HIMSS

IIP Bulk Query Toolkit

Immunization Integration Program

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Problem Statement and Bulk Query Definition

Providers or organizations need to retrieve immunization information from immunization information systems (IIS) without relying on individual queries which can be time consuming for users and overwhelming for IIS. Near real-time query for individual patient records is broadly available across IIS. However, if information is needed on an entire patient group or set of health plan members, this method of single query may be slow and inefficient. Additionally, a significant increase in queries may adversely affect production systems due to volume. The need for data has been exacerbated during the COVID-19 response, since many immunizations were given in settings other than the patients' medical home. In addition, these doses often were not billed for, but rather were funded through the federal government, so claims data is not available for payers.

During the COVID-19 vaccination response, immunization messages of all types increased substantially. In one day in one jurisdiction alone, 570,000 submissions were received, dwarfing the approximate number of 17,000 submissions per day for the average IIS pre-COVID-19. On average, IIS typically receive twice as many queries as submissions. It is estimated that IIS are managing roughly a tenfold increase in queries during the COVID-19 response and have experienced performance challenges created by the increased volume of single query messages. Based on an AIRA 2019 survey, a sample of 20 IIS reported receiving an average of 33,400 queries per day before the pandemic which equates to an estimated 334,000 queries per day during the COVID-19 response. With increased cross-sector awareness of IIS query-response functionality, IIS are likely to continue receiving high query volumes even after public health emergency response efforts subside.

To address this need "bulk queries" can be utilized. For the purposes of this toolkit, a bulk query is a single request for the information for an entire group of people (patients, members, or students) known to and affiliated with a requestor. Bulk query in this context is an asynchronous technical approach for efficiently requesting a server to export multiple patients' records to a pre-authorized client. Bulk immunization queries occur when an authorized entity (e.g. healthcare organization) requests immunization data for a group of people from an IIS. A bulk query is a single request containing a list of patient/member identifiers and demographics to be matched to records within the IIS. Typically, this request is submitted but the requester does not maintain an active connection while awaiting a response. Instead, once the data is available the requester retrieves or receives it from the IIS.
While the term "bulk" suggests there may be a size requirement for the amount of data, size requirements and limitations should be published by the responder (receiver) system and discussed with the data requesters (senders). This toolkit will reference the need for making this information transparent, including a potential need for scheduling and for queuing and throttling to avoid overwhelming servers; however, the focus is primarily on methodology.

Methods

In the fall of 2021, the Immunization Integration Program (IIP) identified "bulk query" as one of four high-priority topics to address in 2022 by the IIP Collaborative, a diverse, interconnected network of key partners who identify challenges and develop solutions to improve immunization interoperability. In the spring of 2022, IIP staff and consultants reviewed use cases, existing technical means for obtaining immunization history and forecasts from IIS for groups, limitations, emerging practices, and policy considerations for queries of patient groups. Information was obtained from grey and peer-reviewed literature, Health Level Seven (HL7) version 2 (v2) and Fast Healthcare Interoperability Resources (FHIR) standards material, and AIRA IIS bulk query meeting minutes. Additionally, individual key informant interviews were held with more than 40 experts from EHRs, IIS, healthcare payers, provider organizations, school health, pharmacies, and public health. The IIP would like to thank and acknowledge the contributions of the individuals listed in Appendix I.

The IIP convened a workgroup to analyze the issue and recommend a path to improve queries in bulk to IIS. The workgroup included volunteer members representing IIS, EHR vendors, IIS technology partners, patient-focused portals, pharmacies, health information exchanges, provider organizations, healthcare payer organizations, clinicians, and technology standards experts. The workgroup met every two weeks between April and June of 2022 to develop the content of this toolkit. The IIP would like to thank and acknowledge the contribution of the IIP Bulk Query Workgroup members listed in Appendix II.

Approaches to Group Data Exchange

There are several common approaches to obtain immunization data for a group of individuals in terms of data exchange, methods, timing, and operating environments currently used.

Data Exchange Methods

Various methods of immunization data exchange for groups are possible. Current common methods of data exchange employed today include: single HL7 v2 Query by Parameter (QBP) messages sent in rapid succession (serial QBPs), a group of QBP messages appended together (batch HL7 v2) and submitted in one large file, and interface-specific predefined flat or delimited field text file formats. New emerging methods include subscription services and bulk FHIR (Fast Healthcare Interoperability Resources), also called "flat FHIR".

Table 1. Potential Data Exchange Methods – Benefits and Risks

	Benefits	Risks	Recommended Use
Group of individual HL7 QBP messages sent in rapid succession	Standards - Often uses transport standard (SOAP CDC WSDL) and its SubmitSingleMessage operation that is adopted by many IIS, EHRs and HIEs -Uses HL7 v2 and SOAP WSDL – limiting variability Ease of Implementation -simple and can leverage existing standards (SOAP CDC WSDL)	Intended Use Case - Not originally intended to support bulk queries as data is exchanged synchronously, yet the need for group data is almost always asynchronous Efficiency - Too many single message queries can adversely affect performance for all data exchange: VXU-ACK and QBP-RSP Mitigation - May require utilization of strategies to avoid overwhelming the IIS such as scheduling, queuing, and throttling Timing -Although a requester may not require an immediate response (e.g., patients schedule in three days), IIS cannot easily ascertain the need and then	**- This method is NOT recommended to support NEW bulk query needs** - Current implementations that work well for both senders and receivers may continue as negotiated - Obtaining up-to-date data rapidly for a group that is manageable (as defined by an IIS)

		treat the response requirement as immediate	
Batch HL7 QBP-RSP – HL7 Messages appended to one another that may include a header and footer	Timing & Efficiency - Allows IIS to determine best time to process and respond, i.e., asynchronously instead of in real-time Standards - Uses existing standard, see Chapter 13 of the US HL7 v2.5.1 Implementation Guide for Immunization Messaging revision 1.5 Intended Use Case -Aligns well with asynchronous batch query needs	Standards - Uses various transport standards Ease of Implementation - Earlier implementations may have been abandoned by IIS to support use of a unified transport standard (SOAP CDC WSDL) which does not support single batch messages	- Use by EHRs, HIEs, and other health IT systems already using HL7 v2
Flat or delimited files	Ease of Implementation - Simple format potentially supportable by any submitter and receiver, especially those without HL7 v2 standard understanding or capability	Standards - Non standardized approach among IIS such that submitters have different mechanisms, query data elements, and response data elements based on jurisdiction Mitigation	- Use when not possible to exchange using Batch HL7 QBP-RSP or Flat FHIR - Schools, payers, or others who can generate a roster in a flat or delimited format and can consume a returned flat or delimited format file

