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ICAT Design Report
Phase 4 Report

Final Report
Oct 29, 2019

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Terms and definitions

- **AFP:** Alternative financing and procurement
- **AGVs**: Automated guided vehicles
- **ADCs:** Automated dispensing cabinets
- **AHUS**: Akershus University Hospital
- **AI**: Artificial intelligence
- **AR:** Augmented reality
- **BIoT**: Building Internet of Things
- **BYOD:** Bring your own device
- **CCs**: Command centres
- **CDS**: Clinical decision support
- **COTS**: Commercial off the shelf
- **CPOE:** Computerized physician order entry
- **CRM**: Customer relationship management
- **DBF**: Design, build, finance
- **DBFM**: Design, build, finance, maintain
- **DAS**: Distributed Antenna System
- **ED:** Emergency department
- **EMR**: Electronic medical record
- **GPS**: Global positioning system
- **HNHB LHIN:** Hamilton Niagara Haldimand Brant Local Health Integration Network
- **HHS**: Hamilton Health Sciences
- **HIS:** Hospital information system
- **IaaS**: Infrastructure as a service
- **IoT**: Internet of Things
- **IBT**: Integrated bedside terminal
- **ICAT**: Information communication automation technology
- **IO**: Infrastructure Ontario
- **ISP**: Internet service provider
- **MDR:** Medical device reprocessing
- **MIS**: Management information system
- **MM**: Material management
- **MOH**: Ministry of Health
- **NH**: Niagara Health
- **OHT**: Ontario Health Team
- **OR**: Operating room
- **ORIS**: Operating room information system
- **OTN**: Ontario Telemedicine Network
- **POA**: Procurement options analysis
- **PaaS**: Platform as a service
- **PPE**: Personal protection equipment
- **Project Co.**: Project Consortium
- **RFID**: Radio frequency identification
- **RAH**: Royal Adelaide Hospital
- **RPA**: Robotic process automation
- **RTLS**: Real time location system
- **SaaS**: Software as a service
- **SCS:** St. Catherine's site
- **SNH**: South Niagara Hospital
- **SNUBH**: Seoul National University Bundang Hospital
- **TCO**: Total cost of ownership
- **VDI**: Virtual desktop infrastructure
- **VR**: Virtual reality

Executive Summary

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Introduction & background

Niagara Health (NH) is underway with the redevelopment project of a new hospital in the southern part of Niagara. This green field hospital is tentatively called the "**South Niagara Hospital** (SNH)" and will consolidate and rationalize services from three existing sites in Niagara Falls, Port Colbourne and Fort Erie. Currently, NH is in the phase 2 planning stages of the new build of the SNH and is developing the **ICAT Design Report** that will guide the ICAT (Information, communication and automation technology) planning, design, implementation, and ongoing operations of the new SNH.

The ICAT Design Report is expected to include technology solutions that **enable seamless interactions between all patients, caregivers, families, providers, and staff to support care delivery in the hospital but also in the community and at home**. The ICAT Design Report will also position NH to become a leading agent in delivering "connected care" for patients and enable streamlined partnerships with the Niagara community.

The development of the SNH ICAT Design Report was completed in the context of NH's evolving role in the broader regional health system given the emergence of the Niagara Ontario Health Team.

Key ICAT takeaways

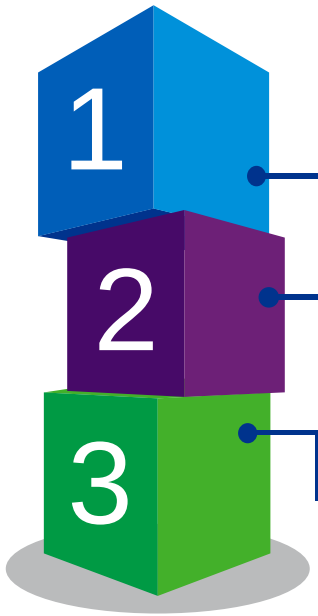
ICAT is an enabler, not the solution: It is well understood that at SNH, ICAT will be an enabler used to help improve efficiencies and transform experiences. ICAT on its own will not be the solution to address challenges in efficiencies and experiences. The implementation of ICAT will require training, change management and workflow analysis in order to be successful.

ICAT will extend beyond NH: As care delivery and planning extends beyond the “walls of the hospital” at NH, the role of ICAT and the processes and people that it will support will also extend beyond NH and into the community partners of the Niagara region.

ICAT will transform the care experience for all stakeholders: The SNH redevelopment provides NH with a unique opportunity to leverage new ICAT solutions to transform the care delivery experience for patients, families, caregivers, staff and other stakeholders who are instrumental in the care journey.

NH requirements

NH developed the following requirements for structuring the ICAT Design Report and a set of key activities to complete. This is depicted in the overview below:



Part 1: Understanding Phase

- Complete a current state analysis through stakeholder interviews to understand NH's strengths, challenges, and opportunities.
- Survey recent hospital projects that have redeveloped their facilities and document any best practices/lessons learned.
- Complete a jurisdictional scan of "smart" hospitals and emerging technology trends around the world.

Part 2: Analysis Phase

- Complete an analysis on NH's 32 functional programs (e.g. workflows, clinical efficiencies, opportunities for technology enablement, & space requirements).
- Create an evaluation criteria that will be used to evaluate the ICAT Design Vision.

Part 3: Synthesis Phase

- Create the ICAT Principles, Vision, and Strategic Project Initiatives.
- Develop an ICAT Design Program which includes an ICAT Equipment and application list for the SNH project.
- Identify key performance metrics that could be used to evaluate desired experiences in support of the ICAT Design vision.

NH's target state: an integrated delivery system

Hospital
Acute care at the right time for the right cost

Community Care
Strong emphasis on community prevention and public health initiatives

Social Care
Care coordination between housing, education, etc. assistance

Patient
Able to seamlessly access their care through single point

Staff
Operating at top of grade, using technology to alleviate admin tasks

Carers and Mobile Workers
Using a flexible workforce to support patients

Universities
Supporting academic health science research and training for future workforce

General Points:

- A guiding objective of the health system is: "Delivering the right care in the right setting at the right time".
- This "health system" can be comprised of a single OHT to an array of health partners working together to integrate health delivery services.

