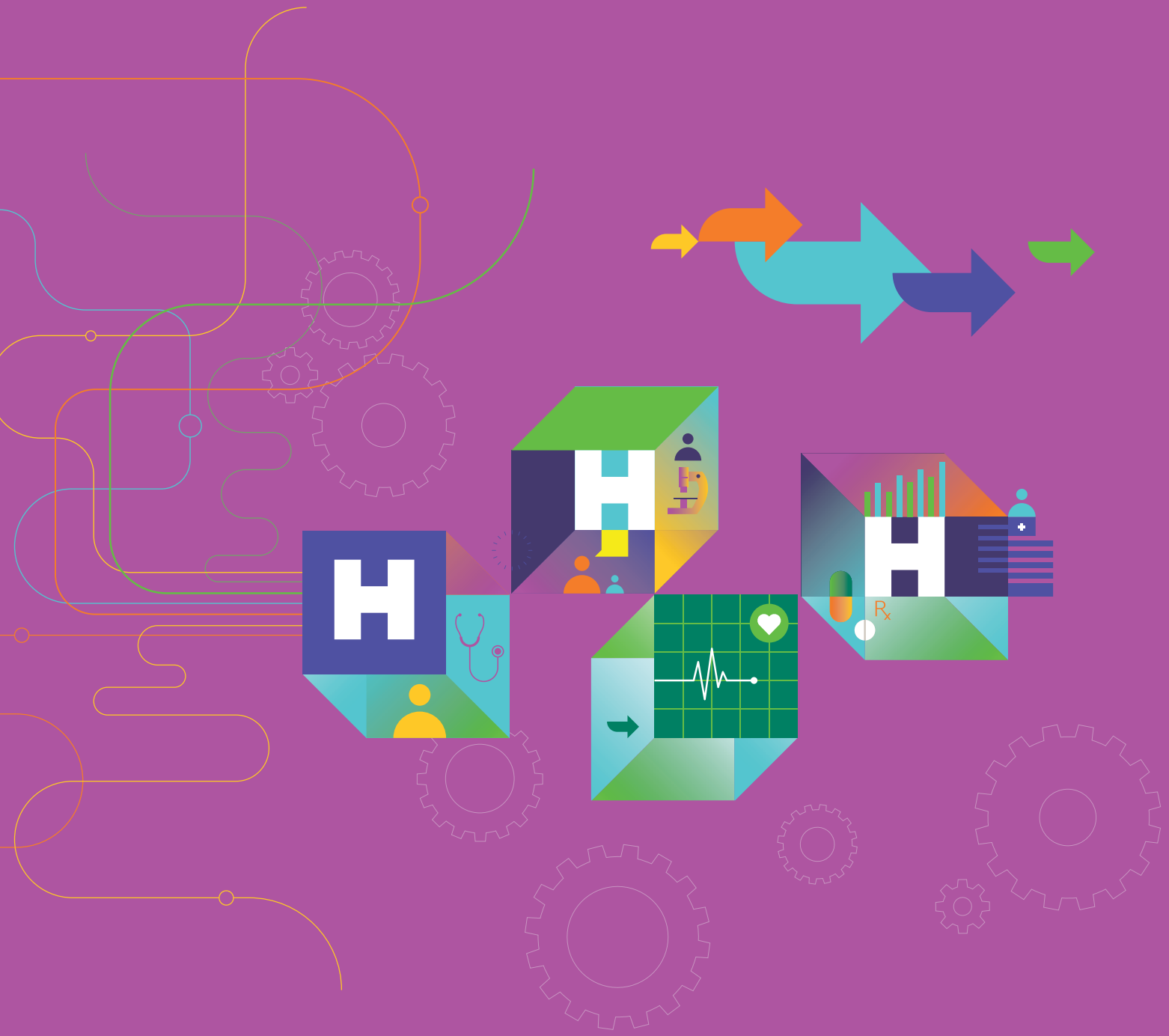
Redesigning Care through Digital Health Implementation

Lessons Learned from Ontario Hospitals



Ontario Hospital Association

Acknowledgements

The Ontario Hospital Association (OHA) would like to thank all the member hospitals and provincial partners who contributed to this resource. Individual contributing authors are noted at the end of each story. The OHA also acknowledges the ongoing and valuable work of all health care professionals who embrace change as hospitals innovate to improve care delivery and patient experiences.

Disclaimer

This publication is a collection of hospital submissions showcasing digital health implementation initiatives across the province. It has been created for general information purposes only and implementation suggestions should be adapted to the circumstances of each hospital. Hospitals should seek their own legal and/or professional advice and opinion when developing their organization's approach and plans for digital health implementation.

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Introduction

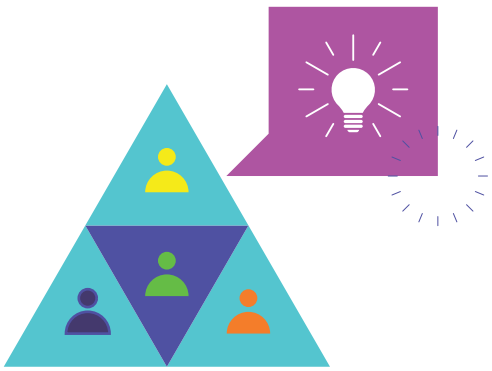
Digital technologies have, and will continue to, dramatically change the delivery of care in Ontario's hospitals and health care organizations. However, technological innovations are not solutions in themselves, but offer a powerful opportunity to redesign the way care is delivered and leverage existing resources, streamline processes, and modernize care. Hospitals across the province are actively working with local and provincial partners to jointly identify opportunities to utilize technology to enable more seamless, high-quality patient care.

This publication is a collection of stories showcasing successful digital health implementation in Ontario hospitals. Each story is focused around a key challenge, an explanation of the process taken to address it, and a reflection on the impact of the work in question. Hospitals have also shared valuable insight into the lessons learned in the achievement of their goals.

In gathering these examples of technological adoption, contributing authors were asked to choose from a predetermined set of success factors[1] which they considered most relevant to the successful completion of their initiative. Factors most often selected were (in descending order): involving stakeholders, involving end users, project leadership, workflow redesign, and feedback and dialogue.

These factors point to what may be the key ingredient in achieving impactful implementation of new technology, namely, collaboration. Involving stakeholders and end users in meaningful opportunities for feedback and dialogue is clearly critical for developing impactful solutions to address challenges in health care delivery and patient and provider experiences. Within the collection, some stories feature work on large-scale digital health architecture or data and analytics. Others focus on connecting care within and across provider organizations. Many detail patient experience improvements or virtual care. Although every story is unique, each one is a testament to the great work being done in Ontario hospitals.

The OHA hopes this collection will act as a catalyst in spreading innovative ideas to those seeking digital strategies for improving care delivery and patient experiences in their own organizations and heath care communities.



1 Adapted from: B. Kucukyazici et al. Best practices for implementing electronic health records and information systems in Health Information Systems: Concepts, Methodologies, Tools, and Applications. 2009

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Enabling Integrated Care and Mitigating Hallway Medicine through Transitions, Discharge Planning Pathways and iPlan

Humber River Hospital

Our Challenge

Humber River Hospital (HRH), along with many hospitals in Ontario, is under enormous pressure to provide care to a growing and aging population. Hospitals in Ontario regularly operate over 100% capacity; this negatively affects patients as there are fewer hospital beds available for care and may result in hallway medicine. The biggest contributor to capacity challenges is that many patients who do not require the intensity of resources/services provided in an acute care hospital – designated Alternate Level of Care (ALC) – are waiting to transition to care in more appropriate settings.

The majority of ALC patients waiting in hospital are frail, elderly, and at risk of deconditioning, nosocomial infections and iatrogenic injury, affecting their future health status. Efficient and timely transitions for these patients to appropriate care settings minimizes risks and allows for better care and outcomes. Patients designated ALC are influenced by both hospital process and system capacity challenges:

- Hospital process can be defined as how efficient the hospital is in transitioning patients to their next level of care and how effective they are at connecting patients to their most appropriate care setting.
- System challenges are a result of misaligned services, where available services in the community are not accessible in a timely manner.

To address these barriers, hospital processes must be optimized, and system challenges identified and made visible to regional authorities to allow for better alignment of community resources on a continued basis.

Our Process

In March 2016, the Central Local Health Integration Network (LHIN) formed an ALC Collaborative with Central LHIN Hospitals, Central LHIN Home and Community Care, and the Central LHIN to provide focused, collective resources across the continuum for the benefit of patients.

The ALC Collaborative leveraged the Cancer Care Ontario (CCO) Provincial ALC Leading Practices User Guide and developed clinical workflows to meet identified strategies outlined in the Discharge Planning Pathway. Over the course of a year, the Guide was used to identify gaps and opportunities in hospital processes, through a current-state analysis conducted at each hospital site.

Qualitative data were obtained from staff through surveys and engagement sessions, and from patients through patient experience surveys and feedback communicated to discharge coordinators. ALC metrics were collected and compiled from the CCO Wait-Times Information System (WTIS). The current analysis revealed variation in discharge planning practices within and across organizations. There were no standardized processes which often resulted in miscommunication with patients and families, late engagement, avoidable delays in discharge planning, and lack of a team approach. This was echoed in qualitative data, and evident in quantitative ALC metrics.

During the summer of 2016, the ALC Collaborative prioritized opportunities for improvement and formed two subgroups to work on a standardized substitute decision-maker (SDM) and escalation process. Subgroups were comprised of representatives from each hospital site, Home and Community Care, and the Central

LHIN. It included planners, unit managers, patient flow managers, discharge coordinators, ethics and program directors. An iterative and collaborative approach to development was used to ensure all stakeholders affected by newly devised processes were included in solution development.

Our Solution

The goal was to create efficient and effective processes at the hospital level in partnership with community agencies by leveraging leading practices in ALC and to align community services through system-level data. This would allow for:

- Timely transition of patients to their most appropriate setting for better care.
- Improved hospital capacity minimizing/eliminating the need for hallway medicine.
- Efficiencies at the system level resulting in cost avoidance, and better utilization of health care dollars.

The achievement of this goal was measured by a reduction in ALC days and ALC Rate, against the provincial ALC target rate of 12.7%. To do this, the collaborative sought to develop the discharge planning pathway to ensure:

- Early identification of patients that require discharge planning;
- Standardized workflows with applications processed and services arranged while patients approached medical stability; and
- Escalations to engage the right level of leadership for effective utilization of community resources.

As such, discharge planning for every patient was performed parallel to their recovery allowing patients to transition from hospital when they are medically stable, unless community services were not accessible. These clinical workflows effectively reduced ALC days associated with hospital process challenges.

Additionally, HRH in collaboration with Central LHIN Hospitals, Central LHIN Home and Community Care and the Central LHIN, developed iPlan, a new and innovative application that was implemented across five hospitals and home and community care in a phased approach. iPlan automates the Discharge Planning Pathway to support:

- Day-to-day operations;
- Corporate quality improvement; and
- System-level decision making.

iPlan integrates with the hospital electronic medical record (EMR) and centralizes information from the hospital, community and referral systems, allowing for consistent, timely and coordinated discharge planning by hospital and community staff, promoting high reliability. Patient data from each hospital site are manipulated to remove patient identifiers, and aggregate data from each hospital site are centralized in a system-level database, with information available on business intelligence screens. This provides real-time situational awareness and quantifies specific gaps in the community that have resulted in hospital ALC days to better align services.

Our Success Factors

Involving Stakeholders

The Discharge Planning Pathway was developed through the collective effort of the Escalation and SDM subgroups, which consisted of a hospital lead, managers, and frontline staff from the hospital and community. Each group met five times from July to September 2016, developed workflows that were tested with staff at all hospital sites, and recommendations which were shared at the ALC Collaborative to obtain consensus and submitted for approval by the ALC Collaborative Executive Sponsors. Consensus was crucial to ensure clinical workflows were standardized at all hospital sites. If a proposed solution did not work for all organizations, it was not included within standardized workflows.

iPlan was a separate initiative that was funded by the Central LHIN and developed by HRH in partnership with representatives from the ALC Collaborative, as well as IT representatives from each hospital site. Five clinical design sessions were held from April to June 2017, with updates provided monthly at ALC Collaborative Meetings. IT teams from each hospital site were engaged at least one month prior to application launch.

Standardization

The Discharge Planning Pathway created clear accountabilities at all levels of the organization including processes for early identification, advance planning versus discharge planning, and minimizing the need for ALC designation as planning occurred in parallel to medical recovery. As these best practices were implemented at multiple hospitals and home care, staff at all organizations had similar expectations, with consistent interactions and messaging to patients and families across the Central LHIN.

Involving End Users

iPlan was created using a sophisticated Human Factors approach, with an iterative User Centred Design (UCD) process for development. Five design sessions with Central LHIN hospitals, home and community care and Central LHIN staff were held from April to June 2017, with usability testing performed at each hospital site to promote use across all organizations. iPlan was implemented at each hospital site in a phased approach.

Training

Each of the hospital sites conducted the original training for implementation. In hindsight, a combined sustainability plan might have been ideal. We did follow up and conducted a "Plan Optimization" initiative with support from the Central LHIN to maximize value.

Feedback and Dialogue

Patients and families were engaged during the 'stakeholder feedback' phase in the development of the Discharge Planning Pathway. Patient feedback was also obtained from National Research Corporation (NRC) and Post-Discharge Call Centre surveys by both hospital and community partners, with ongoing collection to ensure sustainability and continuous quality improvement. Feedback was used to ensure processes aligned with patient needs, with patient experience continuously monitored.

Our Impact

The target ALC Rate was aligned with the provincial benchmark of 12.7%. The acute length of stay for ALC patients and volume of patients discharged home with services or to an alternate facility were monitored to ensure improvements were a result of the Discharge Planning Pathway and iPlan. Patient experience was measured using the NRC Survey, specifically reporting on improvement in the key drivers for Access to Care and Discharge Transition. To better align community resources and inform system-level decisions, five business intelligence screens were created that aggregated data from each hospital site and displayed information in real-time.

Without this implementation of digital health technology, we may not have achieved the following reduction in ALC days associated with system capacity limitations:

- 3.1% decrease in ALC Rate and 4,458 decrease in ALC days were observed one-year post implementation at HRH, the equivalent of 12 acute inpatient beds.

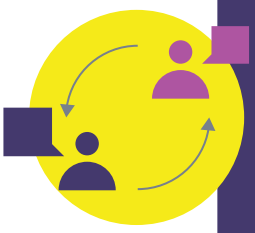
The total number of patients discharged home with supports or to an alternate facility did not increase significantly, indicating the volume of patients discharged to those destinations remained constant. Moreover, the average typical acute length of stay for ALC patients remained constant one-year pre- and post-implementation, indicating that it was not impacted. Patients transitioned earlier to their destinations resulting in the decrease in ALC days.

Our Learnings

The Discharge Planning Pathway and iPlan have had remarkable success in improving efficiency in patient transitions, enabling patients to access their most appropriate level of care in a timely manner while creating much-needed acute inpatient capacity. Key enablers of success include collaboration across hospital sites and community partners, leveraging the collective intelligence from all organizations and using technology to ensure high reliability in practice. Executive leadership at each organization was essential to enable success, and the collaborative approach to development across all levels of the organization ensured change was well-received.

"The iPlan is a user friendly and integrative tool which has successfully enabled collaboration between hospital and community partners. It has been valuable in identifying patients at high risk for ALC and to work together in an upstream approach to implement discharge strategies for safe transitions to the community."

- Shyla Sittampalam, Central Local Health Integration Network



"We are proud of the technology we developed, but even more proud of our collaborative approach to its development. The clinical workflow of the Discharge Planning Pathway was incorporated into iPlan, making discharge planning faster and more transparent. iPlan centralizes information from hospital and community, enabling patients to receive the most appropriate care in the right settings."

- Carol Hatcher, Vice President, Clinical Programs, Humber River Hospital

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Increasing Access to Specialized Care: The Ontario eConsult Program

The Ottawa Hospital

Our Challenge

Timely, equitable access to specialist advice remains a major concern for hospitals and health care providers across the province. Ontarians often wait too long to access specialized care; the average wait time to see a specialist in Ontario is 53 days and growing. Hospitals are grappling with the need to reduce patient backlogs in accessing specialized care, though with some treatment guidance, many patients could be cared for solely by their primary care provider (PCP), where they are often more comfortable and confident in the advice they receive. Patients who live in rural or remote areas must often travel for hours just to attend an appointment, while patients who are frail, mobility impaired, or face other challenging circumstances may find attending an in-person specialist appointment overwhelming.

The Ontario eConsult Program enables PCPs to consult with specialists and ask clinical questions about a patient's care through a secure online application. Providers receive a response in less than a week, which often eliminates the need for a patient referral to an in-person appointment. eConsult reduces patient wait times, decreases patient backlogs, and can be a key tool in improving overall operational efficiencies in hospitals across the province.

Our Process

The Ontario eConsult Program (eConsult Program) was created to enable timely and equitable access to specialist advice for all patients in Ontario. The program, with the support of the Ministry of Health (Ministry), integrates two successful initiatives: the Champlain BASE™ eConsult service and Ontario Telemedicine Network's (OTN) Direct to Specialist eConsult service. Ever evolving, the program is currently working in partnership with Ontario MD (OMD) and eHealth Ontario (now Ontario Health) to integrate the eConsult program into Electronic Medical Records (EMRs), an enhancement which further enables care coordination and brings added efficiencies for health care providers and hospitals in Ontario.

Our Solution

The eConsult program enables physicians and nurse practitioners to ask specialists clinical questions electronically and receive a response within days, often eliminating the need for an in-person patient visit. Accessed primarily through the secure OTNhub (otnhub.ca), the program is led by the Ontario eConsult Centre of Excellence (COE), housed at The Ottawa Hospital in partnership with the Bruyère Research Institute. Delivery partners are OTN, OMD, and eHealth Ontario, with the support of the Ministry.