	Timing & Efficiency - Allows repeated queries to be performed at intervals determined by requester - IIS may determine best time to process and respond - Allows IIS to send only new information for patients previously queried (i.e., those with no new data can be returned as identified with no updates)	- Format is not standard and must be "translated" to IIS data model Timing & Efficiency -Requesters will submit the same 'bulk' list of patients on a requester-defined frequency which may overwhelm the IIS unless there is a way to identify which of the patients have been part of previous queries and the timing of such queries.	
Subscription Service	Timing & Efficiency - Allows IIS to determine best time to process and respond - Could provide near real-time data to requestor without having to initiate queries - Eliminates excessive queries	Standards - No standard approach among IIS such that submitters have different mechanisms based on jurisdiction - Few implementations - Complex authorization considerations Ease of Implementation - Complex implementation that requires subscription and un-	**- This method is NOT considered "bulk query"** -As an alternative to the typical query-response process which requires repeated queries for the same patients to obtain newly entered vaccine records within the IIS. Instead, subscriptions allow subscribers to provide a roster of individuals a single time; when new immunizations are entered into the IIS they are also forwarded to the subscriber

		subscription for individuals moving in and out of the cohort	- Subscription authorization agreement exists - An agreed upon approach to add and remove individuals from the subscription roster exists
Batch FHIR / FlatFHIR	Timing & Efficiency - Allows IIS to determine best time to process and respond Standards - Uses more recently developed interoperability standard (FHIR) - Offers possibility of a new and uniform approach - Can be built upon existing FHIR Bulk Data work	Ease of Implementation - Lack of FHIR immunization-related resources implementations by IIS - Few implementations by requesters -May not serve well as a short-term approach due to limited IIS adoption of FHIR Mitigation - Requires testing and piloting to determine precise best practice for IIS use and to determine ideal minimum data set(s) for various use cases	- Requesters and responders with expertise in HL7 FHIR willing to test new method of exchange

Content of Queries

The content of a query request assists IIS in matching patients and returning requested information. A variety of input parameters could be included in a query including, but not limited to: patient demographics, type of response requested (immunization history alone or history and forecast), potential match restrictions, and requests for vaccinations (type of vaccine or vaccines recorded as of date).

Table 2. Content of Query Requests – Benefits and Risks

Request Parameter	Benefits	Risks
Patient demographics (included in QBP current requests): ID number and ID type, name, mother's maiden name, date of birth, sex, address, home phone number, multiple birth indicator, birth order, last updated date, last update facility[1] Additional patient demographics may also be helpful in some use cases including but not limited to: insurance ID/coverage information, school information, email address, previous address, maiden name Note: patient matching is considered "out-of-scope" for this document	- These data elements can assist IIS in matching queries to patients within the IIS - Well established input parameters based upon existing implementations	- Current QBP inputs are limited to single values, apart from ID number and ID type, which may restrict possible matches (for example only using a single value for a patient may exclude a person who changes their name, address, or phone number) - Additional demographic data elements may be helpful for patient matching
Type of request: history only	- Almost always of interest to requesters	- Requesting system may only count doses, and not evaluate dose spacing and patient age to determine if a dose is valid

[1] HL7 Version 2.5.1 Implementation Guide for Immunization Messaging Release 1.5 Updated October 2018 Page 143 US Centers for Disease Control and Prevention and the American Immunization Registry Association. Accessed on 6 June 2022 https://repository.immregistries.org/files/resources/5bef530428317/hl7_2_5_1_release_1_5__2018_update.pdf#page=151

	- Provides basic vaccine history information	
Type of request: evaluated vaccine history and forecast	- In addition to basic vaccine history, may include vaccine dose validity and forecast for recommended vaccinations - Helpful for systems that do not include clinical decision support functionality (e.g., childcare system interesting in knowing if a dose was valid or what vaccines may be recommended in the near future)	- IIS and requesting system vaccine schedule may not be congruent - Requesting system may not require forecast as it may have its own forecast engine - May require additional IIS computational resources to generate
As of date - the date when vaccine was entered into the IIS and which the IIS should begin looking for doses requested; it may be as of the last query	- This can eliminate the return and processing of vaccine doses already known to the requestor	- May require additional IIS computational resources to limit returned data - May lead to the exclusion of deleted or doses of vaccine from the same vaccine group that are more specific than those on already on file with the requester
Type of vaccine - could be a single NDC/CVX code, vaccine group (e.g., influenza), or type (routine, travel, adult, pediatric)	- This allows requesters to specify the vaccines that may be of interest.	- May require additional IIS computational resources to limit returned data
Match restrictions - current QBP supports maximum number of returned matches requested in RCP-2. Other possibilities could be to request to limit to single exact matches only or request results for multiple match candidates	- Could allow for a more complete picture when matching algorithms are too restrictive (an IIS that never returns exact matches)	- May require additional workflows to address inexact and multiple matches as well as duplicate immunization doses

to allow the requestor to resolve uncertain matches.		

Content of the Responses

IIS may provide a variety of data to requesters including, but not limited to: patient demographics found within the IIS, vaccine history, vaccine validity, recommended vaccine forecast, and relevant clinical information (history of disease or vaccine preventable disease serology), and contraindications.

Table 3. Content of Reponses – Benefits and Risks

Request Parameter	Benefits	Risks
Additional patient demographics not included in the request: the IIS could return additional patient demographics that could be fed into the requesting system (e.g., IIS Patient ID)	- Assist with subsequent matches - Provide demographic information missing in requesting system	- Requesting systems might be more up to date than IIS so requesters may not wish to reconcile returned information into a person's record such situations could also result in additional work to decide which system is "source of truth" for demographics and a way to verify with patient at the point of care.
Vaccine history alone – excludes forecast and dose validity	- Provides basic vaccine information (vaccine product and date administered) required for a variety of use cases	- IIS may report doses that are invalid in terms of the IIS vaccine schedule - As with any query, IIS may provide doses that are later deleted from the IIS
Vaccine forecast	- Can assist with efforts to keep a client's vaccine status up to date - Helpful for systems that do not include clinical decision support functionality (e.g., childcare system interesting in knowing if	- IIS and requesting system vaccine schedule may not be congruent - Requesting system may not require forecast as it may have its own forecasting engine

	a dose was valid or what vaccines may be recommended in the near future)	- May require additional IIS computational resources to generate - Some use cases may not rely on a clinical forecast (*e.g.,* some school admission)
Match confidence flags - could be flags indicating the confidence of a match (exact, inexact, or multiple matches - including the number of matches) or could be an assigned match confidence score	- Avoids missing vaccine information for clients with common names or whose record has not been consolidated in the IIS - Empowers requester to determine if a match is "good enough" and if additional work may be required to obtain requested information	- Requester may have to sort through extraneous data -Different IIS may have different notions of "confidence" making this difficult for the requestor to evaluate.
Deleted vaccine flag - when responding to subsequent queries for patient the IIS notes vaccines that have been removed from a patient's consolidated IIS record	- Assists with keeping the requesting system up to date - Assures clients are compliant with vaccine requirements	- Could be difficult for IIS to determine if a vaccine was reported to the requester in the past; this can be complicated further in cases where requesters are merged - Required IIS to maintain a list of deleted vaccines and restrict display/sharing depending on use case
Relevant clinical information - history of vaccine preventable disease (e.g., varicella, measles), serological	- Avoids indicating a client is non-compliant with vaccine requirements	- May be difficult to interpret for some requesters, especially non-clinical

evidence of protection from VPDs, vaccine reactions and contraindications	due to prior history and vaccination - Provides a more complete medical history for patients - Helps providers avoid administering vaccinations that may result in adverse reactions	- May not be appropriate to share with some requestors - Some requesters may not wish to receive information about vaccine refusals and some responders may not collect or share refusals
Up-to-date status - for a given vaccine type a notation that the client is up to date	- Easily signals compliance with vaccine schedule without having to count doses and evaluate age at vaccination or dose spacing	- IIS and requesting system vaccine schedule may not be congruent - Requesting system may not require forecast as it may have its own forecasting engine - May require additional IIS computational resources to generate - Vaccine up-to-date requirements may change (e.g., the required number of COVID-19 vaccine doses)

Data Exchange Timing

There are two messaging paradigms for immunization data exchange: synchronous and asynchronous. When querying using synchronous messaging the requestor (querying entity) sends a request message (e.g., CDC WSDL's submitSingleMessage_Message) and waits for a response message (e.g., CDC's WSDL's submitSingleMessageResponse_Message) from the receiver in a narrow window of time using the same connection[2]. Nearly all IIS support this synchronous data exchange using CDC developed Webservice Description

[2] Integrating the Healthcare Enterprise (HIE). Asynchronous Messaging https://wiki.ihe.net/index.php/Asynchronous_Messaging accessed 23 May 2022.

