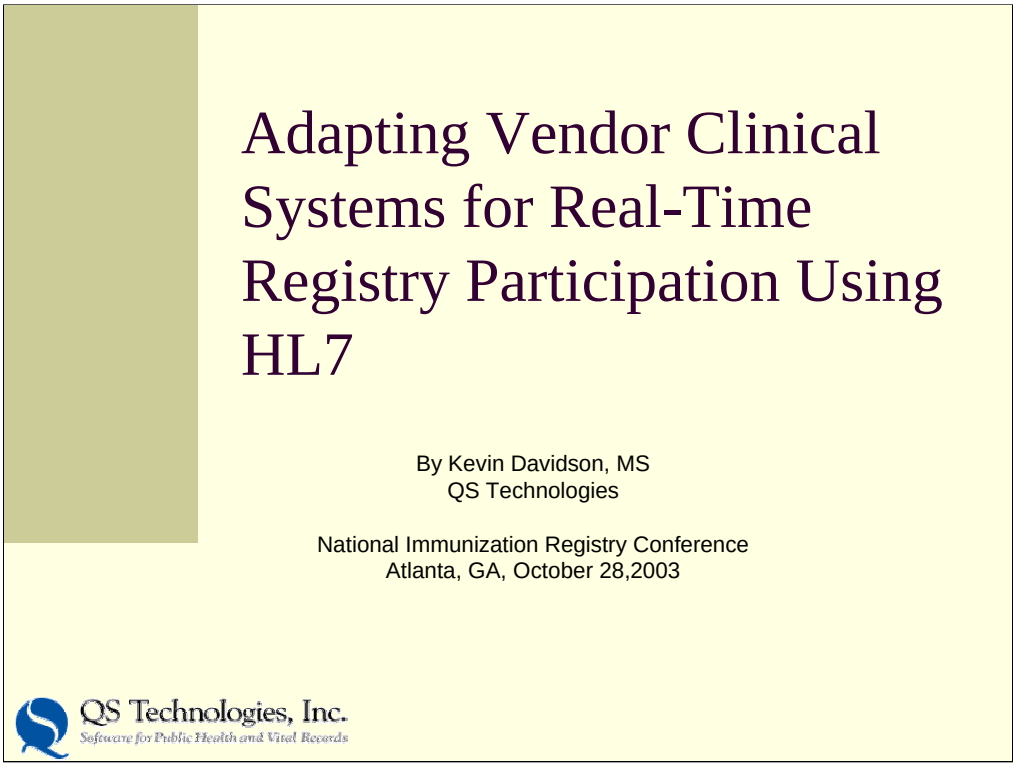


QS Technologies, as part of a contract to provide clinic management software for the Health and Hospital Corporation of Marion County, Indiana, developed a real-time HL7 interface between its Insight clinic management software and the Indiana immunization registry, CHIRP. Indianapolis is the 12th largest city in the United States.

This presentation discusses one approach to adding an interface to a vendor's software package.

The project began with a meeting of all the parties that would be involved in the project:

- •The Software Vendor (QS Technologies)
- •The “customer” – (Health and Hospital Corporation of Marion County)
- •The Indiana state immunization registry (CHIRP)
- •The immunization registry software vendor (Scientific Technologies)

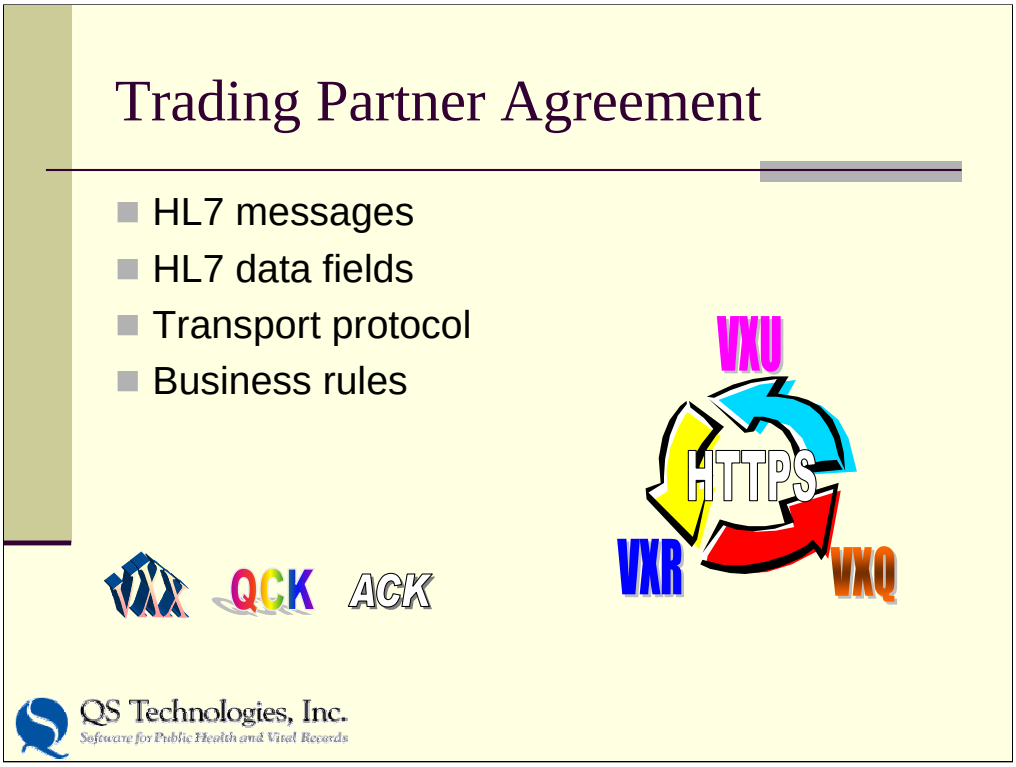
At the stake holder’s meeting a consensus on a two-way interface was reached. We decided that demographic information from the registry would not be stored in the clinic database—only immunization histories.

