

November 2016



Review of the Functioning of IHealth:

Nanaimo Regional General Hospital, Oceanside Health Centre and
Dufferin Place



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DR. DOUG COCHRANE'S MESSAGE

November 17, 2016

On behalf of the review team, I would like to thank the physicians and staff of Island Health, particularly those at Nanaimo Regional General Hospital, Dufferin Place and Oceanside Health Centre. The people we had the opportunity to meet provided open, honest and forthright feedback about their experience with the functioning of the IHealth system. I would like to recognize their willingness to contribute to the review, and the genuine desire to make improvements. The commitment and dedication to caring for patients on Vancouver Island was evident throughout, and I thank you for it.

We heard many examples of the challenges generated by the latest phase of IHealth implementation, and have sought to capture these themes and perspectives in the report. While we were not able to include all of the experiences that were shared with us, they did inform the findings of the review. I hope that the report is reflective of the issues experienced by users, and that the individuals who spoke with us will see their contribution.

The report recommends a way forward from the current position. This includes the rapid assessment of the functional requirements of delivering care, and the reaffirmation or refinement of these needs in an expeditious manner. The success of this approach will require the collaboration and engagement of staff and physicians throughout Island Health. I encourage all parties to approach this as an opportunity for re-engagement – an



Dr. Doug Cochrane
Chair & Provincial Patient
Safety & Quality Officer



DR. DOUG COCHRANE'S MESSAGE

opportunity to learn from the challenges of the past and co-create a system to serve the needs of patients.

Thank you again for all of the work you do to care for patients in BC.

A handwritten signature in cursive script that reads "D. Cochrane".

Doug Cochrane

HEALTH MINISTER TERRY LAKE'S MESSAGE

November 17, 2016

This message has been sent on behalf of Health Minister, Terry Lake

On July 21, 2016, after a meeting with physicians, staff and Island Health executive, the Ministry of Health and Island Health requested an external review by Dr. Doug Cochrane, Provincial Patient Safety & Quality Officer, of the IHealth system at Nanaimo Regional General Hospital, Oceanside Health Centre and Dufferin Place.

I want to thank Dr. Cochrane and his team for the hard work they put into developing this report. I also want to thank everyone who participated in this review: frontline care providers, IHealth staff, Island Health executives, and the Local Medical Advisory committee and Medical Staff Associations. The input that was received was essential in understanding the issues that were taking place.

This report provides a way forward for the refinement and stabilization of IHealth at Nanaimo, and gives clarity on steps to improve future implementations at other sites across Island Health. It will also provide valuable insights in the planning and implementation of other electronic health record systems across British Columbia.

Electronic health record systems ultimately will support patients in being active partners in their care – as well as assisting our health professionals in the provision of high



Honourable Terry Lake
Minister of Health



quality care. The availability and portability of information in electronic health records systems can transform the way

HEALTH MINISTER TERRY LAKE'S MESSAGE

patients are cared for, strengthening and empowering British Columbians to proactively manage their health.

The experience with IHealth confirms that adapting to new technology can be a significant challenge. It also emphasizes the importance of working together toward a shared goal of creating a better system for patients. We live in a digital age, and the health system needs to take advantage of the benefits that this technology can give us.

This is an important time for our health care system, and it is exciting and rewarding to be at the forefront of this transformational change. We are presented with a great opportunity as the face of health care, and how it is delivered, changes. I am confident that the dedicated staff in Nanaimo and across Island Health will work closely together to improve the IHealth system and ensure we are building a system that is better for all patients.

Sincerely,

A handwritten signature in black ink that reads "T. Lake". The signature is written in a cursive, flowing style.

Terry Lake
Minister of Health

ISLAND HEALTH BOARD CHAIR MESSAGE

November 17, 2016

This message has been sent on behalf of Don Hubbard, Chair, Island Health Board of Directors

On behalf of the Island Health Board of Directors, I am pleased to accept the report and recommendations completed by Dr. Doug Cochrane on the early functioning of our IHealth system implementation.

The Board’s plan now is to work through the recommendations with physicians, clinical teams and Island Health leaders and chart our course forward.

The work that has been done to prepare Island Health to implement an electronic health record including a cross continuum of clinical systems is ground breaking and will change the way care is delivered on Vancouver Island, in the Province and potentially across the country. This work has been hard and I applaud our clinical teams, physicians, front line staff and leaders for your efforts to navigate our organization through this important work.

As noted by Island Health President and CEO Dr. Brendan Carr in his message to employees and our physician partners, the report contains 26 recommendations all of which will help us refine our processes and continue on our journey to provide our patients with the highest level of safe, quality care.

I would like to thank Health Minister Terry Lake and our colleagues at the Ministry of Health for their ongoing support since we began the IHealth journey. I would also



Don Hubbard
Board Chair Island Health



ISLAND HEALTH BOARD CHAIR MESSAGE

like to acknowledge and thank Dr. Doug Cochrane for leading the review and making recommendations that will allow us to implement one of the safest, most efficient and integrated health and care systems in the country.

Thank you to each and every one of our staff and physician colleagues for continuing to maintain high quality service, support and care in all communities across Island Health while this transformation has been ongoing, particularly those working in Nanaimo.

Thank you

A handwritten signature in black ink, appearing to read 'Don Hubbard', written in a cursive style.

Don Hubbard
Board Chair Island Health

ISLAND HEALTH PRESIDENT AND CEO MESSAGE

November 17, 2016

This message has been sent on behalf of Dr. Brendan Carr, President and CEO Island Health

As you are aware, an external review of IHealth system implementation was launched in late July, about four months into implementation at Nanaimo Regional General Hospital (NRGH), Dufferin Place and Oceanside.

The review has now been finalized and I would like to thank Dr. Doug Cochrane for his work in compiling a set of recommendations that are both forward thinking and aligned to our vision of creating excellent health and care, for everyone, everywhere, every time.

Island Health’s Board and Executive have received the final report and are anxious to pursue the recommendations. To do this, we will chart a new path forward working collaboratively with our physician colleagues, clinical teams and the IHealth team.

The report contains 26 recommendations all of which will help us refine our processes and continue on our journey to provide our patients with safe care of the highest quality. They will enable us to continue the important work we do on behalf of the patients we serve now and into the future.

The report affirms that we should continue to use the system while reviewing and validating workflows and



Dr. Brendan Carr
President and CEO, Island Health



ISLAND HEALTH PRESIDENT AND CEO MESSAGE

making refinements to fully integrate IHealth with clinical care processes.

The report also suggests that we modify our approach to training physicians and teams.

Perhaps most significantly, the report gives voice to an important truth; we underestimated the impact moving to a fully automated Electronic Health Record would have on clinicians both individually and as team members. This placed tremendous strain on what is already a very challenging work environment. It is a reflection of their commitment to quality that the system continues to provide safe care to patients.

Moving forward we must match their commitment to ensure that future system activations benefit from the early learnings in Nanaimo.

On behalf of our Board and Executive Team, I want to say thank you to our staff and physicians in Nanaimo, the IHealth Steering Committee, and our teams who have worked so diligently over the past several months to implement this system. Together you have done an amazing job! I would also like to acknowledge the support of Health Minister Terry Lake as we prepared for the IHealth activation, during implementation and throughout the review. Our ministry colleagues have been working with us shoulder-to-shoulder since we began this journey. I am grateful for the confidence that has been shown by the Minister and his staff in Island Health's ability to undertake an initiative of this scope.

I am extremely proud of the work that is being done at Island Health in the pursuit of greater safety, higher quality

ISLAND HEALTH PRESIDENT AND CEO MESSAGE

services and a better experience for patients. The IHealth system will establish a single health record and plan of care across multiple settings. This represents a significant advancement in the use of health technology in Canada. It's important to acknowledge the tremendous efforts of our Nanaimo colleagues who are paving the way.

I would also like to thank each and every one of you for continuing to maintain high quality service, support, and care in all communities across the very large region we serve.

While some of us have been focused on IHealth, I know a tremendous amount of work is being done to keep the rest of the organization moving forward on other major priority areas while at the same time, not losing focus on our top priority, the people in our care.

Our plan now is to work through the report and recommendations with physicians, clinical teams and IHealth leaders.

The review document, a summary of the recommendations and Frequently Asked Questions related to the review will be made public at:

<http://ihealth.islandhealth.ca/2016/11/the-cochrane-report>

ISLAND HEALTH PRESIDENT AND CEO MESSAGE

Thank you for your patience and your resilience; we are committed to keeping you informed as we move forward. And thank you again for your ongoing commitment to providing the highest standard of quality care for our patients.

A handwritten signature in black ink, appearing to read "Brendan", with a period at the end.

Brendan

REPORT CONTEXT

The Opportunity for Change

The delivery of health services in a digital age is increasingly complex. Medical knowledge and digital technologies are experiencing exponential growth. Virtual teams are caring for patients over great distances. Patients and families are interested in accessing their health information and being active partners in their health and care. Care providers have growing expectations about how technology can or should support their work. Together, these changes are creating new pressures within a health care system that is still almost entirely paper-based.

There is an imperative for technology to be used to support secure and immediate access to critical information; seamless communication and coordination among all members of the care team, including patients and families; and to support decision making within a continuously changing and expanding body of evidence.

However, in healthcare worldwide, and in Canada in particular, has lagged behind other industries in the adoption of technology, and specifically the implementation of Electronic Health Records (EHRs).

The opportunity for EHRs to support the delivery of health services has long been recognized, and to-date, has been primarily focused on addressing patient safety related concerns. This focus was created through the landmark 2004 Canadian Adverse Events study that reported that 7.5% of all hospital patients experienced an adverse event; and 37% of those events were deemed preventable.

The opportunity was underscored again in the recent October 2016 Canadian Institute for Health Information (CIHI) report on Measuring Patient Harm in Canadian Hospitals, which reported that hospital patients are still particularly vulnerable, because many are very frail and hospital care is increasingly complex. The report reveals that in 2014/15, harm was experienced by patients in 1 of every 18 hospital stays, and of those, one in five involved more than one form of harm.

REPORT CONTEXT

For those Canadian healthcare organizations that have implemented advanced EHRs, important and measurable improvements have been achieved, particularly in medication safety and reducing preventable drug-related errors. At Canadian sites with longer term experience with an advanced EHR, statistically significant improvements in patient outcomes, including mortality rates, have also been demonstrated.

And despite almost universal limitations in the usability of current EHR tools, experienced healthcare organizations also indicate that over time, EHRs become an extension of clinical practice, improving both the patient and provider experience – augmenting, but not replacing, communications and supporting a culture of continuous improvement.

Island Health’s Cerner-based EHR

For over 15 years, Island Health has been advancing its EHR in support of its vision for excellence in health and care. The Cerner clinical information system was first procured by one of Island Health’s predecessor organizations in 2000 through a competitive process, and it forms the basis for Island Health’s EHR.

By 2008, Island Health was one of few Canadian healthcare organizations to have implemented the foundational capabilities of an EHR across a diverse geography and multiple care settings, including all acute care sites, residential care sites, and some ambulatory care settings.

With these foundational capabilities, the Cerner-based EHR is used as the primary source of key clinical information where it is implemented; however, it does not actively guide treatment decisions or care plans against protocols or best practice.

