Background and Evolution

In 2007, when Niagara Region was working on its pandemic planning, it wanted to investigate new ways of using technology to support the medical needs expected during a pandemic (including mass immunization and alternate assessment centres). The focus was on developing a software application that could support clinic operations, drive client throughput, and allow the examination of workflow and management of patient records in all community-based influenza immunization clinics. The main factors motivating the initiative were:

- **The opportunity to streamline processes in order to make the service operate more effectively.** Inefficiencies in the paper-based model of immunization service delivery were recognized. The goal of the project was to implement a design that facilitated client immunization records at point of delivery, enhanced work flows, improved communication, provided inventory control, and had the ability to gather real-time data to promote effective decision making during seasonal immunization programs and pandemic influenza outbreaks.

- **The need to deliver service with fewer staff.** Niagara recognized that during a pandemic, resource needs would be high but resources would be limited. It was also recognized that an electronic system would enable nursing staff to process more clients than they could with the traditional paper model.

- **The opportunity to leverage new technologies.** Leveraging this type of technology raises the bar for infection control measures and provides a safer and more time effective approach to health care delivery. Niagara is passionate about the benefits and power of technology within the public health environment. “Medical Informatics and Innovation” is one of the 2010 public health strategic goals.

- **The desire to improve client satisfaction.** Niagara wanted to see an overall increase in taxpayer (client) satisfaction with better use of the Region’s resources, more efficient clinical service, and overall reduced cost.

Niagara recognized the many inefficiencies in clinic delivery of community influenza vaccination, including a manual paper-based system, redundancies and ineffective use of resources. The idea of developing a system to address these inefficiencies was initially brought forward to Niagara Region’s senior management team for approval. After much discussion, it was agreed that the application should be developed in house, using Niagara Region IT Solutions business analysts and programming staff. The application
(hereafter described as the Software) was developed in 2008 and piloted with great success in November 2008 during the community seasonal influenza campaign. In the early stages of this project, the Region had felt that the technology had merit in the provincial and even in the federal sphere. Thus, it engaged the Ontario Ministry of Health and Long Term Care (MOHLTC) to discuss the technology’s prospects.

In April 2009, the pandemic H1N1 (pH1N1) influenza hit. Recognizing the need to ramp up mass vaccination campaigns to provide vaccine delivery in the most effective and efficient way to communities across the province, the MOHLTC requested proposals from public health units with pre-existing software. With full support from Niagara Region’s Medical Officer of Health and Board of Health, Niagara was selected to further develop, implement and support its mass immunization software. With this combination of leadership from MOHLTC and the Niagara Region’s willingness to take a risk in a time of uncertainty, 29 out of 36 public health units across the province successfully utilized the Software to support their mass immunization clinics.

The Software supports immunization clinic operations for the community, who receive vaccines through Niagara’s Vaccine Preventable Department. Currently, the Universal Influenza Immunization Program that was initially used to pilot the Software is funded by MOHLTC. During the (p) H1N1 period, both the seasonal and the pH1N1 vaccine were distributed at community clinics. The Vaccine Preventable Department mandate states: “The board of health shall promote and provide provincially funded immunization programs to any eligible person in the health unit including board of health based clinics, school based clinics …”

The Innovation

The innovation is a customized Software application developed by Niagara Region to address components of a mass immunization clinic, including information collection, patient movement and quality control. This paperless model automates client immunization records at point of care, streamlines client throughput within a clinic, and provides a central repository for analysis and reporting capabilities. The Software was designed to optimize the six clinic activities that drive clinic throughput:

1. A client enters the clinic where a receptionist records demographic information by swiping the client’s Ontario health card and/or driver’s license, using a magnetic strip reader attached to the laptop computer.
2. The receptionist directly inputs the client’s medical history into the software application.
3. Client names are automatically time stamped and placed in a queue within an electronic waiting room.
4. The client is directed to a vaccination nurse when one becomes available and where the client’s information is brought up on a medical information/history screen and reviewed by the nurse.
5. Using a pre-populated drop down list of available vaccines (e.g. lot number, dose) the administered vaccine is recorded for the client.
6. Immediately post-vaccination, clients are provided with a paper record of the immunization received that is generated by the application.

Elaboration on these points is provided below.

The Software is innovative in several ways.

**Immunization Clinics.** Use of the Software allows for a more efficient model at a time when resources are significantly limited. This aggressive electronic approach provided an easier environment for staff to manage patient flow, and reduced the manual process of entering patient data into the system. A centralized data system provided a standardized approach to health care delivery and facilitated communication between associated stakeholders such as the Medical Officer of Health, Incident Management Unit, and MOHLTC. The ability to provide this level of service to the public enabled patient flow to progress faster, thereby reducing the required staffing load at a site, while providing better quality of care and greater public satisfaction.