Language (WSDL) Simple Object Access Protocol (SOAP) (also known as the CDC WSDL)[3]. Synchronous data exchange works well when the ultimate user of the data (e.g., a clinician) manually initiates a single query for an individual's immunization data and anticipates a response within seconds. As mentioned later, synchronous data exchange is not ideal for a single query of a group and is not recommended for new bulk query implementations.

Alternatively, when exchanging messages asynchronously the requestor sends a message, waits for an acknowledgement of receipt from the responding system, and then ends the connection. After processing the request, the responding system returns (pushes) the requested data to the requestor. In some cases, the responding system may send a message to the requestor indicating the data is available for retrieval (to be pulled).

The support of asynchronous data exchange by IIS varies considerably in terms of data transportation and format. For asynchronous messaging some IIS support: batch HL7 v2 messages over, (s)FTP, HTTP(s) POST/REST, (including uploads within IIS web portal), ebXML, and SOAP (not using CDC WSDL); flat and delimited files; and cloud-based solutions.

Table 4. Data Exchange Timing – Benefits and Risks

	Benefits	Risks
Synchronous messaging	- Widely supported by IIS, EHRs and HIEs - Near real-time response - Data is up to date - Easy to implement - Paradigm used in current CDC WSDL SOAP operations	- Too many queries can adversely affect performance for all data exchange: submission-acknowledgement (VXU-ACK) and query-response (QBP-RSP) - Can only support single requests - Organizations with few resources may not be able to implement the required infrastructure (e.g., schools)
Asynchronous messaging	- Works well when data takes more than a few seconds to be processed	- The response data may be out of date by the time it arrives

[3] In 2021, 89 percent 55 of 62 (89%) IIS had a CDC WSDL available and were measured in AIRA's Measurement & Improvement Initiative. Of the 55 measured, 54 (98%) connected IIS were Validated at the basic level for Transport See: https://repository.immregistries.org/files/resources/5ae759f692a6c/transport_validation_basic_2nd_half_2021.pdf

	- Works well when there are network latency issues - Does not require a constant and active connection	- Not the paradigm used in current CDC WSDL SOAP operations; see SOAP-Based Asynchronous/Batch Exchange content from the 2015 Transport Layer Protocol Recommendation Formal Specification[4]

Preparing for Bulk Queries

Both requesters and responders (usually IIS) should prepare for eventual bulk query needs. Even if the need for bulk query is not currently known, it may occur without the knowledge of the requester and/or responder. It may be difficult for IIS to ascertain that a large number of individual queries are actually a single group being queried using existing infrastructure (CDC WSDL) unless these queries begin to negatively impact IIS performance. Similarly, users of query response data (e.g., clinicians or population health outreach teams) may be unaware of how it was retrieved and the potential negative impact of the process upon the IIS. For example, clinicians may have requested their EHR product be configured to automatically request patient immunization records from IIS but may not understand the frequency of the query trigger, technical environment the query is executed in, or timing of the query.

When planning for bulk query needs it is important to include all stakeholders in configuration decisions so that all needs may be carefully reviewed alongside others. Requesters and responders can assist one another by communicating their own needs and expectations by discussing the following:

- Needs
  - For what reason is the data needed?
  - What parameters are available for query input (e.g., name, date of birth, address)?
  - What data is available (e.g., vaccine history, dose validity, vaccine forecast, non-vaccine clinical information - such as history of vaccine-preventable disease or serology)?
  - Is the data available elsewhere (e.g., another source or even a report accessible within the IIS) or is it already being retrieved by an existing process such as reports that are built into the IIS web portal?
- Methods
  - What methods are available for bulk queries?
    - Which is most preferred?

[4] https://www.cdc.gov/vaccines/programs/iis/technical-guidance/soap/downloads/transport-specification.pdf#page=11

    - What are the query triggers?
- Timing
    - What is the desired schedule for queries and corresponding responses?
    - Will bulk queries be ad hoc or be regularly performed on a consistent schedule?
    - How up to date must the response be?
    - How up to date is the queried system (generally, the IIS)?
    - How will the responder know the time at which the response was generated?
    - When will the response data be used?
- Limits
    - What are the limits?
        - Roster size
        - Can multiple rosters be sent?
        - Rate (e.g., 50 queries per hour or a single query once a week)
- Policy
    - Is the querying entity allowed by IIS policy or law to bulk query?
    - Is bulk query part of the IIS data use agreement?
    - How will the retrieved data be used?
    - Will retrieved data be disclosed to third parties?
- Reconciliation
    - How are multiple or inexact matches to be handled?
    - What information will be included in the response?
    - What information from the response will be stored and used?

Bulk Query Recommendation Considerations for Requesters and Responders

Bulk query is an asynchronous technical approach for efficiently requesting a server to export multiple patients' records to a pre-authorized client. While the term "bulk" suggests there may be a size requirement for the amount of data, size requirements and limitations should be negotiated by the data requester and responder (sender and receiver). This toolkit will reference the need for such negotiation, including a potential need for scheduling and for queuing and throttling to avoid overwhelming servers; however, the focus is primarily on methodology.

Recommendations within this document were developed with the intent of being used for *new* bulk query needs and were not intended to replace processes working well for *both* requesters and responders.

Note, the recommendations purposely avoid architecture recommendations. For example, the recommendations may suggest the IIS use a parallel system for

queries and response, but the IIS needs to evaluate the most effective architecture for such a parallel system (e.g., a data lake, a data warehouse, a replica of the production system, another configuration).

Due to the significant interest in considering FHIR bulk data as a potential solution, the relationship to the three existing FHIR use cases identified in the FHIR Bulk Data Implementation Guide 2.0.0 include the following listed below. While the FHIR bulk data interoperability layer does not currently include immunizations, the use cases are analogous to some of the use cases identified for immunization-related bulk queries:

- "Native" FHIR servers that store FHIR resources directly
    - This use case might represent EHRs and IIS at some time in the future, but it is not representative of the current or near-term state; FHIR is generally considered an interoperability layer defining foundational, structural, and semantic methods for sharing data between disparate information systems.
- EHR systems and population health tools implementing FHIR as an interoperability layer
    - The use case is closely aligned with considerations for immunization-related bulk query with respect to EHRs used by clinicians and clinical organizations, IIS native or parallel systems, intermediaries, and others (schools, camps, pharmacies, etc.)
- Financial systems implementing FHIR as an interoperability layer
    - This use case is most closely aligned with immunization-related bulk queries performed by payers communicating with IIS that have FHIR as an interoperability layer

Scope of the bulk query definition:

Grouped Queries Versus Batch File Queries

Current practice includes two methods for sending a group of HL7 V2 QBP message queries to an IIS to obtain immunization histories:

1. Software configuration for the requester allows clinicians and other authorized users to select a set of patients (e.g., all those scheduled for an appointment in the next day or week) such that the software sends a group of serial single queries for the selected patients rapid succession using the SOAP CDC WSDL to the IIS at a time set in the configuration (usually in an evening). Such grouped queries can be considered convenience queries, but they are managed consistently with the synchronous single query approach. This type of configuration is not considered a bulk query for this set of recommendations. Each IIS that allows such grouped serial queries may have a threshold above which they must be queued when received and may also require throttling of query responses based on activity to allow receipt of immunization administration messages. This type of serial single query set up may work well for specific settings in which the requester and the IIS agree to the parameters.