Telecommunication Companies
Enhancing the patient experience through mobile tech

Primary care
The core of the system, empowered to help manage population health

Retail Sector
Using pharmacy, and retail sites to provide patients with multiple points of access

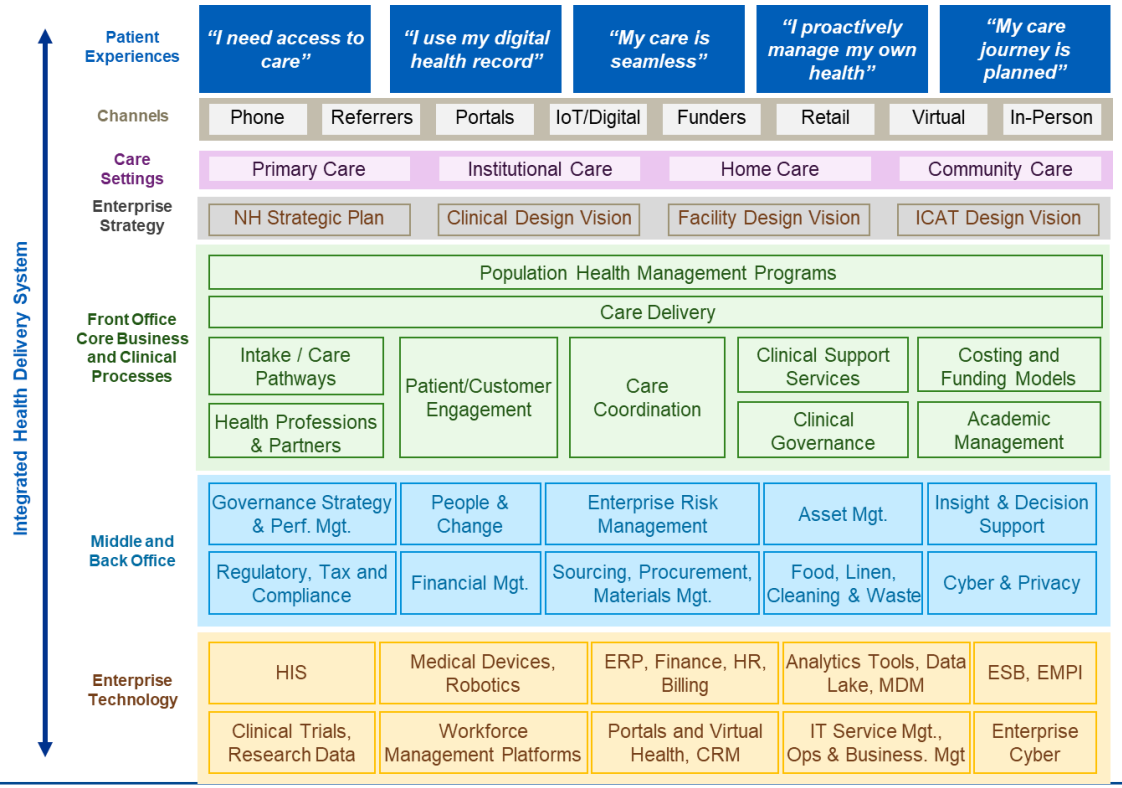
Connected Health framework

The KPMG Connected Health framework provided the foundation in which the analysis was conducted for the core components described in this ICAT Design Report. Connected Health is a digital transformation framework that helps organizations deliver on their promise to patients, citizens and staff by aligning core business practices, enterprise operations and back office functions. The SNH redevelopment presents NH with an opportunity to leverage ICAT solutions as a means to digitally transform the organization and the way care is delivered in Niagara.

An "integrated health delivery system" aligns strategy, organizational functions enabled by technology across a multitude of care settings.

This is described across the different layers of the framework as depicted. A set of experiences described through the patient's perspective help provide the overall direction for the framework.

Supporting these patient experiences are a set clinical and administrative functions (identified in the green and blue layers) enabled by enterprise technology.

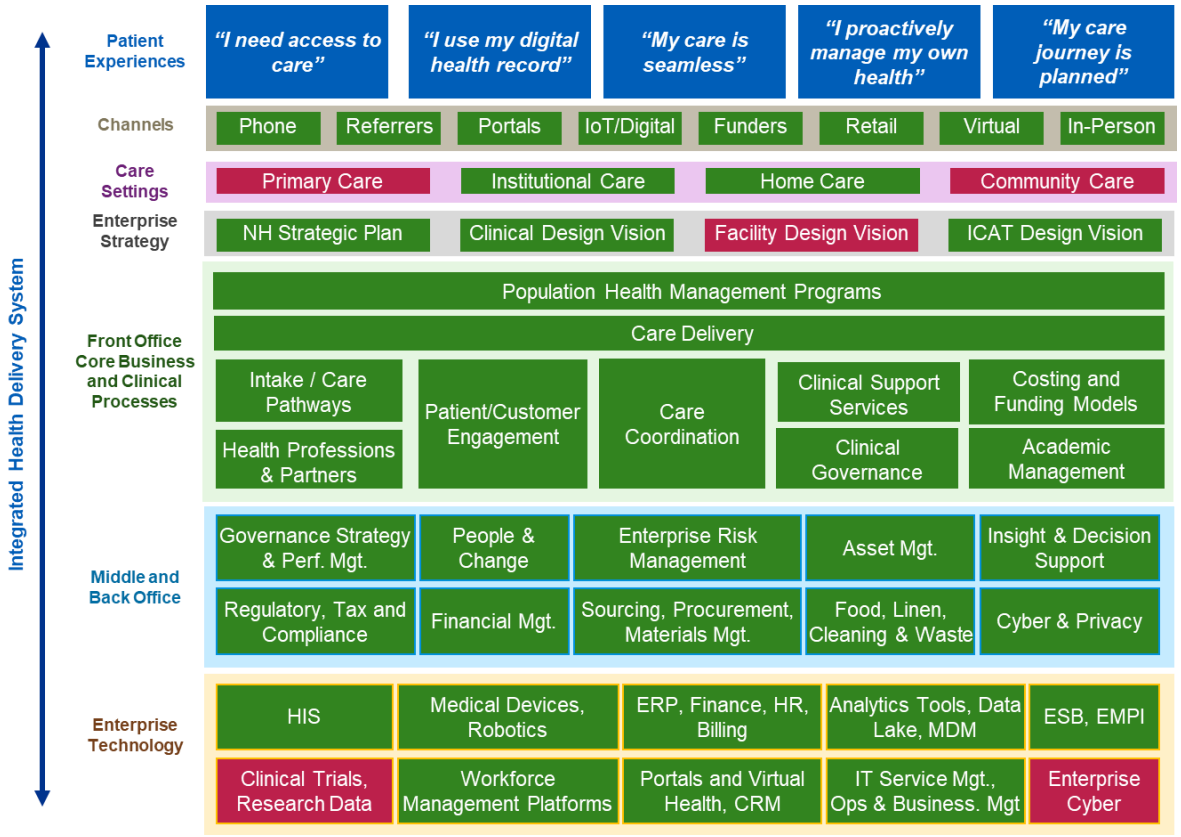


Leveraging Connected Health for SNH

The Connected Health framework may be used to validate the comprehensiveness of SNH's redevelopment planning so far. With the completion of the a) ICAT Design Report and b) stage 2 functional programming, the majority of the components within the framework are considered in the planning completed to date (as depicted in green coloured boxes).

The care settings, strategy and functions highlighted in red, represent gaps in the planning so far:

- *"**Primary Care**" and "**Community Care**"*: Becoming addressed through the emerging OHT efforts.
- *"**Facility Design Vision**"*: Initial work has been completed and a plan is in place to complete an overall project vision by early 2020.
- *"**Clinical Trials. Research Data**"*: Yet to be determined if this will be included in the scope of the upcoming HIS transformation.
- ***"Enterprise Cyber"***: Although internal operational efforts are underway in this domain, plans for SNH have not been reflected in any of the existing redevelopment planning so far.