The eConsult program includes four services which health care providers and organizations can access: the Ontario eConsult service, the Champlain BASE™ regional service, Teledermatology, and Teleophthamology. The Ontario eConsult Service, a multispecialty service available province-wide, offers users the choice of two models of care:

1. the BASE™ Managed Specialty model, in which PCPs submit cases to a regional- or provincial-managed service, where cases are assigned to specialists in the selected specialty group based on availability, and
2. the OTN Direct to Specialist model, in which PCPs submit cases directly to individual specialists.

Since its inception, the eConsult Program has created efficiencies within Ontario's health care system through a reduction of wait times for specialized care (median response time of 1.2 days), avoidance of unnecessary referrals (71% of cases resolved without needing a face-to-face specialist visit), cost savings ($47.35/case, compared with $133.60/case for traditional referrals), and higher levels of patient and provider satisfaction. In 2018-2019, participating PCPs sent 45,538 eConsults on behalf of Ontario patients, an increase of 11,595 eConsults from the previous fiscal year.

Our Success Factors

Project Leadership

Dr. Clare Liddy (Primary Care Lead) and Dr. Erin Keely (Specialist Lead), co-creators of the Champlain BASE™ eConsult service, serve as co-executive directors of the eConsult COE. The COE provides clinical leadership, program oversight, and quality assurance for the eConsult Program, and oversees program operations including specialist remuneration and management of the BASE™ Managed Service model. Mr. Payam Pakravan, Vice President, Strategy & Analytics, and Dr. Rob Williams, Chief Medical Officer, provide leadership from OTN. Their experience in leading digital solutions, relationships with key stakeholders, and commitment to provider engagement and optimizing experience have been critical to the success of the program.

Involving Stakeholders

The eConsult program was formed in partnership with several key organizations. The program leverages OTN's Direct to Specialist service and technology platform, the OTNhub. OMD supported the rollout of the provincial eConsult Program by managing its integration into EMRs, providing change management support in collaboration with regional partner sites, and contributing to program oversight through governance. eHealth Ontario supports EMR integration with provincial Health Information Access Layer assets and provides ongoing support for the provision of ONE ID accounts for eConsult program users. The Ministry provides strategic direction and makes policy decisions for implementation.

In addition to the provincial partners described above, a number of regional partner sites coordinate and administer the program within their region. Existing partner sites include Champlain BASE™, the South East Academic Medical Organization, Hamilton Health Sciences (HITS team), eHealth Centre of Excellence (Waterloo Wellington), Women's College Hospital (Toronto Central), Connecting South West Ontario, TransForm Shared Services Organization (Erie St. Clair), and St. Joseph's Care Group (North West). Collaborating with stakeholders enables the strength of each organization to be leveraged, exemplifying a key factor in the successful implementation of the eConsult program.

Involving End Users and Creating a Feedback Dialogue

Any successful digital health initiative must meet the goals of the providers using it. Through the provincial Clinical Advisory Group for eConsult, PCPs and specialists have provided input to the eConsult Program throughout the planning, design and dissemination process. Additionally, PCPs complete a mandatory closeout survey at the end of each eConsult in which they identify whether the response provided them with new information, the impact on their decision to refer, and their satisfaction with the service. An optional free-text field allows them to elaborate or provide any additional feedback they consider relevant. The closing survey helps the eConsult program team improve the service by offering a prompt overview of PCP satisfaction, flagging any issues as they arise. Additionally, comments regarding individual specialists are passed on to those individuals, allowing them to receive feedback as well.

Workflow Redesign (listening to PCPs, using delegates, EMR integration)

While the eConsult program has the potential to improve access to specialist advice and reduce wait times, its implementation can potentially create additional work for PCPs, who must learn the system and find a way to incorporate it into their workflow. Our team has explored strategies to minimize the eConsult

program's impact on PCP workflows and improve the experience of adoption. One strategy is the use of office staff as delegates, allowing PCPs to conduct eConsults using the same model as traditional referrals, which are then adapted into eConsults by a central administrator who gains proficiency with the service. Implementation of the delegate model has been shown to increase the eConsult program's uptake and use.[1] In addition, OMD is exploring the integration of the eConsult program into EMRs in order to simplify adoption for PCPs.[2]

Patient-Centred, Population-Based Approach

A key factor for the success of the eConsult Program has been the application of a patient-centred, population-based approach that also meets the needs of health care providers and organizations. To facilitate implementation, the COE connected with regional partner sites across Ontario to create local models operating in conjunction with an overarching provincial "umbrella service." By allowing regional partners to administer the eConsult program in partnership with the eConsult COE, the eConsult program can tailor its delivery to the needs of individual populations and health care organizations, ensuring that priority areas receive sufficient attention, and that the development of local communities of practice is supported. Regional services are supplemented with access to a roster of provincial services, allowing local providers to connect with providers from different specialties in cases where local specialists are unavailable. The provincial providers act as a safety net for patients in regions where fewer specialists practice, thereby ensuring equity of access.

Our Impact

The eConsult program has demonstrated a significant impact on key areas of care quality including population health, the timeliness of service and the impact on provider course of action. A total of 54,498 eConsults were completed between December 2018 and November 2019, with the top three specialty services accessed being Dermatology (13%), Hematology (10%), and Endocrinology and Metabolism (7%). There are currently 93 provincial BASE™ managed specialty groups, 2,542 active PCPs, and 748 active specialists on the Ontario eConsult Program. A 47% increase was seen in active PCPs using the eConsult program in the past year, resulting in greater access to health care for Ontarians, and increased efficiencies across Ontario's hospitals and health care organizations. The median response time for an eConsult was 1.2 days* and average time spent completing eConsults was reported to be 15 minutes.* Moreover, 99.8% of cases were sent with a response time of less than 30 days.* Requesting provider survey results demonstrated that the eConsult program resulted in a new or additional course of action 55% of the time, and confirmed an existing course of action 41% of the time.† Unnecessary referrals were avoided 52% of the time.†

*Based on a subset of 28,020 eConsults

†Based on a subset of 25,029 eConsults

Our Learnings

Through the process of implementing the eConsult program, our team has learned a number of key lessons:

- **Collaborate with like-minded experts**: Connect with individuals and organizations that share your goals and can provide invaluable resources and insight.
- **Focus on the problem you are trying to solve**: Avoid "scope creep," in which your team pursues tangentially related objectives at the expense of your original goal. Flexibility is important in terms of approach but stay focused on the original problem.
- **Base your conclusions on meaningful metrics**: Find a way to measure the desired outcome and focus your efforts there. When implementing a technology solution, the goal is to improve care for the population being served, rather than the success of the technology itself.
- **Establish clinical networks**: As the end users of eConsult, clinicians are essential to the success of the innovation. Find passionate clinicians to serve as local champions and seek feedback whenever possible.

1 Thind, A., M. Stewart, D. Manuel, T. Freeman, A. Terry, V. Chevendra et al. (2012). What Are Wait Times to See a Specialist? An Analysis of 26,942 Referrals in Southwestern Ontario. *Healthcare Policy 8*(1), 80-91.

2 Liddy C, de Man G, Moroz I, Afkham A, Mercer J, Keely E. The successful integration of an eConsult service into a Family Health Team's workflow. Telemedicine and e-Health 2019 [epub ahead of print]

"This service enhances care so much. I am now more certain about a plan of action. And the consultant added another course of action to prevent stroke that I had never considered! My overall care of this patient has been improved immensely…as well, I now feel more confident with other diabetic patients who are not yet 'at target'."

– Primary Care Provider

"I really believe in this type of technology as a means of physician education. There are many times a patient does not need to see a specialist, the PCP just needs a bit of guidance on management. This is perfect for that."

– Specialist

"It [eConsult] just kind of gives me a bit of peace of mind knowing that there's more than one person involved in making the decision."

– Patient

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Modernizing Health Care Communications

West Park Healthcare Centre

Our Challenge

Our frontline staff and physicians reported to us that when they need to communicate patient information, they are highly dependent on secure email, fax, telephones and pagers to reach others within the Circle of Care. However, in many instances, the use of, or immediate access to one or more of the aforementioned resources may not be possible, convenient or efficient. Thus, valuable time is lost. The issue is amplified in situations where a quick consult or clarification is needed that a mobile text message could solve; unfortunately, SMS texting is not a compliant method of communication.

To clearly understand the issue, we observed routines and surveyed therapists and physicians utilizing existing standards of communication and verified that a considerable amount of time is lost between sending a communication, and receiving a response. It should be noted, however, that the amount of time lost varied across the different methods. As expected, email is fastest, followed by telephone, pagers, and finally fax, which is slowest. Causes for delays included challenges such as the sender or recipient being away from their desk or not having access to these resources.

Our Process

After taking steps to understand the challenge, next we identified the top priorities for potential solutions, investigated solutions against our priorities and ruled out solutions that did not meet our needs.

We were able to identify our top five priorities. First and foremost, we knew we needed to protect the privacy of our patients and our solution needed to be fully compliant with Canada's heath information and privacy legislation. Obviously, this was non-negotiable. Our next priority was security and it was crucial that the solution offered full end-to-end encryption and had all the tools within it to ensure data are protected and secured against unauthorized access (digital and physical). We also had a strong desire to be able to remotely wipe data from a device if it became compromised, lost or stolen, as a last-resort measure. In an effort to maximize our comfort moving forward, we were looking for a solution that was easy to use and could be centrally managed by our Information Technology (IT) team. Finally, we felt that making use of mobile devices would address the challenges with speed and access to technology, resulting in a decrease in the delay of communication.

After identifying these top priorities, we spent approximately one month researching instant messaging solutions that met our needs. Popular solutions like Facebook Messenger and SMS texting were quickly ruled out due to privacy and security concerns. Others, such as Signal, which has built in end-to-end encryption and a full suite of security measures, were eventually also ruled out due to deployment and scaling, limiting our ability to centrally manage the solution.

Our Solution

After further research, we came across the ShareSmart application which stood out because it is a Canadian-made application that specifically caters to health care organizations and meets our unique needs. We discovered that it gave frontline staff and physicians a new way of communicating sensitive information between one another through a mobile device while remaining fully compliant with privacy and security requirements. Delivery of information was quicker, turn-around times improved, and, in the end, the application would result in better patient care.

Our IT team tested the application by using it as a replacement for our regular and non-clinical communication over iMessage for one month. This gave us the opportunity to really understand how it operates, to discover any flaws, and prepare us for the next stage: training the end users.

We then collaborated with service managers and clinicians to form a pilot project group. This group included our Code Blue and Rapid Response teams, consisting of respiratory therapists (RTs) from all units, pharmacists and nurse practitioners. Training and deployment took approximately two weeks. Once the pilot kicked off, we set weekly touch points to get feedback and discuss any and all benefits and issues. There were a few challenges in the beginning, as expected, but nothing major. During this period, we were constantly surveying RTs and clinicians for any noticeable improvements to their workflow and we received positive feedback.

Our Success Factors

Early Planning Strategies/ Workflow Redesign

In the very beginning, we noted that this type of solution would provide us with new workflow possibilities that would allow our clinicians to be more efficient in their work and provide more timely care to patients. It was crucial for us to achieve this in order to get buy-in from our users. ShareSmart definitely met this need.

Technology Usability Factors

We made sure that the application we ultimately selected was user-friendly, had a familiar, modern graphical interface and was compatible with different types of smartphones. ShareSmart ticked all those boxes.

Feedback and Dialogue

Active dialogue with our end users throughout the early planning and testing stages allowed us to learn more about their needs and use-cases, and to troubleshoot any technical issues and knowledge barriers as they emerged.

Making ourselves open and receptive to feedback, and addressing user concerns, led to the success of this initiative allowing end users to overcome the learning curve and fully adopt this solution.

Our Impact

The team reported improved efficiency and ease of communication. Staff were able to ask for and receive assistance with patient files much quicker. Patient data and attachments sent between users were clearly and securely labeled within the application, which was an important improvement that provided greater clarity over simply using email. The team was relieved that they could finally send quick and secure messages instead of having to stop what they were doing to take phone calls. Some labeled this method of communication as “familiar and comfortable”, as it is similar to how they communicate outside of work. Since staff were able to receive answers quicker over ShareSmart (e.g., when confirming medication order details, reviewing an X-ray), patients were able to receive care sooner which increased overall satisfaction.

The pilot was originally intended to run for approximately two months. Due to its success, the group continues to use this application, six months later. It has become an integral part of their day-to-day work.

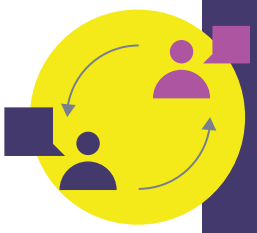
Our Learnings

We knew that getting the buy-in of end users was going to be one of the keys to our success. For this reason, we were upfront and honest about wanting to improve their workflow and compliance along with patient outcomes, but that learning a new application may be challenging. We also shared that it would be necessary to test the application for any security and privacy gaps which may mean trialing several solutions. We believe that this level of transparency helped ease users into trying this new application.

We feel that clear and regular communication and our efforts to build trust were what ultimately allowed our team work collaboratively and find the solution to our challenges.

“Using initials over unsecured platforms like iMessage can be confusing and potentially pose a risk to patient safety. Having an app that is PHIPA-compliant is really beneficial for clarifying orders and other patient communications with the team.”

- Raj Kohli, Clinical Practice Leader in Respiratory Therapy and Clinical Coordinator, Long-Term Ventilation Strategy



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Using Smartphones to Improve Patient Care

Humber River Hospital

Our Challenge

The patient call-bell system is a fundamental element of health care facilities; however, it has remained largely unchanged in the last 30 years as an indirect communication tool between patients and nurses. One of the primary disadvantages of the call-bell system is that the nurse must frequently shift focus from his or her current task to retrieve the message from the nursing station in order to answer the call, which leads to interruptions in patient care. These interruptions can negatively impact patient safety and are seen as contributors to medical errors (Prakash et al. 2014; Tomietto et al. 2012).

Our Process

Humber River Hospital (HRH) has taken a technological leap by adapting the smartphone from a personal device to a clinical tool to further support nurses' communication and prioritize patient needs. HRH worked with a company which provides a wireless, onsite communication system that can integrate smartphones seamlessly with the hospital's systems and is already used by other large, technically-advanced institutions.

Our Solution

HRH's smartphone continuously filters alerts so nurses are only notified of alarms triggered by their assigned patients. This process significantly reduces alarm fatigue and eliminates the need for the nurse to go to the nursing station when a patient calls for assistance. The smartphone also features a different tone for call bells, alarms activated from the patient's bathroom and alarms activated when patients at high risk for falls exit their bed.

Our Success Factors

Selling Benefits and Addressing Barriers

Throughout the decision-making process, it was important to identify optimal solutions that fit the hospital environment. The handheld wireless phone provided nurses with the ability to be highly mobile, an important factor considering the magnitude of the hospital's physical space. Furthermore, the device had to be durable enough to withstand the demands of a fast-paced hospital environment; the smartphone at HRH is easily transportable, durable, fully sealed against dust, water resistant, and designed to protect against impact. Additional technological features were also integrated into the smartphone, including receiving real-time access to their patients' clinical information and automatically escalating call bells to a secondary nurse if the primary nurse is occupied and cannot respond.

Technology Usability Factors

Nurses helped to communicate their needs and the needs of patients when using the technology to address challenges. For nurses to communicate with their patients, a wired phone was set up on the integrated bedside terminal (IBT) in each patient's room. Nurses stated that some older patients did not know how to use the call system to speak to the nurse or had trouble increasing the volume. Though nurses still receive an alert when the patient presses the call button, patients who experienced these issues were not able to verbally communicate with the nurse. To resolve the issue, trained hospital volunteers introduce the system to patients upon admission.

Feedback and Dialogue

Feedback was collected throughout planning and execution through interviews and surveys in order to evaluate the system and gauge nurses' satisfaction with the smartphones. Recent interviews with nurses revealed that they were highly satisfied with the smartphones and due to the vast technological resources that have been integrated to support nurses' work, the smartphones have been regarded as a "lifeline". However, nurses also identified a few challenges in using the smartphones, including poor call quality and short battery life. Improvements and upgrades have been made to the technology to address these issues. One of the solutions was to add a hot-swappable battery that allows the smartphone to stay on while the battery pack is being changed, thus eliminating downtime for nurses.

Our Impact

In order to assess the efficacy of the smartphones at improving patient care and nursing workflows, we conducted in-depth interviews with nurses in November 2018. These findings were published in the *Canadian Journal of Nursing Leadership* (Volume 32, Special Issue).

In the interviews, nurses stated that the smartphones had positive impacts on time management by helping them avoid unnecessary interruptions as they did not have to constantly head to the nursing station to find out why a patient was calling. Furthermore, the smartphone ensured that the nurse would always receive their patients' calls even at night when the nursing station is not staffed.

Interviews with nursing staff also highlighted improvements to patient safety. Nurses stated that receiving separate alerts from the bed-exit alarm and bathroom call bell meant that they could quickly respond to those urgent situations as well as hear the alarm no matter where they are on the unit. These devices were also able to contribute to reducing overhead paging noise, and due to the hospital's large size, bring down the time nurses spend running around the wards, thus optimizing workflow. Additionally, because the patient's call now goes directly to the nurse rather than to the nursing station, nurses are better able to establish a one-to-one relationship with the patients.

Our Learnings

Nurses experienced the same psychological stress from receiving multiple notifications via the hospital smartphone due to overusing their personal smartphones. It is important for hospitals implementing this technology to continually strive to achieve a balance between alarm support and alarm fatigue.

When the smartphones were first introduced, they were perceived unfavourably as some patients mistakenly thought that nurses were using their personal cellphone. Hospitals proposing to introduce this technology should ensure that patients are educated about the smartphone's clinical use to avoid unfavourable perceptions.

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"You can answer the call and tell the patient, "I am coming; I [was] just busy," and there's that communication with the patient that you build with them so that they don't wonder why you aren't coming."