2. Batch file specifications as specified in Chapter 13 of the HL7 v2.5.1 Implementation Guide (the standard) provides detail about how to create request for a batch (large number) of patients asynchronously to an IIS. The standard provides details about what must be included in the header as well as referencing the standard information required for the individual patients in the batch. This specification allows format and content standardization for sending an asynchronous batch query and, thus, is preferred to non-standard flat file configurations that may differ by IIS jurisdiction when considering bulk query. The existing standard does not indicate a recommendation for the volume of patients that might be included in a batch and requesters should work with their respective IIS to identify an acceptable time for such requests as well as a preferred volume of patients that should be included in each batch. Since the transaction is asynchronous, the IIS can process the batch content as it is capable. There is not an agreed upon transport standard for batch files; though it is common these are exchanged using a secure file transfer protocol server (sFTP) or via the IIS web portal.

Direct Reporting Capability within IIS

As an alternative to bulk queries, some IIS have enabled authorized users or organizations to access data for their existing clients as a report accessible through the IIS web portal that uses data from a data warehouse. For example, such data may provide a line list of current clients and their vaccination status. Such reports are tailored to specific use cases and may provide better control of user access to data based on legitimate business needs and such capability may limit the need for bulk queries.

Subscription Considerations

Some use cases identified a preference to subscribe to receive immunization histories for a set of patients to avoid the need to query on the same cohort repeatedly to be sure to obtain the most recent immunization status. Consensus of the Bulk Query Workgroup is that subscription is different than bulk query and while it may use a similar method to submit the patient cohort to obtain immunization data, the subscription operation requires investigation to define a standard approach. The reason for recommending a different standard for a subscription model is that it must not only assure the requester is authorized to receive an initial set of immunization data on each cohort member, but that such authorization persists through the subscription period. Future consideration of use of a subscription model instead of bulk query should, at minimum, ensure authorization agreements are in place to allow the IIS to share new immunization data intermittently or continuously. An agreed upon procedure for removing and adding individuals to the subscription cohort should also be developed as individuals may come and go from the group. A subscription model is out of scope for this Bulk Query Workgroup. It requires future work and identification and testing to enable maturation of a standard approach and clear definition of authorization and sharing parameters especially since any

given patient in a cohort request may need to be removed from the cohort if the requester's authorization for that patient lapses. We direct readers to consider current efforts in HL7 FHIR Subscriptions Framework and proposed Subscription Resource.

Note regarding requesting and responding systems
Some IIS currently accept flat file submission that enables submission of a set of patients for query and receipt of a flat file of patient and immunization data responses. The format is non-standard and that is potentially problematic for querying organizations (EHR vendors, payers, large, multi-state provider organizations, etc.) to create IIS-specific output formats rather than a common format. Some have suggested sending what is currently exchanged in HL7 v2 QBP and RSP messages; however, that data may be different among IIS and requesters. Future work might derive a basic minimum data set from the CDC's IIS Recommended Core Data Elements or HL7 Version 2.5.1 Implementation Guide for Immunization Messaging to encourage consistency. Further, some requesting and responding systems are establishing pilots to use FHIR as the interoperability layer for sending requests and receiving responses. Such standards-based work should be encouraged and may inform the minimum data requirements to successfully manage the various use cases.

Requesters

Entities requesting (querying) patient immunization information from IIS. There are a variety of request stakeholder groups which may include the following:

Requester Stakeholders

- EHR developers
- Clinicians and their supporting team members (e.g., those at clinics, hospitals, long-term care facilities, etc.)
- Occupational health systems
- Pharmacy and pharmacy clinics
- Child-care centers
- Schools
- Camps
- Payers
- Local public health agencies
- Health Information Exchanges (HIEs)
- Third party aggregators
- Professional health credentialing organizations
- Consumer-facing applications
- Researchers
- Pharmaceutical companies

Bulk Query Requester Capabilities

Business Requirements

RECOMMENDED:

- Discuss bulk query submission requirements with the corresponding IIS or other query response organization and align with such requirements.

- Maintain communication with responding system to understand and agree on refresh frequency, to inform about planned outages and delays or change in policy, and to inform about the available method(s) for submitting queries

Technical Requirements

Bulk Query Format

RECOMMENDED:

- Support the FHIR standard for bulk query for submitting queries
- As an interim approach until FHIR bulk query testing leads to greater maturity, requesters and responders using the following methods should continue their current processes and evaluate appropriate timing to transition to FHIR. IIS and requesters using these interim approaches must agree upon the transport mechanism:
    - Use of batch file specifications as specified in Chapter 13 of the HL7 v2.5.1 Implementation Guide as an interim approach until FHIR bulk query testing leads to greater maturity.
    - Use of flat file specifications developed by the respective IIS, which may be configured directly by the IIS or the IIS vendor, understanding that such specifications are not derived from a common standard and that requesting organizations may need to establish different configurations when using the flat file approach in different IIS jurisdictions.

Bulk Query Configurability

RECOMMENDED:

- Allow querying organizations to set the time(s) for submitting bulk queries to responding systems
- Allow querying organizations to define the time period for the data requested (i.e., immunizations administered within a specified date range)
- Provide capability to limit duplicate queries – defined as those for the same patient queried within the past x hours; such capability should be configurable by the organization supporting the queries to an IIS
- Allow querying organization to limit the sites within that organization with access to submit queries to an IIS

SUGGESTED:

- Allow querying organizations and individual users to identify a patient cohort by selecting parameters in the requesting system (e.g., treating provider, diagnosis, etc.) and provide the cohort definition parameters in the request

Bulk Query Configurability Future Considerations

SUGGESTED FUTURE CONSIDERATIONS:

- The following considerations represent requesting system (e.g., EHR) functions or configuration settings that workgroup members have suggested; each requires further effort to determine its value and priority:
  - User-focused display of (a) last time queried for each patient in a list with indication of (b) success (match/no match) and (c) last time new data were retrieved
  - Minimum time delay to allow re-query for an individual in a set of persons
  - Time out parameters (how long the responding system should continue searching for new data)
  - Allow the individual sender to adjust the time for the query within parameters negotiated with the receiving system

Bulk Query Responder Capabilities

Business Requirements

RECOMMENDED:

- Publish and discuss bulk query submission requirements with authorized submitters
- Maintain communication with bulk query submitters to understand and agree on refresh frequency, to inform about planned outages and delays or change in policy, and to inform about the available method(s) for submitting queries

SUGGESTED:

- Communicate acceptable time periods (e.g., weekends or off-peak business hours) for bulk query submissions which MAY be individualized to submitting organizations

Technical Requirements

Bulk Query Format

RECOMMENDED:

- Support FHIR standard for bulk query for receiving and responding to queries
- As an interim approach until FHIR bulk query testing leads to greater maturity, requesters and responders using the following methods should continue their current processes and evaluate appropriate timing to transition to FHIR. IIS and requesters using these interim approaches must agree upon the transport mechanism:
  - Use of batch file specifications as specified in Chapter 13 of the HL7 v2.5.1 Implementation Guide as an interim approach until FHIR bulk testing leads to greater maturity

- Use of flat file specifications developed by the respective IIS, which may be configured directly by the IIS or the IIS vendor, understanding that such specifications are not derived from a common standard and that requesting organizations may need to establish different configurations when using the flat file approach in different IIS jurisdictions.

