

In healthcare, there is a common misnomer that clinicians - particularly physicians - are slow to embrace information technology. While the familiar paper-and-pencil based order of communication is a proven utility, and getting clinicians to abandon this is difficult, the promise of information technology is too appealing to pass up.

At University Health Network, we were convinced that information technology meant a number of better things for a number of stakeholders - better quality of care for patients, better integration of information and a better bottom line for the organization. However, making all those things better would require implementation on a significant scale and that would not be easy. Any route to success included clinician support, and to secure that buy-in, we had to prove value.

University Health Network: a technological overview

One of the largest teaching hospitals in Canada, University Health Network (UHN) is a 1,000-bed integrated healthcare organization that includes Toronto General Hospital, Princess Margaret Hospital, and Toronto Western Hospital.

Delivering multi-disciplinary care across these disparate sites is a logistical and informational challenge. The best solution to this challenge was a clinical information infrastructure that would seamlessly connect all entities. So in November of 2000, UHN officially launched a strategy to enhance its information infrastructure and further integrate patient care systems. This enterprise-wide plan, called *care@uhn*, is being implemented over a five-year period and will significantly change the way both clinical and business information is stored, accessed, shared and analyzed. Designed to support care delivery at and between all facilities with electronic tools, *care@uhn*'s five key goals are to:

- Replace the traditional paper chart with an electronic patient record (EPR)
- Support clinical decision-making
- Improve scheduling and workflow
- Allow integration with external providers as Canada moves toward a system of regional, longitudinal patient records
- Support the clinical research that is so important to a teaching hospital

At the heart of *care@uhn* is Patient1®, a clinical information system offered by Per-Se Technologies, an Atlanta-based company that provides integrated financial and clinical software applications for healthcare organizations. Although Patient1 was first installed at UHN in 1986, by 1999 it was clear that increased functionality, speed and enterprise-wide integration were needed. To achieve this, UHN adopted an enhanced version of the solution, providing not only the new functions required by *care@uhn*, but also a Java-based graphical user interface (GUI). The new GUI enables the creation of an intuitive, interactive clinical desktop that simplifies clinical operations by employing Internet-like navigational standards that people are already familiar with.

Armed with the new information system, five programs - each corresponding to one of the key goals - was developed:

- **e-Chart** is reducing the dependence on the paper chart by integrating aspects of inpatient and outpatient care into a single, secure electronic chart. Ultimately, the e-Chart will serve as a single database, allowing authorized clinicians to



-MATTHEW ANDERSON -

MAKING THE CONNECTION: How University Health Network is Bringing the Information Age to Healthcare

Matthew Anderson, vice president and chief information officer at University Health Network, is leading a five-year strategy that uses advanced information technology and decision support tools to change the way clinical and business information is stored, accessed, shared and analyzed.

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instantaneously access patient information such as histories, pharmacy records, lab results and imaging results from a single application, from any computer within UHN.

- **Clinical Decision Support (CDS)** provides clinicians with tools, such as electronic alerts and reminders that will support the quality and efficiency of care. In addition, implementing CDS functions helps UHN achieve process improvements that translate into financial benefits.
- **Resource Management and Scheduling** optimizes patient flow through the organization and improves the way resources are utilized - positively impacting both the patient and staff experience at UHN. Achieving this goal requires major changes to both clinical and business processes and the implementation of an enterprise-wide, electronic scheduling solution will support these new and improved processes.
- **Community Integration** positions UHN to meet the challenges presented by the move toward regionalized electronic patient records. This program not only aims to improve access to information within UHN, but also allows real-time information exchange with organizations not affiliated with UHN. It will ultimately enhance patient care by providing clinicians with access to a longitudinal record, accessible from any device that has an Internet browser.
- **Research Informatics** supports the development of the analytical data warehouse by integrating clinical and research activities. This program promotes an environment of innovation, allowing research to be done more efficiently and effectively, and supports UHN researchers to continue to conduct groundbreaking studies.



Toronto Western Hospital, a member of University Health Network, has served the needs of its culturally diverse local community for more than 100 years and is a world leader in neuroscience.

Care@uhn is a solid plan for a 21st century, technology-minded organization like UHN. It is revolutionizing the way UHN delivers care. And while it is visionary, it is based on the kind of vision our administration supports. However, all of these benefits come at a high cost of implementation. The cost is more than financial, it is time for implementation and it is disruption to operations. It is also about learning new ways of doing things and maintaining the highest quality of care while doing it. The success of each project is tied to the support of clinicians, and ultimately whether or not they will leave their paper behind and use the electronic system.