As different paper and electronic health record systems are still used across Island Health services, critical patient data is recorded in separate information silos – creating safety risks as patients move from one care setting to another. In almost 40% of cases where patients or family members contact Island Health with a concern, they reported issues related to gaps in information and communication.

REPORT CONTEXT

IHealth

In 2011, Island Health identified the advancement of the EHR as a priority to address the risks related to the fragmentation of care and to provide key enablers for quality and safety improvement. With this direction, the vision for IHealth was articulated - One Person, One Record, One Plan for Health and Care.

Advanced Cerner EHR functionality will be introduced to embed practice standards into care activities and related documentation. Evidence and best practice will be used to actively guide clinicians in ordering medications, diagnostic procedures, and other decision making processes. End-to-end medication management will also be supported with automation that enables safe medication administration.

Targeted quality and safety benefits include:

- Elimination of preventable adverse drug events and medication related errors
- Prevention of venous thromboembolism and sepsis
- Improved timeliness, and decreased duplication, of diagnostic investigations

The advanced Cerner-based EHR will be extended across the full continuum of services Island Health provides, including: primary care, home and community care, residential care, mental health and addictions services, ambulatory care, and acute care. With the new tools in place across all care settings, the safety of care transitions and coordination of care will be improved.

Island Health has adopted a new approach for the IHealth EHR design and engagement of end users. The approach involves clinical staff and physicians from across Island Health and focuses on validation of clinical workflows against a demonstrated EHR design.

REPORT CONTEXT

The Nanaimo Regional General Hospital, Dufferin Place, and Oceanside Health Centre were selected for the first activation of IHealth as together, they provide a unique representation of Island Health's population and scope of services - with an acute care hospital, residential care facility, and integrated urgent and primary care centre serving a shared population. The learnings from advancing the EHR tools within, and across, these facilities provide key learnings for future IHealth activations.

Advanced EHRs in Canada

Only seven Canadian health care organizations have implemented the full scope of advanced EHR capability to-date; with four using a Cerner-based EHR. There are 34 Canadian healthcare sites with over 3,800 physician partners using the Cerner tools for computerized provider order entry, one of the major new functional capabilities introduced through IHealth.

The experience of these Canadian organizations demonstrates the significant transformation in clinical practice that is inherent to the change, and that the implementation process is highly disruptive, particularly in the first number of months following activation.

These organizations report that clinical staff and physicians identified concerns about safety and loss of productivity as they worked to incorporate the new tools into their practices. They also experienced frustrations with the technology as the multiple device types and peripherals were introduced and stabilized. Their training materials and approach were revised following their activations and refreshed education was required. All organizations have shared the need for increased physician involvement in future implementations.

While Island Health incorporated these and other learnings into the IHealth plans, the first IHealth implementation has brought focus to the need for even more supports to minimize disruption and support clinical staff, physicians, and patients through the activation process.

REPORT CONTEXT

The Third Party Review

In the months following the first IHealth activation, concerns were raised about the safety of the system and confidence of users to use the system safety. Based on these concerns, Island Health and its senior Medical Advisory Committee completed an internal review in June 2016. Recommendations from the internal review were endorsed by Island Health's Board, and a work plan was initiated to address care provider fatigue, adjust resources to alleviate workload burden, improve trust in the EHR, and work collaboratively to improve the EHR for quality and safe patient care.

In July 2016, the Ministry of Health and Island Health jointly agreed to conduct a third-party review to further assess the concerns raised, and ensure that Island Health is on a similar path to peer organizations that have implemented advanced EHR capability and over time, enhanced the quality, safety and experience of care.

As the third-party review was initiated at just over four months after the first activation, the review assesses the early experience with the new tools at a point in time, and provides important insights and direction for moving forward across Island Health, British Columbia and beyond.

IHEALTH SUMMARY

IMPLEMENTATION SCOPE

ACROSS ALL SERVICES PROVIDED BY ISLAND HEALTH

- + Home & Community Care
- + Ambulatory
- + Residential Care
- + Acute Care
- + Speciality/Primary Care

NEW FUNCTIONALITY

ADVANCED EHR CAPABILITY

- + Computerized order entry
- + Clinical documentation across all disciplines
- + Closed loop medication management
- + Clinical decision support

INVESTMENT

TOTAL CAPITAL \$ **100.3** MILLION

Cerner contract

55.5M

Internal costs

44.8M

A STRONG FOUNDATION

A 15+ year history with the Cerner-based EHR that

INFORMS CARE, EVERYWHERE

- + Lab results
- + Diagnostic images & reports
- + Medication profiles
- + Transcribed documents
- + Structured emergency, mental health & other clinical documentation

DAILY REGIONAL STATS

25,000+ Charts opened
69,000+ Transactions

INCLUDING

2,900+ Medical imaging tests
25,000 Lab orders
4,925 New encounters

VISION

One **PERSON**

One **RECORD**

One **PLAN**

for **HEALTH & CARE**

STRATEGIC AIMS

IMPROVE POPULATION HEALTH

IMPROVE

1. QUALITY & SAFETY

2. CARE COORDINATION & TRANSITIONS

3. OUTCOMES & PATIENT EXPERIENCES

REPORT HIGHLIGHTS

REVIEW SCOPE

a point in time review of the

Early Experience with Advanced EHR Functionality

- + Nanaimo Regional General Hospital
- + Dufferin Place
- + Oceanside Health Centre

SCOPE

IN SUMMARY

CONTINUE

to use the system for care and

- + VALIDATE
- + REFINE
- + COLLABORATE

to improve IHealth functionality in context of clinical practice and workflows


REVIEW PROCESS

- > **100** INTERVIEWS
- 80** WRITTEN SUBMISSIONS
- 32** HOURS OF SYSTEM USER OBSERVATIONS

LED BY
Dr. Doug Cochrane,
Provincial Patient Safety and Quality Officer

Andrew Wray, BC Patient Safety and Quality Council

Expert Review Team



KEY QUESTIONS

1. Does the system as implemented impact the safety of care delivered?
- 2.
- 3.
4. What impact has the system had on the delivery of care?
- 5.
6. How can implementation of electronic systems at other BC locations be improved?
- 7.

26

DETAILED RECOMMENDATIONS INCLUDING

- + SYSTEM REFINEMENTS
- + SYSTEM MONITORING & QUALITY ASSURANCE
- + EDUCATION & TRAINING

MOVING FORWARD

COMMITMENT TO WORKING TOGETHER THROUGH CONFLICT

SUMMARY OF RECOMMENDATIONS

1. Island Health analyze and correct the medication ordering process that allows medication doses exceeding accepted dose ranges to be ordered.
2. Island Health implement a dose checking algorithm for high risk medication orders to ensure that prescribers are alerted to excessive doses or frequencies. Dispensing doses above recommended levels should require an explanation from the prescriber and be covered by a clinical care policy.
3. As part of the quality assurance measurement system for medication use, Island Health concurrently monitor high risk medication dosing, timing of administration, route of administration and duplicate orders for the same medication in a patient.
4. To remove the risk of missed medication doses when patients are transferred, Island Health create an algorithm that alerts pharmacy and the ward that medications have not been given when a patient is transferred.
5. Island Health address the issue of medication orders persisting on the Medication Administration Record (MAR). In this context, Island Health review its policy permitting multiple narcotics and multiple routes to be ordered concurrently for any patient. A patient specific algorithm should be developed that allows for patients who require concurrently administered narcotics by different routes. Health care providers for all other patients should be alerted when multiple orders and routes are placed.
6. To ensure that reports are provided to the physicians who are responsible to take action upon them, Island Health review their education curriculum to ensure that users are aware of the processes to designate an individual as the most responsible physician for all or part of a patient's care and how to flag other individuals for copies of results and information.
7. Island Health ensure that diagnostic imaging, laboratory and other test results, provided by NRGH or other Vancouver Island facilities are being received by the providers responsible to take action on them.

8. Island Health monitor the messaging system to ensure that the correct responsible individual(s) are receiving communications.
9. Island Health implement a process that consolidates nursing and other observations and displays this information on the patient summary layouts for every type of user.
10. Island Health ensure that the ability to match a monitor and/or ventilator to a patient is restricted to designated users and that bar coding or other technology be used to ensure the integrity of the patient/monitor (ventilator)/location match.
11. Recognizing the dependency of the all care processes on the IHealth system, Island Health provide an analysis of system failures (network outages, system and machine hang-ups, peripheral failures and peripheral mismatches) and upgrade hardware where the network and work stations are underpowered for the demands placed on them.
12. Island Health review down time procedures and the function of “down time computers”, and establish a preventative maintenance and testing schedule.
13. The Ministry of Health redesign the PharmaNet system to allow for the full integration with the IHealth (and other EHR) in the Province.
14. Island Health simplify the user interface to include only the clinically required parts of a process or workflow and base these design changes on human factors, interface design principles and user co-design.
15. Island Health correct errors in terminology and ensure Canadian context is reflected throughout the EHR (e.g., Celsius vs Fahrenheit).
16. Island Health conduct a staffing assessment in all future rollouts and where the re-designed processes result in a change in workflow, the staffing needs and the scope of responsibilities for all staff members (including non-regulated employees) be incorporated into the planning. Where it is determined there is a gap (pre-existing or as a result of the re-designed process), Island Health develop a plan to staff to levels that enable learning

while working for implementation, stabilization, and the future state as required.

17. Island Health review their current practices with respect to paper ordering and how that process uses the team (physicians, nurses, support personnel, pharmacy and other departments) and develop a policy and process for computerized order entry in urgent situations that optimizes the process by fully utilizing the team and the system.
18. Island Health commit to staffing support (physician, nursing and support staff) in the NRGH emergency department to achieve patient volumes within 10% of pre-go live levels in anticipation of a return to full CPOE after the workflow and process review and improvement.
19. Island Health use the results of the revalidation process to inform a decision regarding the future medication ordering process used in the ED and ICU.
20. Island Health undertake a workflow and system design review separate from order set review and rebuilding. Reconvene reconfigured clinical user groups to include users from NRGH and future implementation site(s). Using this group of users, supported by Cerner and IHealth program experts, assess the NRGH experiences for each of the clinical areas listed in the Provider Education Strategy.
 - a) Consider “work as done” and not just “work as imagined” when reviewing workflows, in particular the documentation and ordering processes. Clarify what new best practices are needed for patient care and share these practices with the relevant Island Health user committees. Incorporate their input into refreshed workflow before any effort is made to integrate this workflow(s) into the IHealth system.
 - b) Simplify the workflows and data entry/ordering to provide the majority of users with one process for workflows relevant to their job that is/are simple and intuitive. Eliminate structured data entry and interface items where there are no clinical care reasons for having such data and create data entry and display layouts that support care. Circulate these workflow changes through medical and clinical communication channels

(departments, divisions, programs) for discussion and confirmation before implementing into practice.