Production versus Parallel System

RECOMMENDED

- Accept immunization administration data submissions using existing transactional/production systems
  - IIS may benefit from enabling immunization data submission to a parallel system based on local architecture and configuration needs
- Accept and respond to bulk queries from a parallel system (e.g., duplicate systems, data lakes, data warehouses)
  - IIS may choose to enable queries to the same production system used for immunization submissions in communities with well-established interoperability and ability to manage temporary increased query demands especially those with limited IT staff to accommodate change; such systems should consider bifurcating the ability to submit immunizations to the production system from the ability to bulk query for past immunization data. Bifurcation of a single submission and bulk query interface can improve processing speeds and remove contention issues however this may increase the complexity of interface implementations.
- Set priority for receiving immunization data if using IIS production systems for receiving and responding to bulk queries

Bulk Query Transparency and Configurability

RECOMMENDED:

- Set priority for receiving immunization data
  - IIS should enable throttling, i.e., limiting or pausing/queueing query response activities to allow continuous receipt of immunization submissions to the IIS
- Develop and communicate required metadata parameters to allow bulk query requests, e.g., organization identifiers, practitioner identifiers, credential requirements, requested information effective dates; such information to be used to assure the requester is the authorized entity and the parameters for the responses, all of which may also be used to prioritize fulfillment
- Develop and maintain auditing functions to evaluate effectiveness and quality assurance activities as well as assuring compliance with requester

policy; such auditing functions may need to address state or other jurisdictional laws or regulations

- Enable query configurations for Production *and* parallel systems, specifically including the following items:
  - New queries from approved providers or other requesters
  - New queries for patients in a previously submitted list only after a minimum delay of 48 hours, or such time as defined by the IIS for repeat queries
  - Queries from authorized organizations, for which the organization may request only a subset of its full patient population based on that organization's parameters (e.g., specific clinics, patient conditions)
  - Allow scheduling of asynchronous queries at mutually acceptable times by requesting and responding organizations
  - Enable the ability to queue and throttle, i.e., slow down or delay query response processing as needed to enable reasonable system performance for the IIS, data submitters, and data requesters. This can create a layer of protection for the system for surge volumes and capture of message data so no data loss. They can process the data (VXUs or QBPs) sequentially (line by line), so it does not fail all data submitted in a file. This strategy may add to interface implementation and maintenance costs.

Bulk Query Response Content

RECOMMENDED:

- Include the complete immunization history in query responses:
  - IIS should allow limitation of responses to include only the specific immunizations requested in the query (e.g., only immunizations in the last 5 years, or only COVID-19 vaccination history)

SUGGESTED:

- In addition to returning complete immunization history, returned information may include the following elements as determined valuable for specific use cases:
  - non-vaccine data representing potential immunity (e.g., serology, prior incidence of vaccine-preventable disease)
  - non-vaccine data representing vaccine-specific issues (e.g., allergies, adverse reactions, refusals)
  - non-exact matches or multiple matches
  - match confidence indicator
  - vaccine dose validity (e.g., valid, or invalid: too closely spaced to prior doses, too closely spaced live vaccines, too young, too old)

- In some cases when requesters do not have clinical decision support engines it may be helpful to also return a forecast of vaccine doses due.

Future Bulk Query Considerations for Requesters and Responders

This set of requirements represents best practice recommendations identified by the Bulk Query Workgroup members and as part of the landscape overview development process. The best practices are divided into business requirements and technical requirements. Some of the technical requirements address infrastructure, yet they stop short of recommending specific architecture. Other technical requirements address software functionality; still others address interoperability requirements. Best practices require all three – business, functionality, and interoperability requirements. Further details and more specific testable requirements will become evident during testing and evaluation, including efforts planned by the HL7 Accelerator, Helios.

Use Cases & User Stories – Specific Recommendations

General

Regardless of bulk query use case, all requesters and responders should communicate their needs and expectations which may be in the form of a discussion, or a review of IIS published requirements for bulk query. A starting point could be the review and discussion of questions from the "Preparing for Bulk Queries" section of this document which covers needs, methods, timing, policy, limits, and reconciliation.

- Additionally, requesters and responders should regularly monitor query-response interface activity to ensure activity is consistent with agreed upon use, patient matching results are within acceptable limits, performance is as anticipated, and query request parameters are as complete as possible[5].

Some examples of the above principles are reflected in the use case specific recommendations listed below.

Notes: For additional recommendations see Bulk Query Recommendation Considerations for Requesters and Responders. Multiple interfaces may exist between a given requester and responder depending on their use case needs. For example, an organization might have two interfaces between its EHR and the IIS:

1. An asynchronous bulk query interface to obtain immunization histories in three days in advance of a patient encounter.

[5] See IIP Immunization Query Response Aggregate Measures for Multiple Matches Report https://www.himss.org/resources/immunization-query-response-aggregate-measures-multiple-matches-report

2. A real-time interface for obtaining immunization history during a patient encounter for patients whose inclusion in the bulk query ahead of their visit resulted in a multiple match.

Bulk Query Use Case List

The IIP Bulk Query Workgroup identified the following bulk query use cases:

1. Prepare pre-visit
2. Perform reminder/recall
3. Report performance metrics
4. Perform population outreach
5. Manage licensing/operational requirements
6. Perform case investigation
7. Evaluate vaccination status of specific, known populations
8. Obtain patient data to support multiple stakeholder types
9. Provide vaccination credentials
10. Provide consumer access to vaccine history
11. Query known patients
12. Post-market surveillance

In addition to the general recommendations listed earlier, specific recommendations for each use case are detailed below. Principles of needs, methods, timing, limits, and reconciliation are highlighted in **bold** text below.

User Stories

Prepare pre-visit

A health system wishes to have updated immunization histories readily available before scheduled patient encounters in which immunizations may be administered and/or recommended. The health system plans to do away with manual queries within its workflow.

The requester (the health system) should:

- communicate its **needs** with the IIS rather than unilaterally implementing its new workflow using an existing interface **method**
- not include patients who are unlikely to be vaccinated or referred for vaccination during the encounter. In this scenario patients with upcoming physical therapy appointments should be excluded but the bulk query should include obstetrics patients who may be administered, or referred to other providers for, a pertussis vaccine (**needs and policy**)
- provide enough lead **time** to allow data users to evaluate the response (e.g., data must be received no more than 72 hours before the appointment to allow providers to order enough vaccine product)
- use data up to date enough to provide accurate vaccine recommendations (**needs**)
- plan for responses from the IIS which do not match a single exact match; this may require manual real-time queries for a small number of patients (**reconciliation**)

Perform reminder/recall and perform population outreach

An exceptionally large private health insurance carrier, which is already permitted to access IIS data, wants to send greeting cards to all of its members that have 50th birthdays in the next month to wish them well and to remind them to obtain a shingles vaccine. They also wish to send reminder mailers to all members over 50 years of age with one dose to obtain a second dose. It's estimated that each month there will be 15,000 patients meeting these criteria. After waiting 30-days the insurance carrier will review the vaccine status of those mailed a card and if they have not yet received a vaccine a call will be placed reminding the member of the recommendation.