For more information about the Connected Health Framework refer to Section K of this report.

Current state analysis

As part of the stakeholder engagement plan, key stakeholders at NH were consulted to understand NH's current strengths, challenges, and potential opportunities for improvement for the future. The outputs from these discussions (see below) were used to develop the major components of the ICAT Design report.

STRENGTHS

- Staff are passionate to deliver the best care to the Niagara region.
- There is a strong understanding of the role of ICT as an enabler.
- NH has invested in partnerships and innovation with the Niagara community.
- A robust enterprise process is in place for in-taking new ICT work to manage capacity.

CHALLENGES

- NH will need to integrate multi-site processes, infrastructure and systems.
- There is a significant dependence on paper documentation.
- Wayfinding and parking have been a challenge at sites including SCS.
- There are limited capabilities to leverage real time data to inform decision making.

OPPORTUNITIES

- Establish a vision and brand for the SNH redevelopment enabled by ICAT.
- The patient experience supported by ICAT should be an important area of focus.
- Implementation of the new HIS needs to be prioritized prior to launching the SNH.
- ICAT Design solutions will be "age friendly" to reflect the demographics of Niagara.
- SNH's ICAT will enable NH's future role in OHTs.
- Considerations to pave the way in becoming a smart city.

Jurisdictional scan

A comprehensive global scan of “smart” hospitals and emerging technology trends was conducted. Findings from the research (i.e., types of technologies) created a baseline for developing the potential ICAT solutions for the new SNH. The types of technologies have been categorized into four major categories:

Patient Engagement & Experience

- Hospital Navigation Apps
- Smart Patient Rooms (e.g. Integrated Bedside Terminals (IBTs)
- Interactive/live walls
- Patient Portals
- Smart Parking Space Management Systems (e.g. parking automation and self-service parking)
- Self-Service Check-In Kiosks

Hospital Performance & Operations

- Artificial Intelligence (AI) Powered Command Centres
- Radio Frequency Identification (RFID) Chips
- Blockchain Technology
- Smart logistics and materials management solutions
- Real-time performance dashboards and corporate performance management solutions

Use cases were also developed to demonstrate how ICAT solutions could potentially impact the current state of clinical and business workflows and processes. These use cases can be found in Section F of this report.

Clinical Care

- Advanced CPOE
- HIS Integration/Automation
- Nurse Call Systems
- Smart Alerting/Early Warning System
- Telemedicine Technology
- Virtual and Augmented Reality (VR/AR) Technology
- Voice Recognition Technology

Building Automation

- 5G technology
- Automated Guided Vehicles (AGVs)
- Automated Mobile Security Robots
- Smart Waste Management Systems
- Smart Building Management Systems (including building Internet of Things (BIoT))
- Real Time Location System (RTLS)

For more detailed information about ICAT solutions refer to Section G of this report.

Functional Program analysis

A thorough analysis was conducted of the 36 functional programs/services defined in the Stage 2 Functional program report to identify ICAT solutions that could enable the 1) front 2) middle and 3) back office functions at the new SNH. These ICAT solutions were considered based on findings from the jurisdictional scan of smart hospitals and emerging technology trends around the world.

The 36 programs/service areas were divided into four major categories and colour – coded throughout the report. Detailed use cases for each of the four category areas were also created to illustrate how ICAT solutions could enable workflows and processes and the impact that these solutions may have on both clinical efficiencies and facility spatial designs.

Ambulatory care Services	Inpatient services	Clinical, Diagnostic and Therapeutic Services	Support & Administrative Services	
1A. Ambulatory Care: Clinics & Medical Day Care	**7.** Complex Care Inpatient Units	**10.** Cardio-Respiratory Diagnostics	**17.** Administrative Services	**26.** Interprofessional Education & Learning
1B. Ambulatory Care: Ambulatory Procedures Unit	**8.** Critical Care Unit	**11.** Diagnostic Imaging (DI)	**18.** Biomedical Engineering	**27.** Logistics
2. Hemodialysis Unit	**9.** Medical/Surgical Inpatient Units	**12.** Emergency	**19.** Clinical Support Services	**28.** Medical Device Reprocessing
3. Mental Health & Addictions Ambulatory Services		**13.** Laboratory	**20.** Engineering Services	**29.** Medical Staff Facilities
4. Chronic Disease Management, including Outpatient Rehabilitation		**14.** Pharmacy	**21.** Environmental Services	**30.** Nutrition and Food Services
5. Pre-surgical Clinic, Orthopaedic/Fracture Clinic and Regional joint Assessment Program		**15.** Respiratory Therapy	**22.** Foundation	**31.** Parking & Security
6. Seniors' Wellness Services		**16.** Surgical Services	**23.** Health Information Management	**32.** Planning & Development
			24. Human Resources (& Occupational Health & Safety and Staff Facilities)	**33.** Public Areas
			25. Information & Communication Technology	**34.** Registration
				35. Spiritual Care
				36. Volunteer & Auxiliary Services

ICAT considerations

The most common ICAT solutions identified across all 36 functional programs/service areas for the new SNH are depicted in the graphic below. ICAT solutions are tools that will help enable future workflows and processes. To effectively deploy these ICAT solutions, change management, training and workflow analysis will be required to support their application.

For more information about the ICAT solutions identified across all 36 functional programs refer to Section H of this report.

ICAT considerations:

- **5G**
- **AR/VR**
- **Automated Dispensing Cabinets**
- **Automated Guided Vehicles**
- **Barcode/Biometrics Technology**
- **Collaboration/hoteling systems**
- **Integrated HIS**
- **Navigator App**
- **RTLS/RFID Chips**
- **Self-service Kiosks**
- **Smart Glass**
- **Smart Lights**
- **Smart Security**
- **Smart HVAC**
- **Speech Recognition**
- **Touchscreen Monitors**
- **Wearables**

Community facing:

- **Collaboration tools**
- **Remote patient monitoring**
- **Virtual care/telehealth**

ICAT Design Principles

The **ICAT Design Principles** are intended to be the set of "rules" for how ICAT investments should be made as part of the redevelopment project and to help future proof SNH. The ICAT Design Principles were developed based on information provided by key stakeholders throughout the engagement process. The six ICAT Design Principles are identified below:

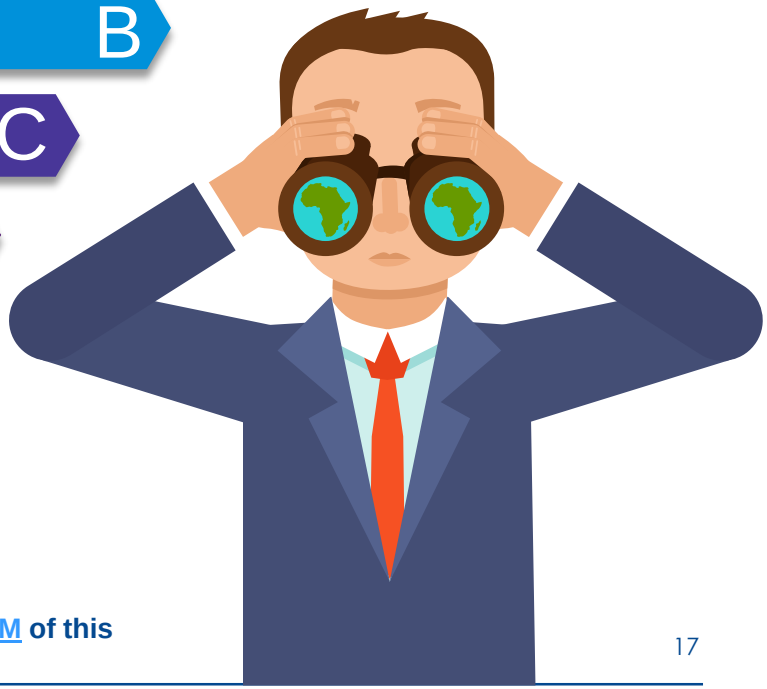
Safety & user-centered design	**Digital first and "frictionless"**	**Aligned with SNH & NH Strategy**
Secure, scalable and flexible infrastructure	**Accountable and affordable**	**Clear accountabilities & responsibilities**

For more information about the ICAT Design Principles refer to Section L of this report.

ICAT Design Vision

The development of an **ICAT Design Vision** is intended to help articulate the future state of how NH envisions ICAT enabling care delivery and desired experiences among patients, staff, families and caregivers (see next page). Identified below are preliminary ICAT Design Vision statements that were developed based on outputs from visioning sessions and stakeholder engagement sessions.

- **"Enabling connected care".** A
- **"Enabling a connected care campus".** B
- **"Connecting care for the Niagara region".** C
- **"Enabling connected health".** D
- **"Enabling connected care between patients and providers".** E
- **"The health campus of/for the future".** F
- **"A hospital without walls".** G



For more information about the ICAT Design Vision refer to Section M of this report.

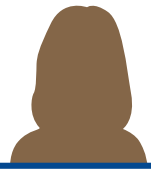
ICAT Design Vision stakeholder statements

The ICAT Design Vision is intended to help articulate the future state of how ICAT will enable desired experiences among key stakeholders. Identified below are ICAT Design Vision stakeholder statements that describe the desired experiences for all key stakeholders involved with developing and/or receiving care at the new SNH. These stakeholder statements were also used to develop qualitative performance metrics (see next page) to help NH evaluate whether the ICAT Design meets stakeholder expectations (i.e., their desired experiences).

ICAT at SNH will enable:

Patients, families, & caregivers *to receive care virtually and have ownership, oversight and access to the right information, where and when they need it to enhance their care experience .*

Providers and staff *to be supported by a modern and safe work environment that creates a positive and fulfilling work experience.*



Leaders *to readily access and apply information to inform evidence-based decisions that improve health system performance.*

Health system partners *to seamlessly exchange information with SNH to support patient-centered, connected care.*

ICT *to deliver secure, resilient, scalable and flexible systems and technology to support all aspects of SNH's role in the health system.*

Supplier and vendor partners *to collaborate and provide innovative leading practice goods and services that will future proof SNH.*

Qualitative ICAT Performance Metrics (1/2)

Qualitative and quantitative performance metrics have been developed to support NH with evaluating the various ICAT Design components. Identified below are the qualitative performance metrics, which were developed based on stakeholders' desired experiences described on the previous page. The quantitative performance metrics can be found in Section P of this report.

Desired experiences	Measureable outcome statement
Patients, families and caregivers *to receive care virtually and have ownership, oversight and access to the right information, where and when they need it to enhance their care experience.*	**Patients, families and caregivers** *will have access to health records from a multitude of different providers including NH and other community providers. They will also have the ability to manage appointments and the option to remotely connect with care providers and other support services.*
Providers and staff *to be supported by a modern and safe work environment that creates a positive and fulfilling work experience.*	**Providers and staff** *will document and chart electronically. They will also have access to communications and automation tools that help to improve the patient experience and enhance the efficiency of care delivery.*
Leaders *to readily access and apply information to inform evidence-based decisions that improve health system performance.*	**Leaders** *will have access to critical organizational and environmental data on a dashboard to make timely decisions.*

Qualitative ICAT Performance Metrics (2/2)

Identified below are the qualitative performance metrics, which were developed based on the desired experiences described on the previous page.

Desired experiences

Health system partners *to seamlessly exchange information with SNH to support patient-centered, connected care.*

ICT *to deliver secure, resilient, scalable and flexible systems and technology to support all aspects of SNH's role in the health system.*

Supplier and vendor partners *to collaborate and provide innovative leading practice goods and services that will future proof SNH.*

Measureable outcome statement

Health system partners *will exchange and communicate patient information with a network of providers in the Niagara region.*

ICT *will integrate multiple solutions to create a cohesive environment where interoperability exists between systems to enhance patient and staff experiences.*

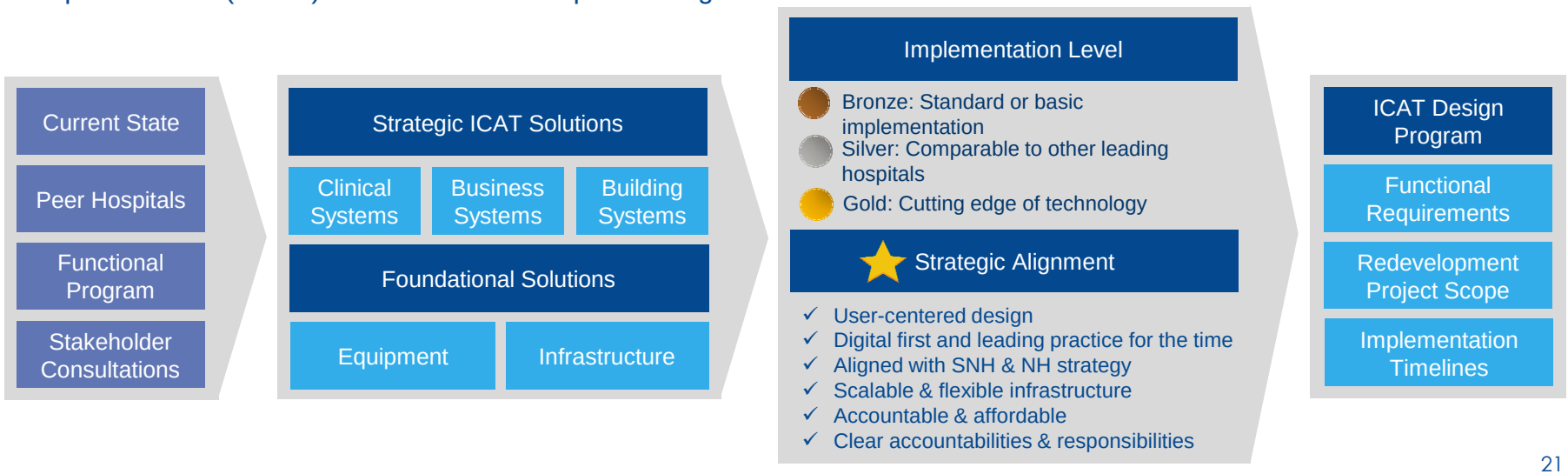
Supplier and vendor partners *will provide leading practice insight and create actionable opportunities for NH to leverage ICAT solutions for clinical and/or business programs/services across all sites.*

For more information about the ICAT Performance metrics refer to Section P of this report.