- c) Engage provincial bodies, whose role is to define standards of care in BC, so that care plans, order sets and documentation schema are based on their standards to enable consistent implementation province-wide for the EHR products. Where provincial bodies do not exist, engage in a process to harmonize workflows with the implementation teams in the lower mainland.
 - d) Simplify the user interface to include only the clinically required parts of a process or workflow and base these changes on human factors, interface design principles and user co-design.
21. Island Health incorporate the following into the education plan being developed for NRGH and future implementations:
- a) Provide clarification of the strategic goals of IHealth for users and reconcile differences in these goals with those of front-line care providers;
 - b) Provide the rationale for workflow changes that will shift work between users (e.g., data collection, parameters for ordering or administrative tasks such as registration);
 - c) Explain to every user, based on the work they do, how the system is organized, describe underlying assumptions, terminology, what background rules exist and how and when they are triggered and what they do to the data;
 - d) Clarify the auditing functions that are operational in the background so that users are aware of when and how tracking of changes in data entry and orders is done and who has access to the audit trail;
 - e) Develop a curriculum that provides individual training and knowledge for the trainee's role;

- f) Train teams so that members understand their roles and how the system will affect these roles and their interactions;
 - g) Develop post-go live training for individuals and teams who want to optimize the system for their work (power users)
22. Island Health clarify for all users the reporting methods, processes and expectations for IHealth related events, both technical and sociocultural to ensure learning from the observations of users and to ensure that the review processes have the highest integrity. Feedback on the status of an issue should be provided directly to the reporter(s) if known, within a specified period of time known to the reporter.
- a) For issues already submitted, Island Health should close the loop on all user reported observations with the individual reporter, if known, and the relevant user population.
 - b) Island Health should develop a communication plan to ensure all users of the system are aware of how to access and use the reporting methods. Specifically, with respect to PSLS submissions, Island Health should provide ongoing feedback describing the time lines for analysis and results of investigation to those who have submitted reports.
 - c) User observations submitted through the reporting systems, their review and fixes should inform the re-development of the IHealth learning environment
 - d) Island Health resource the IHealth team to ensure the response to reported issues can be provided in the time interval appropriate for a live system.

23. **Phase 1. Functional Capability revalidation in the BC context Recommendation**

That the NRGH medical staff and Island Health join in a process to revalidate the order entry and clinical documentation capabilities of the IHealth system and test the ability and suitability of the implemented functionality to meet the clinical care needs of patients based on current clinical workflows. The revalidation process will be supervised by an oversight committee. This committee will receive the results of the clinical reviews and will develop options to address situation(s) where the functionality as provided, does not address the clinical needs in the Island Health context.

24. **Phase 2. Moving forward in Nanaimo and Island Health Recommendation**

Based upon the results of the revalidation of order entry and documentation functionality and the determinations of the Oversight Committee, a plan for moving forward should be developed.

25. All parties re-commit to working through areas of conflict.

26. Where violations of Island Health organizational policies are revealed, actions should be taken as defined by the relevant policy.

Review of the Functioning of IHealth:

Nanaimo Regional General Hospital, Oceanside Health Centre and Dufferin Place

Submitted by:

D. Douglas Cochrane
Provincial Patient Safety & Quality Officer
November 11, 2016

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Introduction

Island Health has been on a journey to digitize the medical record over the last decade. Their vision of “*One Person. One Record. One Plan for Health and Care.*” is an embodiment of the IHealth goal of achieving:

A single, person-centred Electronic Health Record (EHR) that includes all clinical documentation, orders and results from across the continuum of healthcare services that Island Health provides.

Advanced EHR capabilities embed evidence and standards into practice, and clinicians are alerted to quality and safety improvements in real-time.

Patients and providers collaborate on goals and plans for health and care, which are shared, monitored, and refined over a person’s lifetime.¹

These goals are aligned with the strategic direction of the province² and trends around the world. Harnessing the potential of the electronic health record (EHR) is a goal of the health system, and promises a variety of improvements to the way care is delivered. Delivery on this potential requires an effective EHR to be implemented in a manner that supports care delivery.

There have been incremental implementations of components of the Cerner IHealth (IHealth) system over a number of years. The most recent changes have included an update to the base EHR in February 2016 across Island Health, and the implementation of the advanced IHealth functionality (clinical documentation and provider order entry) at Nanaimo Regional General Hospital (NRGH) and Dufferin Place in March 2016. Oceanside Health Centre had been using this advanced functionality for two years.

Challenges following the recent implementations led to concerns about the safety of the system and the impact on care delivery. Staff and physicians were reporting orders disappearing or being changed, an unstable system and other challenges in delivering care to patients using IHealth. The interface was described as complicated and unintuitive, and the time required to use the computer system was affecting access and safety. Physicians in the Emergency Department and Intensive Care Unit reverted in whole or in part to paper charting due to these issues.

In response to these concerns, Health Minister Terry Lake requested an external review by Dr. Doug Cochrane, Provincial Patient Safety & Quality Officer, of the IHealth system on July 21, 2016.

¹ IHealth Background

² EHealth strategy

External Review Process

Terms of reference for the review were provided by the Ministry of Health (Appendix A). The terms of reference allowed for a broad view of the IHealth system and provided considerable latitude to explore the issues as the review team saw fit. Discussions with the Health Minister and Ministry staff identified key questions about the implementation of the IHealth system, specifically:

- Does the system as implemented impact the safety of care delivered?
- What impact has the system had on the delivery of care? and,
- How can implementation of electronic systems at other BC locations be improved?

The review initially focused on generating an understanding of the issues and concerns raised by Island Health, IHealth, Nanaimo Regional General Hospital, Dufferin Place and Oceanside Health Center staff and members of the medical staff. Documents supplied by Island Health were reviewed and initial site visits were planned³. The preliminary fact finding site visits took place from August 2 – 5, 2016, and were conducted by Dr. Doug Cochrane, Provincial Patient Safety & Quality Officer and Andrew Wray, Director, Learning & Strategic Initiatives, BC Patient Safety & Quality Council. This included visits to NRGH, Oceanside Health Center and a meeting with staff from Dufferin Place (at NRGH). Meetings included Island Health executives, Island Health site leaders, front-line care providers, IHealth staff and provider groups, including both the Local Medical Advisory Committee and the Medical Staff Association. Individuals who had approached the review team directly or who had been recommended to the team by others were also met with. Island Health was asked to schedule many of the interviews during these preliminary visits, with a number of others scheduled by the review team directly. For more details of the individuals and groups interviewed, please see Appendix B.

Following the initial site visits, a review plan was developed. This included plans for an additional site visit to conduct interviews and to observe the IHealth system in use by providers at NRGH. This visit was intended to clarify the issues identified in the initial documents and interviews. Written submissions were also invited to be sent directly to Dr. Cochrane from any Island Health staff member or physicians to supplement information gathered to date; 82 submissions were received.

Based on the preliminary information and discussions, the review narrowed the focus from that described in the terms of reference. This allowed for the review to be completed in an expeditious manner, while addressing the areas of greatest concern as expressed by users. The review focused predominantly on NRGH, and particularly on clinical documentation and medication order entry. There was no attempt to examine the strengths of the IHealth system overall. The experience in other jurisdictions with the Cerner product was not examined, although input from some sites was used to inform the review findings.

The review assessed IHealth implementation and use since March 19, 2016. There has been constant refinement of both the computer system and the way care is delivered at NRGH since that time. The review sought to understand and make recommendations related to concerns that had been raised since that date, but did not attempt to track whether issues had been addressed or to continually update the findings to reflect the most current status.

³ Documents reviewed included the HAMAC report, Medical Staff Association concerns, Island Health responses and extensive documentation on the design and planning for implementation for IHealth.

A second site visit to NRGH took place on August 16 – 19, 2016. It included meetings with Cerner representatives, members of the medical staff, Island Health front-line staff, and IHealth and site leaders. In addition to interviews, four members of the review team (Appendix C) observed the use of the IHealth system in various clinical settings. These reviewers were experts from outside of BC who provide clinical care and have experience using contemporary EHRs, including provider order entry in community and tertiary care settings. Following an orientation to the NGRH EHR by Island Health staff, 32 hours of observation were conducted in a variety of clinical areas (Appendix B). These observations were an opportunity to see the IHealth system in use by those delivering care. The intention was to see typical users and their interactions with the system while caring for patients.

After the site visits, the review focused on the analysis of the information gathered, corroborating and fact checking the information, and the distillation of observations and input from stakeholders into themes. This included additional conversations with physicians and Island Health staff to clarify previous observations and receive additional information. Additional documentation was also requested and reviewed. The final phase involved report writing and the generation of recommendations.

We have based our analysis on the view that the computer product, and its safety and effectiveness, are components of the overall system. As such, it is the interaction of the computer with the people, processes and physical environment that impact the way care is delivered to patients. In this paradigm, errors are consequences of the design and functioning of the overall system, not the individual components. When a patient suffers a close call or is harmed, the “important issue is not who blundered, but how and why the defences failed them”.⁴ Our analysis has sought to identify the sources of potential error in this socio-technical system, and to recommend defenses that can mitigate them. These sources of error are not uniquely computer or human based, but created by the interactions of the system as a whole.

There are caveats that should be acknowledged with respect to this review. There was no attempt by the review team to catalogue or investigate every issue with the IHealth system in place in Nanaimo that were known to IHealth or reported by users; it was not a forensic audit. Instead, the review focused on listening to the concerns of staff and physicians, considering the impact of these concerns on the quality of care and developing recommendations to address these concerns, and improve the experience and future implementations of the system. These exemplar issues are expected to be representative of the system as a whole. In this process, there were also observations about the way the system was implemented and the local context in which it occurred.

While not all of the challenges with the IHealth system are discussed in detail, other examples raised with the review team are included in Appendix E. Island Health is aware of these issues, and many may have been addressed at the time of this writing. The time line for the review did not allow for the complete tracking of these concerns over time; they are presented as illustrations of the concerns present in the system after it was launched for use.

The efforts that Island Health staff and physicians made in the implementation of the system and their openness to contributing to this review are valued and appreciated.

⁴ Reason J. Human error; models and management. *BMJ* 320:768-770,2000.

Findings

The IHealth system has changed care for many patients since its staged implementation began in 2007. For those authorized to access the system, the availability of demographic information, laboratory and diagnostic imaging results, consultations and discharge summaries has brought new information to decisions about care. Properly implemented computerized order entry is known to work well in supporting care that is straightforward and standardized. Similarly, medication prescribing as performed in the office setting can be made safer by automated dose, allergy and interaction checking.

As indicated in the introduction, the review narrowed its focus to the introduction of medication order entry and clinical documentation that went live March 19, 2016, at NRGH and Dufferin Place. This new functionality was introduced to all levels of care simultaneously throughout the facilities; care that was simple, routine and predictable and care that was complex, requiring dynamic cognitive management.

The findings presented below have been organized according to the three questions identified in the introduction. Specifically:

Does the system as implemented impact the safety of care delivered?

What impact has the system had on the delivery of care? and,

How can implementation of electronic systems at other locations be improved?

Comments are also included specifically related to Dufferin Place and Oceanside Health Centre. While many of the findings apply, the different nature of the care delivered and the history with the Cerner product has changed the experience with the implementation in these settings. In addition, there is a concluding discussion related to moving forward at NRGH, and the reengagement that will be required to do so.

Does the system, as implemented, impact the safety of care delivered?

Assessing the safety of the EHR was done in the context of the care delivery process in the environment in which it is used; it is the interaction of the EHR with the users and the processes of care that defines the presence or absence of safety. A system designed and used safely in one environment may be unsafe in another. The system may perform exactly as designed, but can be rendered unsafe if the design does not match the processes used to deliver care.

In any system, there are risks and the potential for error that can lead to a lack of safety. The comparator therefore is not an absolute lack of risk or potential for error, but an assessment of the probability and impact of errors occurring. The shift to the enhanced functionality of the IHealth computerized provider order entry (CPOE) system was promised as an opportunity to improve the safety of care.