(as quoted in Burkoski et al., 2019, *Patient Care in a Digital Hospital*, The Canadian Journal of Nursing Leadership)

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Command Centre: Large-Scale Technology to Support Patient Care, Efficiency and High Reliability

Humber River Hospital

Our Challenge

Hospital care accounts for approximately 28% of the resources in our health care system (Canadian Institute for Health Information, 2018). Furthermore, health care organizations often struggle with occupancy exceeding capacity, limited budgets and resources to treat an ever-growing and aging population. We need to look for solutions to create a more sustainable future for our health care system which can support population needs long term. If we can dramatically change the performance of a hospital, we can make a significant contribution to managing patient flow while improving quality, safety and efficiency. One such hospital that is garnering global attention for its performance is Humber River Hospital (HRH). It is demonstrating how acute hospitals can provide patient care that is highly reliable, efficient, and effective using state-of-the-art digital health technology. HRH is one of Canada's largest community acute care hospitals, serving a population of 850,000 people in the northwest Greater Toronto Area. HRH has 722 beds, 4,015 employees, 699 physicians and 1,151 volunteers.

Our large team of highly knowledgeable and skilled health professionals meet the needs of patients ensuring they receive quality, safe and efficient care as they move through their health care journey. This process is not without challenges, as during the last several years, Emergency Department (ED) visits increased from 97,000 per year to 139,672. Moreover, it is anticipated that HRH will have a 40-50 acute care bed deficit in 2020 if trends continue due to an aging population, longer wait times in hospitals, and challenges with the number of Alternate Level of Care (ALC) patients residing in the hospital. This has put pressure on HRH to manage patient flow, safety, quality and outcomes.

When a new HRH site was in the process of being planned, the leadership team recognized we had a unique opportunity to deliver efficient, quality and safe patient care using state-of-the-art technology. Bringing together a large group of patients, management, physicians, nurses and other health professionals during stakeholder consultation sessions, we envisioned opportunities to leverage digital health technology to create a high reliability hospital with excellent patient and family care, staff and physician engagement and little or no hallway medicine. One key method for achieving our goal was through the development and implementation of Canada's first hospital Command Centre (the second in North America).

Our Process

HRH's quest for a 'mission control' centre emerged approximately 10 years ago, when several of our leaders visited a Dell Computer Command Centre in the United States. They were impressed at how efficiently the company operated using alerts generated to surface potential or actual challenges.

Our current President and CEO also reflected that the airline industry has been using command systems for years to ensure client and employee safety, and deliberated whether we could do the same at HRH. Soon after, our executive leaders explored the creation of a command centre with internal stakeholders, and General Electric, our vendor of choice.

Our Solution

HRH's Command Centre uses real-time data, advanced algorithms, predictive analytics and data displays to show a comprehensive view of how patients move through the hospital. The centralized team of health professionals who previously occupied offices elsewhere on campus, now reside in the Command Centre and use these data to identify challenges early and implement agreed-upon Interactions, Procedures, and Operating Mechanisms (IPOMS) to resolve problems in an efficient and coordinated way.

In partnership with GE Healthcare, HRH successfully launched its Command Centre in 2017. The 4,500 square-foot facility supports administrators, physicians, nurses and other health professionals through three notable features:

1. Centralized decision-makers at the apex of hospital operations, which enables getting the right information to the right people, and enhancing quick and efficient decision making;
2. Real-time intelligence garnered through analytics from predictive algorithms; and
3. All data points are action-oriented and provide core information for our day-to-day operations, which is fundamental for continuous organizational development.

Using data from a variety of internal and external systems in the hospital, information is updated every four minutes and displayed on multiple GE Tiles, each with real-time analytics to harmonize, organize and facilitate better patient flow, experience and outcomes. Our system uses a 12-stage scale to monitor ED patient volumes and spot problems.

We are able to track ED wait times, admissions, and potential bottlenecks through the 'pathways' tile, which displays the steps to be completed for patients to be on track for timely discharge in the Command Centre, emergency, medical imaging and inpatient unit. This tile also confirms that patients are at the appropriate stage of their care, using various order sets to ensure high reliability and quality care.

Another major benefit is the warning system that is displayed through the 'early warning tile'. For example, it detects patients in distress and can spot those with abnormal blood result readings and alert a clinician in the Command Centre to investigate and follow-up with the appropriate patient caregiver. These breakthroughs using the Command Centre digital technology are just the beginning.

HRH and GE Healthcare have worked together to create a multigenerational plan for the Command Centre focusing on:

Generation One (**completed**) which includes patient flow and patient care logistics, bed allocation, room cleaning, patient transport, medical imaging, capacity management, discharge planning, surgical scheduling, patient throughput, and delays in care.

Generation Two (**in progress**) which focuses on developing and implementing clinical pathways and reducing never events, ensuring compliance to pathways and best practices, advancing early warning systems, specialized care, and clinical delays in care. For example, HRH and GE have developed tiles that support advanced alerts and care related to perinatal care, clinical deterioration, seniors care, and harm prevention.

Generation Three (**planned for 2020**) emphasizes community outreach and reduced acute utilization, support for health and wellness, virtual visits, home monitoring, and communication and collaboration.

The following parameters are monitored for success and opportunities for improvement:

- ED volume and wait times
- Bed allocations and assignments
- Room cleaning
- Critical care capacity
- Surgical scheduling
- Discharge planning
- Impact on budget
- Overall patient satisfaction

Our Success Factors

Project Leadership

The success of HRH's Command Centre is dependent on the strategic direction provided by the Board of Directors, vision of both the past and current President and CEOs, drive and commitment of the leadership team, knowledge and skill of our Information Technology experts, and extensive contributions from physicians and staff.

Involving Stakeholders

Management, staff and physicians were engaged throughout the planning and building of the centre. For instance, while formulating Generation 2 plans, 350 suggestions were garnered from diverse internal consultation sessions resulting in 29 themes, 14 actionable criteria, and an action plan to develop 4 tiles to improve patient care and experience (perinatal care, clinical deterioration, seniors care, and harm prevention).

Choose Technology Solution Carefully

HRH's partnership with GE Healthcare resulted in a state-of-the-art Command Centre, with experienced consultants, and the opportunity to connect with The Johns Hopkins Hospital to glean real-life successes and learnings. The ecosystem partners, of which there are 11 around the world, continue to share and learn from each other.

Workflow Redesign

Examples of how the Command Centre provides real-time information to optimize the patient care and experience through redesign includes advanced analytics that inform decision making to:

- Manage patient flow (e.g., expediting ED visit wait times),
- Select appropriate infrastructure (e.g., obtaining an additional MRI), and
- Change practices (e.g., decreasing the time of allied health professionals to assess and treat patients).

Change Management

Implementing an innovative 'mission control' centre involved significant change in health professional practices and patient care monitoring. This might have resulted in staff and physician fear, resistance and conflict. A comprehensive change management plan facilitated communication, engagement, and quality of the project work while reducing stakeholder fear and anxiety.

Our Impact

For our patients, the Command Centre means timely access to care: less time waiting for beds to open up, shorter hospital stays, and speedier discharges. For our physicians, nurses and other staff, it means they can focus their attention and energy towards delivering quality patient care to achieve the best possible health care outcomes, while spending less time coordinating patients' movement through the hospital. For our community, the centre means we will be able to serve the changing needs of a growing population and continue to deliver high-reliability care.

The Command Centre's impact on patient flow in the first year has reduced conservable beds by 52%, freeing up 23 beds for patient care, and saving $6.5 million.

Other metrics indicating the effectiveness of the Command Centre (January to April 2017 compared to January to April 2019):

- Inpatient Ultrasound Turnaround Time: Reduced 12%
- Repeat ED Visit Rate: Reduced 13%
- ED Time to Inpatient Bed: Reduced 33%
- Allied Health Delays in Care Alerts: Reduced 76%

Nursing Home Patient Length of Stay (May to October 2018 compared to November 2018 - April 2019) was reduced by 14%.

Our Learnings

HRH has had remarkable success in the development and implementation of the Command Centre because we were open to learning along the journey. Several other key takeaways:

- The need for commitment by the whole team including the Board of Directors, leadership team, staff, and vendor consultants.
- Do not select 'toys' for 'toys' sake. Artificial intelligence offers a plethora of digital tools for selection. Leaders should always determine the indicator they are moving towards before investing in a specific technology.
- To that end, ensure interoperability that enables various and different computer systems or software to exchange and make use of information.
- Start with process redesign – automating a bad process nets poor automation.
- Finally, the work is ongoing. As new challenges arise, new innovative approaches are created, and new technologies are developed.

"Humber River Hospital is focused on high-reliability health care. We are implementing cutting-edge solutions through our Command Centre to ensure patients receive the highest quality of care in alignment with our organizational values. It is the type of care each of us would want for ourselves and our family members."

- Barb Collins, President and CEO, Humber River Hospital

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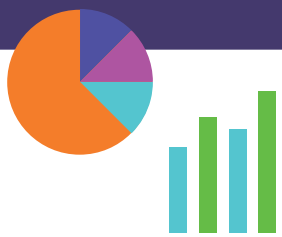

Our Journey to Quality Metrics

St. Joseph's Healthcare Hamilton

Our Challenge

St. Joseph's Healthcare Hamilton's (SJHH) replacement of our Hospital Information System was initiated to transform the care we provide and position the organization as a leading academic health science centre. Our organization was primarily paper-based and our previous systems did not meet our clinical business needs. Additionally, our current vendor announced that it was sunsetting its products in the Canadian marketplace.

In October 2016, the decision to implement Dovetale, our Epic Health Information System (Epic), was made, kicking off a 14-month journey. We chose a big-bang approach because it was more cost-effective and promised quicker, visible improvements in care. Dovetale was introduced on December 2, 2017, and overnight, we had access to millions of analyzable data points. Many SJHH staff have come to realize Epic's potential in providing our organization with vast amounts of valuable data, leading to numerous questions: What does the new data mean? Who owns and has access to the data? What are our quality thresholds? How can we use the data? Because of this potential and the increased interest, we needed to develop a robust data strategy and a data governance structure to ensure report quality, efficiency in data collection and review, and high value of our realized benefits.

Our Process

In June 2017, we launched the Benefits Realization Committee to define benefits metrics (indicators) that would demonstrate the impact of Epic implementation on the quality of care. The Committee developed benefit metrics in alignment with SJHH strategic priorities, Quality Improvement Plans (QIPs), Epic's Key Performance Indicators (KPIs) and the Canada Health Infoway Benefits Realization Framework.

Data sources were also identified by the Committee, taking into consideration the scope of the implementation. The two main areas of focus were clinical value of investment and business value of investment. In November 2017, applicable baseline metrics were gathered, validated and documented. Non-applicable baseline metrics were assessed and compared to relevant clinical literature. The metrics – available on various dashboards and reporting workbench reports – were measured and monitored post-launch to identify Dovetale's clinical benefits. Additionally, QIPs, Incident Reports and impact of Dovetale were analyzed.

Our Solution

A Data Steering Committee has also been formed to make policy recommendations and define our data management strategy. One of the most important roles of the Committee is to standardize measurements across the organization to ensure data quality and the value of the analysis based on data collected.

In many cases, different departments have varying definitions for each measurement. For meaningful results that are representative of the entire organization, there needs to be only one source of truth determined for each measure. As we continue to optimize Dovetale, data are transforming how we work, including utilizing real-time data to make key decisions, improve access and transfer of information, create efficiency for clinicians and patients, and increase intrinsic motivation to improve KPIs. In the future, we will continue to leverage data analytics to understand, engage, track and better the health of our patient populations.

Our Success Factors

Involving Stakeholders

Stakeholder engagement is absolutely critical to success and strongly influences return-on-investment. Assigning a visible owner to the development of metrics creates operational accountability, transparency and awareness among staff that a specific metric has been reviewed, tested and signed off appropriately.

Workflow Redesign

The Benefits Realization Committee developed the benefits indicators that would demonstrate the impact of the electronic medical record (EMR) implementation on the quality of care. These were defined in alignment with the SJHH strategic priorities, QIP, Epic's KPIs and relevant Canadian literature utilizing the framework below.

Feedback and Dialogue

Standardized definitions across the organization encourage a focus on improvement. When these are not used, the focus of the requestor leans towards eliminating data from the dataset, compromising its quality.

Senior Management Support and Governance

Benefits Realization, Data Governance and Data Stewardship Committees were launched, respectively, with the purpose of defining data points; determining business terms needing definition; identifying privacy, confidentiality and ethical challenges; developing appropriate frameworks for effective collaboration; and establishing procedures for data sharing requests from internal and external partners.

Technology Usability Factors

Development of a "Data Dictionary" was completed to provide staff with a clear definition for each metric, how they were developed and who approved them. The purpose of the dictionary is to create a shared understanding of data points across the organization.

Language and Collaboration

Discussion between the requestor and analyst is essential. Requestors value the consultative and collaborative approach. Appropriate prompts like "what question am I trying to answer" and "what data are we currently collecting", direct requestors towards a more data-oriented mindset and stimulate future data-related questions.

Benefits Realization Framework

Identify the Benefits ☑	Define the Benefits ☑	Map the Benefits ☑	Monitor the Benefits ☑	Measure the Benefits ☑	Access Success ☑	Refine the Benefits ☐
Clinical Business Technical	Identify metrics Ensure alignment to desired outcomes	Map benefits to project strategy Identify sources of date	Capture baseline data Ensure decision making is benefits-driven	Capture post go-live data	Evaluate the success as compared to desired outcomes	Refine the benefits plan
	♡ Benefits Metrics Development March 2017	♡ Benefits Framework and Recommendations Approval June 2017	♡ Pre-Dovetale Measures Collected November 2017	♡ Clinical Outcomes Collected via Dovetale Dashboard August 2018	♡ Review and Validation Data September 2018	

Our Impact

Dovetale has become an important tool that staff and physicians at SJHH use to improve our ability to provide compassionate care. Having one patient chart means improved ability to make informed care decisions through real-time clinical decision support. We are only beginning to realize Dovetale's potential with respect to care.

By scanning medication barcodes, we are able to eliminate medication administration errors. We initially experienced some challenges in Barcode Medication Administration (BCMA) compliance due to several reasons:

- Scanner not available; all in use or cord too short
- Wristband failure; wristband unable to be scanned due to wear and tear
- Scanner failure
- Hospital culture; change management and staff empowerment
- Time-sensitive; medication was to be administered in an emergency

In an effort to mitigate these challenges and risks, the following measures were implemented:

- More devices have been deployed to support scanning workflows and feedback from staff is used to refine device scanning strategy.
- An awareness and educational campaign promoting the ease-of-use and benefits of barcode scanning involving senior leadership is underway.
- Managers and end users are encouraged to track their progress in Dovetale using the Nursing Compliance Dashboard metrics. Many managers list their compliance graphs and top performers (available through Dovetale) on their Quality boards. This provides departments with intrinsic motivation and a sense of competition, encouraging them to improve.
- By collecting, tracking and having an accurate list of patients' home medications, we are able to identify potential medication discrepancies and ensure patient harm is avoided. As a result, the team is better able to make important treatment decisions.
- VTE prophylaxis is one of the most important patient safety strategies for admitted patients.
- Monitoring antibiotics and reducing timelines for when they are administered has reduced risk of sepsis. On average, SJHH treats Emergency Department patients with sepsis 20 minutes faster compared to the pre-Dovetale period.
- Monitoring the completion of violence risk assessments which is an important component of a safety culture for patients and staff. Dovetale allows us to do this consistently; we'll never run out of photocopies or struggle to read what someone noted. We see the Violence/Aggression Screening Tool (VAST) every time, have the chance to complete it every time, and have those screenings inform our decisions and subsequent care plans.
- To help with drug allergy indications, we can track instances when a provider (e. g., physician, nurse practitioner, etc.) orders and is alerted to a potential severe/contra-indicated drug-allergy interaction. Timely communication from the hospital to the community is vastly improved with Dovetale, helping to improve completion of discharge summaries and emergency room records, which come the next day and are always legible.
- Ensuring all discharged patients receive an after-visit summary which provides a post-stay synopsis that is clearly laid out in one document, is comprehensive and easy to go through with the patient and their caregivers. It provides a visual document for patients and their families to easily follow and refer to once they get home.
- Dovetale has helped us reduce transport turnaround time dramatically; we now have an accurate account of turnaround times, with real-time, to-the-second feedback provided at each stage of the transfer process.

- We are better able to understand the immediate and future needs of bed flow to ensure efficient use of resources, and the transfer process has been streamlined by eliminating the need for landline use that significantly slowed transporters down.

Our Learnings

In our assessment of baseline to post six-month go-live data, the team has seen a shift from 'data is a by-product of the application' to 'data as an asset'. The quality of data output (metrics, reports, dashboards, etc.) is entirely dependent on the quality of data input (discrete data, time series data, and not free text). Through analysis and metric re-development with operational stakeholders, the team has learned that:

- Turnaround time on a data request is shorter when the description of the request is well-defined.
- Language and collaboration are important. When the requestor and analyst collaborate and learn from each other (i.e., the requestor), the request is completed efficiently, and the requestor and analyst appear to be more satisfied.
- Requestors value the consultative and collaborative approach – questions like "what question am I trying to answer?" and "what data are we currently collecting?", direct requestors towards a more data-oriented mindset, and stimulate future data-related questions.

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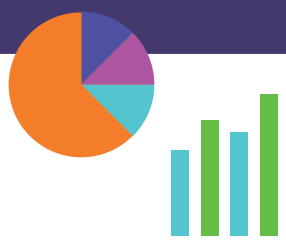
"95% of orders are being entered by providers through digital order entry, this means safer, more consistent patient care."

- Chief, Emergency Medicine Physician

"With Dovetale, clinicians are able to access their patient information from anywhere at any time. Care is at their fingertips. There have been more than 200,000 logins from remote locations since go-live."

- Coordinator, Integrated Comprehensive Care



Electronic Health Record Optimization – Transformation Project

London Health Sciences Centre and St. Joseph's Health Care London

Our Challenge

Our regional network of 10 hospitals (in 2014, totaling 2,955 beds) shared the foundational components of an electronic health record (EHR) for over 10 years. To realize the benefits of a fully functional, integrated EHR, more software implementation and practice-change were needed.