ICAT Design Program (1/3)

The ICAT Design Program identifies and examines key ICAT solutions specific to the SNH Redevelopment project, including Clinical, Business and Building Systems, and the supporting infrastructure and equipment required to enable them. The design program solutions were developed through analysis of the current state systems, a review of peer hospitals and best practice, the functional program analysis and interviews with NH stakeholders. Working group sessions with NH staff were used to further develop the high level requirements for each system including features and functions, lessons learned and operational considerations for the ICAT solutions planned for the new SNH site. These solutions were also evaluated against the ICAT principles and vision to ensure they align with the organizational priorities.

The ICAT Design Program, along with the Implementation plan, forms the basis of the Project-Specific Output Specifications (PSOS) which will be developed in Stage 3.



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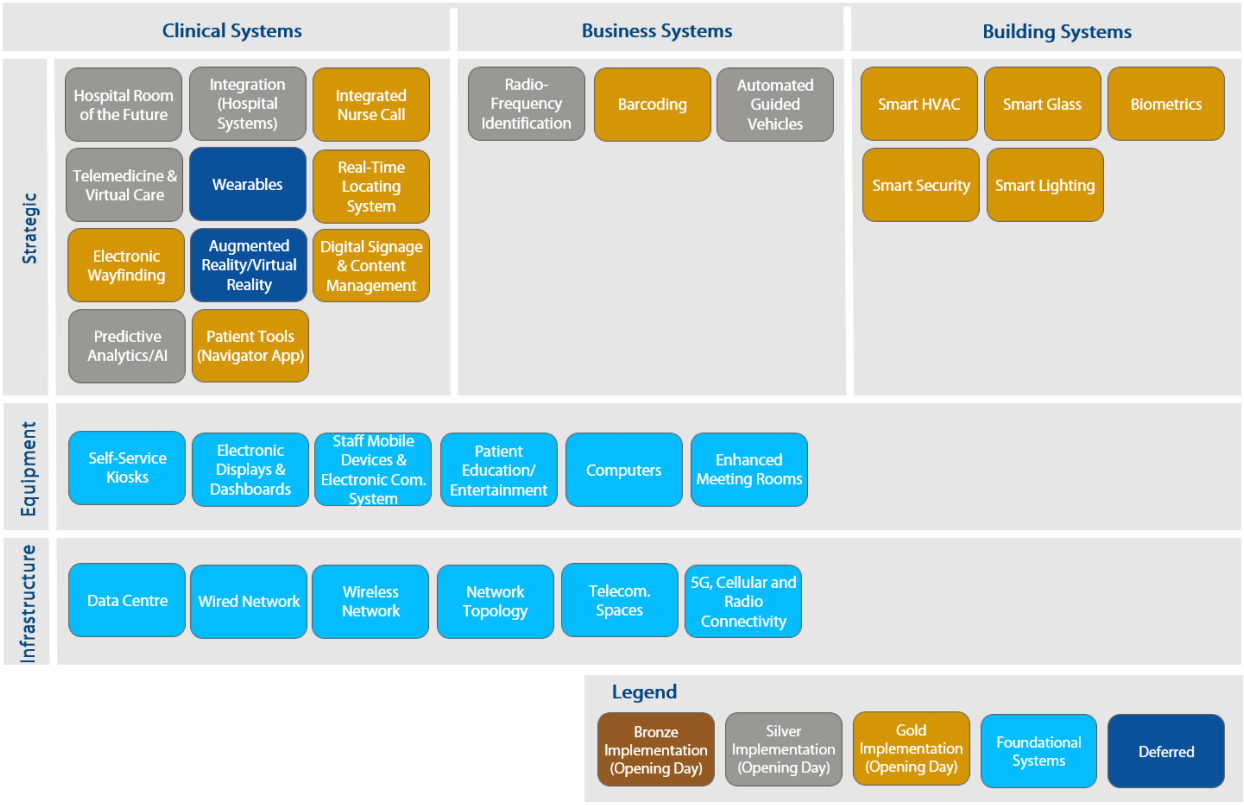
ICAT Design Program (2/3)

Through a series of user engagement interviews, visioning sessions and a detailed analysis of the Functional Program, nineteen strategic ICAT solutions were identified as being key to achieving the future state vision for SNH. Analysis of the solutions included recommended timelines for implementation (before, during or after the redevelopment project), opening day implementation recommendations, alignment with the ICAT design principles, key change management strategies, operational considerations and intended outcomes.

The high level functional requirements and ICAT design scope of the strategic solutions drive the design and planning for the foundational infrastructure and equipment solutions.



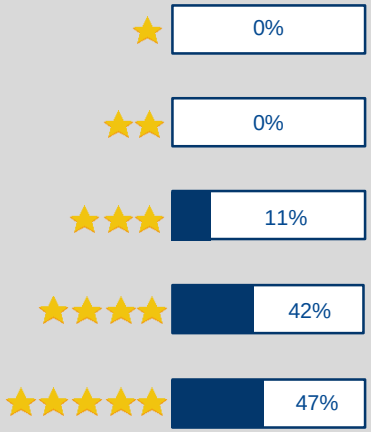
ICAT Design Program (3/3)

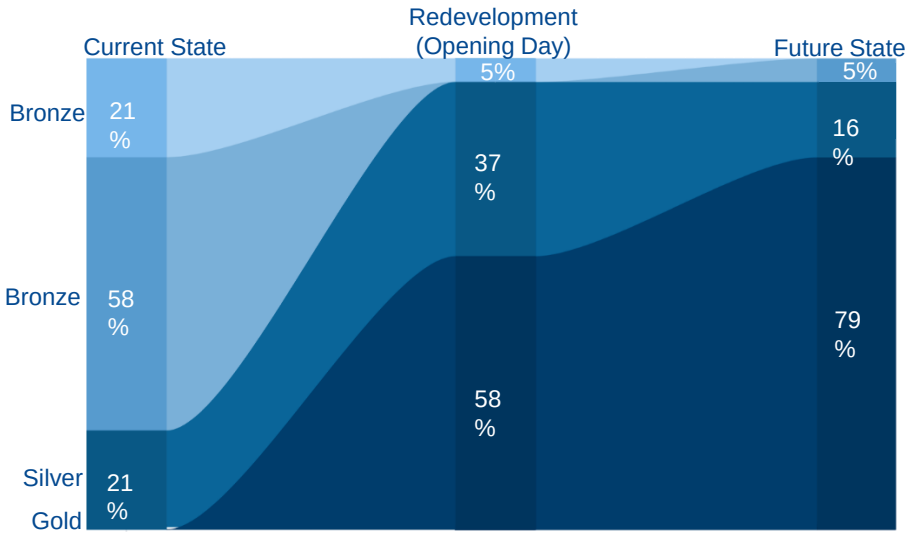
The analysis revealed a high degree of alignment with the ICAT Vision and Principles, with nearly half (47%) of the solutions having high alignment with the principles, and 42% having medium-high alignment. No ICAT solutions scored below medium.