The HL7 Immunization Registry Implementation Guide and the HTTPS Immunization HL7 standard were selected.

It was agreed that the registry would create staff records for providers from input HL7 messages, rather than having to set them up in advance by phone or by fax.

The project plan was scheduled to begin testing after the August 2003 release of new registry software by STC. Testing was scheduled for completion before the QS general release of Insight 5.1 on December 1, 2003.

We organized the primary point of contact between the technical staffs of the two vendors involved. STC provided liaison with the Indiana Immunization Registry and QS with Marion County HHC.



After the initial stakeholder meeting, technical staff from the participating organizations developed an agreement in principle of how the interface would work. We agreed on what fields the registry would require and what HL7 messages would be supported (VXR, VXX, VXU, ACK, VXQ, QCK).

Just one example of an issue was the medical record number. The CHIRP software requires some unique patient identifier be supplied in the HL7 message. We had to work out which of the HL7 patient identifiers qualified for this requirement.

Another was that the Immunization registry captured guardian information, while the clinic system captured father and mother. Initially we tried to work from a mapping between the two vendor's databases (clinic management system and registry). This was unworkable. Mapping on both sides needed to target HL7 using the Implementation Guide.

It was agreed that the transport would be the HTTPS protocol that had resulted from work within the CIRSET group with participation from both vendors. It was later decided to use the Digital Certificate option for the HTTPS protocol.

Design Goals

- Transparent to the user
- No double entry
- Don’t make the user wait
- Control costs
- Deliver on time

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After reaching agreement between the parties on what data would be exchanged and how, QS began an internal design for the interface to its clinic management software.

As a commercial software vendor, we want to create marketable products that please our customers. From long experience, we know what end user’s hate: slow software and double data entry.

Our design was intended to work in the background and largely unseen, obtaining data from the registry in anticipation of user’s needs. It would be fully integrated with the existing clinic management software’s immunization module eliminating any double entry of data.

For our own benefit, we wanted to minimize costs by making as few changes to the complex clinical software as possible.

Adapting the Software

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The Insight clinic management system is a large software package. Many events occur in the processing of patient data including their immunizations in the system. Because Insight is primarily a public health application, it addresses program-specific areas, such as Immunizations explicitly (as opposed to a general-purpose medical records system or a billing system that might contain immunization data only in the context of other program functions).

However, no matter what system is being adapted, certain basic functions must exist in some way and these functions are patient identification and the recording of procedures performed. These are the key functions necessary to send Immunization histories to a registry. In order to retrieve information from the registry and present it to the user, we looked at two options:

•Presenting immunization history from the registry directly, without integrating it into the clinic data

•Integrating registry data into the clinic database.

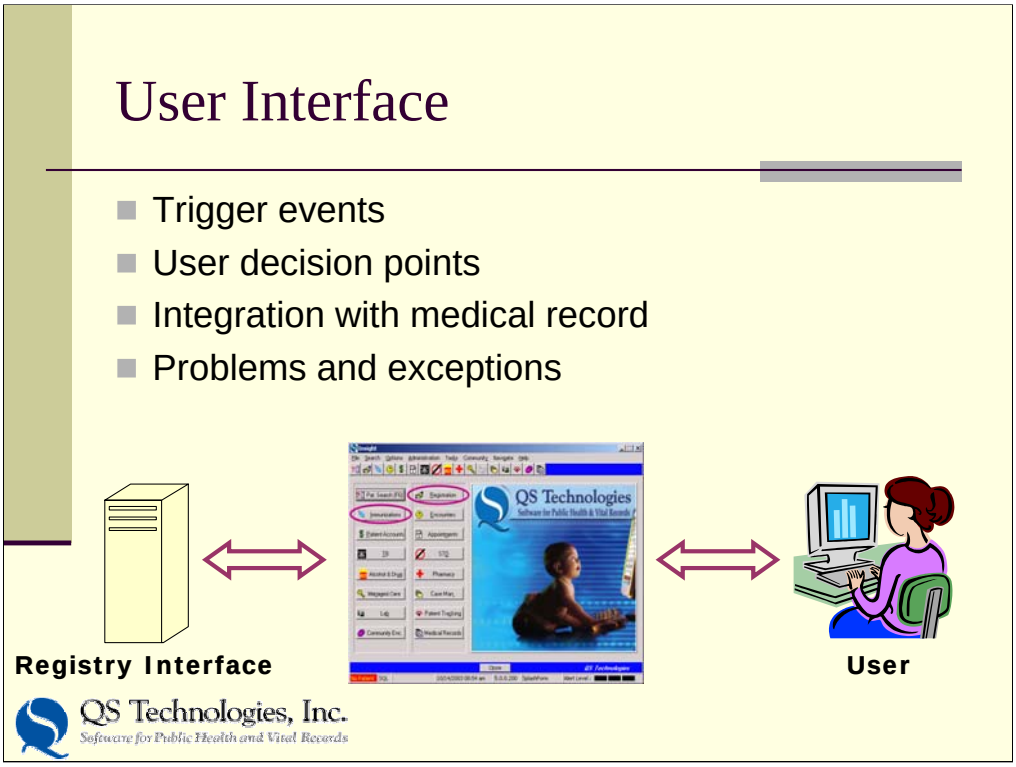
The second approach has clear advantages:

•Local copies of registry history information support functions such as reminder/recall, clinical decision support and reporting.

•Local data is available when the registry is not.

•It looks like one system, not two.

The first option might be considered in the case where the clinic software has no inherent immunization capability.



In modifying the clinic management software we had to identify the points in that software where modifications were required.

Modifications were required to interface with the registry when certain application-level triggering events occurred.

A user interface had to be provided when the user has a decision to make.

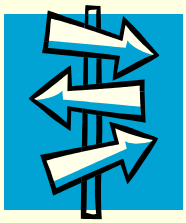
The database had to be reviewed against required HL7 data items. Fortunately, the clinic management system already had a robust immunization component and no additional data items were needed. We did, however, need to add database tables to support the operational aspects of the interface.

We had to merge registry data with the immunization data already in the clinic management system (this turned out not to require modification)

And finally, we needed to provide administrative users with the tools to see the progress of the interface's activity and to force transactions to occur when needed.

Trigger Events

- Registering a new patient
- Changing Demographic Info
- Resolving Multiple Matches
- Changing the Immunization Record
- Retrieving Demographic Info



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We were able to isolate a small set of five trigger events necessary to run the interface.

When a new patient is registered in the clinic management software, we check the patient's age. If it's within parameters, we sent a VXQ to the registry, requesting a vaccination history. This anticipates the patient presenting in a clinic setting where Immunizations could be administered. If a vaccination history is received, it is stored as "historical immunizations" in the immunization tables for the patient. If no history is received, no action is required. If multiple matches are returned, that information is saved for later.

Later when an immunization history is viewed, the user is prompted to resolve multiple matches. When the user makes a selection from the VXX, then the registry is queried again, this time with the unique registry ID number from the VXX. The registry ID number is not used in other situations.

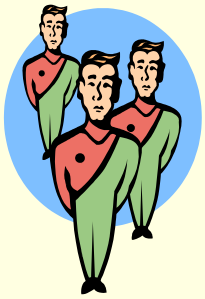
When demographic information is changed for a patient known to be in the registry, then a VXU is sent to the registry complete with vaccination history.

When an Immunization is added, then again, a complete immunization history is sent to the registry. To prevent peppering the registry with VXU transactions, a 5-minute delay is inserted to "collect" all of the updates before sending a transaction. All VXU transactions contain complete demographic information and vaccination history.

When Demographic data is retrieved for a patient, the registry is queried to refresh the immunization history.

User Decision Points

- Is it the same child?
- Is it the same child?
- Is it the same child?



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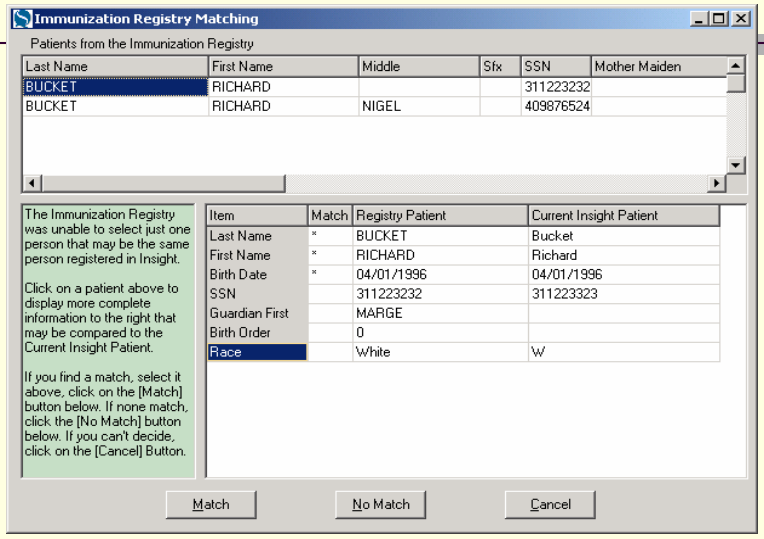
We discovered only one situation where the user must make a decision. This is when the registry is unable to settle on one unique person in response to a query (VXQ).

The VXQ includes all the information we can about the patient. We rely on the registry (which after all is the only repository of all the information about the patients in the registry) to make the determination.

If the registry cannot determine which patient to send, then the user has to get involved.

Resolving Multiple Matches



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We created this user interface form to help a user resolve duplicates. The list of patients from the registry are listed at the top. The user can select each one, and using the comparison chart at the bottom, look at the data from the registry alongside data from the clinic management system. This vertical presentation is easy to follow. The software marks obvious matches with an "*" to assist the user further.