The regional hospital network includes:

- Alexandra Hospital Ingersoll
- Listowel Wingham Hospitals Alliance
- London Health Sciences Centre
- Middlesex Hospital Alliance
- St. Joseph's Health Care London
- St. Thomas Elgin General Hospital
- South Huron Hospital Association
- Tillsonburg District Memorial Hospital
- Woodstock Hospital

Our Process

In May 2014, we completed the transformative project HUGO (Healthcare Under Going Optimization), which included the following additions to our EHR:

- Computerized provider order entry (CPOE)
- Closed loop medication administration and bar code scanning (CLMA)
- Electronic medication administration record (eMAR)
- Electronic medication reconciliation (eMed Rec)

We had a number of key priorities for this project:

- Increase patient safety
- Reduce the number of adverse drug events
- Ensure best practice and guideline adherence, using imbedded decision support tools
- Provide detailed data to support quality improvement initiatives (e.g., venous thromboembolism prophylaxis)

Our Solution

The HUGO project introduced profound transformational change to patient care for our participating hospitals. To support this level of change associated with new functionality, several strategies were employed:

- Clear scope and outcome goals
- Broad stakeholder engagement
- CEO and full executive level sponsorship
- Readiness assessment by third party
- Leader training in transformational change
- Strong governance/project structure
- Formalized communication and engagement strategies

We completed baseline information on these processes and clinician/provider surveys, to support providers and clinicians through the design and stabilization of the project. Over 80 process redesign sessions were held,

engaging over 600 clinicians to review current-state and design future-state processes. There were multiple project streams, each with assigned teams responsible for design review, implementation planning and collaboration with stakeholders. Changes were guided by frontline user feedback.

A key benefit of working as a region was the ability to "go live" initially at a smaller site. Alexandra Hospital Ingersoll embraced this early-adopter role. Learnings from its go-live experience were applied to implementations at other sites. A two-month pause enabled the collective learnings from seven hospitals to shape a revised implementation plan for the two large academic hospitals: London Health Sciences Centre (LHSC) and St. Joseph's Health Care London.

Two innovations contributed to the success of go-live events. First was the development of a real-time dashboard measuring 21 key indicators of patient safety and metrics related to adoption. The second was collaboration across 10 hospitals to successfully deliver the transformation.

Our Success Factors

Senior Management Support and Governance

A major success factor was shared leadership. Senior teams and hospital boards across 10 hospitals established a core committee to drive transformational change with respect to new processes and technology. The hospitals had almost 10 years' experience working together on the EHR; but driving process, clinical practice and technology changes of this magnitude was unprecedented.

Structure and Roles

Structure and roles were created in the project framework so all 10 hospitals could closely collaborate, including site-based teams at each hospital and work-stream teams focused on specific elements of clinical care, each under the direction of a project lead. A core project team was led by a project sponsor and a project executive and steering committee, all with the support of an executive sponsor. At each site, the respective CEO initiated the project, emphasizing that the values and culture of each organization would be strengthened through the project. This demonstrated the project's priority and commitment to patient safety.

Leadership

Leaders were instrumental in supporting and encouraging adaptability. Early on, the team had to switch implementation vendors. This was very disruptive and negatively impacted the timeline. The steering committee and the core team assessed various options, communicated the issues to key stakeholders and were able to make a timely decision. Another challenge arose when the Emergency Department (ED) of one of the larger hospitals expressed serious opposition, jeopardizing implementation. The core team rallied to engage members from each ED, organized site visits and developed strategies to address identified issues.

Key leadership success factors:

- Three key roles (executive sponsor, project sponsor, chief medical information officer) were clinicians.
- Adopted a common framework for change that included Influencer Model and Crucial Conversations principles.
- Established a physician advisory committee with representation from all sites that was supported by six physicians hired part-time over the life of the project.
- Used multiple communication methods to keep leaders across all hospitals informed and engaged, including: monthly calls with clinical leaders, website with tools and project information, email bulletins, leader preparation sessions, a dashboard to show go-live impact, monthly updates for senior leadership teams, and medical advisory committees and boards.
- Appointed a lead clinical and physician user for each team as a key contact and stakeholder for over 75% of the project life.

- Governance transitioned after go-live to local program teams, ensuring frontline physician and clinician engagement in ongoing enhancements.
- Engaged patient and family advisory groups/ councils.

Our Impact

Many clinical programs used new functionality to radically change how they deliver care. One example was the Department of Rheumatology at LHSC's University Hospital. This was the first ambulatory clinic to implement MultiPhase PowerPlans (MPPs). These electronic order-sets replace hand-written, sometimes illegible, paper orders and allow rheumatologists to plan complex treatment protocols following standardized Canadian guidelines. Using MPPs, the protocols support entire clinical pathways, including medications, labs, communications and follow-up appointments, with all components appropriately timed.

CPOE compliance increased from 75% to 96.6% in the Rheumatology clinic (based on about 4,000 physician orders monthly). The use of MPPs has also enhanced patient safety, triggering electronic alerts for allergy and drug interactions and eliminating risks associated with illegible orders.

MPPs allow nurses to initiate orders and copy them forward, ensuring seamless and accurate transitions between treatment visits. MPPs also support standardized patient treatment, for both orders and protocols, following research and best practice guidelines.

To ensure appropriate usage, all plans were used for a period of six to eight months before going live, and reviewed by key stakeholders, physicians, nurses, clinical educators and clinical informaticists. Process improvements were identified and implemented, including regular review to ensure plans aligned with best practice and current research.

Data and metrics

To ensure early identification of trends in new types of errors, extensive analysis was completed. After go-live, hospitals closely monitored HUGO-related errors. A quarterly, in-depth analysis of HUGO-related medication errors was completed by LHSC. A monthly review of medication error rates, severity levels, and causes was also completed.

Overall, there's been a reduction in errors reported related to HUGO functionality.

- Immediately following go-live, a total of 78 HUGO-related errors were reported, over a period of 106 days (0.73 errors/day).
- This decreased in the fall of 2014 to 55 errors, over a period of 106 days (0.52 errors/day).
- In the spring of 2015, one year after implementation, 45 HUGO-related errors were reported, over a period of 181 days (0.25 errors/day).

Focused efforts to prevent errors included changes to software, alterations to medication displays, redesigned workflows and re-education.

While medication barcode scanning rates by nurses are increasing, they remain at or below the target of 85% for some of the hospitals. With continued education, audits and feedback to individual nurses, barcode trouble-shooting and scanner enhancements, rates rose from 80% to 84%.

Overall, medication error rates at all hospitals dropped significantly. The rate at LHSC decreased from 0.35 errors per 1,000 doses prior to go-live, to 0.18 errors per 1,000 doses in August 2015. Errors related to transcription, a frequently reported error type, went down by 70%. Medication administration errors were reduced by 20%.

Analysis

This transformational change was intended to increase patient safety and reduce adverse medication events (ADSs). We achieved this across all participating hospitals.

Hospital	% Reduction in Medication Errors	Number of Beds
Alexandra Hospital Ingersoll	54	35
St. Thomas Elgin General Hospital	49	166
Tillsonburg District Memorial Hospital	38	51
St. Joseph's Health Care London	37	1,278
London Health Sciences Centre	33	998
Listowell Wingham Hospital Alliance	30	89
Woodstock General Hospital	28	178

Within 12 months of transformation, the average reduction in reported medication errors was 38%. With eMedRec, a patient at any hospital site has a single medication list, which is considered the one source of truth. Clinicians at any site can access the most current and accurate medication list with just a click. The shared EHR, using electronic order information, mitigates communication errors between care settings and improves care delivery efficiency. An example of improved patient outcomes, as reported by one of our lead physicians:

> *When a patient's condition deteriorates in a smaller community hospital, transfer to another higher-level-of-care facility is often required. Within our hospital network, staff can review the treatment at the sending site with one click (even before the patient arrives): which antibiotics were given and when for a patient with sepsis, or the sequence of blood-thinning drugs administered to a patient with a heart attack. At the other end of the patient's stay, the consistent digital record of initial home medications (maintained during transfers between hospitals) ensures drugs held in the flurry of acute treatment are not forgotten when the patient is discharged. The digital record enables an accurate electronic medication reconciliation.*

We know from talking to our patients that the changes that are visible to them build confidence in the safety and quality of their care. Bar code scanning (a nurse scanning a medication and then a patient's arm band) is an engaging action. It's clearly visible to the patient and signifies a double check is being performed.

Many ambulatory clinics have embraced the ability to electronically order medications and generate prescriptions. Orders are checked against a patient's documented allergies and best possible medication history (BPMH), triggering immediate alerts for drug-to-drug interactions or allergies. These alerts reduce the likelihood of errors and reduce calls from pharmacies trying to fill prescriptions. Our system is currently generating about 50,000 electronic prescriptions per month. In 2010, Canada Health InfoWay conducted a study in Alberta that suggested one out of every 200 prescriptions resulted in unplanned health care utilization. Based on this study, HUGO functionality has the potential to avert 250 such events per month.

The new system provides medical leaders with analytics which can be leveraged to improve clinical practice and quality of care. Physicians can more quickly identify when drugs were started, changed or stopped. They can discern which elements were used and which were omitted from an order set and they can investigate previous admission information to which they would otherwise not have access.

Implementing a region-wide system across independent hospitals, encompassing all four components of medication ordering, administration and management, was new in Ontario. The result is a HIMSS EMRAM score of 5.05-6.05, as verified by the OHA, for all the hospitals. Fewer than 10% of hospitals in Ontario, and less than 5% in Canada, have achieved scores of five or higher. These figures demonstrate how technology is positively impacting quality and safety of patient care in our region.

An article by the American Medical Informatics Association indicates medication errors are reduced by 12.5% per year in hospitals that adopt CPOE. Again, our group of hospitals has achieved, on average, an annual reduction in medication errors of 38.4%.

Our Learnings

Three critical success factors were identified:

1. **Effective governance** – Our governance structure was revised, placing frontline providers/clinicians in decision-making roles around clinical processes. The highest level of decision making includes the Chief of Staff or Chief Nursing Executive from each of the hospitals as the voting member representing their organization, with one vote per hospital.
2. **Stewarding ongoing operating costs** – Each hospital contributes to operating costs to maintain and advance the system.
3. **Reflective evaluation** – A formal debrief was conducted by the Ivey School of Business, with professors included on our Steering Committee as observers throughout the project. Their key findings are summarized below.

Category	Increase or do more of	Decrease or do less of
Project management	Implement stronger project management practices at all levels and improve budget practices	Don't expect strong plans to translate into easy wins or low change impact
Learning as a deliverable	Build learning mechanisms and opportunities into the project	Don't mistake learning as a failure
Accountability	Establish better mechanisms to consistently hold people accountable for their project roles	Don't see this accountability as just a project issue but rather as an ongoing transformation requirement
Benefits realization	Continue to focus on who owns the HUGO benefits	Don't look for results without direct active management every day
End-user focus	Focus more on the people vs. systems; create plans that are adaptable to needs of end users	Don't over-estimate people's understanding of what's going to happen

Our work to improve quality and safety of patient care in our region isn't done. Our hospitals are collaborating to introduce the next phase of work, toward a fully electronic health record, increasing use of standardized order sets. This will allow us to focus on predictive analytics in the future.

There are five hospitals in the Erie St. Clair LHIN planning to transition to our system in the next few years to leverage our innovative work and improve patient care.

"I was pleasantly surprised that HUGO allowed my doctor to prescribe medication changes and testing, and even admit me to hospital REMOTELY, greatly expediting the whole process compared to what I had become accustomed to in the past."

- Sharon Tambeau, a patient from a small town in the region

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From Paper to Pixels: How Niagara Health Avoids Costs for Distributing Paper Reports to Community-Based Clinicians

Niagara Health

Our Challenge

Ontario hospitals, such as Niagara Health, used to spend a lot of resources preparing, downloading or eFaxing clinical reports for hundreds of clinicians, on behalf of thousands of patients. These methods of processing patient reports were not efficient for hospitals and for continuity of care, often resulting in complications and readmissions for patients. Niagara Health and our clinician community identified a need for a digital health report solution that could reach clinicians anywhere in the province and free up time spent by hospitals and clinicians' practice staff managing paper reports. Hospital staff were managing multiple distribution methods to deliver paper reports. The time spent preparing and distributing paper reports could be invested in more valuable patient care activities and the time spent filing and scanning these same reports at clinician practices could also be redirected to patient care. The digital solution would need to augment regional digital report delivery solutions and complement their other functionality. Niagara Health defined its problem by identifying a desired future state:

- Simplify work for the clinicians (physicians and nurse practitioners) and the hospital;
- Reduce opportunities for error (misdirected reports, etc.);
- Leverage provincial investments, where possible, including investments in regional integration (ClinicalConnect infrastructure);
- Connect via OntarioMD's provincial Health Report Manager (HRM) solution to clinicians' electronic medical records (EMRs).

Our Process

Niagara Health had trialed a local technical solution – ClinicalConnect – to increase efficiency of report delivery in the absence of a solution with provincial reach. Once a scaled-up provincial electronic report delivery service was available, we jumped at the chance to leverage it. The integration process was aided by the existing ClinicalConnect regional infrastructure provided by Hamilton Health Sciences (HHS); they took care of integration testing and establishing connectivity. Niagara Health had to establish commonalities among five sites that had maintained independent, report-type lists, so there was a significant effort by the hospital to align these for consistent delivery to clinicians. We thank HHS for its early partnership and contribution.

Niagara Health was the first hospital in the Hamilton Niagara Haldimand Brant Local Health Integration Network (HNHB LHIN) to go live on OntarioMD's HRM – the report delivery solution that began provincial expansion in 2013. Niagara Health trialed HRM on behalf of other hospitals in the HNHB LHIN due to an advanced state of readiness compared to other hospitals. Our work made it easier for the other HNHB LHIN hospitals to take advantage of the integrated ClinicalConnect-HRM solution. The estimated timeframe for the whole process of connecting to HRM was approximately six months.

Niagara Health went through HRM's pre-defined onboarding cycle. The implementation process started with information sessions to outline the HRM integration requirements and determine development effort. Following these sessions, a series of testing cycles were conducted. Once complete, all parties signed-off on the finalized integration and a go-live date was scheduled.

Niagara Health also benefitted from the work that the regional ClinicalConnect solution provided as an intermediary for technical integration. They had the foresight to align the work of the five hospitals to send reports out consistently through a single interface. Niagara Health's information technology (IT) department and staff from ClinicalConnect and OntarioMD worked together to ensure the HRM implementation was a success.

Our Solution

Niagara Health used HRM's digital health technology to address the secure and efficient distribution of the reports not only to the community-based clinicians in the Niagara region, but to any clinician in Ontario whose patients visited the hospital. The breadth and reach of this report delivery are important as the Niagara Region is a major tourist destination. HRM is currently used by more than 10,000 physicians and nurse practitioners across the province, and this number is still growing. Prior to Niagara Health's go-live in 2015, there were less than 20 clinicians live on HRM in the HNHB LHIN. Today, that number has grown to over 800 clinicians receiving reports in their EMRs from HRM.

The network and amplification effect of HRM was also an important value proposition for us because of the number of visitors to our region every year. Officially, the Niagara Region welcomes approximately 14 million visitors yearly. In 2017, of the total visitors to Niagara Region, 67.1% came from within Canada, and many of these visitors were Ontarians. In addition to providing care to the people in our region, Niagara Health also provides care to Ontarians from outside the Niagara Region as well as to other Canadians and international visitors who need medical attention while visiting the region. HRM was an attractive digital health solution for Niagara Health amplifying our reach by enabling the hospital to electronically deliver hospital reports outside our LHIN to clinicians who also use HRM in all other LHINs, including many remote parts of the province. As of December 31, 2019, we have sent reports through HRM to 1,688 clinicians in all five interim/transitional regions (all of the former LHINs).

HRM's value increased after the addition of the eNotifications functionality. eNotifications are short electronic messages from the hospital information system to Ontario Health's Shared Services' (formerly Health Shared Services Ontario) Client and Health Related Information System (CHRIS) and then to HRM. eNotifications are triggered every time a patient is discharged from the Emergency Department or admitted to or discharged from in-patient units. They contain critical admission-discharge-transfer data and enable clinicians to follow up with patients sooner within the post-discharge guidelines and inform ongoing treatment if required. eNotifications also alert clinicians to reports such as discharge summaries, consult notes, CT scan reports (and much more) that will arrive from Niagara Health as soon as they are transcribed and transmitted via HRM.

Our Success Factors

Senior Management Support and Governance

Niagara Health's senior management team took a long-term view and saw the value in aligning to provincial services such as HRM and leveraging existing regional tools such as ClinicalConnect. They had the foresight to align the work of all five of its hospital sites to send reports through a single interface. As with all IT implementations at Niagara Health, the project to implement HRM followed our process/gating/quality control as well as participating in HRM's hospital onboarding process.

Project Leadership

The project team's leadership ensured that reporting, communication, progress and status between the hospital and the HRM team at OntarioMD was clear, frequent, thorough, and ensured all objectives for the implementation were met. The complexity of working with multiple integration partners through the ClinicalConnect infrastructure made effective project leadership even more critical as all members of the broader team had to collaborate toward a single, common goal. Under the direction of hospital senior leadership, Niagara Health's project lead worked closely with internal hospital stakeholders, the ClinicalConnect team, and OntarioMD.

Choose Technology Solutions Carefully

Niagara Health followed a thorough process for selecting a cost-effective solution that would achieve its objectives. The hospital was already using an effective regional solution, but this was limited as it did not have the scale and spread of HRM. Considering Niagara Health's need to offer care to Ontarians from across the province and share information seamlessly and securely with primary care providers in their region, HRM was the only solution that could meet these needs and could still leverage ClinicalConnect for a streamlined technical integration.

Selling Benefits and Addressing Barriers

Niagara Health understood the benefits of HRM, particularly its provincial scope, which is an important consideration for a region that receives millions of visitors each year. The potential barriers to implementation such as time, cost and resources, led to the decision to implement this digital health solution in March 2018 based on cost avoidance, the ability to leverage the ClinicalConnect integration as well as the single interface for its five sites.