These alignment scores were used to prioritize which solutions would be implemented during redevelopment and which would be deferred to after the project. Infrastructure and hardware for all solutions were included in the redevelopment project as a minimum.

The current state analysis revealed that there are already a significant portion of technologies (79%) which meet the bronze or silver level of implementation at the St Catharines Site. Recommendations for opening day at SNH include progressing the majority of solutions (95%) to a silver or gold implementation level, with the ultimate goal to be 79% of technologies at gold level by 2030. This represents a significant organizational change from the current to future state, and positions NH as a leader in delivering connected healthcare. To support this, strong change management strategies will be key enablers for success.

Alignment with the ICAT Vision





Key Change Management Strategies

- Clear Governance & Ownership
- User Training
- Flexible & Adaptable Design
- Phased Implementation
- Pilot Programs
- Champions of Change
- Consultation with Stakeholders
- Smart Engagement & Communication

ICAT Strategic Initiatives

In support of the ICAT Design Report, strategic initiatives were developed to help NH with preparing their people, processes, and technology for the completion of the SNH redevelopment project. These ICAT strategic initiatives are intended to compliment the activities in the next phase of the SNH redevelopment project. The ICAT strategic initiatives have been categorized into four categories. The four categories include:

A. ICAT Readiness & Foundation

- Prioritize the implementation of the new HIS.
- Conduct wireless/wired network upgrades.
- Develop an integration platform and specifications.
- Adopt a cloud first strategy including future data centre needs assessment.
- Complete an inventory of current state information systems and capabilities.
- Establish an enterprise change management program.

B. ICAT Innovation & Transformation

- Continue piloting new technology solutions at existing sites.
- Assess the impacts of the changing health system on NH's hospital design and partner ecosystem.
- Explore opportunities related to tourism in the Niagara region.

C. ICAT Sustainability

- Re-evaluate the mobility plan and strengthen cyber security.
- Define the comprehensive requirements to optimize patient & staff experience.
- Establish an enterprise data governance model to support digital transformations across NH.
- Re-evaluate the current ICT operating model to ensure applicability for SNH in 2026.
- Create an ICAT retrofit plan for existing programs and services across all sites based on the new SNH.

D. Impacting ICAT

- Refine the redevelopment project vision and develop a brand for SNH.
- Re-evaluate business and clinical workflows for SNH.
- Create a transition/migration plan from existing multi-site structure to the SNH.

The ICAT strategic initiatives have been mapped on to a prioritization matrix and roadmap to provide NH with a recommended plan to complete the ICAT strategic initiatives. The prioritization matrix and roadmap can be found in Section P of this report.

Prioritizing the ICAT solutions

In October 2019, members of the NH Senior Team completed the Connected Health capabilities self-diagnostic based on NH's current state. The mean scores for each of the capabilities is summarized in the table below.

Based on the results, NH can use the areas with lower maturity to prioritize ICAT investments. For example the "seamless interactions" capabilities may help to guide future investment decisions made around ICAT solutions. Other areas of lower maturity will be future proofed at the SNH as the technology evolves.

Capability	Maturity Statements*				
Insight-driven strategies and actions	High quality information in real-time.	D&A Strategy is foundation to running our business.	Effectively manages and influences the collection and utilization of data.	Analytic tools, skills and capabilities are used to deliver timely insights.	Gather and leverage sources of data to drive quality and cost improvements.
Innovative services	Identify and understand the current and future health and care needs.	Design service using available evidence and leading practice.	Planning is dynamic and underpinned by data and evidence.	Clear approach to collecting, monitoring, reviewing and evaluating outputs.	Delivering value-based care throughout the care continuum.
Experience-centricity by design	Holistic patient-centric strategy and continuous accountability.	Designing flawless patient journeys.	Engaging the customer in shared decision making and co-design.	Create the right ecosystem for care delivery.	Patient experience as the basis for continuous improvement.
Seamless interactions	Tailored interaction and channel strategy to support seamless access.	Digitally enabled personalized health recommendations that optimize patient outcomes.	Timely and appropriate intake or referral.	Integrated channel mode has a high degree of flexibility.	Suite of integrated traditional and digital solutions and touch points.
Responsive operations and supply chain	Clinical practices and pathways are based on evidence.	Predict accurately and efficiently the future clinical demand.	Manage the flow of goods and services in an effective and efficient manner.	Effective management of categories.	Approach for improvement that is embedded and engages frontline staff.
Aligned and empowered workforce	Our culture encourages leaders to work across boundaries.	Clearly articulated mission, vision and values with outcome metrics.	Accountability built into job roles and aligned with governance frameworks.	Workforce strategy.	Culture that supports and promoted change.
Digitally enabled technology architecture	IT operating model that promotes the business strategy.	Proactive security program.	Enterprise architecture supports the business strategy.	"Digital first"	People, systems and technology interoperate to deliver integrated services.
Integrated partner and alliance ecosystem	Program for contract management and optimization.	Internal and external capabilities that align to the business strategy.	Effectively engage and manage partnerships, alliances and vendors.	Partner value chains are agile and continuously respond to needs.	Engage in transactions and restructuring to rightly scale our organization.

Legend: 1 – Very Poor | 2 – Poor | 3 – Average | 4 – Good | 5 - Excellent

**Mean scores are represented*
n = 6

Next steps

Outputs from the ICAT Design Report will be used to:

Create the PSOS: Inform the development of the stage 3 PSOS (Project Specific Output Specifications) which will form the basis for the Project Consortium RFP.

Prepare for SNH's opening day: Inform any immediate strategic planning for ICT and Clinical Operations in preparation for SNH including: preparation activities for the HIS transformation, and clinical workflow/workload analysis for transition planning.

Finalize the SNH Project Vision: Support the completion of the Project Vision for the SNH Redevelopment based on key themes and findings from the ICAT Design stakeholder engagement process.

Support integrated care planning: Inform ongoing efforts for integrated care planning in Niagara based on ICAT's role to transform and enable care delivery and care coordination.

Part 1: Understanding

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A) Introduction & background

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Background

Niagara Health (NH) is a regional healthcare provider with multiple sites and a growing network of community-based services that provides healthcare services to more than 450,000 residents across 12 Regional Municipalities of Niagara. Formed with the amalgamation of eight hospitals in the year 2000, and subsequent direction by the Province in 2004, NH is the sole provider of acute inpatient care for most of Niagara and is spread over five sites. The NH sites of Douglas Memorial, Greater Niagara General, Port Colborne, Welland, and the newly built St. Catherine site, together employs 4,800 employees, 600 physicians, and 850 volunteers. NH services are spread across these sites and, through a growing network of community-based services, provide healthcare to communities with unique geographies and identities, unlike any other in the province.

NH is proposing a new **South Niagara Hospital** project: a new greenfield hospital that will consolidate and rationalize services from three older facilities located in Niagara Falls, Port Colbourne and Fort Erie.

