENCE ERROR 1227997 E RXA vaccination ndc code is missing - Message Rejected AE 01/02/2021 SEGMENT SEQUENCE ERROR 1227997 E RXA vaccination cvx code is missing - Message Rejected AE 01/02/2021 REQUIRED FIELD MISSING 1227997 E RXA(1)-5.1 vaccination ndc code is missing AE 01/02/2021 REQUIRED FIELD MISSING 1227997 E RXA(1)-5.1 vaccination cvx code is missing AE
2.	1228005	01/02/2021 SEGMENT SEQUENCE ERROR 1228005 E RXA vaccination ndc code is missing - Message Rejected AE 01/02/2021 SEGMENT SEQUENCE ERROR 1228005 E RXA vaccination cvx code is missing - Message Rejected AE 01/02/2021 REQUIRED FIELD MISSING 1228005 E RXA(1)-5.1 vaccination ndc code is missing AE 01/02/2021 REQUIRED FIELD MISSING 1228005 E RXA(1)-5.1 vaccination cvx code is missing AE
3.	1228016	01/02/2021 SEGMENT SEQUENCE ERROR 1228016 E RXA vaccination ndc code is missing - Message Rejected AE 01/02/2021 SEGMENT SEQUENCE ERROR 1228016 E RXA vaccination cvx code is missing - Message Rejected AE 01/02/2021 REQUIRED FIELD MISSING 1228016 E RXA(1)-5.1 vaccination ndc code is missing AE 01/02/2021 REQUIRED FIELD MISSING 1228016 E RXA(1)-5.1 vaccination cvx code is missing AE

Image 5: Example Report Featuring Drill-Down Capability Part 2 | Source: Stuart Weinberg, MD; Vanderbilt University Medical Center Department of Biomedical Informatics

A continuation from Image 4. The user now sees the most granular report available which includes the message control ID of the VXU message that contains an error. The user can see that an individual VXU message has multiple problems that are related.

Clinical software developers should consider developing functionality described for receivers and third parties in this document.

Guidance for Third Parties (Typically HIEs, Data Hubs, Integrators, Report Developers)

Third-party software developers (those not sending or receiving ACK data) or data analysts using data from clinical software or IIS should review the requirements listed above in [Guidance for Immunization Data Receivers \(IIS\)](#) and [Guidance for Immunization Senders \(EHRs and Other Clinical Software\)](#) sections. Third-party functionality may require an interface with live data or rely upon data extracted from the IIS and/or clinical software. Health information exchanges and integrators may find themselves in a good position to provide added value by producing reports, reviewing data and working with their clients to minimize errors in the future and resubmit corrected data.

Third-party software developers should consider developing functionality described for receivers and clinical software in this document. Additional examples of ACK error report and data extraction functionality can be found below.