With the use of a swipe card reader, the Software utilized Ontario health card and drivers licenses to pull demographic information into a client’s immunization record. This decreased manual data entry, increasing accuracy and efficiency of client throughput.

**Surveillance and Communication.** The Software enabled the surveillance team to provide accurate real time information. Real time data was used to ensure that consistent and reliable information was made available. Reports and analysis provided valuable business intelligence, including, for example, effects on client throughput of the implementation of client eligibility guidelines for receiving a vaccine. In addition, clinic time study analysis could be completed to provide a definitive understanding of the capacity of clinical service based on resources, hours of operations and staffing needs.

**Inventory Control.** The Software facilitated better inventory control and minimized the possibility of individuals attempting to abuse the health care system. This was especially important at a time when there was high demand for the vaccine and restrictions on administration.

**Partnerships**

The success of the Software resulted from senior management’s buy in, collaboration and a sense of ownership between two Niagara Region departments - Niagara Region Public Health and Niagara Region IT Solutions. Unlike the traditional transactional service based model of IT services, during this initiative IT was a full partner in delivering client services, an integral part of the strategic planning process, and viewed as part of the business.

Upon the declaration of a pandemic, the MOHLTC chose to fund Niagara Region to develop the Software further and to train and support public health units that chose to use it for their mass immunization clinics. This partnership started with full support from Niagara’s Medical Officer of Health and Board of Health, and included co-operation
among the commissioners of all departments in ensuring allocation of space for software testing and training and in providing staff to develop and support the project.

With proven success and subject matter expertise on the technical and operational side of electronic clinic models and limited time for implementation, MOHLTC and Niagara agreed that the Region would continue with development, training, and support rather than hand over the Software to the MOHLTC for their technical team to execute.

Niagara Region asked all public health units that chose to use the Software to sign both Service Level Agreements and Licence Agreements. All health units signed a service level agreement that outlined in detail the services to be provided. The Region retained ownership of the intellectual properties and defined the training and support that was provided. Each public health unit identified its Software leads who consisted of technical and public health staff. They were responsible for attending train the trainer sessions and supporting their local clinic staff.

**Performance Measurement**

Service delivery performance was measured for both partners and the public.

**Service Delivery to Partners:**

<table>
<thead>
<tr>
<th>Description of the Performance Measure</th>
<th>Frequency of Measurement</th>
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<tbody>
<tr>
<td>1. Training Surveys</td>
<td>1. One per trainee following training sessions</td>
</tr>
<tr>
<td>2. Initial Software Satisfaction Surveys</td>
<td>2. One per health unit 3 weeks after implementation</td>
</tr>
<tr>
<td>3. User Survey</td>
<td>3. One per public health unit staff</td>
</tr>
<tr>
<td>4. User Feedback Forum (Focus Group)</td>
<td>4. 2 months following completion of clinics</td>
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**Service Delivery to the Public:**

<table>
<thead>
<tr>
<th>Description of the Performance Measure</th>
<th>Frequency of Measurement</th>
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</thead>
<tbody>
<tr>
<td>1. Staffing model</td>
<td>1. When required to make new clinic</td>
</tr>
<tr>
<td>2. Number of Clients Processed per Clinic</td>
<td>2. Nightly</td>
</tr>
<tr>
<td>3. Average Processing Time for Nurse/client</td>
<td>3. Following pH1N1 Campaign</td>
</tr>
<tr>
<td>4. Average Processing Time for Clerk/Client</td>
<td></td>
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<tr>
<td>5. Factors Effecting Client Throughput</td>
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Use of the Software provided a wealth of data that could be transformed into knowledge that could not have been captured using paper. Use of the Staffing Model, for example, made it possible to justify staffing needs based on expected client uptake. This innovative way of assessing staffing needs minimizes overstaffing and decreases overall costs.

Additional metrics included assessing business processes after the fact. These included average client throughput through the clinic (i.e. average time client spent within the waiting area and average time client spent with nurse).
Issues/Challenges Encountered

Early Challenges (2007 - 2008)
When the idea and needs assessment for this software application were initially being developed, the scope of the undertaking was very large. It incorporated many stakeholders and involved a high level of risk. After the scope was refined, the Software met much better the specialized needs of immunization clinic operations.