If we build it, will they come?

Clinicians at UHN have demonstrated a history of adopting advances in diagnostic technology when such innovations enhance delivery of care. As they interact with patients, these clinicians constantly see a need for clinical interventions that are more effective, less invasive and quicker to produce positive outcomes — there's a clear connection between technology and better patient care.

But the technology-to-better care connection can sometimes be difficult to see with information technology. It is a difficult to sell clinicians on information systems technology unless it can demonstrate the same value as described above for clinical interventions. Yet this situation seems to be getting easier, as key world and industry trends have played a role in accelerating technological change in healthcare. Whether it's cell phones, ATM cards or automated voice mail systems, most professionals are now regular users of technology. The proliferation of the personal computer in homes and the popularity of Internet use for everything from banking to e-mail have also served to familiarize clinicians with automated processes - making it difficult to reject technology within the workplace when technology has become so ubiquitous in everyday life.

Certain trends within the Canadian healthcare industry have also sharpened UHN clinicians' perceptions of what information technology can do to enhance patient care. At the forefront of these trends is an industry-wide effort to reduce medical errors, including those relating to medication orders. A computerized order entry system can prevent many of these problems, particularly when accompanied by decision support functions that can alert providers to drug interactions or the inappropriate use of a drug. However, implementing such automation can present its own challenges, one of which is physician order entry (POE) compliance, discussed later in this article.

Another trend is Canada's push for regionalized medicine. With the formation of healthcare regions in the West, opportunities for sharing information between organizations and other care providers are growing rapidly. With a true regional health record, an emergency room physician treating a trauma patient could have near-instantaneous access to the records kept by that patient's family doctor — providing valuable information about allergies, current medications, and other factors that could influence care.

Such access to data could prove critical to patient outcomes. It is clear that the benefits of a regional health record can only be realized if patient charts are electronic. While the desire to reduce medical errors, the movement toward regionalized care and technological ubiquity has created an effective environment for the development of the electronic record, it takes more than this to get an electronic record system accepted and used by clinicians.

Clinicians also tell us the system must be fast — sub-second response time is the benchmark in an acute care environment. One of the criteria that led UHN to choose Patient1 was its processing speed. Streamlined access to information also makes the system more attractive to busy clinicians. One of the major strengths of the Java-based GUI is that it gives users at-a-glance information in fewer steps - and fewer clicks - because it establishes a common “launch point” not only for Patient1 functions, but for e-mail, Internet access and other applications.

Table 1: Effect of diagnostic alerts on laboratory test utilization

Initiatives	Annual Test Reductions	Cost Savings* (\$thousands)
ESR Alert	6240	25.8
Calcium Duplicate Alert	2084	4.3
Creatinine Duplicate Alert	281	12.9
Plasma Electrolytes Duplicate Alert	5102	15.8
Plasma Protein Duplicate Alert	544	1.1
AST Duplicate Alert	858	1.8
Magnesium Duplicate Alert	1032	2.1
Phosphate Duplicate Alert	1568	3.2
Bicarbonate Duplicate Alert	4223	8.7
Bilirubin T. Duplicate Alert	526	1.1
MRSA Alert Duplicate Alert	1090	5.6
VRE Duplicate Alert	184	0.9
AFB Duplicate Alert	111	9.2
Albumin Alert	12510	25.8
Blood Film Review	6140	69.7
Urea	51332	105.7
HbA1c	672	2.1
B12	468	3.9
D-Dimer	72	0.6
Serum Folate	516	4.3
Total	101,553	\$304.6

* Based on total variable cost data

Fast, reliable and focused on patient safety

Above and beyond demonstrating the need for - and the benefits of - an information system, clinicians tell us there is a critical factor in gaining their acceptance: *the system has to work*. It has to work all the time. Hospitals run 24 hours a day, seven days a week, 52 weeks a year - and so must the systems that support them. If there's frequent downtime, it will obviously undercut the confidence that clinicians will place in the system as unreliable and they will cling to their paper charts.

If a system has speed and reliability only part of the battle is won. Another challenge is balancing expectations. The electronic system is often compared to the “perfect” system. At UHN this means a hybrid environment of all of the positive aspects of the paper system, and the vision of how the electronic system should be. It presents a difficult challenge, given the electronic system is not compared to the reality of the paper system - both good and bad aspects - but to an ideal system that has never really existed.

Many UHN clinicians have also said they want to see that the system supports clinical decision-making. Alerts and reminders at the point of care not only prevent errors, but also help organizations reduce costs by flagging redundant or unnecessary orders.