Implementation Assistance

Throughout Niagara Health's HRM implementation, its project team worked closely with the HRM team at OntarioMD and the ClinicalConnect team at HHS's Hamilton Information Technology Service (HITS) Office. The teams were in frequent contact with one another to ensure the implementation was progressing according to plan. Funding and governance were provided by the Connecting South West Ontario (cSWO) program.

Feedback and Dialogue

With the Niagara Health, ClinicalConnect and OntarioMD teams working closely together, there was constant dialogue and feedback before, during and after, the HRM implementation. This led to a smooth and efficient implementation. The HRM team was attentive after go-live recognizing that Niagara Health may need assistance in the 30-day period following to ensure any minor glitches were promptly addressed on the HIS and HRM sides.

Our Impact

The outcomes of Niagara Health's implementation of the HRM digital health solution are regularly quantified. Within our LHIN, we send reports to support the continuity of patient care to nearly 600 clinicians in our region. Our ability to send reports to another 1,000+ clinicians outside our region is improving care transitions and patient outcomes for patients beyond Niagara Region's borders. As of December 31, 2019, the hospital has sent 1,842,431 reports via HRM to 1,688 clinicians in all five interim/transitional regions in Ontario.

Physicians and nurse practitioners who receive reports from Niagara Health through HRM and eNotifications can follow up with patients much sooner, within the recommended guidelines. Clinicians have also reported that the timely receipt of the reports into their EMRs has resulted in better care transitions and continuity of care, especially for patients with complex care needs. This improved continuity of care improves the patient experience and has a direct effect on patient outcomes by avoiding complications such as adverse drug events. Patients have told their primary care providers that their providers' access to discharge summaries and other reports electronically is a big improvement from the days when patients would have to contact their providers to inform them that they were in the hospital, usually before the arrival of the discharge summary by fax or by mail.

Having access to critical patient information has had a positive effect on avoiding complications by knowing patients' medications and dosages, tests performed at the hospital, as well as having timely access to the information contained in a myriad of report types.

OntarioMD undertook an independent evaluation of HRM by Deloitte in 2017 to validate HRM's benefits to hospitals and to clinicians which include workflow efficiencies for hospitals and clinicians; much lower faxing and printing costs; and administrative, legal and operational efficiencies. This analysis suggested that, by the end of 2020, Niagara Health will have avoided nearly $150,000 in costs as a direct result of HRM. The Deloitte report concluded that HRM enabled millions of dollars in cost avoidance for the health care system every year.

For 2018, because of the increase in sending reports through HRM to facilities and clinician recipients, this cost avoidance has grown to $36 million per year.

The Deloitte evaluation of HRM validated time savings for primary care providers who use HRM, citing a conservative estimate of average time saved by clinicians or their staff totaling 23 to 33 minutes per day, per clinician/staff. Primary care providers have cited time savings amounting to several hours per day or week. A clinic in southwest Ontario, Grand River Sports Medicine, reported a 50% reduction in time spent matching reports with the proper clinician once it began using HRM. This time saved has been redirected to patient care activities. Another clinic in south west Ontario, Urology Associates, cited time savings of four hours a day due to no longer scanning reports since they began using HRM.

The HRM solution has also had a positive impact on Niagara Health. We have experienced administrative efficiencies from our HIS interface to HRM. From a cost-avoidance perspective, the hospital has achieved savings of well over $100,000 since we went live with HRM.

OntarioMD is currently undertaking a study to assess the impact of eNotifications on Emergency Department readmissions and we will be very interested in the impact on our hospital. HRM also has the potential to expand to patients so they can access the information contained in their hospital reports, another objective of Ontario's Digital First for Health strategy.

Our Learnings

As Ontario's health system organizes health care providers, including hospitals, into Ontario Health Teams (OHTs) and takes a streamlined approach to the use of digital health solutions across the OHTs, HRM will be an indispensable tool for hospitals allowing them to share patient information across the continuum of care. HRM's plans to be bi-directional (hospital to EMR and EMR to hospital) and include patient access to their hospital reports will also fulfill hospitals' and the health system's goal to provide more integrated, patient-centred care.

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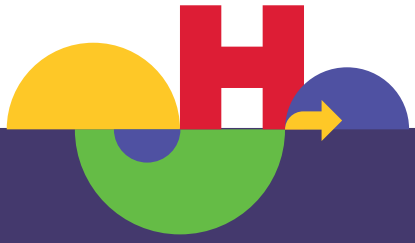

"HRM has had a positive impact at Niagara Health and is definitely a tool to be leveraged by the Ontario Health Teams (OHTs) as they form!"

- Sime Pavlovic, Chief Information Officer, Niagara Health

One Tube One Label – Specimen Collection

London Health Sciences Centre and St. Joseph's Health Care London

Our Challenge

The One Tube One Label project started in 2015 to address blood collection labeling errors resulting from incorrect or sub-optimal ordering, collecting, and labeling processes and practices. The number of errors was more than 10 times the minimum recommended standard, costing the organization approximately $1.2 million in rework, staffing and supplies. Most importantly, errors affect patients — repeated collection and unnecessary lab tests, improper diagnosis, and even adverse events can occur when inappropriate medications are given based on incorrect lab results.

Every label issue or error can lead to:

- Repeated specimen collection for patients
- Increased risk of missed or delayed tests or collections, which can lead to delayed treatment
- Increased risk of "wrong blood in tube" (patient X's blood in patient Y's tube)
- Unnecessary workload for clinical teams and nursing (searching, sorting, keeping tabs)
- Unnecessary workload for labs (rework, problem-solving, order-entry fix)

Our Solution

At London Health Sciences Centre (LHSC), we're using Specimen Collection (Specimen Collect) to address those errors. Specimen Collect is the functionality within the Cerner system that uses positive patient identification intelligence to ensure on-demand printed labels are immediately matched to a patient's record.

At LHSC, nurses can now easily print on-demand specimen labels for sample collection right at a patient's bedside, at the point of collection. Test tubes are labeled and scanned with the patient's wristband to ensure the correct sample lands in the correct tube, with the correct label. This confirms positive patient identification and that the sample belongs to the patient. It's immediate and accurate, eliminating additional touch points in the process. This capability is reducing labeling and misidentification errors, ensuring safer care for the patient.

The Cardiac Care Unit, Women's Health, Paediatric Emergency and St. Joseph's Urgent Care Centre tested this new practice in 2016-2017 and experienced a significant decrease in labeling and misidentification errors (wrong blood, wrong tube, wrong patient). Specimen Collect was then rolled out in all inpatient units and Emergency Departments at LHSC.

About 540 workstations on wheels (WOWs) and bedside workstations at LHSC are now equipped with new label printers and barcode scanners to facilitate bedside scanning and labeling. LHSC has two major hospital sites. Implementation started at the University Hospital site in August 2018 and was completed in November 2018 at the Victoria Hospital site.

Our Success Factors

Senior Management Support and Governance

This initiative included a strong collaborative relationship between three departments: Pathology and Laboratory Medicine, Information Technology Services (ITS) and Professional Practice. Senior management support from all three translated into a collaborative project

team deploying a new solution that was extremely well-accepted by end users. This initiative was promoted by the lab, rather than ITS. This meant users focused on the outcomes (decreasing labeling errors and improving patient safety) rather than the change (having to use new hardware and software). This contributed to the success of the project.

Involving Stakeholders

Stakeholders were engaged very early on during departmental readiness assessments that aimed to generate excitement and accountability, assess physical space and hardware needs, complete individualized workflow assessments, and identify change management strategies that would ultimately lead to each unit's success. Next time, it would be valuable to sit down separately with leaders to review the ongoing accountability components in-depth. The project team had to revisit some units to encourage leader accountability for scanning compliance and error follow-up. These appeared to be units that have historically had compliance issues, so we could have anticipated the problem. Once these units were revisited and supported, improvements were made; however, it was time-consuming.

Choose Technology Solution Carefully

One of the most challenging parts of this project was related to hardware. We deployed a mix of desktop printers and mobile (Wi-Fi) printers. This meant there was a lot of validation required to ensure compatibility. There were issues with the Wi-Fi printers, but we still chose to deploy them to almost 500 units during the LHSC implementation.

We also deployed a new barcode scanner that works extremely well, which had been a pain point for nurses, and became a huge win for the project early on. However, the Wi-Fi printers introduced new issues that required hands-on support by the ITS Help Desk. Printers needed to be sent off for warranty support, and we quickly ran out of backups while our vendor was resolving the issues. Next time, it might be valuable to perform a proof of concept using multiple hardware options to see which works best in our environment. Creating a more robust pilot to better understand the hardware requirements or potential hardware issues across departments would also have been valuable.

The Cardiac Care Unit participated in our pilot phase. We knew that adding the printers to the WOWs was the best strategy for best practice and nurses' workflow. However, we had to settle for hallway printers due to ongoing printer failure until we addressed the problem with dynamic DNSs.

Early Planning Strategies

Having a strong, thorough pilot phase of the project helped ensure success of the full implementation at LHSC. So much detail went into hardware and software validation, building training material and reviewing workflows, that when it came time to deploy the solution to the rest of the organization, we were essentially "operationalizing" the Specimen Collect process across LHSC.

Training

The project team used the "just in time" education model, which allowed for at-the-elbow support during go-live. We also used super users to ensure continuous support. The training for Specimen Collect included hands-on training by a clinical informatics specialist, using a demo WOW on the units. This allowed users to see the new workflow a few days prior to go-live. During go-live, the clinical informatics specialist spent two days with each unit to ensure they were comfortable with the processes before moving on. At the end of the go-live, the clinical informatics specialist returned to the units to do follow-up training and support.

The lab leadership had originally encouraged a big-bang approach whereby we would implement for an entire building at once. Due to the low volume of support on the project team, we suggested a rolling implementation would be better. This proved true, as we had very little issues during go-live with the rolling approach. We used the same approach at the next hospital site.

Our Impact

Results are proving to be very positive. The International Federation of Clinical Chemistry proposed a benchmark of 0.07% labeling error rate. Since implementation of Specimen Collect at LHSC, several inpatient areas have reduced their rates to 0%. Results are being closely monitored on an ongoing basis to ensure compliance and sustainment of reduced labeling errors. LHSC is developing a sustainability model that will address individual and leader accountability around compliance with bedside labeling best practices.

Our Learnings

The collaboration between the Lab, ITS and Professional Practice was truly the most successful factor in the implementation. The lab drove the change by promoting patient safety, error reductions and cost savings. ITS supported the change by providing the infrastructure, technology, processes, training and support. Professional Practice holds the ongoing accountability by ensuring the change in practice is supported by leaders and that users are held accountable for their actions.

Leaders, educators and other clinical users also have positive feedback about the new process, and about the preparation, support and troubleshooting help they received. Each unit went through a customized readiness assessment to ensure the hardware devices were integrated in the Specimen Collect workflow.

"It's rewarding to see the immediate impact of Specimen Collect in reducing mislabeling errors. Also, the feedback from clinical users and educators has been positive. Uptake has been great."

- Channpreet Sekhon, Clinical Informatics Specialist

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Ontario Lab Information System Direct Integration to Hospital Information System

St. Joseph's Healthcare Hamilton

Our Challenge

St. Joseph's Healthcare Hamilton (SJHH) was upgrading its Hospital Information System (HIS) and wanted to take advantage of advanced workflows and lab result trending tools. One area identified was the consumption and direct integration of lab results from the Ontario Lab Information System (OLIS). OLIS results were typically reviewed by clinicians through read-only external clinical viewers, which did not allow results to be brought directly and automatically into the HIS/patient electronic medical record. This also meant results could not be used for trending or as part of other clinical documentation. This was impacting clinical care as clinicians were sometimes unaware of external lab results.

Access to the additional lab information directly in the HIS from OLIS would provide a greater view of a patient's information, offering additional clinical information to care providers and others. This would enable the best clinical decisions for patients. The integration would also streamline the process for clinicians – so they wouldn't need to look for it in different places – and provide an opportunity to reduce the number of lab tests ordered. This would benefit both the patient, through a reduction in required tests, and the system by reducing the overall cost due to unnecessary duplicate lab orders.

Our Process

SJHH, in partnership with Children's Hospital of Eastern Ontario (CHEO), Hamilton Health Sciences (HHS), Group Health Centre (Sault Ste. Marie) and Women's College Hospital (WCH), worked closely with eHealth Ontario (eHO - now Ontario Health) and OLIS to draft a joint Project Opportunity Summary. A joint submission was needed because all the noted sites had the same HIS, which would help share learnings across the group of hospitals. It was presented to eHO to kick off the internal review and gating process.

From a technology perspective, the Epic Health Information System (HIS) already had the integration pathways available to easily consume external lab results directly via HL7 interfacing. Given the approval process, threat risk analysis and privacy impact analysis, as well as the internal project gating process, it was anticipated that the project would take approximately 12 months to complete. Though the direct consumption model already existed via OntarioMD, integrations to approved Primary Care Physician EMRs had never been done to an acute care HIS. Since this was a new data usage model for an eHealth asset, it was decided that a single site would be piloted to test out the implementation working closely with eHO and OLIS teams. SJHH was selected to be that site with the ambitious goal of aligning this go-live with their big bang HIS upgrade scheduled for December 2017.

Our Solution

The solution used existing technologies, interfacing via the SJHH interface engine with the eHO OLIS services. SJHH was required to purchase a web service adaptor for their existing Cloverleaf engine to connect with OLIS. On the technical side, one of the biggest challenges was ensuring proper certificate and encryption configuration to allow data exchange outbound and data decryption algorithm alignment for inbound.

Several other challenges also had to be overcome. Since this was a new model for eHO, both organizations spent significant effort analyzing the privacy implications and practices that needed to be considered. For example, who would have access to the OLIS lab data in the HIS? How would it be displayed in the HIS to ensure clinical validity? How would the same lab results from different sources trend with different units of measure? How would differences in terminology between OLIS and HIS be interpreted and matching of lab results to patients be addressed? How would logical deletion of potentially erroneous lab results be addressed? These were just some of the questions raised and jointly addressed as part of the implementation.

The solution ultimately involved building both an automatic OLIS query data pull within the HIS and also a button within the HIS that would allow users to have data pulled from birth for the patient. Initial use scope was limited to physicians only. eHO's concern for capacity intake and substantial volume increase to the service was the driver behind an initial role limitation during implementation. They proposed to study activity for a pre-defined period before allowing expansion to future roles. Upon access to an active patient, the HIS system would automatically query OLIS to consume the most recent 180 days (configurable in days) of OLIS lab data into the HIS for the patient that was viewable directly within the HIS lab results view workflow. This was a seamless presentation of all lab data. If the user wished to have a larger data record set, they could click the button and have the entire OLIS lab data set for that patient downloaded into the HIS. Ensuring native viewing functionality and trending of lab results was a priority. It enabled maximum value for clinical decision making.

Though initial scope was physicians, it has expanded to include all care providers that require access to patient lab data. OLIS lab data (where it has been updated as part of a patient encounter) is also available to patients via the SJHH MyDovetale Patient portal. Various levels of leadership at both SJHH and eHO were involved, and a project lead on the SJHH side partnered with a project lead at eHO, interface specialist, lab application specialists as well as security and privacy representatives at both organizations. The SJHH Chief Medical Information Officer (CMIO) and several physicians were also heavily involved with workflow review and testing as well as an Interface and Lab Technical Specialist from the HIS vendor.

Our Success Factors

Project Leadership

This project would not have been successful without leadership from both eHO and SJHH. Since this was a new model of data consumption for eHO, both internal approval, and careful monitoring through their gating process was required, as eHO also recognized that this is a fundamental shift in strategy and this integration would act as a good test case to guide learning for the future.

Involving Stakeholders

This initiative was originally conceived via discussions that occurred between SJHH and HHS as well as an initial attempt at a similar integration by the Group Health Centre (Sault Ste. Marie). The CMIOs from SJHH and HHS met with eHO initially to outline the clinical benefits and perspective. This initial stakeholder meeting was the catalyst that triggered additional discussion that eventually led to the project submission proposal, pilot and successful implementation.

Selling Benefits and Addressing Barriers

Both organizations easily recognized the benefits to clinicians, patients and the health care system. The shared goals of patient safety, privacy and security, encouraged the eHO and SJHH teams to work closely to overcome barriers especially around privacy and data presentation.

Technology Usability Factors

The technical team with Epic (HIS vendor) deserves significant credit as their experience helped shape the implementation of the data consumption and integration workflow with ease of usability in mind. The automatic 180-day pull for active patients and a simple button to pull in more data if required, meant this was a one-button click for clinicians, so no additional training

was required to benefit from this integration. The two constructs were modularly designed in the background – the same process in the background invoked by the two different methods.

Implementation Assistance

The wealth of external lab data integration experience by the HIS technical team was invaluable in smoothly implementing the solution.

Addressing Privacy and Confidentiality

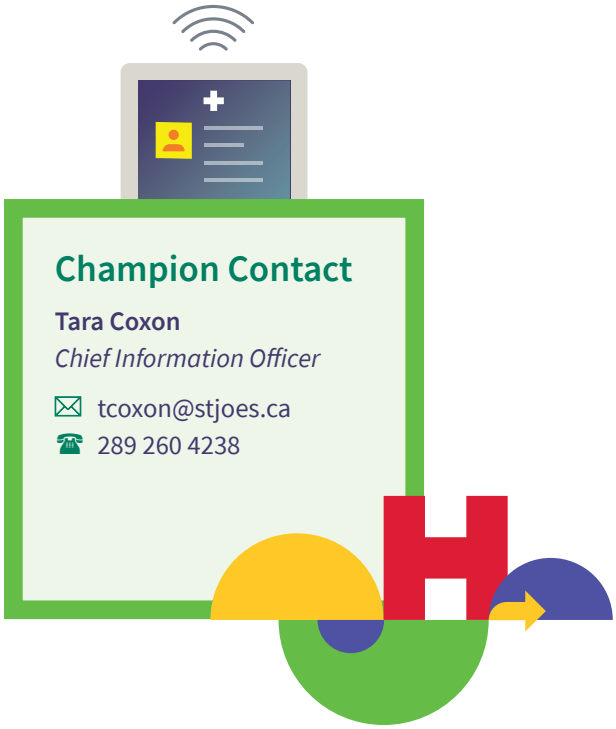
OLIS-consumed data are filed in the same repository as SJHH lab data, meaning all current HIS rules (accessing, auditing) are captured for review if warranted. Moreover, eHO's consent directive is honoured during HIS consumption at either the patient or test level. SJHH and eHO's Privacy resources were part of the core group in analytics, design and execution to ensure that all *Personal Health Information Protection Act, 2004* requirements were met across a broad range of usage scenarios.