Provincial pH1N1 Challenges (2009)

Communication
Niagara Region faced many challenges when it was selected to further develop, train and support public health units throughout Ontario. Both the IT and Public Health Departments in the Region indicated that communication was the greatest challenge involved in deploying the application to external public health units. For example, due to many policy changes directed by the MOHLTC during pH1N1, further development of the Software was required even after the initial implementation date. The requested changes did not always come from a single source (i.e. MOHLTC); at times, direction came from local senior management on behalf of the MOHLTC. This indirect communication made it tricky to gather development requirements, especially when time was of the essence.

Emergency events tend to be complex and chaotic and to lend themselves to mixed messages. The lack of a clearly identified authoritative source of information resulted in mixed messaging to the public, which in turn impacted communication and messaging to clients at a local clinic level. There was a lack of clear messaging from the higher level agencies, that is, the World Health Organization versus the Canadian federal government versus the Ontario government. Clients at our clinics asked many questions regarding the discrepancies they heard in the news media.

The Software - Requested Changes
During the pH1N1 campaign, there were many changes in policies (e.g. changes in client eligibility, mid-campaign introduction of new vaccines) that required revisions to the Software. The requested changes did not always translate well at the clinical level. For example, the Software must be flexible enough for clinicians to sometimes go outside of political decisions to make the right medical decision.

Training
Since public health unit size and capacity varied, Niagara had to provide different levels of training. Larger public health units had the capacity to have on-site IT staff at their local clinics which meant that from a training perspective Niagara did not have to provide their frontline staff with clinic/hardware setup training. The opposite was true for small public health units that relied on their administrative/nursing staff to assemble clinics.

Although public health units had a common goal of injecting clients with vaccine, that process often varied between the units. With the introduction of the Software, the units had to alter their processes to allow the Software to effectively drive their clinic
operations. During training, Niagara had to assist health units and provide tools or “work arounds” to prevent undue interruptions in their individual clinic practice.

**Support**
Niagara Region was essentially providing a service to two different customers, the MOHLTC and external public health units. The functional needs for the Software were dictated by the MOHLTC. These changes directly affected the public health units using the software.

As noted above, there were many policy changes during the pH1N1 period that in turn required software additions/changes. These frequent requests for system upgrades in turn required the external public health units to update their clinic computer servers constantly to ensure they had the newest version/functionality.

When completing the workshop to capture user feedback, public health unit staff stated that better understanding of the new functions of the software as they were released mid campaign would have been helpful. Moreover, users felt that if they had a better explanation of the software changes from their side, they would have relayed that information to their frontline staff.

Due to time constraints, the highest level of customer service was not met. In the future, Niagara plans to use a support services software program to track service requests that will provide the customer with a ‘ticket’ with the date and time the request will be addressed.

**Niagara Region (Local Clinic) Challenges (2010)**

Providing adequate resource needs and support was often challenging. Niagara, at times, was trying to provide support both at the local clinic level and to the external public health units. This again showcases the demands that need to be met in an emergency event and staffing limitations for meeting this need.

**Benefits**

Compared to the paper-based model of service delivery, the Software shortens the time needed to process clients through a clinic. Clients no longer have to fill out paper work; now they provide their health card and/or drivers license for efficient electronic input of their demographic information. Rather than reading a list of questions on a paper form, clients are verbally asked the questions during registration. They no longer need to take numbers to see the next injection nurse available; instead, their name is called out in the waiting room upon nurse availability. After completing a visit with an injection nurse, clients automatically receive a copy of their proof of immunization that is printed for them while they wait in the recovery area.

Returning clients are processed even more quickly than in the previous year because their records are automatically pulled up from the previous visit, their demographic and medical history is verified, changes or additions are made, and they progress to the waiting area. Feedback from clients on their experience with this method of delivery was extremely positive. A Niagara Falls Review reporter described his experience at a clinic
as “the most efficient and friendly government-run operation I have ever encountered.”’’ The reporter further commented: “Thanks to the use of a computerized registration system, there were no long forms to fill out.”

Other Canadian jurisdictions that chose paper-based models reported that clients were seen every six minutes per nurse, with wait times as long as six hours. In comparison, with the use of the Software, client processing and clinic optimization resulted in clients being seen every 3.5 minutes with wait times not exceeding 1.5 hours. Based solely on nursing staff time efficiencies, estimated savings of $100k were realized in Niagara (based on the 54,288 Niagara records) and approximately $3.5M saving provincially (based on the 2,000,000 provincial records). In addition, it was crucial during the pandemic to vaccinate as many members of the community as possible. With the Software managing clinic throughput, nurse hours to process a volume of 54,288 clients can be reduced from 5,428 to 3,850. This translates into reducing the number of fully staffed mass immunization clinics from 34 to 24 (8 hour clinics employing 20 nurses).