Additional Examples of Desired Functionality

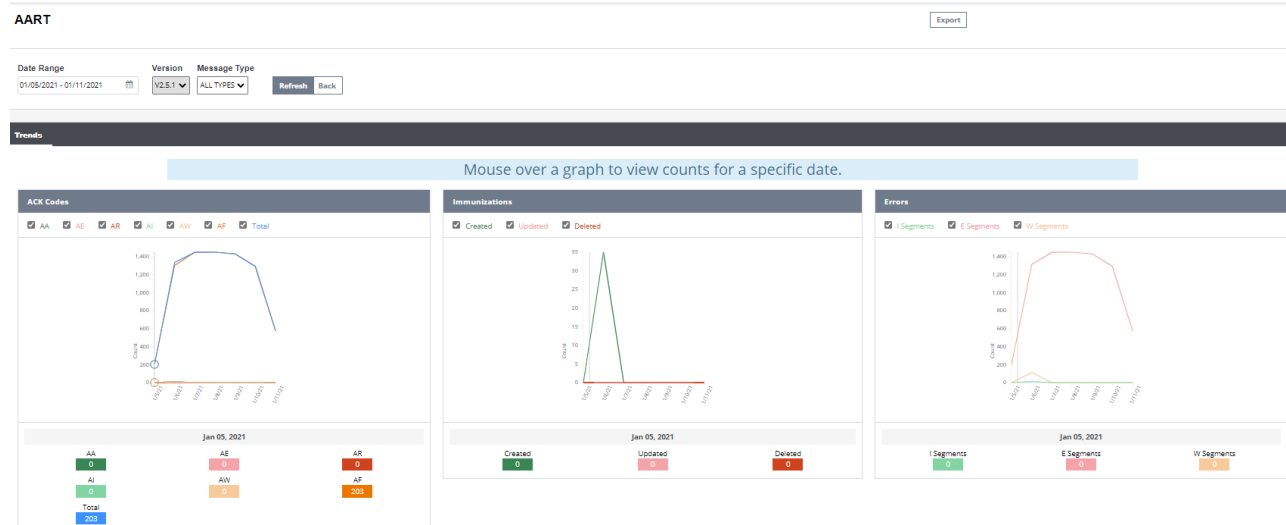


Image 6: Example Visualization of Error Data | Source: Envision Technology Partners

A visualization, incorporated into Envision's WebIZ, demonstrates trends in ACK quality over time. This is further broken down by immunization and errors. When the user hovers their cursor over a date, the data is updated.

The screenshot shows the "Provider Detail Error Report" form with the following fields and options:

- Patient Id:** Text input field.
- Date Range:** From [mm/dd/yyyy] To [mm/dd/yyyy]
- Scope Type:** Radio buttons for Provider (selected), Import Profile, User, and Facility.
- Providers:** Select Some Options (dropdown menu).
- Message Type:** All Message Types (dropdown menu).
- Batch ID(s):** Text input field.
- Message ID(s):** Text input field.
- Sort By:** Select an Option (dropdown menu) with radio buttons for Ascending (selected) and Descending, and an Add Sort Rule button.
- Display:** Radio buttons for Warnings, Errors (selected), and Warnings and Errors.
- Report Style:** Radio buttons for HTML(view in browser) (selected) and CSV(view in spreadsheet).
- Buttons:** Back and Create Report.

Image 7: Example of Parameter Specifying User Interface for Report Generation Part 1 | Source: STChealth

This user interface within STChealth's iWeb (IIS product) allows users to generate an error report and specify the following parameters: time period, error severity (errors, warnings or both). The user may specify the report output format—HTML or comma-separated values. This report allows clinics to monitor the quality of their electronic data and identify any issues that need to be corrected. The user may access the report on demand or may schedule the report to be sent via email in the future.

Start Date: January 18, 2021																				
End Date: January 24, 2021																				
Providers: PROVIDER NAME AND ORG ID																				
Display: Warnings and Errors																				
Provider	Representative Facility ID	User	Profile	# Messages	# unique MRN	# Errors	# Warnings													
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	4	3	0	4													
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	43	17	0	14													
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	1	1	0	0													
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	5	2	0	5													
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	560	521	33	468													
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	2	2	0	2													
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	23	12	0	17													
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	116	114	0	116													
Provider	Representative Facility ID	User	Profile	Import Log ID	Error / Warn	Date Sent	MRN	Issue					Issue Location							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	141715232	W	1/20/2021 6:25	MRNXXXX	next of kin name first is missing					NK1-2.2							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142205167	E	1/22/2021 14:05	MRNXXXX	next of kin name last is invalid					NK1-2.1							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	141715232	W	1/20/2021 6:25	MRNXXXX	next of kin name last is missing					NK1-2.1							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142217758	E	1/22/2021 15:23	MRNXXXX	patient address city is missing					PID-11.3							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142240822	E	1/22/2021 17:16	MRNXXXX	patient address state is missing					PID-11.4							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142240822	E	1/22/2021 17:16	MRNXXXX	patient address street is missing					PID-11.1							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142205937	E	1/22/2021 14:09	MRNXXXX	patient address zip is missing					PID-11.5							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142214499	W	1/22/2021 15:04	MRNXXXX	patient is eligible for vfc but no guardian					NA							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142205167	E	1/22/2021 14:05	MRNXXXX	patient last name is invalid					PID-5.1							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142220205	W	1/22/2021 15:36	MRNXXXX	patient race is missing					PID-10							
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142215799	W	1/22/2021 15:12	MRNXXXX	patient race is unrecognized					PID-10							
Provider	Facility ID	User	Profile	Import Log ID	Error / Warn	Date Sent	MRN	Issue					Issue Location	Vaccination Date	Vaccination					
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	141715166	E	1/20/2021 6:23	MRNXXXX	vaccination date missing					RXA-3		COVID-19, mRNA, LNP-S, PF, ...					
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142200130	W	1/22/2021 13:34	MRNXXXX	vaccination funding source missing					OBX	1/20/2021	influenza, injectable, quad...					
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	141715124	W	1/20/2021 6:22	MRNXXXX	vaccination lot invalid					RXA-15	1/18/2021	influenza, recombinant, qua...					
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142200860	W	1/22/2021 13:39	MRNXXXX	vaccination lot unrecognized					RXA-15	1/20/2021	COVID-19, mRNA, LNP-S, PF, ...					
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	141715381	W	1/20/2021 6:28	MRNXXXX	vaccination lot vaccine expiration date does not match lot					RXA-15	1/19/2021	DTaP-Hib-IPV					
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142203323	W	1/22/2021 13:53	MRNXXXX	vaccination site missing					RXR-2	1/20/2021	COVID-19, mRNA, LNP-S, PF, ...					
XXXX	SIISCUJENTXXXX	XXXXXHL7	8636	142200130	W	1/22/2021 13:34	MRNXXXX	vaccination vfc status missing					OBX	1/20/2021	influenza, injectable, quad...					