Our Impact

Since implementation go-live, SJHH has retrieved 8,283,329 unique lab tests across 178,332 patients from OLIS. On an annualized basis, that translates into 5,360,665 consumed unique lab tests. Patients benefit from not having to encounter repeated tests. Physicians and other clinical users benefit from having data readily available, reviewable from a single source window, so they can act decisively and in a timely manner. This avoids unwarranted data capture and additional workflow to obtain data.

Our Learnings

The largest obstacle that both organizations had to overcome was consensus on the consumption model blueprint and definition. During project initiation, a consumption blueprint was not available, and it became evident as the project completed the defined sprints and passed deliverables gating, that the inquiry model could not be used in place of a consumption model. eHO had a mature inquiry blueprint with a precision conformance test plan, however, the consumption model could not use the inquiry model in its entirety. Jointly, the goal was to design a single solution that could reuse as much of the existing framework and functionality. The goal from the onset was to define, design and implement a solution that would be reusable to all of Ontario HIS vendor clients and would satisfy SJHH and eHO's requirements and guiding principles. This was successfully achieved and both organizations benefited from the collaboration that resulted from implementing OLIS direct consumption in the HIS.



Single Encounter Workflow Project

London Health Sciences Centre and St. Joseph's Health Care London

Our Challenge

The flow of patient information changed when London Health Sciences Centre (LHSC), St. Joseph's Health Care London (St. Joseph's) and their Thames Valley regional hospital partners (nine hospitals in total) transitioned from a paper chart to an electronic medical record. In the paper world, orders were written on a single chart that travelled with patients. In the digital world, the chart still follows patients, but encounter numbers are used to signal when they visit different areas or locations of the hospital. This adds a level of complexity to the electronic system, requiring a great deal of coordination and oversight in the background by clerks and nurses to minimize risk and ensure continuity of orders. For example, nurses on the floor couldn't easily see what medications had been given during the Emergency Department (ED) encounter. It wasn't in their normal workflow, required extra work and there was always the risk of error. The electronic system is intrinsically designed for downstream recordkeeping and reporting; therefore, separate encounter numbers were needed.

Moving to an electronic system forced physicians to be encounter-aware out of necessity. If they weren't encounter aware, there was a problem. If a patient was in the ED and they were going to be admitted to hospital, the consulting service would come in, write their orders, and wouldn't be aware that they were writing orders on an ED encounter, and that their orders wouldn't follow the patient to their inpatient encounter.

Our Solution

LHSC, St. Joseph's and their Thames Valley regional hospital partners are the first Cerner-based, multi-site regional health system live with an order-based, single encounter workflow solution. The new workflow improves patient safety and outcomes by ensuring physician orders and other clinical notes follow patients when they move across different hospital settings, including from the ED or Urgent Care to Inpatient Admission.

The decision to add single encounter workflow functionality was made soon after LHSC and St. Joseph's went live with its Health Care Undergoing Optimization (HUGO) project in 2015. The new system was up and running in September 2018. Throughout the project, the primary focus was what's best for patient care, and how to minimize risk and potential errors for clinical staff.

All communication and messaging really focused on what this meant for patients as they crossed different points within and outside the organization. Patient care has been the hospitals' number-one priority.

Today, an entire hospital visit is treated as one encounter. This allows easier identification and selection of the correct patient for order entry and ensures clinical documentation flows from one part of the hospital to the next. At the same time, thousands of back-end reports and interfaces with other systems, including capacity management, are receiving the specific encounter information required for seamless data flow and recordkeeping.

This was one of the most complicated initiatives the team had ever undertaken. The successful implementation speaks to the high level of expertise within the Information Technology Services (ITS) portfolio and the strong partnership between ITS and clinicians.

The single encounter project was led by Clinical Informatics, Clinical Applications and Clinical Solutions, in collaboration with leaders and physicians across all hospitals. The majority of the programming effort was completed inhouse, supported by Cerner consultants as needed. When the system went live, less than 100 help desk tickets were logged, none of which were severe.

The teams focused on consistent messaging and tried to emphasize the "WHY" behind the initiative. It was positioned from a patient safety and quality of care perspective rather than a technology-driven initiative.

Our Success Factors

Senior Management Support and Governance

The project was identified by senior leaders as a priority, which cleared the path for all staff to work on it. This contributed to a dedicated focus and ultimate success. To cascade and share information around the change and associated downtime, we had direct access to clinical leaders.

Choose Technology Solution Carefully

We went down a number of solution paths before determining the optimal solution for our organization to meet both clinical and reporting requirements. We needed to ensure data integrity while meeting reporting requirements. There were a number of go/no-go stage gates to ensure our solution met both clinical and reporting requirements. We also placed priority and emphasis on improving patient care, safety and user experience, versus reporting.

Involving End Users

The benefits to patients were clear to providers and clinicians, so adoption was high.

Early Planning Strategies

The go-live build was very complex and required a number of rehearsals before the go-live day to ensure downtime was minimized.

Workflow Redesign

Improved efficiencies made the admission process simpler for providers.

Our Impact

In its first two months of operation, single encounter eliminated more than 8,000 opportunities for error. In addition to mitigating the risk for medication error and improving clinician communication across the care continuum, single encounter functionality is enabling the hospitals to standardize practices and prepare for the next phase of our electronic clinical documentation rollout. This next phase includes electronic clinical documentation for nurses and physicians, device integration and advanced analytics. It's also speeding up the process of assigning beds to inpatients, meaning patients are spending less time on stretchers in the ED.

Specifically, LHSC and St. Joseph's generally run at more than 100% occupancy. Prior to transitioning to single encounter, physicians would create an inpatient encounter for patients being admitted to hospital from the ED. Clerks would watch for the order and notify Admissions to make a patient transfer request. Single encounter automates that step, sending a notification to start the bed hunt the moment a physician enters an "admit patient" order. Now, staff can focus more attention on their patients, with less system stress.

Our Learnings

- Keep the patient experience at the forefront of the project – do not design the system for reporting requirements.
- Keep looking until you find the right solution. It took us four tries to get it right.
- Push your vendor to ensure they have the latest information available on functionality.
- Ensure your requirements are clear and determine what is a "must have" versus "nice to have" right from the start.

"Single encounter means we can be less encounter-aware and more patient-aware. An opportunity for stress has been taken away and we free bandwidth for practitioners to focus on what we really want them to focus on rather than what our system demands they focus on."

- Julia Marchesan, Integrated Regional Director, Nursing Informatics, London Health Sciences Centre

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Empowering Patients Using Integrated Bedside Terminals

Humber River Hospital

Our Challenge

During their hospital stay, patients may feel a loss of independence and autonomy due to their dependency on others for help. Though the loss of independence and control is somewhat unavoidable due to the nature of their illness, it is important to ensure that patients feel comfortable and in control of their environment.

Our Process

Initially, the project began when the clinical team at Humber River Hospital (HRH) suggested that a bedside terminal should be installed in patient rooms to provide nurses with the ability to chart and scan medications at the patient's bedside, instead of bringing in a point-of-care cart, when contact isolation precautions were required in a patient's room. This was needed to further augment infection control actions and drive efficiency.

Further conversations eventually led to the planning of an integrated bedside terminal (IBT) whose purpose would be three-fold:

1. Allow the clinical staff to chart and scan medication right at the patient's bedside;
2. Provide patients with entertainment features such as TV and radio; and
3. Provide the patient with greater independence through environmental and comfort controls.

Our Solution

Recognizing that patient empowerment and comfort are vital measures of quality, IBTs were introduced at HRH in 2015 with the primary purpose of enhancing the patient experience. A total of 724 IBTs were installed in rooms on all wards in 2015.

The IBTs help promote independence by providing patients with access to meal ordering service, and room environmental controls that allow them to adjust room lighting, temperature settings and level of window shading. The IBTs also provide patients with access to their personal health information, including results from lab and diagnostic imaging tests and vital signs data, as well as resources for patients to browse a plethora of medical conditions. The bedside terminals are also equipped with Netflix, Amazon Prime Video, instant messaging service, TV and radio. Additionally, a 42" TV was installed at the foot of each patient's bed so that family members could watch TV together with the patient.

Our Success Factors

Choose Technology Solution Carefully

HRH's Chief Technology Officer, Kevin Fernandes, emphasizes that when entering into a partnership with a vendor, it is imperative to find one who is willing to continuously innovate. The team regularly seeks feedback from staff and patients to drive efficiency and improve user experience. Therefore, it was important that the vendor would be willing to continuously work to develop innovative solutions to meet the hospital's

needs. Furthermore, due to the IBTs' integration with different systems, the vendor had to have proven expertise with integrating multiple technology based systems together.

Feedback and Dialogue

Early engagement and input from staff, patients and families throughout the decision-making process were imperative to the success of the project. As previously noted, the project began when the clinical team suggested installing bedside terminals in patient rooms so that nurses could chart and scan medications at the patient's bedside. The final purpose of the IBT evolved immensely due to early input from key players and was critical to their successful design and functionality.

Involving End Users

Patients' experience with the IBT was continuously improved thanks to the dedication from HRH's standing patient and family advisory committee. Feedback was also sought from nurses and current patients through interviews and surveys. Elderly patients commented that they were not able to use the IBT because the text size was too small for them to read and the touchscreen keyboard was not sensitive. As well, some of the patients' family members noted that the text should be available in multiple languages to accommodate HRH's diverse population. Nurses as well as patients' family members also mentioned that elderly patients had difficulty grasping the technology. As a result of this feedback, numerous improvements have been made to the technology to make the IBTs more user-friendly. Additionally, technical support is available to patients 24/7, trained hospital volunteers are also available to teach patients and their family members about the use of the IBT, and future plans will include uploading video tutorials to the IBT.

Our Impact

We conducted a study to contribute to the limited body of knowledge surrounding this novel technology; these findings were published in the *Canadian Journal of Nursing Leadership* (Volume 32, Special Issue). To assess patient satisfaction with the IBTs, surveys were sent to 113 inpatients. Nurses were interviewed to gain further insight on its use. Patients rated the room environmental controls and meal ordering service highly as they provided patients with greater independence. Nurses stated that the IBT was a great source of entertainment for the patient to relieve boredom and help them fall asleep at night and was a good distraction for patients experiencing acute pain. Additionally, they stated that the news channel on the IBT served as a reorientation strategy for reducing delirium among older patients.

Furthermore, numerous health resources and lab results are immediately available for patients to view on the IBT. Nurses stated that they often used these resources to educate patients and their family members about health issues thus, making conversations possible and strengthening the relationship between care providers and patients.

These benefits also had a positive impact on nursing workflow by decreasing demands on the nurse. The study provided empirical support for the positive impact of the IBT on patients and nursing workflows.

Our Learnings

Feedback from patients is vital to enhancing the success of health technology, and supporting patient empowerment goes beyond providing patients access to their health information. We are looking at integrating a feature to allow patients to document their notes on the IBT which will promote involvement and may offer a greater sense of empowerment in relation to health management.

"My patient was going for angioplasty, and she was very worried about the procedure. So, I could pull out the material on the IBT, and she got an idea about what to expect. That made her feel a little better."

(as quoted in Burkoski et al., 2019, Patient Care in a Digital Hospital, *The Canadian Journal of Nursing Leadership*, V32 Special Issue)

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MySMH Pilot Project

St. Michael's Hospital – Unity Health Toronto

Our Challenge

St. Michael's Hospital identified an opportunity for process improvement related to patient wait times and appointment management. To this end, a Design Thinking session was held in the summer of 2017 in partnership with the Ryerson Biomedical Zone (BMZ) and IBM to help identify key patient pain points during a visit to hospital or clinic. Pain points included long wait times, excessive no-shows, a time-consuming registration process, and limited transparency for patients.

As a result, the HealthBound 2 Competition was launched with the BMZ to support the development of a solution with the help of Toronto-based start-ups. A demo day was then held to select the winner of the competition who would move forward to pilot the solution in the Diabetes Comprehensive Care Program (DCCP).

Our Process

As mentioned, a Design Thinking session was held to identify the key pain points experienced by patients during a visit to St. Michael's Hospital or its associated clinics. Participants included patient and family advisors, pilot clinic representatives, information technology (IT) staff, BMZ staff, and hospital leadership.

Once pain points were identified, the HealthBound 2 Competition had three start-ups develop a minimal viable product (MVP) during a six-week rapid development cycle which included consultations with patient family advisors, pilot clinic staff, and IT resources. A winner was selected by competition consultants and hospital and BMZ leadership. The winner moved forward into a pilot project in the DCCP.

More consultations with patient advisors, clinic staff (including clerical and clinical), and IT took place from May 2018 to February 2019. Subsequently, the MySMH application was launched in the DCCP on February 12, 2019.

Our Solution

A collaborative approach was taken to develop the MySMH application. Clinic and patient working groups were instrumental in advising on the most effective and useful functionality for all application users. Together with the vendor, the working groups helped to design the user interface – from the layout of the application to the precise verbiage used.

The goal of the MySMH application is to enhance patient experience and engagement across the organization by providing a way to address previously identified issues such as long wait times, time-consuming registration processes and limited transparency for patients into clinic operations. Phase 1 and 2 roll-outs included the following functionality for patients: SMS wait times notifications, email and SMS appointment reminders, consent management, SMS real-time patient surveys, email education distribution, and the ability for patients to request to reschedule or cancel an appointment. Functionality for clinic staff included: a patient flow dashboard, integration with the hospital's scheduling and registration systems, ad hoc in-clinic referrals, and billing capabilities.

Several phases of testing were part of the implementation process prior to go-live, including user acceptance testing (with patients, clerical, and clinical staff) and end-to-end testing. Although there was a core multi-disciplinary clinic working group, most of the clinic staff were engaged throughout the design and build of the

solution. Several iterations of the tool were produced, and it took approximately five months to complete the build and testing before roll-out.

During implementation in the clinic, the vendor was onsite to provide hyper-care during clinic hours to support staff and patients. During this time, the vendor worked closely with clinic staff to fix any bugs and optimize the platform until it was stable and working as expected. This phase lasted approximately three months.

An evaluation plan was also developed and approved by leadership prior to the implementation. The plan captures all aspects of the solution and user experience, with the ultimate goal of improved patient engagement and satisfaction.

Our Success Factors

Involving End Users

The project worked to ensure that end users were part of all phases of the project, including design, build, and test. Weekly working group sessions were held to discuss the application with each end user group. Moving forward, we will include additional input from physicians as they are responsible for ensuring that patients move through the system, leading to improved wait time accuracy (benefiting patients). We will also incorporate inter-professional and combined working group sessions (both clinician, clerical, and patients) as part of the design sessions to support understanding between varying groups about how the proposed solution would benefit each type of user.

Data Pre-load and Integration

Working with other teams within the hospital helped ensure that the application was integrated with the hospital's current scheduling system. This increased buy-in from staff as they were not expected to duplicate scheduling work between systems, ensuring one consistent source of truth. For go-live, since the clinic often schedules appointments months in advance, a backload of data was completed to ensure that all previously scheduled appointments were included in the system. Additionally, the project was able to pull existing consent data into the tool so that patients who had already consented to receive phone or email appointment reminders prior to the system go-live would not be affected by the move to the new system.

Support

Since this project used an agile approach, go-live support was a critical period used to ensure that all staff were trained, and that the system was stable prior to ending the support period. Since most clinic staff were engaged through the design process, they felt comfortable engaging with the project team to identify system enhancement requests and notifying them when issues arose. The team remained onsite for four weeks during clinic hours to help staff address system issues. System optimizations were pushed out weekly to address issues or implement minor enhancement requests. In the future, we would allow for a longer testing period between optimization periods to enable more comprehensive testing, including regression testing.

Our Impact

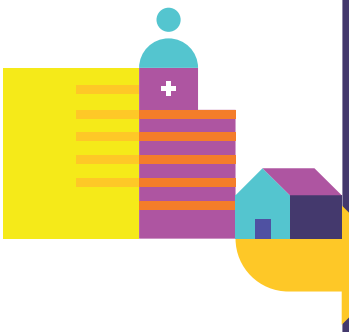
Although this tool was not meant to increase efficiency of the clinic overall, the team is evaluating whether clinic efficiency has been impacted since the February go-live. To date, there have been no major positive or negative impacts to clinic operations (e.g., wait times, etc.). Clinician satisfaction has remained neutral; however, clerical and patient satisfaction have increased as a result of this implementation. Clerical staff have noted a perceived improvement in clinic efficiency (e.g., appointment scheduling, consent management, etc.) and patients have noted increased satisfaction with the improved appointment reminders, particularly via email, as well as transparency respecting clinic wait times. These data were collected via in-person surveys with clinic staff and patients.

The clinic is working on improved use of the tool by clinicians, and are now able to collect specific wait time data and appointment duration data. In addition, we have incorporated real-time patient surveys via text message. This functionality enables patients to provide real-time feedback to the clinic after their appointment, which allows for a timely response. Additionally, staff are able to send out mass or individualized emails to patient re: education and clinic notifications.

Our Learnings

An agile approach, while effective for this type of development project and application, should employ a comprehensive testing plan to ensure that avoidable system issues are not rolled out to the clinic. Doing so may lead to decreased trust in the product among both clinic staff and patients, who may then discontinue use of the tool.

Involvement of end users as well as the vendor is critical at all stages of the project, from initiation to close-out and optimization, particularly those who are expected to use the new tool on a daily basis to manage patient flow. Incorrect usage of patient flow features will affect accuracy of other functionality within the tool.