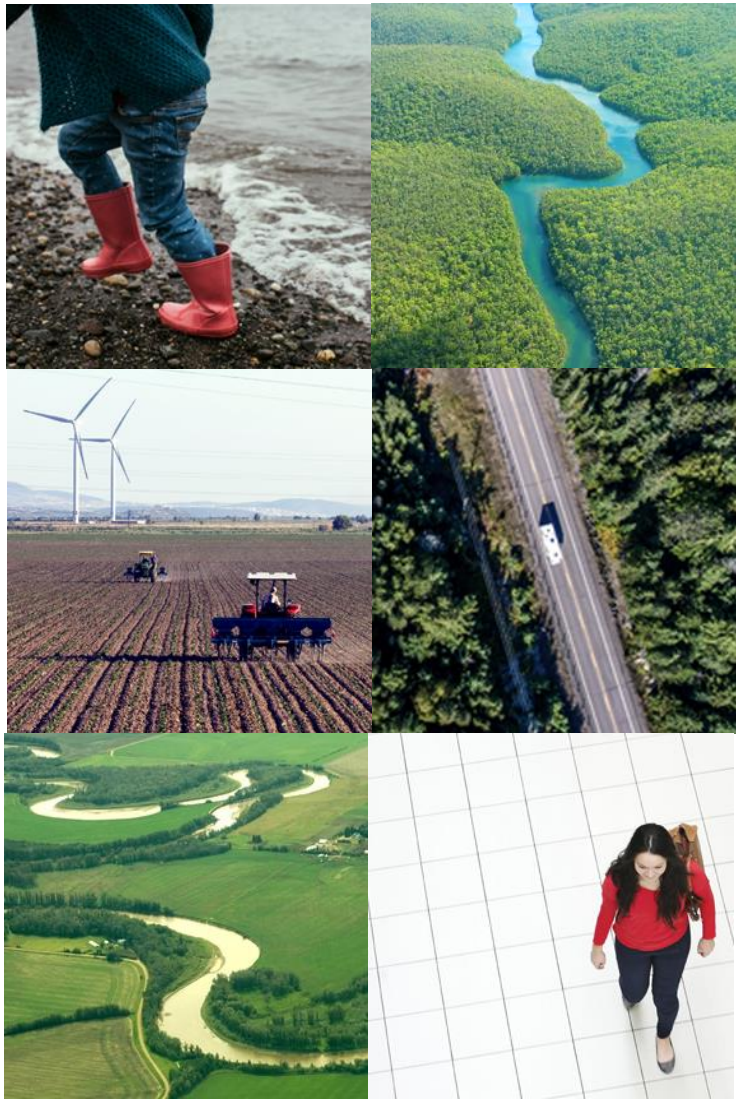
The new hospital will not only serve the current residents of the Region, but also the future residents as the Region's communities continue to grow and flourish.

- The new South Niagara Hospital's 49.8 acres site is located at the intersection of Biggar Road and Montrose Road in Niagara Falls.
- The new hospital will be a full acute care hospital, with emergency, diagnostic, and therapeutic services, surgical services, as well as medical, surgical and intensive care inpatient beds.
- It will also provide ambulatory services as well as post-acute Complex Continuing Care (CCC) inpatient services. A full complement of non-clinical support services will also be provided.

Niagara's population

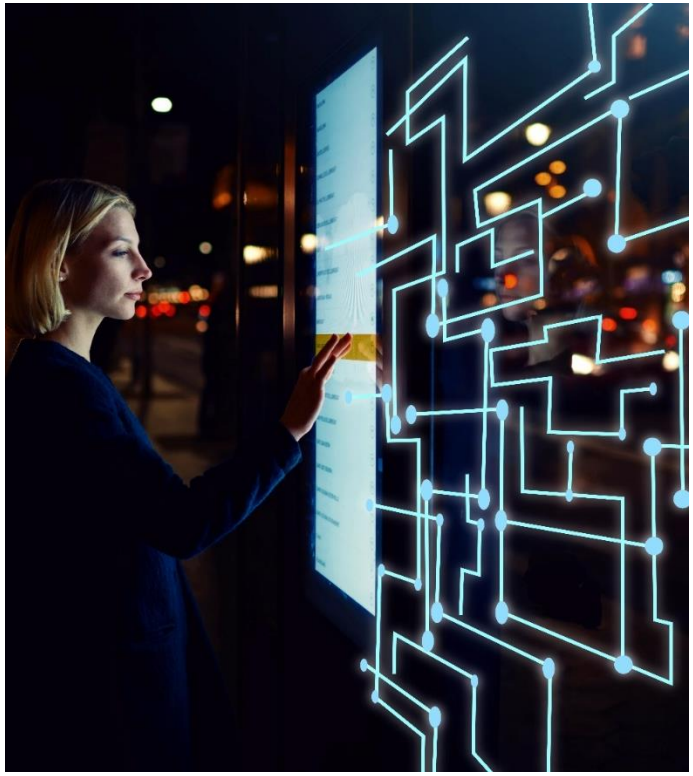
As described in NH's stage 2 Functional Program, key demographic context about the Niagara population include:

- *Twenty percent of the population is over 65, compared to Ontario's average of 15 percent.*
- *The number of Niagara seniors 65+ is expected to increase by 35 percent while the younger populations are not expected to increase over the next 10 years.*
- *Niagara's population is growing slowly relative to the province, and across all age groups and communities; The Niagara region's population is expected to grow by 4 percent over the next 10 years, less than the 11 percent provincial average.*
- *The Niagara population typically has higher morbidity compared to the provincial average, but similar morbidity to the HNHB LHIN average.*
- *NH provides up to 90% of the acute inpatient care received by Niagara patients.*
- *The indigenous population is relatively small with high morbidity relative to other Niagara residents, underlining the need to provide culturally respectful services and environments.*



ICAT Design Report

Niagara Health is in the phase 2 planning stages of building a new hospital and is developing the **ICAT Design Report** that will guide the ICAT (information, communications and automation technology) planning, design, implementation and ongoing operations of the new South Niagara Hospital. The ICAT Design report comprises a key element of the Project Specific Output Specification (PSOS) and should integrate seamlessly within the PSOS.



The **ICAT Design Report** will:

Incorporate technology solutions that enable seamless interactions between patients, providers and staff to support proactive home care and virtual care hospital to home initiatives.

Allow Niagara Health to become a leading agent in delivering "connected care" for patients and enable streamlined partnerships with the Niagara community for future opportunities.