It's important to keep in mind, however, that this process is impossible unless the registry provides enough information to allow the user to make an informed comparison.

Users can sometimes spot typographical errors that software misses.

If the user selects "Match", then the interface requests the full vaccination history from the registry. If they select "No Match" then it is assumed that the patient is not in the registry. If they select "Cancel" then the decision is deferred until the next time the immunization is retrieved, but for all intents and purposes, it is treated like "No Match".

Integrate with Medical Record

- Vaccine
- Lot Number and Manufacturer
- “Opt In” / “Opt Out”
- Distinguish between immunizations the provider gave and history from the registry.

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Because our clinical management software package already had a robust immunization module (including inventory, ACIP recommendations, contraindications and VAERS), no additional data elements were added.

The list above, however, are items that may not exist in some clinical databases

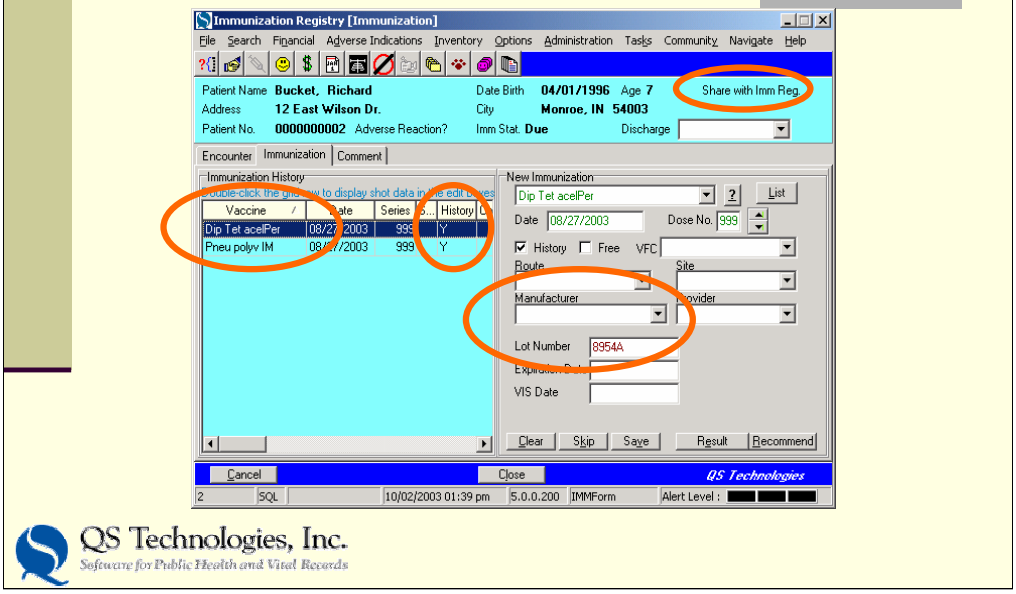
•Vaccines may not be recorded with complete specificity

•Lot Number and Manufacturer are needed

•Permission for registry participation must be recorded

•The clinical system needs to distinguish between shots given by the provider and those supplied by the registry.

Integrate with User Interface



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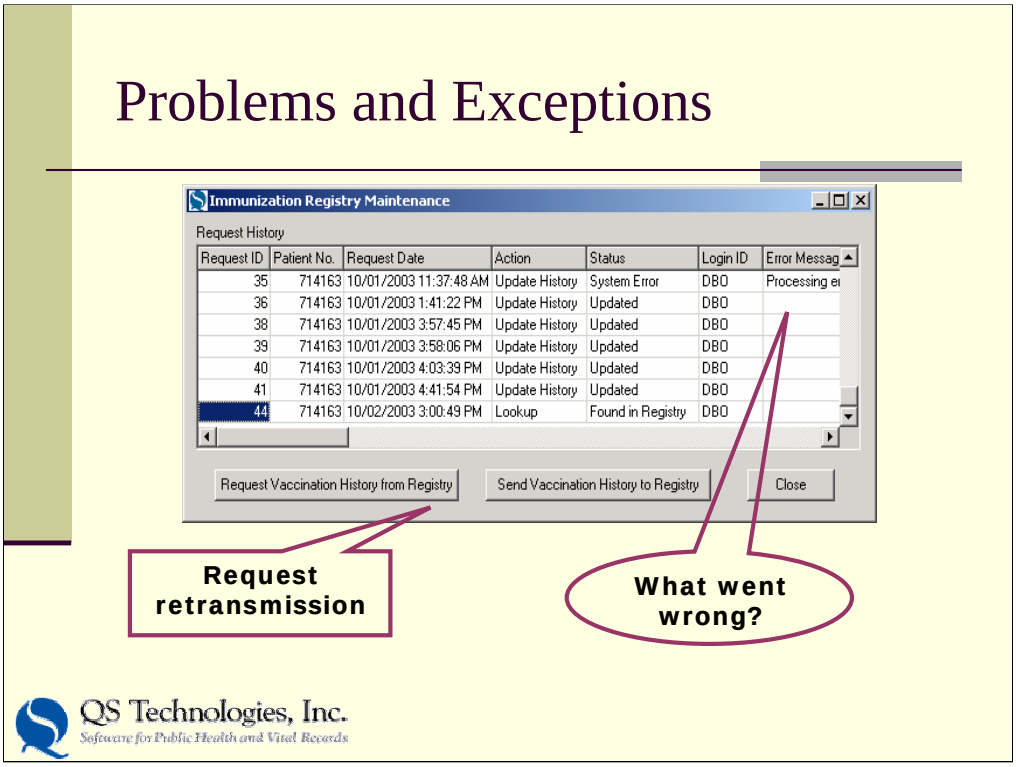
This screen is from the Insight Immunization module.