The EHR has introduced new and different conditions that could predispose to error. Some of these are present in a paper system and known to users, others are specific to the technology as designed and introduced and were not known to users.

The following are examples of events, reported by users who were interviewed, that in our opinion directly impact the safety of patient care. The review did not determine whether these examples are intrinsic to the product or the implementation, only that they existed in the system at go live.

Excessive doses of medication may not be detected by the system

High doses of medication can be ordered and could be administered. Using processes available to any user, a prescriber can inadvertently write an order for an unsafe dose of a medication. This possibility was discovered while prescribing narcotics: presumably other medications can be also ordered in this way. The excessive dose was not signaled by the automated dose checking process and therefore prevention depended on the pharmacy staff and the nurse administering the medication recognizing the dosing error.⁵

Recommendations

1. Island Health analyze and correct the medication ordering process that allows medication doses exceeding accepted dose ranges to be ordered.
2. Island Health implement a dose checking algorithm for high risk medication orders to ensure that prescribers are alerted to excessive doses or frequencies. Dispensing doses above recommended levels should require an explanation from the prescriber and be covered by a clinical care policy.
3. As part of the quality assurance measurement system for medication use, Island Health concurrently monitor high risk medication dosing, timing of administration, route of administration and duplicate orders for the same medication in a patient.

⁵ This issue was brought to IHealth's attention when it was discovered. In other situations the dosing ranges for high risk medications are incorrect (e.g., hydromorphone).

Missed medication administration

Most medications are administered at specified times at NRGH. These administration times are not standardized across the various care areas in the hospital (e.g. ICU, wards, ED). As a result, ordered medications may not be given to patients who are or have been transferred from one location in the hospital to another.

Recommendation

4. To remove the risk of missed medication doses when patients are transferred, Island Health create an algorithm that alerts pharmacy and the ward that medications have not been given when a patient is transferred.

Persisting medication orders

Multiple orders for high-risk medications remain active on the medication administration record resulting in the possibility of unintended overdosing. There appears to be no checking or alerting when duplicate medication orders with overlapping duration of administration are entered. The expected additional human steps of reviewing and “cleaning up orders” create the opportunity for the administration of unintended doses to a patient.

Recommendation

5. Island Health address the issue of medication orders persisting on the Medication Administration Record (MAR). In this context, Island Health review its policy permitting multiple narcotics and multiple routes to be ordered concurrently for any patient. A patient specific algorithm should be developed that allows for patients who require concurrently administered narcotics by different routes. Health care providers for all other patients should be alerted when multiple orders and routes are placed.

Distribution of reports and messages

Concerns have been raised by physicians and other community care providers regarding the process used to distribute the results of investigations and tests ordered on behalf of patients. Not receiving critical laboratory and pathology results can result in diagnostic and treatment delays.

With order entry activation, Island health introduced a new process that required that the ordering physician indicate to whom copies of report(s) were to be provided. This new process was not successful with the result that the physician, for example the emergency department physician, who ordered the test or investigation received results but other providers including those providers responsible to take action on the results did not. As of June 13, Island Health automated the “copy to” process so that primary care providers would receive copies of the test results ordered on their patients in the emergency department and diagnostic imaging reports.

Within the IHealth system, Cerner messaging system seems to have difficulty in reaching the responsible physician or others who need to take actions. Message content may include orders, reports, lab or other values, and transfer of care information. Misidentification of the most responsible physician (MRP) was reported to be a common event that results in messages being misdirected and therefore not acted upon.

Recommendations

6. To ensure that reports are provided to the physicians who are responsible to take action upon them, Island Health review their education curriculum to ensure that users are aware of the processes to designate an individual as the most responsible physician for all or part of a patient's care and how to flag other individuals for copies of results and information.
7. Island Health ensure that diagnostic imaging, laboratory and other test results, provided by NRGH or other Vancouver Island facilities are being received by the providers responsible to take action on them.
8. Island Health monitor the messaging system to ensure that the correct responsible individual(s) are receiving communications.

Nursing narrative

The nursing narrative notes are a central source of information that guides care and facilitates communication for members of the health care team. In the current implementation there is no readily accessible field or report available to all users that describe the condition of the patient and her or his current status. The narrative has been used extensively to ensure consistent communication to all members of the care team.

Recommendation

9. Island Health implement a process that consolidates nursing and other observations and displays this information on the patient summary layouts for every type of user.

Mismatching ventilator/monitor data and the patient record

When a patient is in need of a ventilator or other respiration support, the drop-down menu in some sites contains all ventilators in the health authority. In the NRGH ICU, the assignment of the patient to a ventilator is a manual process. In these situations, it is possible to miss-match the patient with the ventilator with the result that data from the ventilator is sent to the wrong patient record and could be used in error for treatment decisions.

Recommendation

10. Island Health ensure that the ability to match a monitor and/or ventilator to a patient is restricted to designated users and that bar coding or other technology be used to ensure the integrity of the patient/monitor (ventilator)/location match.

System responsiveness and Code Grey⁶

End users report that challenges commonly occur with: system responsiveness, log-in when changing computers, unexplained screen freezes and bar code reader connectivity. The performance of voice recognition software is not consistently satisfactory. Local machine processing power, accessible memory, network configuration and use all appear to contribute.

⁶ Code Gray is a system failure effecting the network, software and or hardware. The system is rendered unusable and emergency downtime procedures must be implemented

System-wide unplanned downtimes are particularly impactful prompting the calling of a “Code Grey”. Island Health reports that there have been three occurrences in the past six months. Based upon a Code Grey event that occurred during the August 16 – 19, 2016 site visit, down time procedures do not appear to be as robust as thought. The down time computers did not function as staff expected them to when the network failed.

Recommendations

11. Recognizing the dependency of the all care processes on the IHealth system, Island Health provide an analysis of system failures (network outages, system and machine hang-ups, peripheral failures and peripheral mismatches) and upgrade hardware where the network and work stations are underpowered for the demands placed on them.
12. Island Health review down time procedures and the function of “down time computers”, and establish a preventative maintenance and testing schedule.

Integration with PharmaNet

PharmaNet integration is not effective and adds to the burden of medication reconciliation. It may not provide a current list of prescribed drugs and doses at the time of patient admission; in particular anticoagulants, narcotics, insulin and antiarrhythmic agents.

Recommendation

13. The Ministry of Health redesign the PharmaNet system to allow for the full integration with the IHealth (and other EHR) in the Province.

Usability

The user interface can make the system easy to use and intuitive or a struggle adding to the cognitive burden that users face when learning and using the system. The IHealth system makes extensive use of small font sizes, long lists of items in drop-down menus and lacks filtering for some lists. The information display is dense making it hard to read and navigate. Colour coding and colour highlighting is used extensively and requires memorization. Spelling of menu choices is inconsistent (e.g., "Hem" or "Haem"), slowing searching for the correct choice. Standard safety displays are not used, such as ensuring separation of amount and unit (e.g., 1500mls). Incorrect abbreviations are used (e.g., mls). Temperature may be displayed in Celsius or Fahrenheit, adding to cognitive overload.

Recommendations

14. Island Health simplify the user interface to include only the clinically required parts of a process or workflow and base these design changes on human factors, interface design principles and user co-design.
15. Island Health correct errors in terminology and ensure Canadian context is reflected throughout the EHR (e.g, Celsius vs Fahrenheit).

There are safety concerns that have been introduced as a result of the change in the IHealth system, and the way that this technology has interacted with the people, processes and environment for delivering care. As in a paper system, the safety of patients is only achieved through the diligence of those working in the system. The

recommendations offered above aim to support the use of the electronic system as an asset to increase the safety of care delivery.

What impact has the system had on the efficiency of care delivery?

The ability to deliver care has been adversely effected by the March 2016 implementation in many areas of NRGH. The extent, and how this impact is manifested, is dependent upon the work being done, patient care needs, the urgency and complexity of care and required treatments. Those users who provide routine standardized care, have found that properly constructed order sets can be helpful. There are few staff members who report that their personal productivity, as measured by patient care delivered, has returned to pre-implementation levels. The review team did not hear of any individuals whose productivity had increased. Examples of the impact seen on care delivery are provided below.

Documentation and Medication Ordering Processes

“Spending 15 minutes with the patient meant that the doctor would then spend 1.5 hours documenting”

The time taken for clinical documentation and medication ordering has increased for many direct care providers due to three factors:

1. the “new, digital way” of working including its new processes, interfaces, and methods;
2. new processes requiring increased volumes of data (both clinical and non-clinical) to be collected by any users; and
3. the impact of structured data entry.

Unfortunately, for many staff, their pre-go live training did not prepare them adequately for the impact of these three changes.

Structured data entry intentionally limits clinical descriptions to a pre-defined schema. While valuable for the purposes of aggregation, users have reported an inability to document accurately. The response has been to select the “closest” option due to an inability to provide an accurate description.

In the ED, following implementation (March and April 2016), the rate of patients *who left the department without being seen* increased to 2.3%. This rate is higher than for any month in 2015. At the same time, the percentage of patient services provided within the emergency department access benchmark ranged between 49% and 59%. Past performance has seen this rate vary between 63 – 80% (mean- 76%).

Medical and other professional staff saw fewer patients as a result of the time needed for documentation. Many staff members gave their personal time to serve patients needing care while trying to complete their documentation. Members of the Department of Internal Medicine have told the review team that they have seen a 50% decrease in productivity because of the time needed for documentation and ordering. Some allied health staff (e.g., physiotherapy, occupational therapy, social work) have reported a similar productivity decrease.

Cerner and IHealth staff did report expecting a drop in productivity while users learned and became more comfortable with the new electronic system, with a gradual return to baseline productivity six months after launch. This has not been the experience reported by the vast majority of users interviewed.

Changes in staffing needed to support the delivery of clinical care using the system

The Emergency Department has added an additional nurse to interface with the order entry system while running code and trauma resuscitations and manage the massive transfusion protocol. The bronchoscopy service has required increased support staffing for ordering and documentation. Incremental pharmacy staff has been required to address issues related to medication reconciliation and order checking.

Other services have not been able to increase staffing (physician, midwives or other professional staff) and therefore provide care to fewer patients or are adding hours to their workday.

Changes in the availability of professionals

Hospital medical staffing varies for many reasons over time. The reasons for such changes are not always known to the parent organization. The relationship of provider availability and the introduction the IHealth system was not investigated in detail by the review team. It was reported however that some individuals had changed their scope of practice since implementation.

Word of the user experience with clinical documentation and medication order entry has spread widely in the health care community. There is concern that the perceptions that others have formed regarding safety and inefficiency will negatively impact the ability of Departments and Divisions to recruit new physicians and locums and support the medical teaching mandate. The requirement for lengthy training may create a barrier to recruitment of some professionals. These factors could worsen human resource deficiencies that existed prior to system implementation.

Medical students are reportedly choosing not to return to the community because of the intra- and inter-professional issues and conflict that have surfaced associated with the March 2016 implementation.

It is the impression of the users interviewed that staff turnover and sick time have increased. Island Health has provided staff turnover and sick time rates over the last two fiscal years and in the months since go live and there has not been an increase. Since go live, additional nurses have been added to the nursing resource pool.