Image 8: Example of Parameter Specifying User Interface for Report Generation Part 2 | Source: STChealth

This is the report resulting from the user interface displayed in Image 7. The report breaks down errors for a provider organization into its one or more facilities. Each facilities' messages, unique patients and errors (broken down by severity). After displaying the summary information, individual messages grouped by facility are displayed along with the error location.

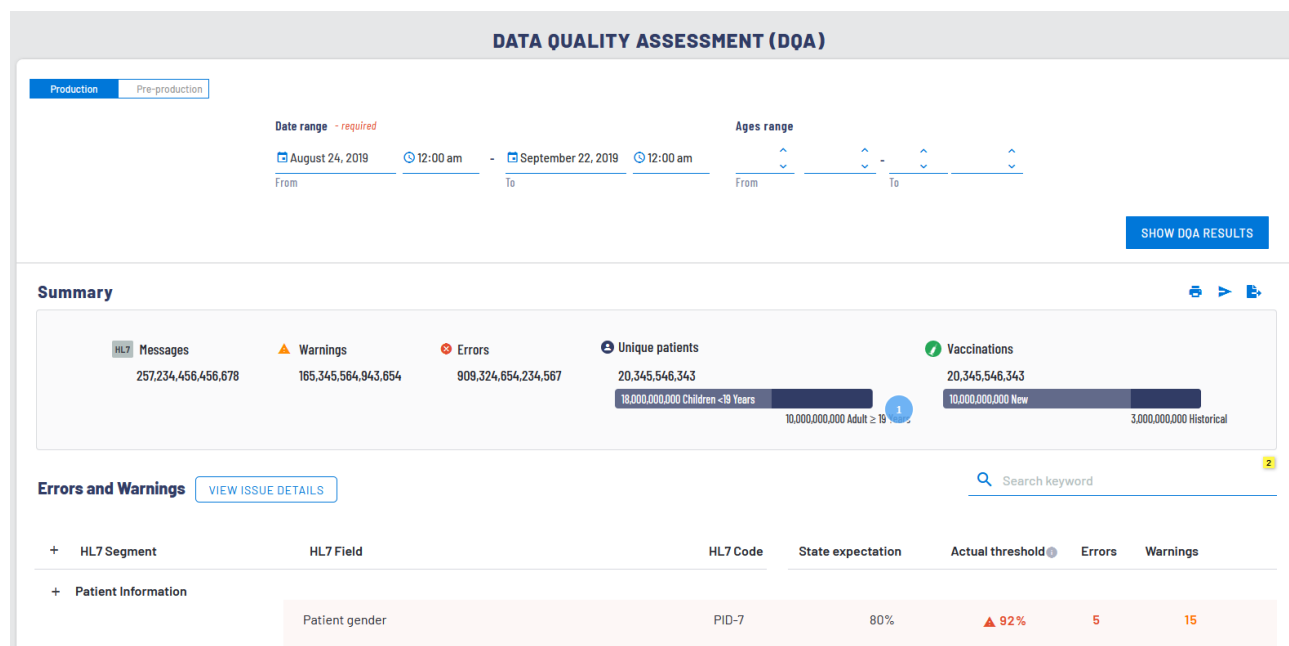


Image 9: Example of Data Quality Report Part 1 | Source: STChealth

This dashboard, incorporated into STChealth's iQ tool (IIS product), is designed to identify, inform, and impact data quality. Users may specify range criteria for date of administration and patient

age. A summary of warnings and errors is displayed near the top, and then a breakdown of issues is provided. Users may drill down further as shown in Image 10 below.