"Our processes are more efficient. Now we see the patient's name when they come to reschedule. We just ask them for their name, and we already have the information we need. We pick the right patient and it's easier to reschedule. We don't have to ask the email and phone every time the patient comes in, over and over."

- Clerical Staff

"[The tool] Brought up the efficiency – specific to clinic days. The door doesn't have to be opened all the time to make sure that people know if I'm available or not. On other days, it's helpful as well, since I don't have to talk to the front desk as much for follow-up appointments. I also don't have to continue to refresh the scheduling tool."

- Physician

"I really like it – the queue is really helpful, especially for diabetics, because we might need to eat something before the appointment."

- Patient

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Reducing the Burden of Opioid Use Disorder

London Health Sciences Centre (LHSC) and St Joseph's Health Care London

Our Challenge

In Canada, Ontario is the province with the highest rate of opioid dispensing. The total amount of opioid tablets prescribed to patients in acute pain settings has similarly increased over time.

- One in five new prescription starts of opioids in Ontario exceed the maximum recommended dosage.
- One in nine new prescription starts of opioids prescribed by Ontario surgeons (for example, for acute pain) are for a supply of more than seven days[1].

Addressing the opioid issue is complex and requires multiple strategies, but an important component is more judicious prescribing by physicians. London Health Sciences Centre (LHSC) and St. Joseph's Health Care London (St. Joseph's) are regional and provincial leaders in patient care, and as a consequence, have a greater responsibility in the prescribing of opioids.

Our Solution

The Opioid Stewardship Council (OSC) was established by the Joint MAC (Medical Advisory Committee) in November 2017 to create a city-wide plan to address the opioid crisis facing the city and southwest region, define the scope of the challenge and develop new processes to alter prescribing habits for acute pain. The OSC includes key physician and pharmacy stakeholders from both organizations, nursing representation from the emergency room (ER) and operating room (OR), clinical informatics and surgical trainees from LHSC and St. Joseph's.

The OSC is focused on developing strategies to influence opioid prescribing for acute pain care in an effort to reduce the burden of opioid use disorder. The OSC has initiated four key strategies intended to change prescribing behaviour within both organizations as well as meet Health Quality Ontario (now Ontario Health) guidelines for acute pain prescribing:

1. Customer tamper-proof prescriptions (i.e., document presented to the patient), which will be used for all narcotic prescriptions across all sites.
2. The Health Canada Opioid Medicines Information Sheet for Patients and Families will be provided with every narcotic prescription. It will be printed automatically with any narcotic prescription and is to be reviewed with patients by their health care provider.
3. All analgesic Quick Orders and Power Plans will be revised to reflect World Health Organization guidelines for acute pain management. Most plans currently in use are in alphabetical order, but the new plans will be listed by level of analgesia required. These changes would affect all prescribers on the Cerner system.
4. The default for any new narcotic prescription start will become three days (18 tabs) maximum, for all facilities and all encounter types. Prescribers can change this if needed, but the default value is based on evidence-based guidelines and is considered sufficient for most types of acute pain management.

1 Ontario Agency for Health Protection and Promotion (Public Health Ontario); Office of the Chief Coroner; Ontario Forensic Pathology Service; Ontario Drug Policy Research Network. Opioid mortality surveillance report: analysis of opioid-related deaths in Ontario July 2017-June 2018. Toronto, ON: Queen's Printer for Ontario; 2019.

LHSC and St. Joseph's have regional electronic health record partner hospitals (on Cerner system) and the four strategies affected them and required their buy-in and engagement; they include:

- Alexandra Hospital Ingersoll
- Listowel Wingham Hospitals Alliance
- Middlesex Hospital Alliance
- St. Thomas Elgin General Hospital
- South Huron Hospital Association
- Tillsonburg District Memorial Hospital
- Woodstock Hospital

Our Success Factors

Senior Management Support and Governance

The issue and its impact were brought to the city-wide medical advisory committee (MAC) for review and discussion. The MAC, including all Chiefs, Vice Presidents, and CEOs, were educated on the extent of the problem and proposed solutions. An Opioid Stewardship Council (OSC) was also created by the MAC and endorsed by senior leadership; it was tasked with solving the problem city-wide.

Project Leadership

The OSC was led by the MAC Vice-Chair and guided by an experienced Clinical Informatics specialist.

Involving Stakeholders

The make-up of the OSC was deliberately inter-disciplinary (nurses, MDs, surgeons, Information Technology Services (ITS), trainees, Medical Affairs) to ensure we brought broad stakeholder representation to developing solutions.

Choose Technology Solution Carefully

CPOE using existing Cerner system made change easier since medical doctors were already familiar with this, and programming could be done across the board to effect behavioural change.

Involving End Users

End-user physicians (staff, residents) and nurses in key areas (ER and OR) were consulted from the beginning.

Feedback and Dialogue

A second MAC session took place to present workflow and proposed solutions and to obtain city-wide endorsement of changes. Discussion at this session helped adjust certain aspects to allow for end user flexibility. Ongoing post-implementation dialogue has taken place as well with certain services with specific needs not entirely met by the prescribing changes.

Communications Support

Existing communications platforms across both organizations were used to deliver consistent key messages using a key spokesperson via a phased approach. We also used a phased approach for the communications roll-out, during key implementation milestones including awareness, launch, and sharing successes (i.e., storytelling). We also worked with the Southwest Local Health Integration Network to ensure alignment of strategy and messages as they develop their own regional communications about opioids. In addition, we identified a key spokesperson for local media, and used storytelling and testimonials to share benefits and successes of prescribing changes after the awareness and launch phases.

Early Planning Strategies

The OSC's first steps were to dive deeply into the extent of the problem, including a review of current literature and assessment of success stories from other sites so as not to duplicate work.

Our Impact

Preliminary data suggests we're making a difference:

- There's been a decrease in opioid prescriptions overall.
- There's been an increase in prescriptions meeting the standard of 18 tabs or less.

Our Learnings

Late in the strategy development process, we became aware that our changes in the Cerner system would affect our regional hospitals too. We called an urgent meeting with the Chair of Thames Valley Chief of Staff group to review the situation and our proposed strategies and system changes. Everyone recognized that the proposed changes were valid, not disruptive to routine workflow or onerous, and that our mistake of not engaging them earlier was not intentional. Everyone recognized and supported the higher purpose of the initiative.

The Chair of OSC met with all regional MACs to review the situation, acknowledge the oversight and ask for endorsement. Eventually, all sites came on board unanimously. The end result is, all regional Cerner hospitals are adopting the programming changes to improve opioid prescribing standards. This was a superb example of regional teamwork to improve our response to a problem for the patients we jointly serve.

"The current prescribing patterns were not matching with World Health Organization standards for pain management. What we found is, there's a better way to prescribe."

- Dr. Brian Rotenberg, Vice Chair, St. Joseph's Medical Advisory Committee and Chair of the OSC

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Two Peppers: Humanoid Robots that Help Patients and Families Cope with Psychological Stress

Humber River Hospital

Our Challenge

Hospitals can be intimidating places for patients and families – particularly when they first walk through the door or for children participating in tests or procedures. They can and often experience psychological stress such as fear, anxiety and even panic.

Our Process

While Humber River Hospital (HRH) prides itself on being the first digital health hospital in North America, the Director of Retail realized that HRH lacked a technological identifier that was quickly apparent when patients and families arrived at the hospital. Curious to explore what options might be available, he conducted a literature review, connected with digital technology companies, and talked with internal stakeholders including leaders, physicians, and staff. This led to a deeper discussion about the psychological stress experienced by patients and families when entering the hospital, especially paediatric patients participating in tests or procedures.

An article about a robot called Pepper caught the attention of HRH's President and CEO which helped kick-off the process for adopting the use of Humanoid Robots to improve the patient and family experience. With that in mind, HRH formalized the direction, built a business case, and gained approval to obtain two Peppers in consultation with internal stakeholders such as the senior leadership team, Director of Public Relations, Child Life Team, paediatric physicians and staff, Surgical Team, and external vendors. HRH developed and implemented a successful plan (with no failed attempts) for the acquisition of two Peppers within a short, four-month period.

Our Solution

In 2018, HRH 'adopted' two 4.5' humanoid robots to improve patient and family experience and satisfaction by decreasing psychological stress. The first Pepper (Pepper 1) greets visitors, responds verbally to a number of questions, and sings and dances at the door. Its interactive touch display helps visitors find departments, washrooms, exits, and more. The second Pepper (Pepper 2) has the same capacity as Pepper 1 but is used exclusively by the Child Life Team to advance and enhance therapeutic, developmental, educational and psychosocial interventions with paediatric patients and families. This Pepper is frequently found interacting with pediatric patients at bedside playdates and teaching children about upcoming procedures, such as taking blood pressure. It even teaches children about specific surgeries they are having and holds the children's hands as they are taken into the operating room and wait with them and their parents while the anesthesia takes effect. Pepper 2 is also used to prepare paediatric patients for intravenous line insertions, suture removal, and cast removal in the Fracture Clinic.

Our Success Factors

Project Leadership

This innovative approach was made possible with the creativity of the Director of Retail, vision of the President and CEO, commitment of vendor support, and knowledge, skill and enthusiasm of a diverse health care team.

Involving Stakeholders

Significant stakeholder involvement occurred with obtaining, using and programming of both Peppers. For example, with the Child Life Pepper, there was extensive interprofessional collaboration with the Child Life Team, Anesthesia, Peri-operative Services and Surgeons in order to use the robot for preparation and intervention among paediatric patients having surgery.

Involving End Users (patients and families)

HRH engages patients and families to plan and initiate the best paediatric patient care possible to support their unique needs. For example, when preparing to support a specific child with Autism, the Child Life Team worked with the child and mother to develop a comprehensive individualized plan including practicing putting on the anaesthetic mask with Pepper, helping mom accompany the child (with Pepper 2) into the operating room, and arranging to have a service dog with the child during the entire experience. These interventions kept the child calm, gave her comfort and facilitated a successful surgery.

Vendor Partnership

Our procured vendor provided us key information that helped HRH select the two Peppers as tools to support the avoidance or mitigation of patient and family psychological stress. Their expertise, availability and patience contributed to our in-house specialists learning how to program the Peppers to meet the needs of our unique patient population. Additionally, the vendor supported our President and CEO and other health professionals in showcasing an actual Pepper at various national and international conferences.

Our Impact

HRH data indicate that Pepper 1 is a popular representative for HRH's digital health technology situated at one of our main entrances. On average, Pepper 1 has 477 interactions per day (from 7 am to 4 pm) and had a peak of 814 interactions in a single day in May 2019.

The Child Life Team has used Pepper 2 with 515 paediatric surgical patients and in the operating room 115 times. Structured assessments indicated the use of this humanoid robot reduces children's anxiety and stress, increases coping and enhances the patient experience. Follow-up survey responses indicate 100% of children/parents thought the child could put on the anesthesia/sleeping mask like Pepper, go into the operating room and do all those special jobs that were practiced with Pepper, which helped them feel better about having an operation. Furthermore, 100% of parents believe it was helpful to have Pepper in the operating room, found the preparation and teaching done with Pepper for the parent and child was helpful, and would recommend the Pepper program for other children, parents and hospitals. There may be an opportunity to conduct surveys to solicit further data with regards to the effectiveness of Pepper on patient satisfaction, particularly psychological stress.

The use of both Peppers at HRH has increased and facilitated many opportunities for internal and external knowledge sharing opportunities, including presentations and demonstrations at internal hospital forums, interprofessional learning sessions, program/departmental meetings and national and international conferences.

Our Learnings

Internal stakeholder feedback suggests that development, implementation and programming of both Peppers was very successful – so much so, that reflecting on what might have been done differently, the Child Life Team would have sought permission to obtain one to two more Peppers in order to have them constantly available on all units with children.

"Pepper, the humanoid robot is a special part of our team. We use evidence-based practice to integrate this sensational, fun technology, along with cohesive inter-professional team collaboration, to provide positive experiences for our paediatric patients and their families while preparing them for anesthetic inductions and surgery in the most child-friendly way. This helps to reduce their stress and anxiety, increase their comfort, familiarity, cooperation, coping and resilience in the operating room."

- Alexandra Christofides MSc, CCLS, Certified Child Life Specialist and Child Life Lead, Humber River Hospital

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Helping Bridge Gaps in Access to Care

Sinai Health System – Mount Sinai Hospital

Our Challenge

In Ontario, patients with inflammatory bowel disease (IBD) experience substantial geographic variation with respect to access to gastroenterologists. As a result, there are areas in Ontario that have longer than recommended wait times. In fact, though the recommended wait times to see a specialist is two weeks, national audits suggest that the current wait time is 126 days. There is evidence to suggest that early specialist care may improve IBD outcomes. Unfortunately, current delays in accessing specialist care may result in unnecessary complications and hospitalizations. Virtual care (telemedicine) has the potential to bridge gaps in access to gastroenterologists by connecting those who practice in areas with a surplus of specialists with patients in areas with poor access.

Ontario Health Administrative Databases were utilized to investigate access across the different local health integration networks (LHINs). Namely, we compared the different LHINs according to:

- Number of gastroenterologist per capita,
- Proportion of early gastroenterology care, and
- Proportion of continuous gastroenterology care.

LHINs with a significant deficit in access were identified as "target" areas in which we worked to raise awareness about Promoting Access and Care through Centres of Excellence (PACE). The extensive results of our analysis were published in the Journal of the Canadian Association of Gastroenterology: *Transforming Access to Specialist Care for Inflammatory Bowel Disease: The PACE Telemedicine Program.*

Our Process

Our needs assessment of IBD health care delivery in Ontario highlighted geographic disparities in access to and utilization of specialist care. We measured three key indicators of IBD health care services as noted above.

Early gastroenterology care was defined as having at least one IBD-related visit to a gastroenterologist within the first 12 months since diagnosis. Continuous IBD care was defined as having at least one gastroenterologist visit every 12 ± 3 months for the first five years among patients with at least five years of follow-up. These indicators were measured for 13 of Ontario's 14 LHINs. Kingston (LHIN 10) was excluded from analysis since physicians in that LHIN are not fee-for-service but perform "shadow billing".

In a review of the literature related to the use of virtual care, our team observed many positive associations. For example, in rheumatology, enhanced access to care and the maintenance of the patient-rheumatologist partnership was demonstrated. In fact, tele-rheumatology was found to be a feasible and acceptable mode of care delivery by patients. Diagnostic accuracy of televisual consultation reached 97%, a level that was acceptable to physicians and general practitioners. Clinicians have also studied virtual care among IBD patients. In one example, Home Automated Telemanagement, which is a patient-centred, computerized disease management program, was found to increase patients' awareness and control over their IBD symptoms. Virtual care was also considered to be critical for improving adherence, self-efficacy, and patient knowledge of IBD. Finally, in a pilot study, IBD virtual care for outpatient service resulted in a high level

of patient satisfaction similar to that achieved in regular clinical consultations. Thus, virtual care in IBD was perceived to be critical to bridging access gaps across the province.

Our Solution

As a participant site within the PACE network, our program began conducting eVisits (Video Visits) through the OTN for patients with IBD or suspected IBD. The PACE IBD Telemedicine Program was developed in collaboration with Crohn's and Colitis Canada to improve access to and quality of care for IBD patients. More specifically, it was developed to improve access to IBD specialists for patients living in Ontario's remote and underserviced areas.

Launched in June 2016, the program operates from Mount Sinai Hospital's IBD Centre of Excellence. The program was started by a team of two health care providers who set about raising awareness of our innovative IBD services among OTN sites, gastroenterologists, family health teams and patients across Ontario. Social media played a significant role in raising awareness about our new method of delivering IBD care. Now, the virtual care team includes eight gastroenterologists specializing in IBD care, three colorectal surgeons, two registered nurses, a dietitian and administrative support.

Virtual consultations are conducted through a secure online platform hosted by OTN. The program aims to reduce the cost and burden associated with long distance travel to an IBD specialist. However, when patients require an endoscopic procedure or specialized testing that is not available in smaller communities, travel to our IBD centre may be necessary.

For patients to be eligible for the program, they must reside at least 100 kilometers away from our IBD centre. The program accepts referrals (a) for the diagnosis of IBD, (b) for the ongoing management of IBD, or (c) as a second opinion regarding the treatment of medically complex IBD patients. Primary care providers or specialists can initiate the referral by completing a one-page referral form that can be downloaded and ask to prioritize the referral as urgent (within 14 days), expedited (within one month), or as a standard appointment (up to three months). Along with completing the referral form, the referring health care provider is requested to forward recent medical imaging results, endoscopy reports, surgical notes and lab results.

Upon triage of the referral, an IBD Telemedicine Coordinator then arranges the appointment and contacts the patient to gather additional IBD-related health information. Based on the patient's residential address, the nurse coordinator identifies the nearest virtual care hosting site, which is often located at a hospital or within a family health team and schedules the virtual consultation or follow-up visit through OTN's online platform. Before the start of the consultation, a physical assessment is completed by an OTN nurse at the remote site, and the results are communicated to the consulting gastroenterologist. The consultation then follows the same procedures as an in-office appointment. After the consultation, the IBD Telemedicine Nurse provides the patient with a brief written summary of their plan of care. They will also follow up with patients to help coordinate elements of their care plan, such as arranging lab tests, diagnostic imaging and referrals to other health-related services. The PACE Telemedicine Program has also expanded its services to include consultations for hospitalized patients who require expertise in medical management of IBD, or in some cases, consideration for transfer to Mount Sinai Hospital for surgery.

Our Success Factors

Project Leadership

As the PACE IBD Telemedicine Program was led by Dr. Geoffrey Nguyen and advanced practice nurse Shelley Bouchard, there was significant collaboration in design of the program, as well as in setting protocol and goals. Multidisciplinary communication ensured the success of this program which involved gastroenterologists, colorectal surgeons, dietitians and nurses.

Training

The PACE IBD Telemedicine Program enabled the training of two nurses since the 2016 launch. We have also mentored 10 nursing students in placement to train them in the use of virtual care and the program protocol.