The requester (health insurance carrier) should:

- discuss its **needs** with the IIS before investing considerable resources; in particular the health plan should confirm with the IIS that the disclosure of a list to a mailing contractor complies with IIS-health insurance carrier data use agreement's provision regarding third-party disclosures (**policy**)
- not seek immunization information for patients with billing data or prior query data (**reconciliation**) that indicates they are already up to date (**needs**)
- as determined through negotiation with the IIS, monthly generate patient rosters in the form of batches of HL7 QBP messages (**timing**)
- as determine through negotiation with the IIS, upload batch files to IIS sFTP server, download returned files from IIS sFTP server, and delete the query file after downloading the returned file (**methods**)
- group queries into batches of a maximum size (e.g., 5,000 or less) as requested by the IIS (**limits**)
- execute the query during off-peak time for IIS (e.g., last Sunday of the month at 9:00 PM) (**timing**)

Report performance metrics

A state Medicaid agency wants to evaluate how well its four managed care plans are performing in six immunization-based performance measures. More than 400,000 people are enrolled in these managed care plans. Plans which reach contracted targets are awarded higher reimbursement rates compared to those not reaching the target. Data is obtained from the IIS at the patient-level and distributed as an aggregate report by the state Medicaid agency to each plan once a month.

The requester (state Medicaid agency) should:

- hold a meeting with the IIS to assure the program's **needs** will not adversely affect IIS operations
- monthly generate patient rosters in an IIS-specified predefined flat file in batches of files group queries into batches of a maximum size (e.g., 30,000

or less) (**limits**) and upload to the IIS web portal as requested by the IIS (**methods**)
- specify an "as of date" to limit returned information to only newly entered IIS data (**needs**)
- retain returned data (including IIS patient identifier) to limit the need to request existing data (**reconciliation**)
- execute the queries during off-peak time for IIS (e.g., last Friday of the month at 5:00 PM) (**timing**)
- not disclose patient-level data to third parties as required by the IIS-state Medicaid agency negotiated data use agreement (**policy**)
- review a listing of inexact patient matches and manually lookup patients in the IIS web portal (**reconciliation**)
- include IIS patient identifier in subsequent queries to decrease inexact patient matches (**reconciliation**)

Manage licensing/operational requirements

Biggest Public School District performs a process analysis to reduce inefficiencies and discovers school nursing staff members spend more than 5,000 hours per school year reviewing vaccine records for compliance with state law for kindergarteners, eight graders, twelfth graders, and students new to the district. The school nurses already use the state's IIS but have to lookup student vaccination records individually. The district coordinator offers a solution – iSchools, an optional module that is integrated into the district's existing student information system. This module allow automatically queries the IIS two weeks after the school year begins and whenever new students enroll mid-school year. The module is in use by several school districts in other states but not by other schools in Biggest's state.

The requester (Biggest Public School District and iSchools) should:
- Contact the state IIS to indicate their **needs** and determine if schools are allowed to query using electronic data exchange using the iSchool vaccine compliance module (**policy**)
- Ask the IIS if it would support queries using a roster of students from within iSchools sent as a flat file and return immunizations in the predefined format
- Explore alternatives to the planned date exchange after being told that schools are permitted to query the registry using electronic date exchange (**policy**), but the registry is unable to integrate iSchool's format **(method)**
- Review the IIS' electronic data exchange implementation guide which indicates the IIS supports the exchange of batch HL7 v2 QBP and RSP messages as long as the QBP batch file contains 3,000 or fewer patients **(limits and method)**
- Develop a **method** to generate multiple batches no larger than 3,000 HL7 v2 QBP messages (**limits**) and import HL7 v2 RSP messages **(reconciliation)**

- Schedule the automated queries to kickoff at times agreed upon by the IIS (**timing**)

Perform case investigation for vaccine preventable and communicable disease

A food handler working at a high school cafeteria was recently reported to the local health department (LHD) as hepatitis A positive. The LHD works with the school and identifies 1,000 students and staff that were exposed and recommended to receive hepatitis A vaccine prophylaxis as soon as possible. The LHD does not have a vaccination program, but every 12 hours wishes to monitor the progress of area private providers at vaccinating patients that appear on the exposure roster.

The requester (local health department) should:

- send its case investigation queries in the manner negotiated with the IIS
  - in this scenario the LHD is directed by the IIS to send a series of individual queries containing a case ID, name, and date of birth of residents is believe may have been exposed through the CDC WSDL to the IIS transactional environment since the state IIS data warehouse used for other efforts is 36 hours old and would not meet the requirement (**methods**)
- only query for the patients with potential exposure at the school building (not the entire school district) (**needs**)
- Stop querying for patients known to be recently vaccinated as ascertained by earlier queries(**needs**)
- request data with enough lead **time** for data users to evaluate the response, in this scenario data must be received every 12 hours

Evaluate vaccination status of specific, known populations

A state's emergency responder association wants to monitor vaccination recommendation compliance for all first responder members. Of particular interest is tetanus for firefighters and rescue crews, and hepatitis B for police. The agency maintains a registry of 30,000 professional and volunteer first responders. IIS policy prevents disclosure of individual vaccine status without patient consent but does permit disclosure of aggregate data for subpopulations which are larger than 10 individuals.

The requester (state emergency response agency):

- hold a meeting with the IIS to discuss the project and proposed input and outputs (**policy and methods**):
  - Input – a pre-defined flat file including name, responder type, date of birth, and zip code
  - output – a report that is a crosstabs of responder type (firefighter/rescue, police), professional status (professional or volunteer) and vaccination group (tetanus, hepatitis B and influenza)

- submit the responder roster once weekly through a sFTP server (**timing and method**)
- review aggregate report by logging on to the IIS web portal once weekly (**reconciliation**)

Obtain patient data to support multiple stakeholder types

New State Health Information Organization (NSHIO) operates a health information exchange used by small private practice clinics to share clinical information but is not currently connected to the state's IIS. Small private practice clinics subscribing to the HIE find maintaining individual interfaces with the state IIS to be too burdensome and wish to use NSHIO's expertise to facilitate interfaces with the IIS moving forward.

NSHIO is also exploring ways to expand its services to allow pharmacists (recently allowed to administer immunizations through a new law) to also submit newly administered vaccinations and lookup existing immunizations within the IIS.

NSHIO was also recently contracted to replace an aging information system set to end operation within the next year. The legacy system is used by Juvenile and Family Courts, Office of State Courts Administrator, Department of Social Services, Department of Mental Health, Department of Health and Senior Services, and the Department of Elementary and Secondary Education to share information relating to a child who is or has received services from a participating agency. As NSHIO does not yet have an interface in place with the state IIS, it proposes leveraging newly published bulk FHIR data exchange guidance for the system.[6]

The requester (NSHIO), that operates a health information exchange) should:

- discuss its various subscriber **needs** with the IIS to determine the technical **method**(s) that could be leveraged and assure that plans comply with IIS **policy**
- leverage its advanced technical expertise to implement data exchange **methods**
- agree to patriciate in a bulk FHIR proof-of-concept project along with the IIS (**method**)
- works with the IIS to develop a new data lake for its muti-stakeholder purposes (**method**)
- implement a separate real-time interface using the CDC WSDL's SubmitSingleMessage operation to support clinicians looking up patients' immunization records immediately before administering vaccinations (**methods, timing reconciliation**)

[6] At the time of publication, bulk query using FHIR was still under development.