Recommendations

16. Island Health conduct a staffing assessment in all future rollouts and where the re-designed processes result in a change in workflow, the staffing needs and the scope of responsibilities for all staff members (including non-regulated employees) be incorporated into the planning. Where it is determined there is a gap (pre-existing or as a result of the re-designed process), Island Health develop a plan to staff to levels that enable learning while working for implementation, stabilization, and the future state as required.
17. Island Health review their current practices with respect to paper ordering and how that process uses the team (physicians, nurses, support personnel, pharmacy and other departments) and develop a policy and process for computerized order entry in urgent situations that optimizes the process by fully utilizing the team and the system.
18. Island Health commit to staffing support (physician, nursing and support staff) in the NRGH emergency department to achieve patient volumes within 10% of pre-go live levels in anticipation of a return to full CPOE after the workflow and process review and improvement.

Impact of the Hybrid System in the ED and ICU

The ED and ICU have abandoned computer order entry for medications because of the complexity and unpredictability of the system and have returned to a paper ordering process (*a hybrid system*). While this may address operational flow and prescribing issues in the ED and ICU, it creates added complexity to management, exposes patients to the possibility of medication error and creates delays in patient flow.

In the hybrid system, the ICU has lost computer-assisted medication safety monitoring and clinical decision support. The hybrid system also results in significant additional workload for physicians accepting transfer of patients when they are discharged from the unit. The Emergency Department hybrid system has introduced additional complexity. While medication orders are now paper based, non-ward stock medications are entered in the EHR system by pharmacy. As a result, some medications are in the electronic system and others are on paper. This is high risk, increasing the potential for duplicate medication ordering and missed medications. Verification of orders is difficult or not possible. Medication entry by pharmacy and by the admitting physician can create duplicate orders.

Due to the requirement to have all orders in the electronic system at the time of admission, significant delays occur in the admitting process; typically, due to awaiting the arrival of the admitting physicians as the ED physicians no longer do admission orders. The result is that patients are held in the ED longer than necessary. This shifts workload to the admitting staff.

The hybrid system as implemented trades off some risks and inefficiencies for others.

Recommendation

19. Island Health use the results of the revalidation process to inform a decision regarding the future medication ordering process used in the ED and ICU.

Factors Affecting implementation

As mentioned in the description of the review, the success or failure of the implementation of the IHealth system is dependent on the care environment in which it took place. The differing contexts reflected in NRGH, Dufferin Place and Oceanside are vital to understanding the impact the new functionality has had on the safety and effectiveness of care. The specifics of the care environment, as well as the pre-implementation assessments, preparation and process for implementation are important considerations. Factors affecting how the implementation transpired are discussed below, with recommendations for consideration when looking to future deployments of electronic systems.

Organizational and medical leadership

Prior to and after go live, Island Health was undergoing re-organization. At the level of care providers, middle managers and frontline care providers, the organization was in flux. As a result, there appeared to be little consistency amongst the individuals representing the goals of IHealth and the implementation of additional functionality. Inconsistent leadership was not limited to managerial roles but was also noted in the medical departments and divisions at NRGH.

The consequence of a changing medical management structure was the lack of advocacy for work as done (rather than work as imagined) during the design and development process. There were only a few consistent local medical leaders providing avenues for communication, problem detection and solving to the IHealth project teams.

It was observed that amongst some of the medical staff, there exists a limited understanding of what constitutes effective collaborative leadership between administration and medicine. This may be founded on pre-existing sociocultural relationship issues between health care providers and Island Health administration, including the perception that Island Health has not recognized and supported the evolution of NRGH from a highly effective community hospital to one with selected tertiary services. This perception has been strengthened by the timeliness and feedback users have received to their reports and their concerns about quality and patient safety.

Appreciation of the EHR design

The review team observed that users were told and expected that the system would directly support quality clinical care as they knew it, and be designed to achieve this aim. Products such as the IHealth system are designed to achieve multiple goals in addition to clinical care. All products in this market place are designed to support patient safety and clinical care, while also facilitating administrative, reporting and payment processes. To achieve this, design decisions are made that attempt to balance these goals.

When design decisions are made to support goals other than direct patient care, and where these decisions directly interface with the provision of care, resulting in additionally complicated care processes and transfer of non-clinical work to care providers, they are seen as a hindrance to caring for patients. The primary consequence of these decisions has been additional data collection and structured documentation that is not relevant to patient care at the bedside⁷.

⁷ Zulman D, Shah N H, Varghese A. Evolutionary Pressures on the Electronic Health Record Caring for Complexity. JAMA 316 923-924.

The current evolution of the EHR has “*many virtues: It supports arduous and time-intensive tasks such as order entry and medical history review, and most systems routinely alert clinicians if they prescribe medication combinations that might cause harm*”⁸. They should be implemented to take advantage of these features.

Users were not made aware of or did not understand the rules and algorithms that are embedded in the Cerner product. As a result, the system appears to behave unpredictably, elevating the probability of human error or misinterpretation. Examples of medication ordering rules that are unclear to users include dose ranges and maximal doses for various age groups, and the rules governing stop orders for medications.

Alignment of user and system values

The system as implemented is seen as the threat to what the clinical users held dear; their ability to provide quality care. A causal contributor was an incomplete understanding of the local culture and the clinical values of individuals and the organization during system design. This led to the system being implemented with goals and processes that were seen to differ from what providers and users held as fundamental, professional values (safe care, timely care, efficient care). When value conflicts exist, trust is eroded; the workplace climate devolves to fear, conflict and despair.

Understanding current work and gaps in care

Detailed workflow analysis prior to system design and development was limited. The documented examples of the workflow examined during the review lacked sufficient detail to be useful in guiding care. No formal gap analyses of the care processes (current vs. future/best care) were done. Although many people were involved in the development of order sets and testing scripts, we could not find reconciliation of the system assumptions with work as done at NRGH or elsewhere.

There was an assumption that physicians across Island Health would accept and use order sets that they had not been part of developing or were aware of in detail. The example receiving the most commentary was the insulin sliding scale. In this case, the Island Health “best practice” was not promulgated as a health authority wide standard prior to go live. Adding to the impact of a new and different approach to care, the order set for the process was found to be difficult or impossible to use by many. In several clinical areas, there was no attempt to standardize care prior to the introduction of the EHR; the users of the system were expected to adapt to both computerized order entry as well as a new best practices.

User engagement in system design

Users must be provided the opportunity to meaningfully contribute to system development. They can ensure that the design is clinically relevant and useable, and can act as expert trainers for colleagues. They become both owners and users of the system.

Island Health’s strategy has included using the IHealth implementation to standardise care across the health authority. This is a critical goal but to be successful must include local users who understand the context of care, and workflows in the environment being implemented. Co-design with individuals working at NRGH was limited and much of the design was done by clinicians from other Island Health facilities.

⁸ Ibid

Bringing together the local context and expertise with the designed capabilities of the system requires collaboration between users supported by product and IHealth program experts. Many of the struggles users have reflect a disconnect between work as done by users and work as imagined by the design, planning and accountability groups. The failure to integrate these two views of work reflect, in part, the lack of experts with in-depth product knowledge who could manage workflow and gap analysis and do the translation necessary to harmonize clinical care as done (with any added best practices) with the capabilities and functions of the product.

Recommendation

20. Island Health undertake a workflow and system design review separate from order set review and re-building. Reconvene reconfigured clinical user groups to include users from NRGH and future implementation site(s). Using this group of users, supported by Cerner and IHealth program experts, assess the NRGH experiences for each of the clinical areas listed in the Provider Education Strategy.
 - a. Consider “work as done” and not just “work as imagined” when reviewing workflows, in particular the documentation and ordering processes. Clarify what new best practices are needed for patient care and share these practices with the relevant Island Health user committees. Incorporate their input into refreshed workflow before any effort is made to integrate this workflow(s) into the IHealth system.
 - b. Simplify the workflows and data entry/ordering to provide the majority of users with one process for workflows relevant to their job that is/are simple and intuitive. Eliminate structured data entry and interface items where there are no clinical care reasons for having such data and create data entry and display layouts that support care. Circulate these workflow changes through medical and clinical communication channels (departments, divisions, programs) for discussion and confirmation before implementing into practice.
 - c. Engage provincial bodies, whose role is to define standards of care in BC⁹, so that care plans, order sets and documentation schema are based on their standards to enable consistent implementation province-wide for the EHR products. Where provincial bodies do not exist, engage in a process to harmonize workflows with the implementation teams in the lower mainland.
 - d. Simplify the user interface to include only the clinically required parts of a process or workflow and base these changes on human factors, interface design principles and user co-design.

Training

A “Play Domain” was set up to enable health care providers to use the system before go live. Unfortunately, the “Play Domain” differed from the system used for training and the live system that was implemented. There was eight hours of mandatory training for employees (e.g., nursing and allied health). Physicians were offered training (eight hours); many took advantage of this. The “Play Domain” was available for self-learning. Training focused on system functionality and was not designed to show how the system could be optimally used for patient care.

⁹ BC Cancer Agency, BC Renal Agency (dialysis), BC Cardiac Services (myocardial infarction), Perinatal Care BC (labour and delivery) , BC Patient Transfer Network (interagency transfer of patient, documentation, imaging and orders)

Nurses and physicians were trained separately. This approach neglected team based care as provided in the work place.

During the review, we heard that the training was said to be *“inadequate”* for physicians and that the *“docs were not competent (in using the system) at the time of go live”* resulting in the feeling that the system was unsafe in their hands. This input was provided to Island Health and local administration in meetings and in writing. An update for training that will incorporate system improvements made since March go live is in process but is not yet available to users.

As the system had not been completely built at the time of go live it was not tested in a clinical environment prior to being used for patient care. Users were not able to test the system, its work flows and its behaviours prior to using the system to provide care. Learning a new system requires knowledge of new functionality, how the system works and how individual providers can work together with the system to achieve clinical goals. Prepared users will have had the opportunity to test the processes of care as implemented that they will use in real life in a training, simulated environment.

Recommendation

21. Island Health incorporate the following into the education plan being developed for NRGH and future implementations:
 - a. Provide clarification of the strategic goals of IHealth for users and reconcile differences in these goals with those of front-line care providers;
 - b. Provide the rationale for workflow changes that will shift work between users (e.g., data collection, parameters for ordering or administrative tasks such as registration);
 - c. Explain to every user, based on the work they do, how the system is organized, describe underlying assumptions, terminology, what background rules exist and how and when they are triggered and what they do to the data;
 - d. Clarify the auditing functions that are operational in the background so that users are aware of when and how tracking of changes in data entry and orders is done and who has access to the audit trail;
 - e. Develop a curriculum that provides individual training and knowledge for the trainee’s role;
 - f. Train teams so that members understand their roles and how the system will affect these roles and their interactions;
 - g. Develop post-go live training for individuals and teams who want to optimize the system for their work (power users).

Hospital capacity at implementation

It is generally recognized that at the time of implementation and for a variable period thereafter (often months), the productivity of users decreases as they learn how to use the system while providing care. With the launch of the system, experts recommend taking steps to reduce demand for services where possible, and provide additional supply of staff and providers. At go live, the hospital was at 99% capacity. The ED was seeing 165 –

190 patients daily and critical care was at full capacity. Other services had existing human resource challenges and were struggling to recruit.