Our Impact

During the first 18 months of its operation, we demonstrated that the PACE IBD Telemedicine Program provided a feasible approach to bridging regional disparities in access to specialist care for IBD. The program's median wait times for new consultations and visits for active IBD symptoms were 17 days and 8.5 days, respectively. In contrast, national audits suggest that the wait times to see a specialist for IBD is closer to 126 days. The program saved the provincial government nearly $50,000 based only on individuals who qualified for the Northern Travel Grant (NTG). Our analysis underestimated savings from indirect costs due to missed work for the patient and family member and for out-of-pocket travel expenses among those who did not qualify for the NTG.

Our Learnings

The implementation of virtual care services for IBD is highly feasible and can reduce wait times to see gastroenterologists that meet nationally recommended targets and can lead to cost savings.

"It's amazing that I can access a world-class gastroenterologist like Dr. Steinhart and his team from Nipigon. I give my disease hardly a thought now. I have peace of mind knowing it is being managed the best it can be."

- Susan Foulds, Crohn's Disease Patient

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How a Progressive Hospital System Is Expanding Care Outside its Walls

St. Joseph's Healthcare Hamilton

Our Challenge

Hallway health care is a significant problem in Ontario; overcrowding in hospitals is the result of patients receiving care in the wrong place. The need for more effective coordination at the system level and at the point-of-care has been identified as a way to improve access to care and health outcomes for patients.

Bundled care is a service delivery and funding model designed to promote greater integration in health care delivery, to drive high-quality and efficient care, resulting in improved patient outcomes and experiences. In a bundled care approach, a group of health care providers receives a single payment to cover all the needs of an individual patient's full spectrum of care, for a specific health issue.

To support this model, St. Joseph's Healthcare Hamilton (SJHH) identified a need to leverage digital tools to implement more integrated, patient-centred care delivery models. SJHH needed a way to bring care closer to home and align with our system's strategic focus on new models of integrated, patient-centred care, while also enhancing the patient-provider relationship, empowering patients, supporting care between visits and, most importantly, improving patient outcomes.

Our Process

In collaboration with OTN, Executive Sponsors and the Public Affairs department, the Project Management Office (PMO) assessed if, where and how St. Joseph's Health System could leverage virtual care, by completing a departmental heat map across the system. The team reviewed visit volumes, types of visits, number of providers, applicability of virtual care on visits and overall program interest. The team also connected with Epic, our Health Information System (HIS) vendor, to identify an appropriate videoconferencing software that could be integrated with our patients' electronic medical records to launch virtual care. A Privacy Impact Assessment was completed to ensure compliance with privacy, confidentiality and legal requirements and to alleviate potential privacy risks.

Our Solution

As part of the Ministry of Health's (Ministry) digital strategy, SJHH's Integrated Comprehensive Care (ICC) program, their associated patients and inter-disciplinary care team, were selected to join the OTN Partner Video Project Proof of Concept (PoC). The guiding principle was increased access to care. The Partner Video Project POC would provide patients and their care team with a secure, reliable and patient-friendly way to connect with their care team. This would reduce unnecessary barriers (like travelling) to receiving the right care in the right place, while providing more cost-effective and efficient ways of delivering care. The ability for health care providers to provide care remotely would also reduce the number of emergency visits by the patient to the hospital, in turn, enabling an ecosystem of coordinated care. Health care providers through this PoC are permitted to apply the telemedicine Ontario Health Insurance Plan (OHIP) billing code when they utilize virtual care services.

This provided SJHH with a unique opportunity to deliver virtual care using Zoom, a secure videoconferencing software, integrated with Epic. Using the Epic-Zoom integration, providers and patients had the opportunity to have a more seamless care experience, eliminating the need for a patient to present on site to receive care.

Our Success Factors

Involving Stakeholders

Seamless integration within clinical workflow was important for provider adoption. Ensuring that providers were involved with the implementation of virtual visits and MyDovetale, a secure patient portal which allows patients to access their health information and communicate with their health team, was critical for successful adoption. A strong focus on change management created an environment that empowered care teams and built champions across the organization. Change management toolkits, including comprehensive training materials were developed for providers, to ensure they were comfortable with end-user workflow changes.

Involving End Users

It is important to ensure the right patient populations and care scenarios were targeted, such as consideration for patients not adept at technology (older populations), and consideration of the program of interest and its services.

Technology Usability Factors ("User friendliness of technology")

Ensuring the Zoom videoconferencing software integrated well with Dovetale (SJHH-branded Epic HIS), MyDovetale (patient portal) and on the patient's cell phone or computer was a key success factor. Similarly, ensuring patients have appropriate devices to launch the visit has a direct impact on whether or not they can participate.

Workflow Redesign

Most providers were familiar with electronic workflows and easily integrated Zoom Video Visits and MyDovetale into their clinical workflows. Technology support is provided onsite to providers for the first five Video Visits, but often times, providers only need support for the first two visits.

Clinical Space

Designing the appropriate space for audio and video quality was critical to ensure clear visibility and audibility for the patient. The quality of care of an in-person visit should be replicated or improved when completed virtually, including using a quiet, private place. In addition, ensuring patients are equipped with and versed in the technology continues to be a key success factor.

Selling Benefits and Addressing Barriers

As mentioned previously, it is important that a Video Visit aligns with what would be discussed and completed as part of an in-person visit. If a patient needs a test or procedure completed, they must be onsite. The value of an in-person visit must be maintained.

Ensuring Privacy and Confidentiality

Measures have been enabled to ensure patient information is kept private and confidential, including: patient terms and conditions, working with our videoconferencing vendor, Zoom, to ensure Video Visits are not recorded and retained, user access to Dovetale is protected and all documentation related to a visit is captured in Dovetale. A frequently asked questions resource is provided, covering topics such as privacy, confidentiality and proxy access.

Other

Sustained adoption across participating clinics is key to further enhance virtual workflows. Competitions were run by clinic leadership to support staff in "ripping off the bandage" and adopting virtual care as part of their practice in a timely manner.

Our Impact

Benefits evaluation will be conducted to assess the impact of the implementation of virtual visit use on health care quality, productivity and access. The project impact will be leveraged to encourage clinician and patient adoption of virtual visits, highlight necessary implementation adjustments, assist in guiding the

roll-out strategy across SJHH and demonstrate the clinical value of the investment. Benefits realization will be evaluated and measured through patient and caregiver surveys, clinician surveys and system metrics. Preliminary results have been collected and the findings indicate that virtual care has had a positive effect on both patient and provider interaction and outcomes.

Our Learnings

Epic-Zoom integration is straightforward to set up and use for both providers and patients. It also allowed us to provide an innovative solution that aligns with Ontario's bundled care service delivery and funding model. Successful implementation requires effective change management for both providers and patients in order to move from a primarily in-person care delivery model to one that augments in-person visits with videoconferencing visits. Effectively redesigning patient and provider workflows within Epic and MyDovetale to enable virtual care for complex patient populations like SJHH's integrated comprehensive care patients, is crucial.

"From my perspective, it is very comforting and reassuring to know that our team's scope and reach extends past the hospital stay... It's good for me to know that my patients have the ability to reach out to me at any point in time and that I can reach out to them at any point in time."

- Thoracic Surgeon

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Putting the *Heart* into Heart Failure Care – Medly Program

University Health Network – Toronto General Hospital

Our Challenge

Heart failure (HF) is a progressive cardiac condition characterized by periods of stability interrupted by periods of worsening symptoms and instability, making it one of the most common causes of hospitalizations and 30-day readmissions in Canada. HF affects more than one million Canadians, costing our health system $2.8 billion per year. According to a recent Health Quality Ontario (now Ontario Health) report (2019), approximately 250,000 people in Ontario are living with HF. The burden of HF on patients, clinicians and health systems is significant, and is expected to worsen. With the growing prevalence of HF, hospitals, specifically cardiac specialty clinics, face a big capacity challenge.

HF is traditionally managed in 'episodes of care', whereby the HF specialist sees patients in clinic every three to six months, to review their care plan, make medication adjustments, etc. Between these 'episodes of care', clinicians have little insight into a patient's health status, and therefore, no ability to intervene at times when medical attention may be most effective. Telemonitoring, which allows patients to record vitals at home and transmit this data to clinicians in remote locations, has been shown to reduce avoidable hospitalizations and improve quality of life and self-management skills. However, traditional telemonitoring programs are resource-intensive (e.g., very low clinician-to-patient ratios) and do not adequately support patient or provider needs for HF management. We saw an opportunity to address this gap and leverage an interprofessional team of clinicians, researchers, and engineers to transform the way patients and clinicians use digital tools to manage HF.

Our Process

The Medly program was developed by an integrated public sector team of HF specialists, researchers, engineers, designers and human factors experts. Based within the University Health Network (UHN), the program is not only evidence-based, it is also infused with the practical clinical knowledge and processes of Canada's leading cardiac care centre[1]. In addition, the Medly program continues to be rigorously evaluated, enabling the continuous deployment of clinically valid and user-tested enhancements to both the system and delivery models.

Our team married fundamental techniques of Service Design with the field of Implementation Science to ensure that all deployments of the Medly program achieve a high level of integration success in a range of cardiac care settings.

Critically, we continue to evaluate the effectiveness of the Medly program and seek to constantly improve the patient experience. This process is facilitated by the multidisciplinary nature of both the executive board, and full team located within the Centre for Global eHealth Innovation. Bringing together a diverse team allows us to tackle patient issues from a variety of angles, in order to properly diagnose the patient experience and address the most pertinent issues they face. Furthermore, as we are embedded within Toronto General Hospital at UHN, the Medly program fundamentally takes a patient-centred approach to health service delivery. Thanks to our location within the hospital, we have unprecedented access to the patients using Medly on a day-to-day basis and employ a formal framework to incorporate their feedback into our design, development, and research. This leads to improved patient satisfaction, which is consistently demonstrated by patient testimonials.

Our Solution

The Medly program was developed at UHN to assist patients and clinicians with the management of HF, and consists of two components:

1. The Medly System: the core technologies that support the active monitoring of patients; and
2. The Medly Service: the people, processes and tools required to operationalize the Medly System.

Medly System: The patient-facing technology includes the Medly smartphone app and peripheral devices (weight scale and blood pressure monitor) which enable patients to measure and record their vitals and symptoms. The submitted readings are analyzed by the Medly algorithm, a rules-based expert system which was developed, refined, and vetted by HF clinicians from the Peter Munk Cardiac Centre [2]. The Medly algorithm automatically generates self-care feedback messages based on personalized thresholds and the treatment plan set by a patient's clinician at the time of program enrollment. Parameters that fall outside these thresholds trigger an alert for the clinicians on the patient's care team. The clinician-facing technology is the web-based Medly Dashboard which provides clinicians with a holistic picture of their patients' clinical status and recent symptoms by compiling graphs for patient readings, alert history, recent lab results, and current medication list.

Because of this advanced decision support functionality, Medly is considered a class II medical device by Health Canada. The engineering team meets the ISO 13485 quality management standards required to develop such a system.

Medly Service: All patients on the Medly program are enrolled by a Most Responsible Physician (MRP), typically a cardiologist, who is responsible for overseeing their HF care plan. However, the core resource for the Medly Program is the Medly nurse coordinator (NC), who acts as a liaison between the patient and their cardiologist and is the single point of contact for patients and caregivers. The Medly NC reviews all the health data and generated alerts on the Medly Dashboard and provides targeted support to patients in real time, while collaborating across the patient's entire care team, including the MRP and clinicians from other disciplines. A technical support service is also available to both the patient and clinician users on the Medly program to troubleshoot issues related to the Medly application or dashboard, or connected devices. The technical support team also supports users with asset/inventory management (e.g., the deployment and recycling of equipment). The roles and responsibilities required to operationalize the Medly program are outlined within the Medly program Standard Operating Procedures (SOPs), which are provided to each new site delivering the program.

We have created flexible options for patients to acquire the devices needed for the Medly program. These range from a full-kit model (the program provides all required devices) to the bring-your-own (BYO) model (the patient uses their own devices). When a patient is onboarded, the Medly NC reviews these options with the patient to determine the best fit, enabling a better patient experience.

Success Factors

Senior Management Support and Governance

A critical first step the Medly team took was identifying a senior leader within the UHN-Toronto General Hospital Heart Function Clinic to serve as the clinical champion for the Medly program. The clinical champion's ongoing commitment, involvement, and accountability to the Medly program's integration and success has deeply impacted the level of resources dedicated for the implementation and ongoing operations of the Medly program and other clinicians' attitudes toward, and value placed on, the Medly program. Investing time upfront to garner clinical champion support and setting up a governance model for the program also enabled the Medly program to become part of the established norms and values of the HF clinic, which is critical for its sustainability year after year.

Involving End Users

The Medly team worked with the Healthcare Human Factors team to support the program design and implementation. Throughout the program design process, many consultations were completed with the Heart Function clinic staff, patients, and caregivers. The consultations, paired with observations and shadowing of the clinical workflows, enabled the development of a Medly program service blueprint. This blueprint implemented the program design and key operational roles and processes. Throughout the implementation and for up to a year following the implementation of the program, the Medly research team completed a series of interviews with patients, caregivers and clinicians to glean insights on the barriers and facilitators of the implementation, patient adherence, clinical outcomes and health service utilization.[3 4 5]

Workflow Redesign

The service blueprint captured existing clinical workflows and superimposed the relevant changes required to embed the Medly program. These changes included physical redesign of the clinic, such as setting up a Medly 'onboarding room' where the Medly coordinator would consult with the patient and provide the training to get patients started on the program. Other proposed changes included building out program artifacts, such as a Medly 'prescription' form and an 'onboarding slip', to further legitimize the program as part of the existing processes in the clinic. Finally, a third layer of proposed changes included developing SOPs and training materials for new and existing resources to ensure that all members of the clinic were comfortable and confident operationalizing the Medly program.

Our Impact

HF patients are encouraged to take an active role in their care between clinic visits. Self-care is associated with a reduction in HF hospitalization. However, HF self-management is often complicated by the lack of access to HF specialists as well as actionable and timely information. The Medly program empowers HF patients with tools for self-management. The morning 'task cards', which prompt the patient to take their required readings (e.g., weight, blood pressure, heart rate, and symptoms), helps patients develop the habits needed for HF self-management. The instant actionable feedback, which informs patients if their readings are 'normal' or if they have to take any action (e.g., restrict fluids or take a dose of their prescribed medication), enables them to feel more confident in their self-management abilities.

Evaluation of the Medly program has demonstrated a significant improvement in HF-related quality of life, and self-management skills at 6 and 12 months. In addition, our qualitative findings indicate a high level of patient satisfaction with the program, owing to the technology's ease of use, the peace of mind they have knowing that all readings are sent to their care team, and improved relationships with their care team. This gives patients confidence to manage many HF symptom exacerbations at home which could lead to fewer avoidable emergency department (ED) visits, thereby saving patients time, stress, and direct/indirect costs associated with ED visits (e.g., transportation, days off work). A review of the evaluation and impact of the program is currently in press[6].

Typical telemonitoring systems require a clinician to review daily patient data and interpret whether the patient requires further clinical triage and intervention, resulting in a clinician to patient ratio of 1:50. In the Medly program, this process is outsourced to the Medly algorithm, freeing up clinician time to interact with patients requiring medication management and more urgent clinical intervention. This has enabled an unprecedented clinician-to-patient ratio, where a single Medly NC can manage up to 300 patients without compromising the benefits of daily monitoring and the delivery of high-quality care.

Through the Medly model, we found patients are less likely to have unnecessary visits to emergency or urgent services, as they have peace of mind knowing that the Medly algorithm or the Medly NC will notify them if there is any cause for concern. Our recent program

evaluation (n=315) revealed a significant reduction (a 50% decrease) in HF-related hospitalizations at UHN over a six-month period, demonstrating the significant resources that are freed up as a result of Medly. We expect this impact to grow as we continue to scale within and outside UHN, including cost savings for the health system and an optimization of resources which can be used to serve patients most in need.

Since launching the Medly program at the UHN-Toronto General Hospital Heart Function Clinic in September 2016, the program has enrolled and supported over 500 patients. In 2019, The Medly program was recognized for its impact on heart failure outcomes and was recommended to expand to UHN's Toronto Western Hospital General Cardiology Clinic. In 2020, we anticipate further expansion within the UHN system via implementation within the ED and General Internal Medicine units. The Medly product is also currently deployed through research and pilot studies at four other sites across the Greater Toronto and Hamilton Areas: at the Toronto Rehab Institute, Sunnybrook Hospital, Mount Sinai Hospital, and William Osler Health System. The Medly program team are also in discussions with the Ministry of Health and partner hospitals to support deployments of the operational program at Regional Cardiac Centres across the province to enable access for all Ontarians with HF.

Our Learnings

We found that adequate planning, socializing the program goals with key stakeholders, and contextualizing the program to meet the unique needs of a particular setting paramount for the successful implementation and adoption of the program. We would recommend that organizations seeking to sustainably implement their solution take a similar approach.

Additionally, our belief is that implementation is not just a 'one-time' exercise, but rather a continuous journey that involves iteration and improvements to the program and we continue to iterate on our program design and operations to support growth and program modifications as new needs arise. For example, we created a new artifact, the Statement of Responsibilities, in partnership with the Medly clinical coordinator, who suggested that a reminder notice may help patients assess when and how best to contact the Medly coordinator. The Statement of Responsibility card is a postcard-sized form that patients can easily tape on their mirror or stick on their refrigerator, that provides helpful hints on when and how to leave messages for the coordinator if they could not directly reach them, how often they should take their measures and when and how they could expect to be contacted by their care team. This reinforcement message was a great way to re-engage some users who had not been as adherent and served as a helpful reminder for patients who had been on the program a long time (over a year).

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"The automated self-care feedback works alongside clinician monitoring to provide many patients with peace of mind. For some, this peace of mind brings a heightened sense of confidence when they are trying to decide if their symptoms are bad enough to warrant a trip to the hospital[7]."

"I'm very diligent...I basically rely on it. I just love the peace of mind that it represents. When you're as sick as I was, it's good to have a big brother or big sister out there[8]."

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