Provide vaccination credentials

The state legislature recently enacted a law that requires that all employers with 5,000 or more employees must assure their employees are vaccinated against seasonal influenza by October 15th each year. Employees who do not provide proof of vaccination are required to wear facial coverings. Once an employee is vaccinated, they may choose not to wear a facial covering. To ensure compliance with the policy, and due to its lack of health data exchange expertise and its desire not to store employee health information, Nile Co, a large online retailer, opts to use a third-party service, UVaxed?. This allows its employees to either consent to their records being retrieved from the state IIS or directly upload proof of vaccination into the UVaxed? system. The Nile Co. occupational health unit performs random checks on unmasked employees who are required to display their vaccine credential upon request.

The requester (Nile Co. and its contractor UVaxed?) should:

- hold a meeting with the IIS to assure the plan is technically feasible and is permissible per IIS **policy**
- internally discuss the option available from the IIS to exchange data; if an existing method does not work, develop a method to send a roster of employees from the to the contractor (e.g., an CSV extract from the payroll system) that will be transformed into HL7 QBP messages (**method**)
- develop an employee consent mechanism (**policy**)
- add employees who consent to have their records retrieved from the IIS to the batch query (**method**)
- as specified by the IIS' web-published bulk query process guide, create, and upload a nightly batch file of HL7 QBP messages (**timing**)
- as specified by the IIS' web-published bulk query process guide, download the daily batch of HL7 RSP messages from the IIS (**reconciliation**)
- perform manual lookups in the registry for opted-in employees that match to multiple IIS records (**reconciliation**)
- remove opted-in employees from nightly queries once flu immunizations have been found in the IIS (**method**)

Provide consumer access to vaccine history

HealthApp Co. offers consumers MyVax as a personal health record that is accessible on mobile devices which allow families and individuals to track vaccine records. Vaccine records can be added by taking pictures of paper medical records, reviewed for authenticity by MyVax employees, or retrieved from certain IIS that have opted to support the service. Additionally, MyVax users can opt to be reminded when vaccine doses are needed. To enable this notification service MyVax regularly queries participating IIS for the immunization records of its customers. HealthApp Co. wishes to expand its support to users who are residents of New State.

The requester HealthApp Co. should:

- discuss its user identification authentication procedures to ensure it complies with health record disclosure **policy** requirements of both New City and New State IIS
- discuss its immunization history and patient demographics only **needs** with both New State IIS and New City IIS serve as IIS for the residents of New State
- Implement an HL7 v2 batch interface (**method**) as directed by New City IIS:
  - upload a batch file containing HL7 v2.5.1 QBP messages **limited** to subscribers with New City zip codes (**policy**) to New City IIS' sFTP server v2 interface each Saturday at 10:00 pm ET (**timing**)
  - download a batch file containing HL7 2.5.1 RSP and ACK messages, each Monday at 6:00 pm ET (**timing and reconciliation**)
  - ignore immunization forecast and dose validity provided which cannot be disabled by New City IIS (**reconciliation**)
- Institute a manual upload/download flat file process within the IIS' web portal (**method**) as directed by New State IIS:
  - A roster of patients is submitted using New State IIS' predefined flat file format is uploaded (**method**)
  - A file containing the immunizations of patients and the unique patient roster ID is posted in the New State IIS web portal once completed
  - As agreed by New State IIS, HealthApp Co. may include any resident of New State, this includes those residing in New City (**policy**) in its roster
  - Because New State IIS routes all bulk query operations to its query-only replica database HealthApp Co. is informed by New State IIS it is allowed to submit bulk query roster flat files at any time and at any interval with no **limits**

Query known patients

Ten years ago, Rural Local Health Agency (RLHA) stopped documenting all its patients' immunizations on paper and exclusively entered data into its EHR, BasicEHR. BasicEHR recently informed its clients that it had filed for bankruptcy and would end support for its EHR in the next six months. Instructions are provided to customers allowing them to extract basic patient demographics but not clinical procedures, including immunizations. RLHA begins a procurement process to find a new EHR. RLHA opts to purchase an EHR designed for public health clinics, PHWorx. The PHWorx package purchased by RLHA includes free data migration. RLHA and PHWorx discuss data migration options agree upon the load of patient demographics from the data extract provided by BasicEHR. Because immunization data from BasicEHR is not extractable, PHWorx and RLHA reach out to State IIS if it would be possible to obtain immunization histories for all RLHA's patients.

After coming to an agreement with the IIS, the requester (RLHA and its contractor, PHWorx) should:

- Transform the patient data from the BasicEHR extract into a batch file containing HL7 v2.5.1 QBP messages and then upload using the IIS web portal batch submission (**method**)
- Download the resulting batch HL7 v2.5.1 RSP messages from the IIS web portal and transform the data and import it into PHWorx (reconciliation)
- Carefully review the resulting RSP and ACKs that indicated a non-match to IIS patients and perform manual lookups in the IIS (**reconciliation**)
- Create a real-time interface for non-bulk data exchange (**needs**)

Post-market surveillance

A state health agency's communicable disease unit is assisting several local health departments investigating large clusters of cases of varicella (chickenpox) cases amongst vaccinated children. After discussions within the state health department, it is determined that a list of varicella cases from the state's communicable disease registry will be used to query the against the state IIS to obtain related-vaccine information.

The communicable disease unit should:

- speak management and legal counsel to ensure data can be shared freely between communicable disease and immunization programs (**policy**), if not a data use agreement should be drafted and agreed upon
- load the IIS pre-determined CSV file containing patient identifiers and demographic information to the IIS-staff accessible network path (**methods**)
- work with an IIS data analyst to determines what data return elements are required - e.g., all varicella vaccination information including: vaccine type, the date administered, dose number, lot number, and the vaccination clinic where the dose was administered (**needs**)
- access the resulting data in a CSV file provided by IIS staff in the shared network path and import (**reconciliation)** the data into biostatistics and epidemiological investigation software to determine if a pattern emerges