Issue Details

WARNINGS AND ERRORS

1

MRN

Patient

Date/Time

HL7 Field

Issue type

Issue Description

Recommendation

Issue fixed?

0835368000008889999

Susan Raul Gardner

02/7/2020 04:53pm

Patient race

Warning

Patient race is missing

There is currently no recommendation

02/7/2020 04:53pm

Patient date of birth

Error

Patient DOB is missing.

A phone number should be recorded in PID-13 for all patients.

02/7/2020 04:53pm

Patient phone number

Warning

Patient phone number/usecode is invalid

A phone number should be recorded in PID-13 for all patients.

03/7/2020 05:12pm

Patient phone number

Warning

Patient phone number is missing.

A phone number should be recorded in PID-13 for all patients.

02/7/2020 04:53pm

Vaccination ID

Warning

Vaccination ID is unrecognized.

There is currently no recommendation

03/7/2020 05:12pm

Vaccination substance refusal reason

Error

Vaccination substance refusal reason is missing.

There is currently no recommendation

03/7/2020 05:12pm

Vaccination manufacturer

Warning

Vaccination manufacturer is missing.

Vaccination Manufacturer should be recorded in RXA-17 for all patients.

Search keyword

Image 10: Example of Data Quality Report Part 2 | Source: STChealth

This is a continuation of Image 9. This displays an individual patient's errors and warnings and recommendations to prevent the error from occurring in the future. The user may also indicate an issue has been resolved by selecting the checkbox on the far right.

Date	Error	Description	Message Number	Severity	Location	Diagnostic Message	User Message	ACK Code
01/11/2021	SEGMENT SEQUENCE ERROR	1242913	E PID	First name required - Message Rejected	AE			
01/11/2021	SEGMENT SEQUENCE ERROR	1242913	E PID	Last name required - Message Rejected	AE			
01/11/2021	REQUIRED FIELD MISSING	1242913	E PID(1)-5.2	patient first name is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242913	E PID(1)-5.1	patient last name is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242913	W OBX	vaccination funding source is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242913	W RXA(1)-10	vaccination person that vaccinated id is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242913	W OBX 69764-9	vis barcode is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242915	W OBX	vaccination vfc status is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242915	W OBX	vaccination funding source is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242915	W RXA(1)-10	vaccination person that vaccinated id is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242915	W OBX 69764-9	vis barcode is missing	AE			
01/11/2021	ERR ACKNOWLEDGMENT ERROR	1242915	W PID(1)	patient is eligible for vfc but no guardian	AE			
01/11/2021	REQUIRED FIELD MISSING	1242916	W OBX	vaccination funding source is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242916	W RXA(1)-10	vaccination person that vaccinated id is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242916	W OBX 69764-9	vis barcode is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242917	W OBX	vaccination vfc status is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242917	W OBX	vaccination funding source is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242917	W RXA(1)-10	vaccination person that vaccinated id is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242917	W OBX 69764-9	vis barcode is missing	AE			
01/11/2021	ERR ACKNOWLEDGMENT ERROR	1242917	W PID(1)	patient is eligible for vfc but no guardian	AE			
01/11/2021	SEGMENT SEQUENCE ERROR	1242918	E PID	First name required - Message Rejected	AE			
01/11/2021	SEGMENT SEQUENCE ERROR	1242918	E PID	Last name required - Message Rejected	AE			
01/11/2021	SEGMENT SEQUENCE ERROR	1242918	E PID	patient address street is missing - Message Rejected	AE			
01/11/2021	SEGMENT SEQUENCE ERROR	1242918	E PID	patient address city is missing - Message Rejected	AE			
01/11/2021	SEGMENT SEQUENCE ERROR	1242918	E PID	patient address state is missing - Message Rejected	AE			
01/11/2021	SEGMENT SEQUENCE ERROR	1242918	E PID	patient address zip is missing - Message Rejected	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	E PID(1)-5.2	patient first name is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	E PID(1)-5.1	patient last name is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	E PID(1)-11.1	patient address street is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	E PID(1)-11.3	patient address city is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	E PID(1)-11.4	patient address state is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	E PID(1)-11.5	patient address zip is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	W ORC-12	vaccination ordering provider is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	W OBX	vaccination funding source is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	W RXA(1)-10	vaccination person that vaccinated id is missing	AE			
01/11/2021	REQUIRED FIELD MISSING	1242918	W OBX 69764-9	vis barcode is missing	AE			

Image 11: Example Extracted ACK Data | Source: Epic

This is an extract of ACK data provided within Epic's electronic health record system. This extract is a pipe-delimited text file with a header row that includes the date the error occurred, a description of the error, the originating message control ID (MSA-2), the severity (ERR-4) of the error, error location, a diagnostic message (ERR-7), and a user message (ERR-8).