Issue reporting and resolution

At roll out, when users were highly supportive and enthusiastic, they actively engaged in reporting issues of performance, usability and safety. At the time, reporting was accepted through multiple sources including the Patient Safety Learning System (PSLS), health informaticists, the Help Desk, emails, red dot reports and meetings. Peer mentors and informaticists were actively engaged in addressing issues as they arose.

Unfortunately, follow up with users that had reported a concern was inconsistent. Many users reported an absence of feedback. The reasons for the lack of feedback are not clear but may relate to the volume of issues being reported and Island Health's capacity to address them. As a result, from the users' perspective, many issues remained unexplained and unresolved, undermining confidence in the safety of the system and the effectiveness of the reporting systems. Users stopped reporting because of fatigue and the lack of feedback.

Some individuals who provided reports perceived that those responding to issues were transferring responsibility to the users. Explanations for issues included *"user error"*, *"bad habits"* and *"users failing to remember"*. Island Health's reactions were described by interviewees as punitive and involved public shaming and bullying (see emotional responses below). It was claimed that there were no gaps in education or training, but rather *"gaps in remembering"* and a *"lack of engagement of staff"* for voluntary learning.

To date, many requests for issue investigation have not been addressed to the users' knowledge. Over 80 reports have been submitted to PSLS by physicians in the ED. It is the perception of some that reports were not welcomed and as with other reporting mechanisms, feedback has been lacking.

Recommendation

22. Island Health clarify for all users the reporting methods, processes and expectations for IHealth related events, both technical and sociocultural to ensure learning from the observations of users and to ensure that the review processes have the highest integrity. Feedback on the status of an issue should be provided directly to the reporter(s) if known, within a specified period of time known to the reporter.
 - a. For issues already submitted, Island Health should close the loop on all user reported observations with the individual reporter, if known, and the relevant user population.
 - b. Island Health should develop a communication plan to ensure all users of the system are aware of how to access and use the reporting methods. Specifically, with respect to PSLS submissions, Island Health should provide ongoing feedback describing the time lines for analysis and results of investigation to those who have submitted reports.
 - c. User observations submitted through the reporting systems, their review and fixes should inform the re-development of the IHealth learning environment
 - d. Island Health resource the IHealth team to ensure the response to reported issues can be provided in the time interval appropriate for a live system.

Cognitive burden of learning while working

In the setting of high clinical demand with no ability to reduce workload, or in situations of complex care, the cognitive burden that users carry is particularly high. The processes that the product, as implemented, is trying to deliver, the complexity of the interface, changed work processes and the lack of “at the elbow” experts to support learning while working all add to the cognitive burden and have collectively conspired to undermine the implementation. Because users did not fully understand the system, they have instituted multiple checks and re-checks to protect patients. These checks have kept the system safe for patients but added to cognitive burden borne by users.

Emotional burden

The implementation has created significant emotional stress for individual users, managers, mentors and informaticists due to decreased efficiency, increased work load, patient safety concerns, and breakdown in collegial relationships, cognitive burden and fatigue. This has incrementally added to an already stressed human resource base. Intra-professional conflict has erupted when the impact of the system on work differs amongst individuals. Some of the individual experiences that were shared with the review team include:

“Moral at my workplace is at an all-time low. Staff are getting sick more frequently, needing extended leaves of absences, taking retirement sooner, personal relationships are breaking down, overtime is through the roof, assessments are not being documented or are being missed more frequently, and we have had doctors leave ... practice because of IHealth.”

“For Managers to tell us “just do what you can”; this became a very patronizing expression that we heard much too often. Most of us are dedicated, hard-working clinicians who have our patients’ best interests in mind and we have ongoing angst about not having the time needed to assess and treat patients in a timely manner. The referrals keep piling up and it weighs heavily on most of us.”

When told that “you are being difficult” recipients of the comment indicated that this was both untrue and felt disrespectful. It did not acknowledge legitimate concerns.

Oceanside Health Centre and Dufferin Place

While many of the findings listed above apply to both Dufferin and Oceanside, the nature of the care delivered, staff and context produced a different experience in those settings. The following findings relate specifically to those two settings.

Oceanside Health Centre

The Oceanside Health Centre, a primary care centre with low staff turnover, has had computerized ordering and documentation systems in place of several years. Many of the staff (nurses and physicians who work in both the electronic and paper “worlds” - Oceanside and Port Alberni), report that they would never go back to paper – *“the system is better than paper”*.

They also comment that the system slows work down because it is not intuitive, despite their months or years of experience using it. Users continue to have to be vigilant of *“safety glitches”* that surface from time to time.

Single step transactional orders are easy to set up and are quick (e.g., lab and radiology testing requests). Complex orders requiring decisional logic are not required in this setting.

With the February 2016 activation of the new EHR platform, medication data for primary care patients was not migrated and medication records were scanned and made available for reference. Staff had to manually re-enter medications for each patient on their next visit.

Dufferin Place

Dufferin Place is a long-term care facility and has a unique relationship with the IHealth system. The greatest impact has been the loss of family practitioners as primary providers to patients in the facility. It is reported that some physicians have chosen not to care for residents of Dufferin Place because of the changes in care processes that are inherent in the system, its complexity, the learning burden and perceived risks because the system does not function as they would expect. Currently, a primary care nurse practitioner is resident on site and provides support to the physicians caring for Dufferin residents. This support includes interfacing with the IHealth system as needed.

An additional issue needing close monitoring at Dufferin Place is managing risks, specifically those related to medications that could occur as a result of transitions in care between Dufferin Place and acute care.

Nanaimo: Re-engaging with users through review and improvement

It is the reviewers' observation that despite the learning over the past seven months and the efforts of providers and Island Health to implement medication order entry and clinical documentation, disagreement persists as to whether the order entry and documentation functionality of the system, as implemented, is suitable for clinical care in the setting of a large community hospital with the care support available to NRGH.

To resolve disagreement and to define ways forward, the reviewers are recommending a two phase process:

1. revalidation of the order entry and documentation capabilities of the current IHealth implementation by clinical providers and
2. considering the finds of phase 1, a review of the common clinical care workflows to ensure they reflect best practice, utilize the IHealth system where it is applicable, can be used across Island Health facilities.

Phase 1. Functional Capability revalidation in the BC context

Recommendation

23. That the NRGH medical staff and Island Health join in a process to revalidate the order entry and clinical documentation capabilities of the IHealth system and test the ability and suitability of the implemented functionality to meet the clinical care needs of patients based on current clinical workflows¹⁰. The revalidation process will be supervised by an oversight committee. This committee will receive the results of the clinical reviews and will develop options to address situation(s) where the functionality as provided, does not address the clinical needs in the Island Health context.

The reviewers propose that this re-evaluation be focused on order entry and clinical documentation capabilities of the IHealth system. Because the system is in use now, timely solutions are needed and therefore the revalidation should be done expeditiously. Further, it is recognised that such a revalidation is detailed work that to be useful, must involve teams (assessment teams) composed of representatives of all relevant disciplines. Because workflows for the same clinical condition differ in various types of Island Health facilities (rural, community, tertiary and those with teaching responsibilities) and to provide Island Health with information that will inform future implementations, the revalidation should assess the ability and suitability of the implemented functionality to address care needs in these various clinical settings. To do this, teams should include not only clinical users from Nanaimo, but also those from the next Island Health site(s) to be implemented and Victoria General Hospital or Royal Jubilee Hospital. To facilitate future BC implementations, consideration should be given to involving members of the lower mainland Clinical Systems Transformation team.

¹⁰ The specific workflows will depend on the clinical conditions encountered by the care providers. Some can be derived from the scenarios that are already developed for education, testing and order development. Others, based on the experience of providing care over the past seven months, will need to be described. It is estimated that each clinical area would assess the ordering and documentation functionality for 5-10 common clinical conditions. Both simple and complex care processes should be assessed in this process.

It is recommended that the assessment teams report to an oversight committee (Oversight Committee) co-chaired by the Ministry of Health and the Island Health Board, comprised of representatives of Island Health Board, the relevant members of the executive of Island Health including the Chief Medical Information Officer (CMIO) and two members of the NRGH medical staff. To facilitate learning, consideration should be given to involving the leadership of the lower mainland clinical system transformation project.

The purposes of the Oversight Committee include oversight for the focused review process, review the functional specifications for the Cerner model system as implemented, comparison of these specifications with the results of the clinical user revalidation and develop options to address situation(s) where the functionality as provided, does not address the clinical needs in the Island Health context. The committee will promote a collaborative way forward for IHealth on Vancouver Island.

Detailed terms of reference for the Oversight Committee will be developed by the Ministry of Health in consultation with Island Health and the Medical Staff Association at NRGH. This committee may need to commission external expertise to support its mandate.

Phase 2. Moving forward in Nanaimo and Island Health

Recommendation

24. Based upon the results of the revalidation of order entry and documentation functionality and the determinations of the Oversight Committee, a plan for moving forward should be developed.

It is suggested that the following components be incorporated into this plan. Work already done by IHealth and the experience of users as reported to the review must be included. The components include:

- defining gaps in care, in particular with respect to “best care”;
- verifying standardized clinical workflows based on the experience gained during the Nanaimo implementation by including Nanaimo staff;
- validating these workflows and clinical practices with relevant users throughout Island Health and other Cerner implementations in BC prior to implementation;
- aligning the workflow of incorporated best practices with the tools that the Cerner product provides to automate these care processes;
- simplifying the user interface to include only those features, controls and data fields that are relevant to the task(s) at hand, thereby reducing cognitive overload for users;
- providing a stable environment for learning updates, functionality changes and user education and
- providing a safe and effective reporting process for system issues and care concerns.

Solutions should be tested by a group of regular users who are separate from those providing input for the re-development to ensure that the process is useable, robust, resilient and defect free.

Input from the engagement process can inform the revamped education strategy (and go forward strategy for new sites). Training for all users should be mandatory and include content that provides them with an

understanding of the Cerner product and how it behaves; what new workflow changes have been put in place; and how the user's care processes will be changed. Team training using the new systems of care and the tools must occur in those clinical arenas where the critical inter-dependence of team members is needed for the care provided. Each individual and team should be required to rehearse the care processes that they will face in the "live clinical" situation. Island Health and users including physicians must resolve the relationship issues that were apparent to the reviewers. Disrespectful, intimidating, threatening behaviours are unacceptable in any work environment and do more to threaten patient care than this information system. The organizational, professional and medical leadership should channel their experience and efforts into improvement and set aside the interpersonal manipulation that has characterized the months since go live.

It is suggested that the re-engagement through review and improvement begin with physical and occupation therapy in the acute setting, the Department of Family Practice and Palliative Care, and thereafter with the Hospitalists and Internal Medicine. Review should be done concurrently with these groups and over a period of 2-3 weeks. The ICU and the ED review should be done in conjunction with the next implementation sites.

Because the complexity and volume of care were specific stressors for the March 2016 implementation and because most of the preparation had involved clinical expertise resident in Victoria, it is suggested that Island Health seriously consider the possibility that one of the Victoria Hospitals be implemented in a phased fashion concurrently with or prior to Comox/Campbell River.

The deployment of EHRs in BC will change how care is delivered in the future. The Ministry of Health, the health authorities and the Doctors of BC share a common interest in the success of these implementations. These groups should explore how they can work collaboratively to foster success for patients and providers.