The circled items above show data fields important to immunization registries that might not be included in some medical software packages not designed specifically for immunizations.

Problems and Exceptions



We hope nothing goes wrong, but it's easier to plan for this up front.

This administrative screen shows each request to the registry for a particular patient from the clinical software. The Action is what the clinic software asked for. The Status is what happened.

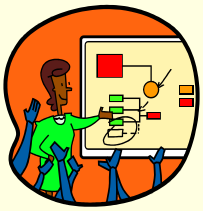
The user can force an immunization history to be sent to, or requested from the Registry at any time by clicking the appropriate button.

This form can also be used to support HIPAA privacy and security requirements.

In normal operation this form is never seen.

Technical Design Principles

- Minimize changes to vendor software
- Isolate HL7 and communications
- Control, monitoring, debugging and logging functions



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When actually implementing the modifications to the clinic management software, we tried to make things easy on ourselves.

We tried to minimize changes to what was a very complex immunization module.

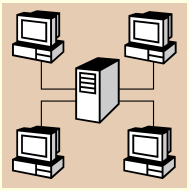
We wanted to put the HL7 interface and communications “somewhere else”.

We needed to provide control, debugging, monitoring and logging functions.

Database Interface

The clinical software just reads and writes database tables

- Off-the-shelf technology
- Isolates HL7 and communications
- Works with both n-tier and host-based systems.
- Supports mixed platforms
- Asynchronous



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We came up with a database interface that works as follows:

When the clinic management software wants something from the registry, it writes a record in a “request” table. This is a short record that just identifies the patient by unique internal ID number, and says what is being requested (basically a “send to” or a “get from” request).

A stand-alone interface server program monitors the database for new requests. It accesses the clinical database for immunization histories and demographic data, mapping to and from HL7 and communicating with the Immunization Registry.

Through this approach, the HL7 engine and communications software need be deployed only on one computer, not on each client workstation.

Because the interface server is not part of the clinic management software, it can run on a machine and operating system other than the clinic management database. As such it can work with multiple databases and application architectures.

Finally, because the interface server is separate, the application doesn’t have to stop and wait for things to happen with the registry.

Four new database tables were created to support the Interface:

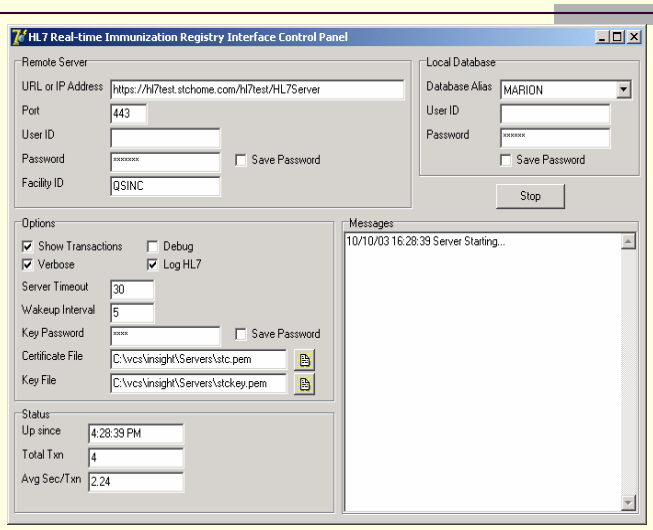
•IIREQ – Requests to the interface and status information

•IIREQX – Returned VXX information from the registry

•IIREQD – Deleted immunizations in the clinic system to be sent to the registry

•IIREQLOG – Transaction log including HL7 messages.