Workflow: Determining which Bulk Query Approach to Implement

Figure 1. IIS Bulk Query Method Options

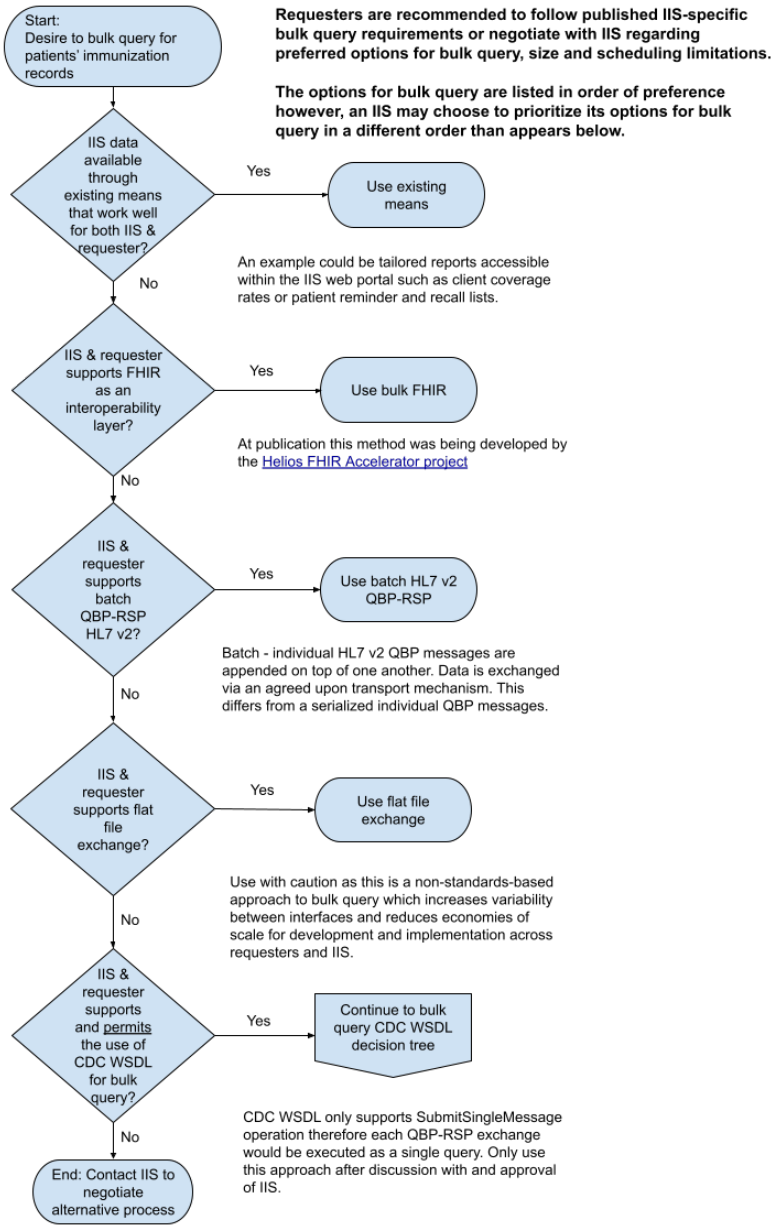
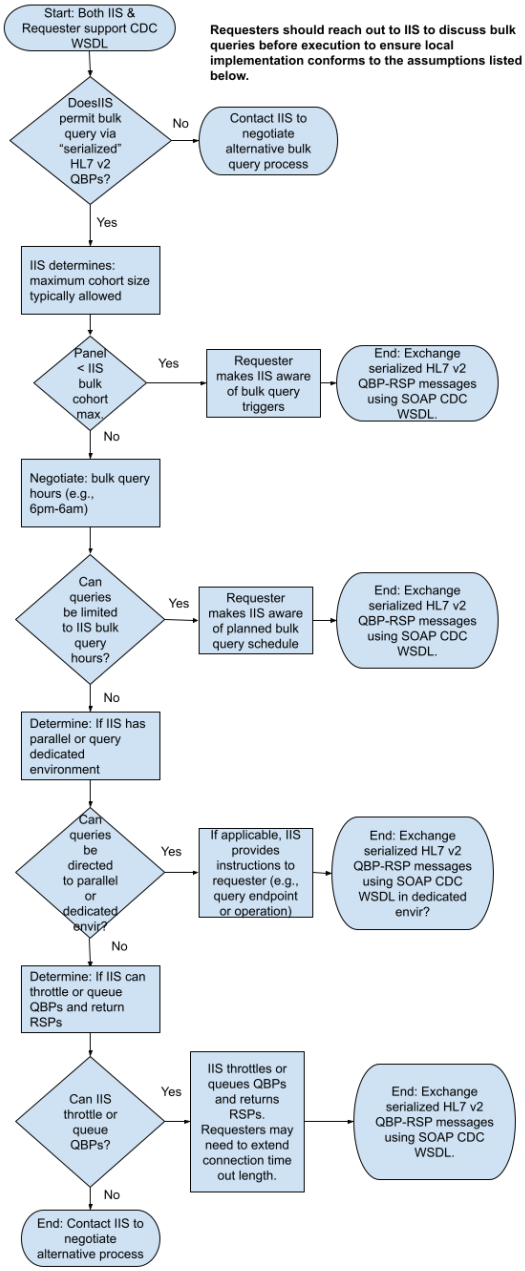


Figure 2. Configuration Options to Consider When Using SOAP CDC WSDL for Bulk Query



Appendix I: Subject matter experts interviewed to develop a bulk query landscape analysis

EHR Vendors

Kristin Glaza - Cerner
Michael Perretta - Docket
Nell Lapres - Epic
Amit Popat - Epic
Deepti Sathe, MS, PMP - Epic
Ted Stamp - Epic
Danny Wise - Allscripts / Practice Fusion

Health Information Exchange (HIE)

Heidi Penix, MPH - Civitas
Kate Ricker-Kiefert, MS - Civitas

Immunization Information System Staff (IIS)

Aaron Bieringer, MPH - Minnesota Immunization Information Connection
Eric Dansby, MS - California Immunization Registry
Baskar Krishnamoorthy - Florida SHOTS
Diane McLeod - Florida SHOTS
Jon Reid, MBA - Utah State Immunization Information System

Other Contributors

IIS Technology Partners

Brittany Ersery-Kemp - Envision Technology Partners
Joe Kelly, PSM CAL - STChealth
Kevin Snow - Envision Technology Partners
Nick Harrar - STChealth
Shannon Coleman, MS - STChealth
Srinivas Tadikonda, MPA - Gainwell Technologies
Steve Murchie, MBA - Envision Technology Partners
Tiffany Dent, MPH - STChealth

Providers

Ambulatory Care

Julia Skapik, MD, MPH - National Association of Community Health Centers

Stuart Weinberg, MD - various responses from pediatrician members of American Academy of Pediatrics

Pharmacy

Pamela Schweitzer, PharmD RADM (ret.) - USPH

Reena Mehta, PharmD, Pharmacy Claims - Optum
Shelly Spiro, BS - Pharmacy Health information Technology Alliance

School Health

Terrie Hamlin, RN - Professional Software for Nurses
Jennifer Junkins, MCIS - STChealth
Donna Mazyck, MS, RN - National Association of School Nurses
Courtney Palmer - STChealth
Dennis Savina - Professional Software for Nurses
Eva Stone, PhD - Jefferson County Public Schools (Louisville, KY)
Rachel VanDenBrink, MSN - Kent Intermediate School District (Grand Rapids, MI)

Payers

Kate Berry - America's Health Insurance Plans
J. Marc Overhage, MD PhD – Elevance Health
Chris Regal, MS - America's Health Insurance Plans
Zachary Gillen, MIMS - Kaiser Permanente

Public Health (non-IIS)

Seth Foldy, MD MPH - Public Health Institute at Denver Health
Michelle Hood - American Immunization Registry Association
Paula Keller, MPH - CDC Foundation FHIR Test Collaborative
Rachael Miles - American Immunization Registry Association

Technology Developers

Craig Newman, PhD - Altarum
Dan Gottlieb, MPA - Central Square Solutions
Jim Daniel, MPH - Amazon Web Services
Sam Sayer - MITRE

Appendix II: IIP Bulk Query Volunteer Members and Staff

Chair

Stuart Weinberg, MD - Clinical Informatics Consultant

Members

Aaron Bieringer, MPH - Minnesota IIS (MIIC)
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Scott Kirby - Physician's Computer Company
Baskar Krishnamoorthy - Florida SHOTS
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Julia Skapik, MD MPH – National Association of Community Health Centers
Kevin Snow - Envision Technology Partners
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Pele Yu, MD - Arkansas Children's Hospital
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Workgroup Staff and Consultants

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