Recommendation

25. All parties re-commit to working through areas of conflict.
26. Where violations of Island Health organizational policies are revealed, actions should be taken as defined by the relevant policy.

Recognition

The review team heard much from the staff that indicated their dedication to understanding the system, supporting its use and trying to fix it. There remains amongst some, the optimism that was present at the time of go live. This is reflected in their advice; *"take it off line and we will help fix it"*.

It is this commitment to care that will enable IHealth and its users to take advantage of the system appropriately while improving patient safety. Island Health has the opportunity to publically recognize the commitment that users have made to quality care and to use the system.

Conclusion

The introduction of the advanced IHealth functionality in March 2016 has had a significant impact on the way that care is delivered. There is the potential for errors to occur when using the system, and these have been prevented by the diligence of users. There has been a decrease in the efficiency of care delivery for most services.

The functionality of the IHealth system should not be discarded, nor should the learning that has come from the NRGH experience; however the functionality must effectively support clinical care in the Island Health context. The revalidation of functionality based on what has been implemented and is now known about the use of the live system forms a basis for the design and planning of future implementations. We recommend that each Island Health clinical area review current workflow, assess their current clinical practices from the perspective of best practices and then reaffirm or refine practice standards for all of Island Health. Once clarified, these new standards and practices must be tested for workability by users. This testing will set the stage for the integration of this work into the IHealth system so the system is useful, understood and safe.

The ability to improve the system requires the input of users. There should be robust reporting mechanisms to capture this feedback and Island Health should close the loop for all of the issues that have been reported to date.

Improving the system for the work it is intended to support, is a way forward.

Appendix A: Terms of Reference



TERMS OF REFERENCE FOR IHEALTH REVIEW

Dr. Doug Cochrane, Chair of the BC Patient Safety and Quality Council and Provincial Patient Safety and Quality Officer, will use his expertise as a physician and an expert in patient safety and quality to review the functioning of IHealth, the new electronic health record system at Nanaimo Regional General Hospital. IHealth is a recording and reporting tool, enabling electronic health documentation, communication, scheduling, ordering and decision-making. Island Health began implementation of IHealth in March 2016.

The review will:

- Provide an overall assessment of the strengths and weaknesses of the IHealth system. This assessment will take into account the current status of the IHealth implementation and action underway to mitigate challenges and enhance its functioning. It will also examine the experience of other sites in other jurisdictions that have implemented the Cerner system.
- Identify, assess, and make recommendations to address patient care quality concerns, including any specific safety concerns, raised by physicians and other health care providers regarding the functioning of new IHealth system at Nanaimo Regional General Hospital, Oceanside Health Centre and Dufferin Place.
- Identify, assess, and make recommendations to address workflow and/or work process concerns raised by physicians and health care staff that may affect the delivery of timely, quality patient care related to the implementation of the new IHealth system at Nanaimo Regional General Hospital, Oceanside Health Centre and Dufferin Place.
- Assess the implementation of the new IHealth system at Nanaimo Regional General Hospital, Oceanside Health Centre and Dufferin Place and make any recommendations to improve implementation at future Island Health sites.
- Involve additional expertise or resources as required to complete the assessment and recommendations.

Dr. Doug Cochrane will be provided full access to any written materials, physicians, other members of the health care staff team, and administrative or management staff as he requires.

The review may include recommendation of immediate, short-term and long-term actions and strategies, with an expectation that it will be completed in a timely manner, with substantial completion by September 30, 2016.

Appendix B: Stakeholder Interviews and Clinical Observations

Interviews took place with a large number of stakeholders over the course of the review. Many of these took place during the site visits, with others arranged via teleconference. The list below is meant to illustrate the number and variety of individuals who provided input and shared their experience.

Written submissions were also invited. A total of 82 were received, and additional documentation was also provided in person.

The following is a list of stakeholder groups interviewed during the review process:

- Island Health Geography 2 Executive
- Island Health NRGH site directors
- Island Health Deputy Chief Medical Officer
- Available NRGH Medical Staff Association members (approximately 12)
- NRGH clinical managers (approximately 10)
- Individual NRGH physicians (15)
- Individual NRGH RNs, LPNs, Allied Health and pharmacy (Approximately 12)
- Available NRGH LMAC members (approximately 10)
- NRGH Nurses (4) and BCNU stewards (2)
- Island Health Executive (6)
- Island Health IHealth project delivery
- Island Health Quality & Safety
- Island Health medication and laboratory leads (5)
- NRGH Clinical Peer Leaders
- CPOE Optimization team
- IHealth Nurse Informaticists (Approximately 12)
- IHealth Physician Leads
- IHealth Education and Training team
- Dufferin Place Director, Manager, NP, RN and LPN
- Oceanside Manager
- Oceanside Physician Medical Director
- Oceanside RNs and NP (4)
- Individual NRGH physicians, including IHealth physician leads (Approximately 7)
- Island Health simulation lead
- Respiratory Therapist
- Pharmacists (5)
- Family physicians (Approximately 8)
- Cerner executives

During the site visit to NRGH on August 17 – 18, 2016, a total of 32 hours of observation were undertaken. These observations were an opportunity to see the IHealth system in use by those delivering care. The intention was to see typical users and their interactions with the system in caring for patients. Observations took place in the following clinical areas:

- ICU
- Emergency
- Medical wards

- Perinatal/Pediatrics
- Surgery/Post Anaesthetic Recovery Unit
- Telemetry Medicine
- Renal Dialysis

Appendix C: Review Team Biographies

Doug Cochrane, MD FRCSC FAAP

Provincial Patient Safety & Quality Officer and Chair, BC Patient Safety & Quality Council

Dr. Cochrane is a practising physician with extensive experience in patient safety, health-care quality and risk management. He completed a pediatric neurosurgery fellowship at the Hospital for Sick Children, University of Toronto, and was appointed as a staff neurosurgeon at BC Children's Hospital and Sunny Hill Health Centre for Children in 1986. He is an Emeritus Professor at the University of British Columbia in neurosurgery, a certificant of the American Board of Pediatric Neurological Surgery, and a Fellow of American Academy of Pediatrics. Dr. Cochrane chaired the BC Patient Safety Task Force from its inception in 2003 to the creation of the BC Patient Safety & Quality Council.

Dr. Cochrane has previously led reviews and provided recommendations on: surgical-site infection control at Surrey Memorial Hospital in 2005; the quality of diagnostic imaging, and the credentialing of radiologists, in 2011-12; Fraser Health's implementation of recommendations for C. difficile prevention in 2012; and a number of other reviews into quality of care and physician performance both in British Columbia and Ontario.

Andrew Wray, BSc MHA

Director, Learning and Strategic Initiatives, BC Patient Safety & Quality Council

Mr. Wray leads the BC Patient Safety & Quality Council's learning programs including the Quality Academy, Clinician Quality Academy and Quality Forum, along with the Council's strategic initiatives and measurement work. He has been involved in a number of reviews at the request of health system partners. Prior to joining the Council in 2009, Mr. Wray spent several years working in the biotechnology industry, with the BC Cancer Research Centre and the BC Ministry of Health.

Jan Davies, MSc MD FRCPC FRAeS

Professor of Anesthesia and Adjunct Professor of Psychology, University of Calgary

Dr. Davies has worked and undertaken research in system safety for more than 30 years in healthcare and aviation. She has been a consultant to various Canadian provincial medical examiners and coroners, Health Canada, the Canadian Patient Safety Institute, and the Health Quality Council of Alberta. She is co-author of the Canadian Patient Safety Dictionary and of Systematic Systems Analysis: A Practical Approach to Patient Safety Reviews. Her research areas include reactive and proactive methods of investigation at the system and individual levels, as well as the application of Human Factors concepts to healthcare safety and quality.

Donna MacFarlane, RN

Lead, Health System Improvement, Health Quality Council of Alberta (HQCA)

Ms. MacFarlane is an experienced healthcare professional who worked for over 20 years as an emergency room nurse and then began working in the former Calgary Health Region quality and safety department as a Clinical Safety Lead with one of her main roles being patient safety investigations. She joined the Health Quality Council of Alberta as a Patient Safety Lead in 2011. Ms. MacFarlane has done a number of patient safety reviews ranging from single patient events to large-scale multi patient reviews and prospective system reviews.

Christine Fantuz, BSN RN CNCC(C)

Clinical Nurse Educator, FMC PACU, Alberta Health Services

Ms. Fantuz is a Clinical Nurse Educator in the Post Anesthesia Care Unit at Foothills Medical Centre with a background in critical care nursing. She is involved in various multidisciplinary quality improvement initiatives leading to positive change in front-line nursing care and improved patient outcomes.

Tom Rich, MD CCFP-EM FCFP

Emergency Physician, Clinical Assistant Professor: University of Calgary

Clinical Informatics lead for Emergency Department and Urgent Care, Calgary Zone, Alberta Health Services.

Dr. Rich is an Emergency Department physician with over 20 years of experience in clinical, educational, and academic aspects of Emergency Medicine in Calgary. He was the Emergency Department Division Chief for Quality Improvement, Health Information and Patient Safety from 2003-2007. In 2007 he became the Physician lead for the successful implementation of CPOE across all acute care site Emergency Departments and urban Urgent Care sites in the Calgary zone of Alberta Health Services. He continues his role as Physician Lead for Clinical Informatics for the Department of Emergency Medicine in the Calgary zone (covering 5 acute care sites and 2 urban urgent care sites) with the expansion of the Electronic Health record. While he continues his role on the expansion of effective and efficient use of the electronic health record, his area of focus continues to be on the use of IT for measurable improved patient outcomes including Patient Safety Initiatives, clinical decision support, standardization of care, Quality Improvement and transfer of information across care providers.

Appendix D: Additional Concerns and Observations Shared with the Review Team

Order Management

- The relationship of orders to encounters is confusing and does not reflect current work flow. Orders can cross encounters. This results in duplicate orders and potential for over dosing. In some areas of medicine practiced in NRGH and elsewhere in Island Health, cross encounter orders are needed (e.g., for renal dialysis patients – antibiotics, anticonvulsants).
- *“CPOE forces you to change your practice. We call it ‘creative ordering’ when you can’t find what you want, so you find a workaround or the next best thing.”*
The use of “creative ordering” augments medication risk (too much or too little), as well as imposing significant workload on pharmacy to correct errors or make adjustments.
- Date format mismatches in the documentation system and the HER - one uses Day/Month/Year and the other Month/Day/Year.
- Consult/referral process is unclear and inconsistent resulting in missed consults for patients impacting patient care.

Patient Care Order Management

- Respirator settings brought into the patient record display information that is not clinically relevant. Such information needs to be processed so it can be excluded during care. The patient record-monitor feed does not record fundamental data (e.g., FiO2).
- Consult/referral process is unclear and inconsistent resulting in missed consults for patients impacting patient care.