Control, Monitoring, Debugging



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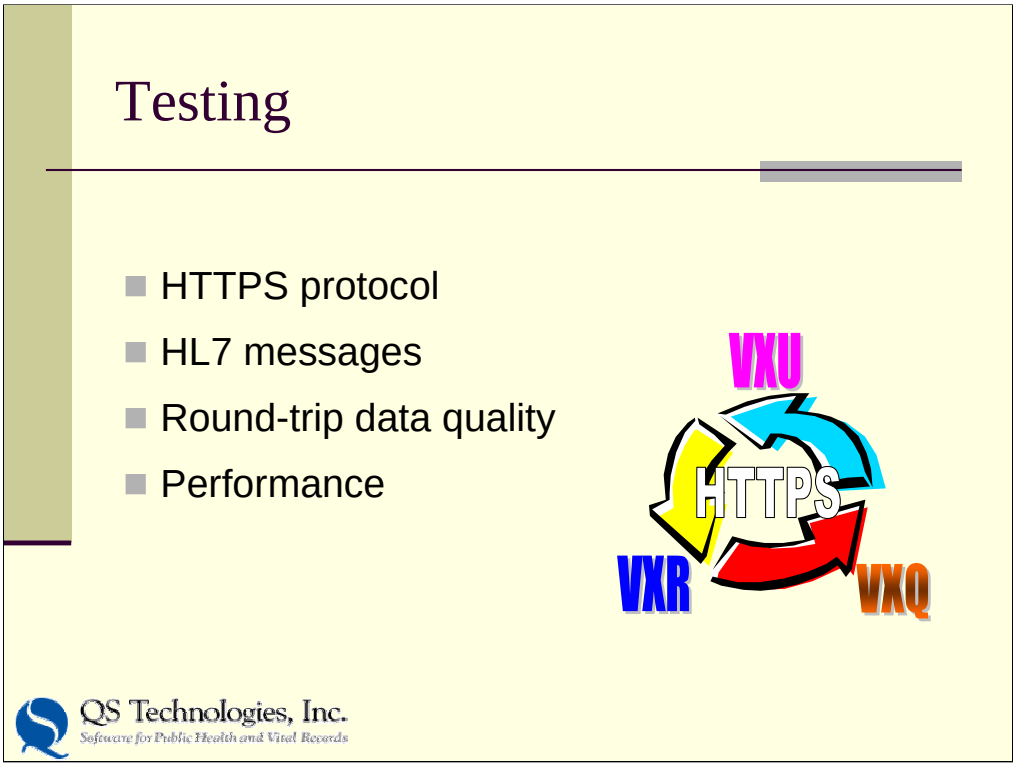
We built this control and monitoring interface for the server. It can provide statistics on server performance and dump HL7 messages for debugging purposes. The User ID fields have been blanked out for security reasons. The passwords are non-display in the actual running application.

In future software releases, we may separate the configuration from the control windows.

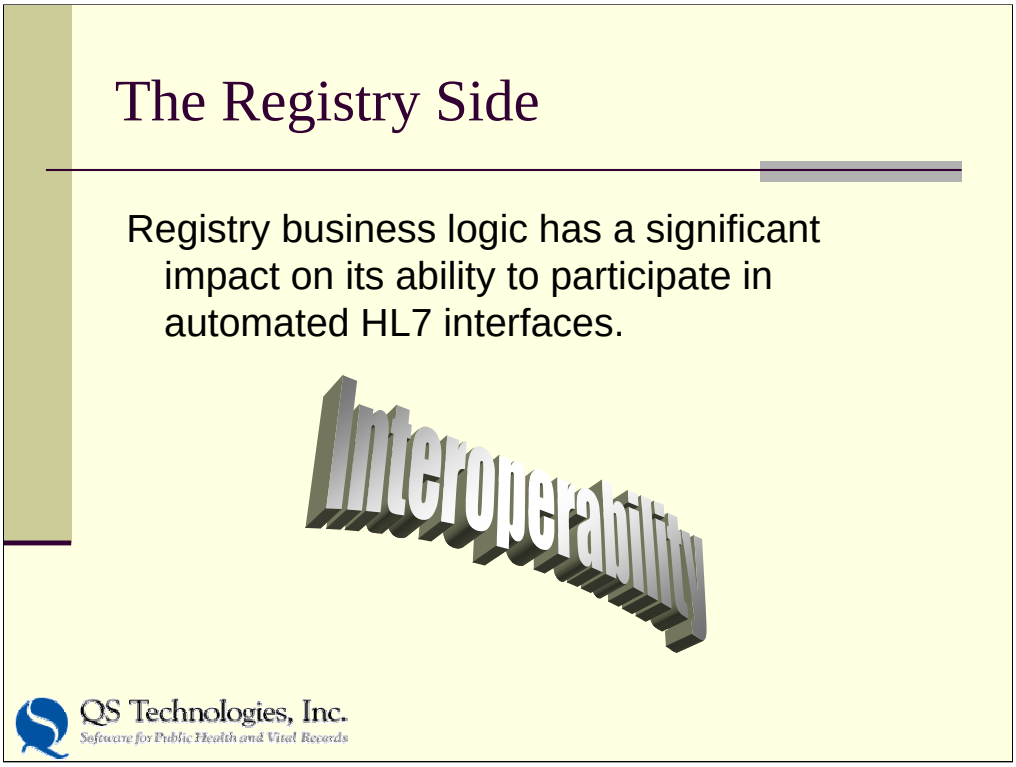


Overall, testing went well. Both vendors were writing new software, so some garden-variety bugs [no pun intended] were uncovered.

Two important factors made things go well:

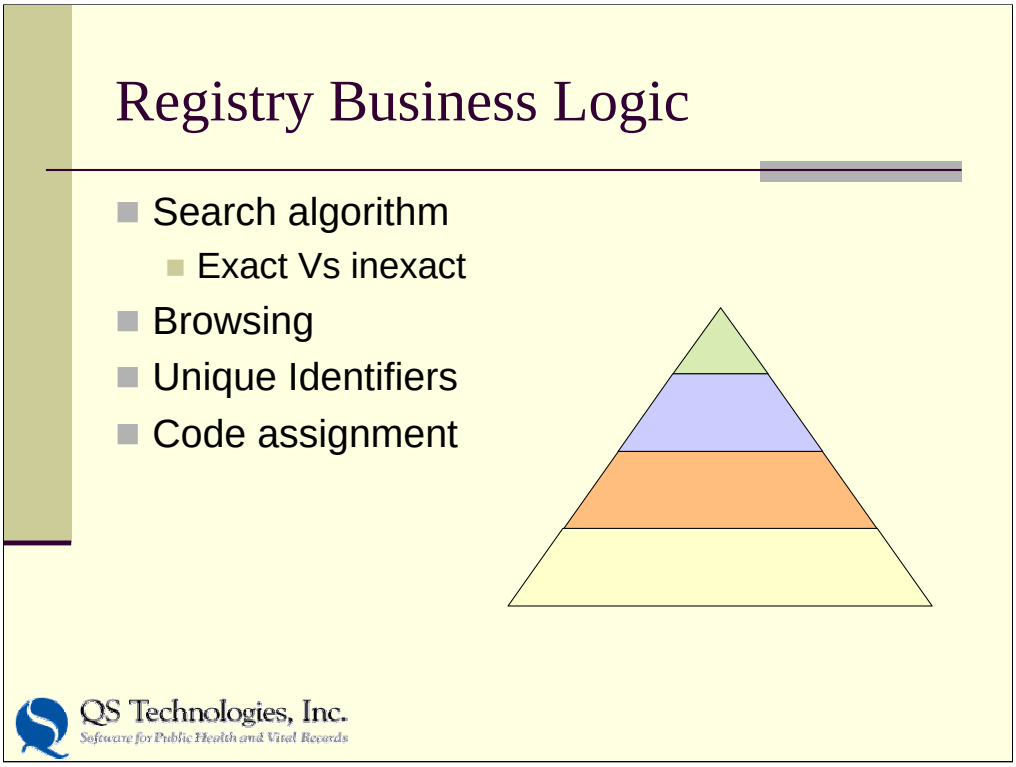
1) The HTTPS protocol allowed immediate feedback on the success of message transmission. Because of the nature of the standard, it was not necessary for both vendors to schedule testing at the same time. We could test whenever we were ready. Sending a VXU and then being able to query it back for comparison allowed a round-trip test to be conducted from one end.
2) The trading partner agreement set expectations at the outset. There were few surprises. The HL7 standard itself allowed painless arbitration over what was “correct”.

Informal test results over the Internet showed transactions averaging just over 2 seconds.



Vendors benefit from a rich HL7 implementation at the registry. They need to be able to deploy their solutions in different states. They don't need to make customizations for non-standard (not HL7 Implementation Guide compliant) state HL7 implementations.

In our project we lobbied hard for (and succeeded) making our project 100% Implementation Guide compliant. (100% compliant means that everything in the HL7 messages is compliant, not that 100% of the Guide is implemented).



The single-most critical issue continues to be vaccine queries. If two automated systems are going to communicate without constant human intervention, then they need to be able to identify patients.

Exact search algorithms are not going to work. The registry has to be smart enough to deal with common typographical errors. It has to work with real-world data and make correct selections.

I would venture to say that registries that do not permit inexact matching and limited browsing will not be successful with two-way electronic interfaces.

Registries must provide service to patients whose records have typographical errors or who have names very much like other participants.

For clinic systems to communicate with registries in the context of patients that are close demographic matches, some system of unique identifiers must operate within a limited context. The registry needs to share its internal identifiers in VXX messages, and it needs to store the medical record number of the clinic system from VXU.

In the HL7 world, real time transactions can't wait for someone to call up the registry for the assignment of a code. Registries have to adapt their coding schemes to accommodate delegation of the assignment of some codes. Of course, everyone must use HL7 standard codes where applicable.

Watch Out!

- Just because it doesn't blow up, doesn't mean it's working right!
- Don't store an immunization when none was given!
  - Deletes
  - Vaccinations Refused
  - Contraindications
- Opt-out
- Deceased patients

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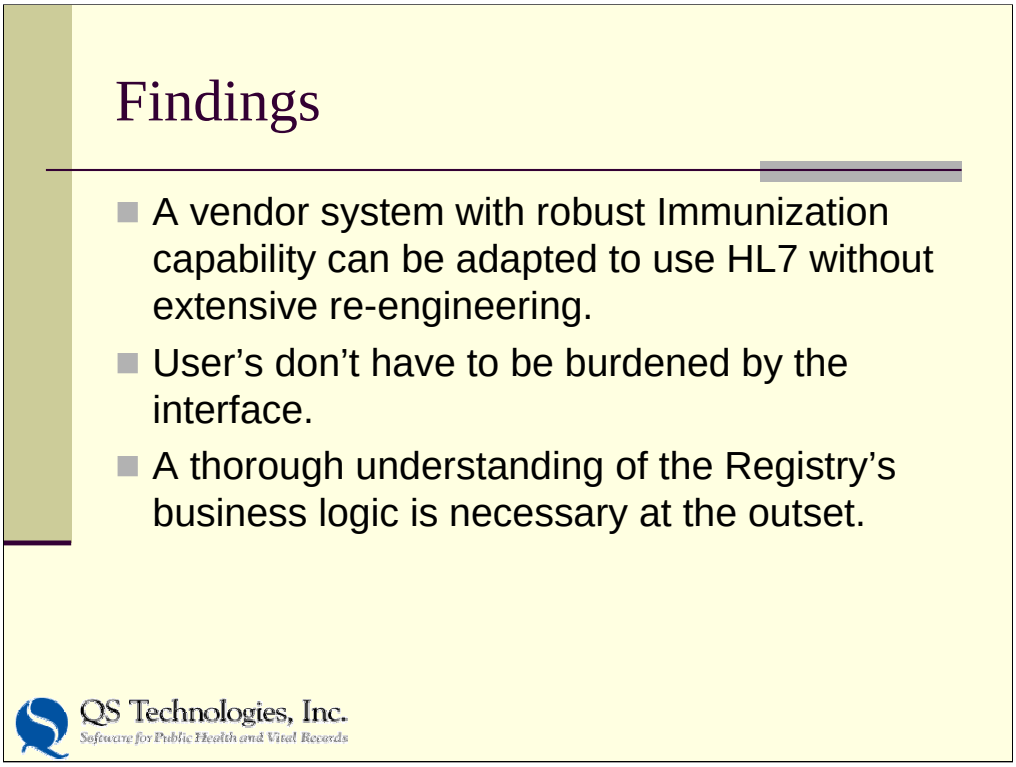
With an automated interface, fewer human eyes look at the transactions. Computers can happily process data that humans see as ridiculous. Just because it doesn't blow up, doesn't mean it's working right. If the vendor system reports 100% of its children as "deceased", who will spot it?