To help decrease unnecessary tests and procedures, the system at UHN can provide interrupt messages that pop up when diagnostic imaging is unwarranted or a certain lab test is likely to be unnecessary given the patient's current condition. The 18 diagnostic alert initiatives implemented in 2000-2001 affected 40 different laboratory tests, of which several had significant reductions in utilization, along with direct cost savings (see Table 1, Effect of

diagnostic alerts on laboratory test utilization). Using test cost data, the annual savings added up to nearly \$305,000. Subtracting the cost of the Clinical Decision Support (CDS) program devoted to these initiatives results in a total ROI of \$155,000 per year.

And those are just the measurable benefits. CDS also promotes best practices by guiding decision-making with scientific evidence, as in the use of critical pathways. The pneumonia critical pathway was the first such clinical guideline to be implemented in the electronic environment at UHN. It provides information about admission appropriateness, a pneumonia severity index, day-specific

recommendations for care and discharge instructions. A medication order entry system to be piloted in 2002 will employ other CDS initiatives including checking for drug-drug interactions, drug-allergy interactions, drug restrictions and IV incompatibilities.

It is important to note that not all UHN clinicians have embraced CDS. Some find it intrusive and others feel that CDS is not necessary, as clinicians at UHN have been providing excellent patient care for years without a computer telling them how to practice. Although there is a growing cohort of leaders for CDS initiatives, it will likely take several years for these tools to become fully engrained in the UHN culture. As the tools become more sophisticated and the reporting of practices and outcomes become commonplace, CDS will become part of everyday life for clinicians at UHN.

As the culture begins to change, UHN can still make significant strides in the immediate term. Which is exactly what the organization is doing with its Virtual Library.

The Virtual Library project

Before there was CDS software, there was the hospital library. Within its walls, clinicians could do research or browse medical journals to stay up to date on the latest medical advances. However, faced with the hundreds of medical articles published weekly, no simple way to access the most relevant information, and no time for more than a quick glance, it was difficult to make the most of library resources. The solution? UHN's innovative Virtual Library that launched in 1999.

The Virtual Library has two purposes: to provide seamless, single-interface access to all library resources, regardless of the physical location of either the resource or the user; and to integrate library resources into UHN's electronic patient record. With the Virtual Library, clinicians can access information when it's most needed - at the point of care. A web interface to the Virtual Library is accessible through Vista, allowing clinicians to move easily between a patient's record and the latest research on diseases and their treatment.

Currently, the Virtual Library gives clinicians one-click access to such core biomedical databases as Medline, Ovid and CINAHL; evidence-based full text collections such as the Cochrane Database of Systematic Reviews and the ACP Journal Club; and more than 1,400 full-text electronic journals, texts, request forms and quality Internet links selected by library staff. What's more, UHN is creating interfaces that actually give clinicians the ability to retrieve library resources directly from diagnostic and order entry screens within the patient record. By tying together the EPR and the Virtual Library, UHN has truly integrated clinical decision support into the patient workflow.

Gaining the clinicians' support

Having implemented a clinical information system and customized it to the organization's environment, UHN had to continue to harness the knowledge and support of its clinicians to ensure they could use it in their everyday medical practice. UHN has had



As UHN's e-Chart evolves, patient information is accessible on-line through Patient1 on 5,000 PCs located in clinics, patient areas, offices and labs.

tremendous success in this endeavour. A few methods that worked well include:

- *Soliciting peer input.* This has been an important part of implementing the various programs that make up the *care@uhn* strategy. Each program has its own clinical advisory committee. An e-Chart clinical advisory committee, lead by a respected physician, has provided consistent direction on and endorsement of e-Chart capabilities. The e-Chart committee is four years old and comprises more than 25 members. The CDS committee, led by a respected senior physician, has a broad membership. These advisory committees have become somewhat of a status symbol to serve, and members often give up their own time to do so.
- *A strategy for user support.* UHN is relying on its human resources department to recruit, train and deploy a team of computer support specialists into clinical areas. These specialists are seen as "super users" and will help the hospital's community of users get up to speed on core systems more quickly. They are not technical specialists, but clinical staff (e.g., nurses, ward clerks) who have received intensive training on specific functions of Patient1 and other UHN systems. This team includes specialists who understand the clinical environment of UHN and the specific applications that support it - so they can help users learn the finer points of the system in the comfort of their own department.
- *Establishing a powerful HELP desk.* Desktop computers are a critical component of UHN's infrastructure. With more than 5,000 PCs in clinics, patient areas, offices and labs, technical problems do arise. UHN is a complex organization with a complex system — clinicians must be able to trust the team that supports the system. A HELP desk has to be available 24 hours a day, 365 days a year. Since UHN could not build this expertise from within, it

was outsourced to Compaq Canada in 1999. With stringent service level agreements, plus a tremendous commitment to customer service, the HELP desk has been the cornerstone of UHN's system reliability agenda.