Medication Order Management

- Entering the wrong dose at the time of admission/medication reconciliation or missing medications altogether are frequent events that users report. It appears that this is largely due to the complicated non-intuitive workflow and user interface. These same issues were observed to occur in the hybrid system.
- All orders populate an electronic “order sheet” resulting a lengthy list of orders. This creates challenges in finding and managing the orders and creates an environment where orders may be missed. There does not appear to be a way of filtering for a selection of orders.
- It is not clear why cancelled medication orders remain on the eMAR. This allows repeated dosing when the medication is not indicated.
- Delay in orders appearing on the orders tab (up to two hours) even when ordered STAT. The delay triggers a mandatory alert that requires an explanation for why the medication is “past due”. It seems that one part of the system is not connecting with another (or the reason for this behavior has not been explained to users).
- No mechanism to transition medications at the time of a transition of care (e.g., ICU to ward). All orders have to be cancelled and ordered. This is reported to be best practice but may not be practical or necessary depending on the nature and type of transition.
- Pharmacy can change orders and make changes retroactive, apparently without an audit trail. If such a trail exists, the physician users do not know it.
- There are non-sensible order options (e.g., amiodarone via nasal passages). These are intrusive, require thought to discard and are clinically irrelevant. It is not clear what the purpose is of them being in the clinical ordering system.
- The system does not recognize that generic and trade names of a drug refer to the same drug. It is possible to dispense duplicate orders in this situation.
- Currently pharmacy needs to verify every order. This includes all orders entered and cancelled as well as intravenous fluids. This is significant workload and results in delays in dispensing STAT or high priority medications.

- Patient care areas have “ward stock”. Many routine orders require the product to be changed to ward stock.
- Difficulty in ordering medications as desired has introduced the use of “non-formulary medication forms” which removes any system benefits in reducing drug errors (e.g., no allergy, drug to drug interaction, duplicate orders, etc.) and creates significant workload for pharmacy to correct.

Clinical Documentation

- CTAS scoring in the emergency department is subjective and is designated by a choice of colour. The colors are not clear on the screen – the blue for CTAS 1 is purple. The CTAS score is not automatically calculated.
- APACHE scores cannot be automatically calculated.
- Lack of a field or “report” that provides nursing and others to provide a general and multiuser updateable patient narrative.
- There is no way to get an “overall feel” for the patient. This is important for the most responsible physician providing care for a patient, as well as for consultants doing episodic care and during emergency situations such as a code blue [see “patient narrative” above].
- Anesthesia module does not communicate with the patient record.
- Partogram (perinatal) is display only; data entry is not directly available from this display.
- Discharge processes and documentation are cumbersome. In post-partum discharge requires interaction with 21 screens. Here and elsewhere physicians are inputting minimal information and reverting to prescription pads rather than using the online prescription functionality.
- FirstNet documentation has autonomous deleting (due to backspacing) behavior resulting in documentation being lost and having to be re-entered. Apparently this behavior was “stopped” only after a reboot of FirstNet and Dragon. Other examples of unpredictable behavior include lost dictation while using Dragon (resolved with a “paste function” but it is not clear how to avoid this from occurring), spontaneous switching to other languages when using the keyboard.
- Due to the complexity of the documentation process, and the fact that there are multiple places to document the same thing, users are likely inconsistent in the locations where they are placing notes and commentary. The consequence is that documentation may be lost (or at least not “findable”).
- Documentation of investigations of vulnerable adults under the Adult Guardianship Act are not readily apparent as they are stored in the Mental Health section of the system.
- PowerNotes – while able to pull information into a report, the generate reports are “dreadful documents to read”. Copies to the primary care provider are not documenting in summaries.
- There are no fields in the respiratory technology documentation to record changes in ET tube position and to comment upon intubation difficulty or challenges.
- Data loss can occur during data entry; data may be overwritten when pasting or using tag functions.

Usability and System Performance

- Modified order sets, and user-configured tools (autotext, macros and templates) can be lost at the time of “upgrades”. From the users’ perspective this is unpredictable and then requires them to rewriting tools, only to have the loss repeated with the next upgrade.
- Interface controls in various settings do not function as expected (e.g., “delete” button that does not “delete”).
- In addition to the interface problem is that of the ergonomics of the portable computer work stations or WOWs (workstations on wheels). WOWs have limited adjustability; users find it is difficult to sit at these as users' knees do not fit. Outfitted with touch screens where height cannot be adjusted. Users find that either the height is acceptable for the lower back or for the neck, but rarely for both. The touch screen function is not being used. The WOWs are heavy and cumbersome, making getting them to the bedside difficult, especially in already crowded patient rooms.

Observations / Comments from the Front Line

- *"We are always finding something new - the system is buggy and unreliable - we do not trust it"*
- *"Each new day there are new errors – intolerable -is not intuitive"*
- *"Design of the program, the forms do not reflect the work that we do"*
- *"There are simply too many choices and options to wade through"*
- *"We are all trying to make this system work"*
- *"Even with proficient keyboard skills you cannot keep up. The system is slow, unwieldy and freezes frequently bringing your day to a complete halt."*
- *"Unnecessarily complicated. Those two words sum up the Cerner IHealth program"*
- *"We were assured that the program was being customized for our needs and plenty of training and support would be available. We were told that within three to six months we would never look back to the old way of charting on paper tools. Well, here it is six months later. The multidisciplinary team I work with are no longer crying daily in frustration as they try to do their work in a timely and effective manner. Now most are just angry that we are still are wallowing through such a complicated, inefficient system."*
- *"I used to consistently see 13-15 pts on floor 6 and now find it difficult to see 8-9 in my day because of the inefficiency in the HER"*
- *"Our first responsibility is to provide the best care we can. That is not possible using this system as it is currently configured."*

The Effect of this Implementation on Relationships in Health Care

- *"We are becoming an appendage of the computer"*
- *"We are losing the art of medicine"*
- *"Bring the human back into the interaction"*
- *"Family physicians have disconnected from the hospital"*
- *"In my opinion this system as it is designed now, reduces direct patient care time and clinicians aren't as efficient. We, in acute care, are spending far more time on the computer compared to the paper chart system and less time directly with the patient so less patients are being seen per day."*
- *"As a therapist, it is important that I truly get to know my patients-- not just medical histories, lab results and vitals. I need to know who they were before they got sick, ie where they live, who they live with and how they were functioning. I also need this "subjective" information to allow me to do my job and communicate to the rest of the medical team when we are getting close to a patient's baseline and are ready for discharge home. I feel this current IHealth system does not accurately capture this very important information. We are all complex human beings and don't always fit into a tick box as this system appears to be set-up to do."*
- *"Another unfortunate outcome was the lack of higher level leadership presence in the building. I used to routinely see these people in the hospital...it is so nice to feel somewhat connected with upper level leadership...makes us feel like we are one big team all working together. Once IHealth started and right through to today, I rarely see the higher-level leadership team in acute care. It's like they have 'holed up' at a time when we most need their support."*

Implementation and Management

- *"There seems to be little accountability and so problems simply remain unsolved."*
- *"As a super user of the system, and clinical expert in workflows, I want to have it known that I do NOT think the system is dangerous and unsafe. I do however think that the amount of user error is astonishing ...I think there is a lot of optimization that needs to be done with this program to make it more user friendly, and easier to navigate. There are still many outstanding issues logged (since go-live) and many new issues discovered since, that have to be followed up and fixed before the next site can go live."*

FREQUENTLY ASKED QUESTIONS

November 17, 2016

REVIEW OF EARLY IMPLEMENTATION OF IHEALTH NRGH, DUFFERIN PLACE, OCEANSIDE HEALTH CENTRE

What is IHealth?

- IHealth is a transformative approach to health and care within Island Health and our community. IHealth is a quality initiative at that will:
 - support quality, safe patient care
 - harmonize and coordinate care across sites and systems
 - help decrease the risk of medication-related errors
- IHealth is anchored on an electronic record that will integrate a patient's health and care information in one record and plan of care.

Why was the system reviewed?

- It is not uncommon for large projects to undergo early review to gather feedback and identify areas that might need to be modified.

Who conducted the review and wrote the report?

- Dr. Doug Cochrane, Chair & Provincial Patient Safety & Quality Officer.

What did the review find?

- The report makes 26 recommendations in the areas of improved safety, efficiency and future implementation to support IHealth's advancement.
- The recommendations include the establishment of an Oversight Committee co-chaired by the Ministry of Health and Island Health, with local medical staff representatives. The role of the committee will be to oversee the two recommendations that speak to the validation of the order entry and clinical documentation functions of IHealth and promote a collaborative way forward.

FREQUENTLY ASKED QUESTIONS

Is Island Health accepting of the report and its recommendations?

- Yes, we are fully supportive of the report and recommendations.
- Many of the recommendations identify work that is already underway.
- We are looking forward to working with our physician colleagues, clinical teams and IHealth leadership to move forward.

Which recommendations are the priorities, and what is the timeline to implement priority recommendations?

- Our first step will be to collaborate with our NRGH clinical and medical teams to review and prioritize the recommendations.
- Our goal is to implement the recommendations as quickly as possible.

Is Island Health confident in the use of IHealth?

- Yes. We will continue moving forward with IHealth implementation and stabilization.
- Patients can be assured that they will continue to receive safe, quality care at NRGH, Dufferin Place and OHC.

Will the ICU and ED immediately fully implement the use of IHealth?

- We will be working with specific clinical teams to determine how best to continue to move forward in specific areas.

What additional costs will be incurred to implement the report?

- We have not had an opportunity to fully analyze the report or determine cost implementations.
- The most significant cost will be additional training costs.
- Additional costs are always built into large projects like this in anticipation that modifications will have to be made along the way.

FREQUENTLY ASKED QUESTIONS

Have physicians seen the report?

- Medical staff has access to the report on the website and it is our understanding the report was shared with the medical staff association leadership.
- We thank our physicians for their input into this review process.

Has NRGH leadership reviewed the report and recommendations?

- NRGH site leadership is now reviewing the report and recommendations.
- The IHealth and NRGH leadership teams will be meeting with staff groups to discuss the report in the days ahead.
- The report is available to all Island Health staff and the public on our public website.

Was implementation of IHealth slowed while the review was underway?

- We continued to move forward during the review to refine workflows.
- We have been continually working with physicians and staff on implementation.
- We want to ensure the IHealth system is fully stable in Nanaimo before we implement in other areas.

What are next steps?

- Island Health will thoroughly review the report and recommendations with our physician partners and clinical teams.
- No significant modifications to the order entry and clinical documentation functions will be made until the validation process is completed. This work will be completed as quickly as possible.

FREQUENTLY ASKED QUESTIONS

Will use of the system be paused?

- No. The report affirms that we should continue to use the system while reviewing and validating workflows and making refinements to fully integrate IHealth with clinical care processes.

Who was interviewed for the review?

- Physicians
- Front Line Staff
- IHealth leaders
- Users of the system
- Executive Leadership

How will the review and its recommendations be used for future site implementation?

- Our learnings in Nanaimo, including the work of the Oversight Committee on order entry and clinical documentation functions, will inform how we implement IHealth at other sites.
- We will not implement IHealth at other acute care locations until it has been fully stabilized in Nanaimo - this has always been our plan.

Were doctors and other clinical staff consulted before IHealth was implemented?

- Yes, they were consulted throughout the development of IHealth.

FREQUENTLY ASKED QUESTIONS

Are we modeling IHealth and the EHR after other health authorities or healthcare systems? Has it been tried anywhere else?

- We are definitely not the first site to do this, including not the first in Canada. EHRs have been used for decades in other settings. North York, Mt Sinai, PEI and London Health Sciences already moved in this direction, primarily in acute and ambulatory clinic spaces. However, in Island Health we are not just looking at individual sites; we are looking at how to use a single, integrated EHR to provide care across all areas where residents of Island Health access the health care system.