There are legitimate RXA (Vaccine Administration) segments that don't indicate that shots were give. Registries have to make sure that their HL7 implementation is complete. Vendors have the same responsibility if they store registry data in their own databases.

Registries must also implement "opt-out" legislation in their states, and properly process the flagging of deceased patients.



Some modifications in the user interface of clinical software are necessary to effectively connect with an immunization registry, specifically in the area of patient identification. It is possible to create a non-intrusive implementation of a registry interface within a clinical system. The key factor in the success of the interface is the quality of the immunization registry's patient identification methods. Refining the user interface is an ongoing project.

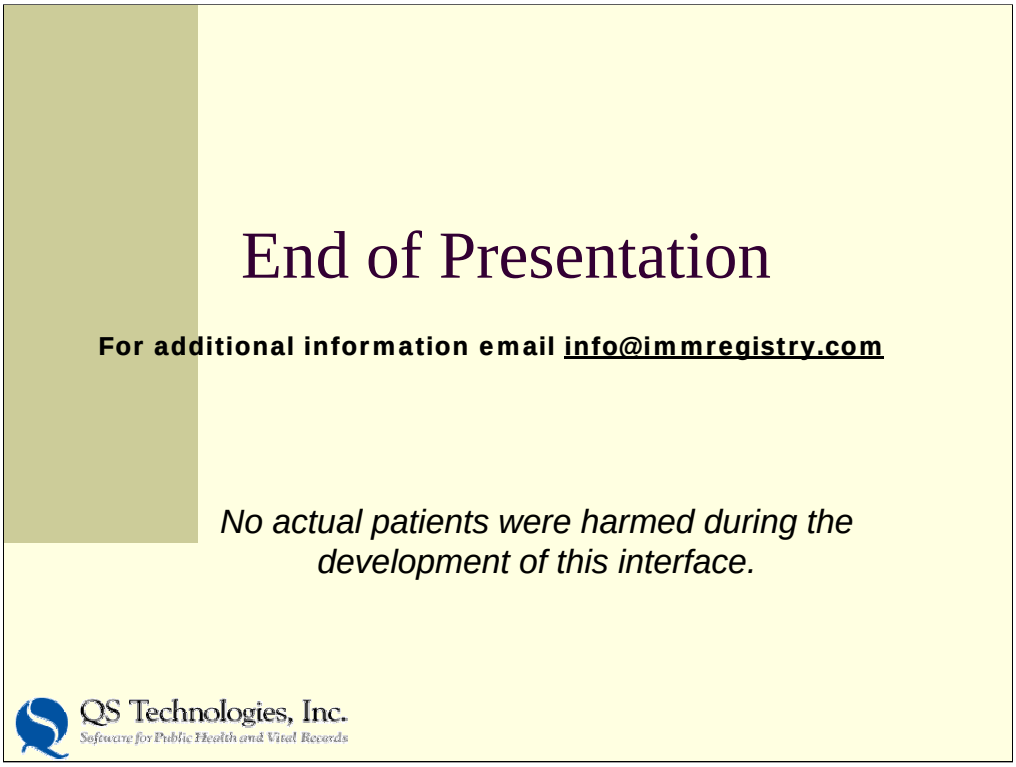
We found our own Immunization Registry Real-Time HL7 interface to be an interesting and satisfying project.

Having a robust immunization module and a strong background in HL7 to start with was certainly a plus in making the project quick and painless. Vendors without HL7 capability may want to consider consulting with other companies for a quick start.

We believe that keeping all the complexity of the interface "under the covers" will make the implementation successful from the user's viewpoint.

It is important that both registry and clinic software vendors understand how the other is using HL7, especially in the handling of searches and multiple matches.

Full interface testing between QS and the registry software vendor, STC has been concluded. Delivery to the customer is scheduled for mid-November 2003. Live production is scheduled for February, 2004.



For additional information email info@immregistry.com