Summary of Current and Desire States

A summary of the current state of ACK data exchange and recommended new functionality is found below in Image 12. Clinician action is listed first, followed by existing clinical software functionality, leading to the exchange of data with the IIS. New functionality that could be incorporated into reporting tools using data from either clinical systems or IIS are shown in the purple "swim lane" labeled as "Reporting Tool." The reports generated by the new functionality could be reviewed by an interface analyst or the analyst could generate their own reports if ACK data extraction functionality was incorporated into their existing tools.

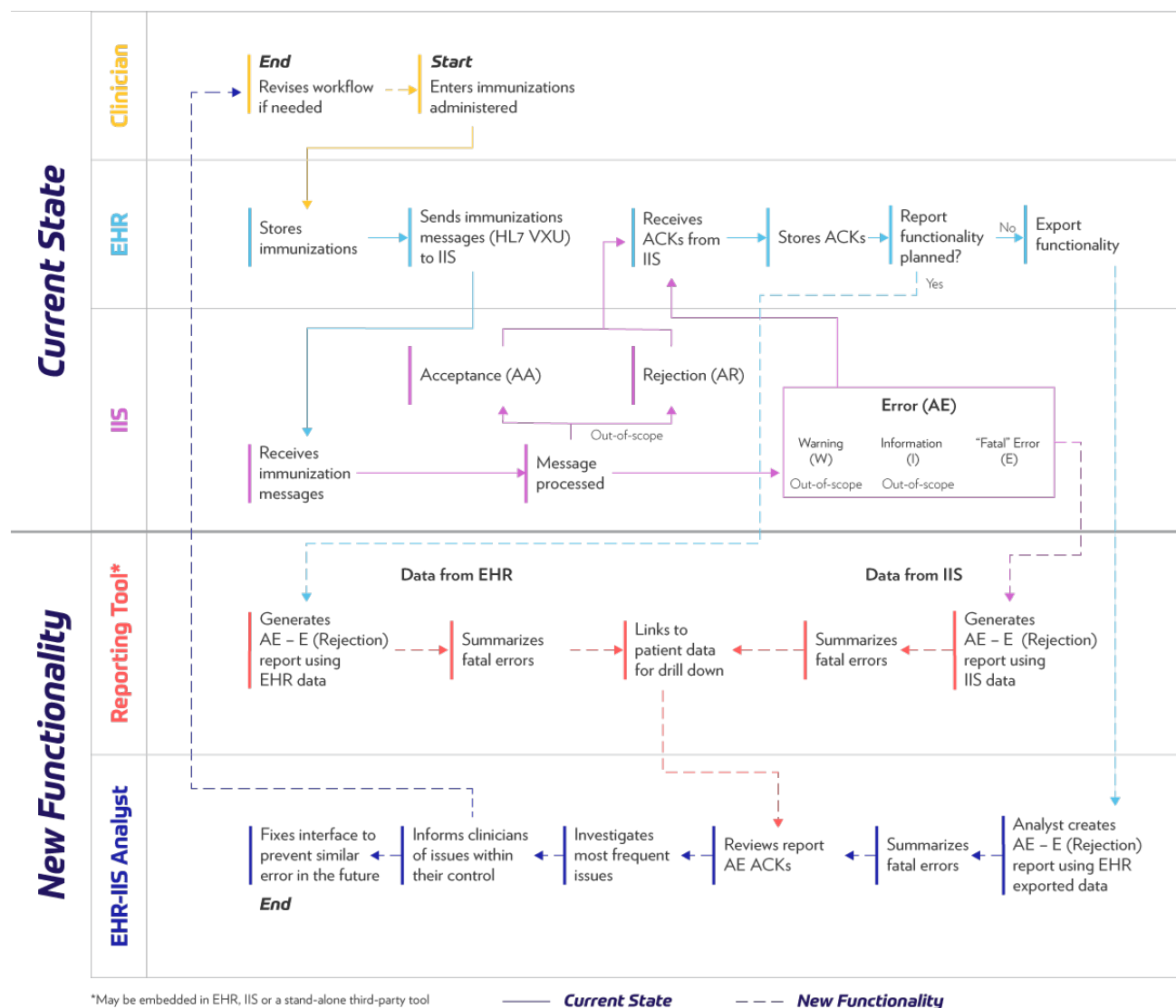


Image 12: Current and Desired State of Immunization Acknowledgment Processing

Other Efforts Taking Place

AIRA's Standards and Interoperability Steering Committee formed a small workgroup to review, refine, update and create new application error codes found in the error segment's fifth field (ERR-5) in ACK messages. The newly proposed codes provide more specificity and understanding to users. These codes either indicate missing or invalid codes for each Centers for Disease Control and Prevention-recommended IIS core data element or describe a violation of a community agreed upon business rule. An example of a violated business rule would be when a vaccine that is only approved for pediatric patients was recorded as being administered to an adult patient. Before this new code's proposal, the IIS could only communicate such an issue by returning a code for "illogical value error" in one portion of the acknowledgment message and "RXA-5" (administered substance - the location of the issue) in another portion. IIS are not yet being asked to implement these more specific codes, but doing so will provide more specificity to those who read these ACKs. These codes do not specify the severity of the issue (Information, Warning, Error). Instead, they focus on allowing IIS to communicate issues discovered.

Conclusion

Real-time or near real-time messaging necessitates all parties passing along standardized ACK messages (e.g., IIS to HIE to EHR to clinic staff). However, merely passing acknowledgement messages between systems without addressing fatal errors is insufficient to keep patients properly vaccinated and conserve limited resources. When ACK messages are not reviewed, particularly when fatal errors occur, unintended or undesired actions can occur for example:

- Clinic staff expecting to see full immunizations for their patients will see incomplete records
- Public health will have incomplete information within the system—this can impact planning for targeted vaccination outreach efforts
- HIEs may be held responsible for incomplete submissions
- Patient records will be inaccurate for record-keeping and future clinical decision support