UHN's clinicians have been an invaluable part of advancing our information management strategy. It is critical that this strategy be adopted as a strategy for clinicians, by clinicians. The CIO and the information management team must be seen as the enablers, not the drivers. The leadership and involvement of physicians and nurses in setting the direction for the strategy at UHN has been a key success factor. Their input into the development and implementation has helped the organization move forward. But does the strategy itself actually benefit the hospital in tangible ways? Yes - and we can prove it.

The pay-off

For the fiscal year 2001-2002, UHN documented an impressive \$1.5 million in clinical practice and administrative savings. Among the financial benefits that were realized using Patient1:

- An 82 percent reduction in certain unnecessary and duplicate lab tests, which saved \$155,000 a year
- Elimination of a three-month backlog of cancer staging reports
- A \$350,000 savings in transcription costs thanks to automatic faxing of more than 500,000 pages of clinical notes a year
- As much as 80 percent reduction in the use of paper MRI requisitions

The Virtual Library project has also been a hit. An average of 400 users access it daily, with 15 percent of that use occurring outside of normal library hours. A recent survey of staff physicians and residents showed that a whopping 95.7 percent believed the Virtual Library saved them time. What's more, 96.8 percent said it helped them make better clinical decisions.

There has also been a dramatic rise in the use of the system, measured by the average number of concurrent users on Patient1. There has been a 50 percent increase in the average number of concurrent users over the last three years. As the system adds value, more clinicians are coming to rely on it.

In February of 2002, the value of *care@uhn* was recognized when UHN received two prestigious awards for the process improvements it engendered. The Award of Excellence and the Best of Category Award for Institutions were presented by Canadian Information Productivity Awards (CIPA), the largest business awards program in Canada relating to the field of information management. The dual awards reinforced to the healthcare industry what UHN has already shown — that patient care can be enhanced through the use of technology.

Tackling the challenges

But it has not all been about success. As we forge ahead, new challenges must be overcome, including:

- Developing our clinical data repository (Research Informatics program). The problem: trying to balance traditional system structure, which is transitional in nature, with the need for analytical data for decision support. It is taking longer to develop than expected and scale issues have also proved problematic in building a

robust and comprehensive system.

- Finding the right scheduling system to meet all of our needs. A critical piece to this project is planning/workflow. With such a fluid environment, there are always new challenges to consider, especially when developing a centralized, all encompassing model.
- Implementing physician order entry, a critical factor for the success of *care@uhn*. With on-line medication order entry going live later this year, having a high-level of physician order entry will be critical. There is a solid base of physicians doing direct order entry at UHN, but this number will have to increase to be ingrained in processes and an integral part of our workflow. The challenges in getting broad-based compliance include: ensuring commitment to order entry practices by leadership, developing user friendly and intuitive order screens, and providing easy access at or near the point of care.
- Improving reliability without escalating costs. Despite the outstanding improvements UHN has made with Compaq in providing support to our users, there is more work to be done. The healthcare technology environment is changing faster than support models and UHN is looking to refine its model to one that is focused on preventative maintenance.
- Managing time, UHN's most significant constraint. The difficulty rests in the balancing of the potential of IT with the rate of change required to realize that potential. A prime example? In a risk assessment conducted last year, one of the key risks identified by clinical staff was working in a hybrid environment of paper and electronic records. The suggested solution was to speed up implementation. Later, in the same list of risks, was the admonition to slow down implementation because it was moving too fast!

Exactly how does UHN plan to deal with these challenges? The same way we are dealing with other challenges-by making sure clinicians are involved and providing input.

Looking forward

Proud of *care@uhn*'s success to date, UHN recognizes there is still more to accomplish. Better information is being provided to clinicians at the point of care and streamlined processes are supporting their clinical practices.

Access to information, however, is not yet as seamless, fast, complete and reliable as it needs to be. As the e-Chart evolves, more information will be moved to an on-line format and finding the best model to support clinicians is key as system usage and reliance increases.

Health care is complex, it changes constantly and patients are highly mobile. UHN believes that information-and its value to all parts of the healthcare equation-is the one constant amid all that complexity. Our success depends on making sure that information is in the right hands at the right time. *Care@uhn* is our key to that success.