The Software also provides a wealth of information for developing tools and models for better business intelligence, including providing historical, current, and predictive views of business operations. Having up to date client immunization records and effectively using this information empower decision makers with the tools to assess future needs. The proven effectiveness of service delivery and analytical capacity makes the Software an invaluable resource.

An additional benefit of this innovation was the ability to test Niagara’s model of partnership and service delivery during a pandemic event. Niagara had the opportunity to test a mixed model of governance and leadership between Niagara Region and the MOHLTC and provide a service that broke down silos between public health units in an emergency event.

**Critical Success Factors**

The success of this initiative can be captured in the four categories depicted below:

**Vision**

When developing its Pandemic Planning needs, Niagara Region considered how service could be most effectively provided in a mass immunization clinic. Initial ideas for using technology and innovation to meet this need were developed. The solution encompassed
a vision that was greater than Niagara and was seen as something that could have potential application in the provincial and/or federal spheres.

People
Leadership from Niagara Region’s senior management in both Public Health and IT Solutions was essential. With the right mix of leadership from Niagara Region, as well as MOHLTC’s funding to support development and implementation, public health units could use technology in their mass immunization clinics.

System
When considering the use of the software for the provincial initiative, Niagara Region could point to success during the 2008 pilot project. The Software scope was clearly laid out and realistic with the deliverables. Development was understood to be standardized and not customized per public health unit. Finally, the Software was built to run on a non-sophisticated technology that could be implemented easily between environments.

Process
Process considerations can be divided into the two categories of training and support.

1. Training
   - Training incorporated both IT and public health unit staff to ensure an understanding of clinic operations and how the technology would be used.
   - Over a two-week period, training was completed for one to four public health units per day (5 – 30 trainees).
   - The day of training contained a mix of PowerPoint presentations, hands on use of the technology, and questions and answers. Separate technical-focused sessions were also conducted.
   - All training was completed in Niagara.

2. Support
   - All public health units were supported by both the technical and clinic operational sides.
   - Access to assistance was made available from 8:00 a.m. to 4:30 p.m., five days a week.
   - Technical tertiary level support and clinic operations inquires were accepted.
   - Direct Telephone numbers to a person, and direct email support were accessible.

It was essential that Niagara’s success level be transferable to other public health units throughout Ontario that adopted the software. In keeping with Niagara’s dedication to high-quality service, a satisfaction survey was distributed in the early stages of implementation to obtain feedback from users. Seventy-five percent of respondents were either strongly satisfied, or satisfied, with the software system. In addition, 98.2% of participants felt this system would be a worthwhile and valuable asset to public health. Following the pH1N1 campaign, Niagara hosted a user workshop to acquire feedback on successes and challenges and to discuss opportunities moving forward. Twenty-nine
public health units had staff attend in person or via teleconference. When invited to write one word to describe their response to the software system, respondents wrote such words as “outstanding”, “fabulous”, “effective”, and “efficient”.

Learning Points

Governance
Based on this unique collaboration between MOHLTC and Niagara Region, a service was successfully provided to many public health units across Ontario. This speaks to the governance structure of this relationship. The ability of the MOHLTC to allocate funding for Niagara Region resources and provide enough autonomy for the Region to complete the necessary development, training, and support delivery were key to the success of this initiative.

Leadership
Initial investigation and development for the Software were directly attributed to the willingness of Niagara’s senior management to consider an idea outside of conventional norms and set a new standard for public health community vaccination delivery. The partnership between public health and IT enabled collaboration and leadership to ultimately steward an electronic model of vaccination delivery services. Cooperation between Public Health and IT Solutions created an innovative, cost-effective solution that delivered enhanced service to the client.

Change Management
Changing tides include the introduction of technology into every day clinical practice. This initiative has empowered front line staff with opportunities to demonstrate their technical abilities and competence.

Next Steps
Niagara is continuing to develop the Software, based on user feedback, for the upcoming 2010/11 seasonal influenza campaign. Currently, 17 public health units across Ontario have chosen to continue using the software to support their clinics. Future usages for the Software may include emergency outbreaks within a local community, school-based immunization programs, and expansion to allow for compatibility with a central data repository, such as provincial or federal databases (Panorama or IPHIS).

For 2010/11 the development of the Software will include implementing bar code readers in order to research the effectiveness, readability, and reliability of bar codes on vaccine vials. Advances in health care technology such as bar code scanning on vaccines, have a positive impact on the accuracy of documentation, as well as fostering quality assurance, reliability and higher standards of clinical practice.

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