Reviewing and, where needed, acting upon acknowledgment messages allows errors to be corrected swiftly and assures high data quality to support all parties that rely on accurate and complete immunization information. Adding functionality to produce or support aggregate ACK reports offers another option to improve efficiency.

Future Work Possibilities

The recommended solutions provided above will benefit public health and healthcare delivery system configurations, but considering these solutions in additional settings will help to provide guidance that will further improve error message handling in different settings. For example, consider a region in which all communication with the IIS occurs through an HIE; in such a scenario the HIE may represent the acknowledgment manager or it may provide a more detailed report to each of its participating healthcare delivery organizations. Other configurations may include support from templates developed by IIS software companies and/or clinical software companies for both aggregate report and drill-down capabilities. Potential solutions should also consider clinical practices with very limited information technology expertise and ability as well as those with large IT staff.

The initial investigation by the IIP Acknowledgment Workgroup identified two functionalities that should be incorporated into software used when exchanging immunization data: aggregate error reports and data extraction. However, these recommended functionalities were based upon a limited set of organizations that currently have resources to support the extraction or summary of ACK error data. Therefore, the release of this guidance should be followed by pilot implementations. Successful pilot projects that demonstrate either a reduction of errors or improvement in preventing errors in the future will significantly improve the likelihood of adoption of the recommendations listed above. The ultimate goal of the guidance is to improve the quality and success of immunization submissions to achieve accurate and timely exchange of individual and population-level immunization information. Once these steps have been taken, an aggregate reporting template or profile could be developed by consensus in HL7 or Integrating the Healthcare Enterprise. A template or profile would enable common ACK reporting and responses to support the various stakeholders. Finally, the immunization interoperability community should consider developing best practice and guidance for resubmitting immunization data that initially contained fatal errors and was subsequently corrected.

To learn more about IIP technical assistance or to serve as a pilot site, please contact iip@himss.org.

Call to Action

HIMSS Immunization Integration Program

Better health outcomes, reduced costs and higher clinician productivity

The HIMSS Immunization Integration Program is advancing the inclusion of enhanced immunization capabilities in EHRs to improve the exchange of data between EHRs and immunization information systems.