Approach

Development of the ICAT Design report took place over a 15 week period across five phases of work described below:

Phase	Phase 1: Project Mobilization	Phase 2: Understanding	Phase 3: Analysis	Phase 4: Synthesis	Phase 5: Making
Key Activities	- Conduct project kickoff meeting - Confirm project scope, timelines and expectations - Develop project workplan - Develop stakeholder engagement plan - Schedule stakeholder meetings	- Review documentation - Conduct stakeholder interviews - Perform research and leading practice interviews - Conduct environmental scan and identify innovative trends - Develop and socialize reports	- Conduct Functional Program Analysis - Conduct ICAT Infrastructure Analysis - Perform opportunities and constraints analysis - Develop ICAT Vision evaluation criteria - Present results of analysis	- Develop and socialize ICAT initiatives and Design/Vision Principles - Present initiatives and vision to project and hospital executives - Develop ICAT Design Program and performance metrics - Develop implementation plan, schedule and cost estimates	- Develop/assemble final report - Present final report to Steering committee and executives - Develop presentation to socialize ICAT vision and strategy
Duration	*1 week*	*5 weeks*	*6 weeks*	*5 weeks*	*2 weeks*

TOTAL EFFORT: 19 weeks
TOTAL PROJECT DURATION: 15 weeks (Elements of Phases 2, 3 and 4 occurred simultaneously)

Stakeholder engagement process

Identified below are the groups of stakeholders consulted as part of the development of the ICAT Design report:

Internal to NHS				External to NHS
1 **NHS Board Committees** Key executive stakeholders involved with the development of the ICAT strategy for NHS.	2 **NHS ICT Steering Committee** NHS leaders and stakeholders involved with providing oversight of this project.	3 **NHS Project Team** Key leaders and staff supporting this project and other relevant SMEs across the organization	4 **NHS Clinicians & SMEs** Key clinical leaders and staff supporting this project and other relevant SMEs across the organization	5 **External** Humber River Hospital, Halton Hospital, Niagara Health System: St. Catharine's Site, Mackenzie Vaughan Hospital, Infrastructure Ontario and MOHLTC.
Board Committee: Board of Directors **Sub-Committee:** Resource and Audit	**Types of roles:** NHS CIO and EVP of Finance and Operations.	**Types of roles:** Redevelopment project team and ICT Team	**Types of roles:** Physician leads, operational leads, clinicians, and other SMEs (E.g. Facilities Management, PFAC)	**Types of roles:** Individuals involved in existing hospital projects, including project managers, project support staff, & staff in FM operations.

We leveraged the following forms of engagement to meet with stakeholders including:

- 1:1 and group interviews to understand the current state
- Workshops and working sessions to provide input on the development of the ICAT design strategy
- The potential administration of a survey to validate current state themes

Guiding principles

The following guiding principles helped to guide the development of the ICAT Design report and were collectively agreed upon by all stakeholders involved:

- **The ICAT Design report will help to inform an overall project vision for the SNH redevelopment project**: There are a number of initiatives underway that define visions for the SNH project. In preparation for Stage 3 submission, these vision statements will be reconciled and the ICAT Design will help shape the overall vision.
- **The success of the ICAT Design report will be dependent on how successfully it can be implemented**: The final ICAT Design report will need to be feasible and translate into a realistic implementation in order to provide value to NH.
- **The ICAT Design report will setup NHS for success in procuring the redevelopment work**: In the future, NH will procure vendors to develop the new SNH hospital. This process will be largely influenced by the outputs of the ICAT Design Report.
- **It will be important to maintain a view on ongoing changes stemming from MOH and Ontario Health**: Although there is no immediate risk to the SNH project, NH and KPMG will continue to monitor ongoing healthcare related changes taking place at the government.

B) Strategic context

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Aligning the ICAT Design Report

The development of the ICAT Design Report was guided by several strategic inputs that helped to set the appropriate context. These inputs are described on the subsequent slides and highlight the relevant context taken into consideration in developing the recommendations and outputs from the ICAT Design Report.

There are 3 primary strategic inputs including the **1) NH Strategic Plan 2016-2026, 2) Facility Design Vision and 3) Clinical Design Vision**. The ICAT Design Report together with the Facility Design Vision and Clinical Design Vision formulate the overall Design Vision for the South Niagara Hospital.

NH Strategic Plan 2016-2026

In 2016, NH introduced their 10-year Strategic Plan that identifies a roadmap and structure to achieve the organization's vision to support people in Niagara to stay healthy, get better, live well with disease and cope with end of life. The Strategic Plan identifies key areas where the organization can lead and where collaboration is needed in order to support their partners in health, community and academia. These four areas of focus are:

1. **Extraordinary Teams**
2. **Extraordinary Care**
3. **Extraordinary Future**
4. **Extraordinary Innovation**

The ICAT Design report is aligned to an initiative in the "Extraordinary Future" area of focus as part of the Year 3 roadmap for the Strategic Plan: *Submission of plan detailing the programs, services and resources required at the new South Niagara Hospital*.

Facility Design Vision

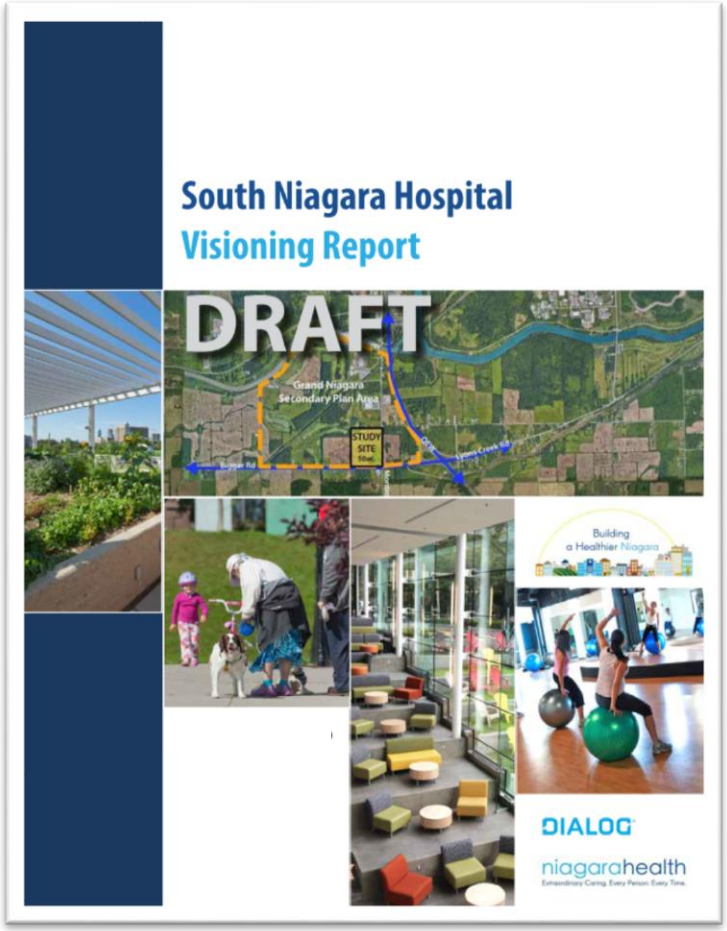
In 2018, NH embarked on a journey to define a Facility Design Vision for the new South Niagara Hospital.

Through a multi-stage stakeholder engagement process, the following design vision statement was created:

*"South Niagara Hospital will be a **welcoming** and **supportive** community health campus which is **accessible to all**. It will be **integrated** to provide a **continuum of care**, offer an **inspiring** place of work, and a supporting environment for **healing**. It will contribute to the **wellbeing** of its community and its natural setting."*

6 themes were identified to support this vision:

1. **Community Health and Wellness**
2. **Focus on Patient, Family & Staff Experience**
3. **Excellence in Senior Health and Wellness**
4. **Accessible, Safe and Inclusive**
5. **Environmental Leadership**
6. **Efficiency and Innovative**

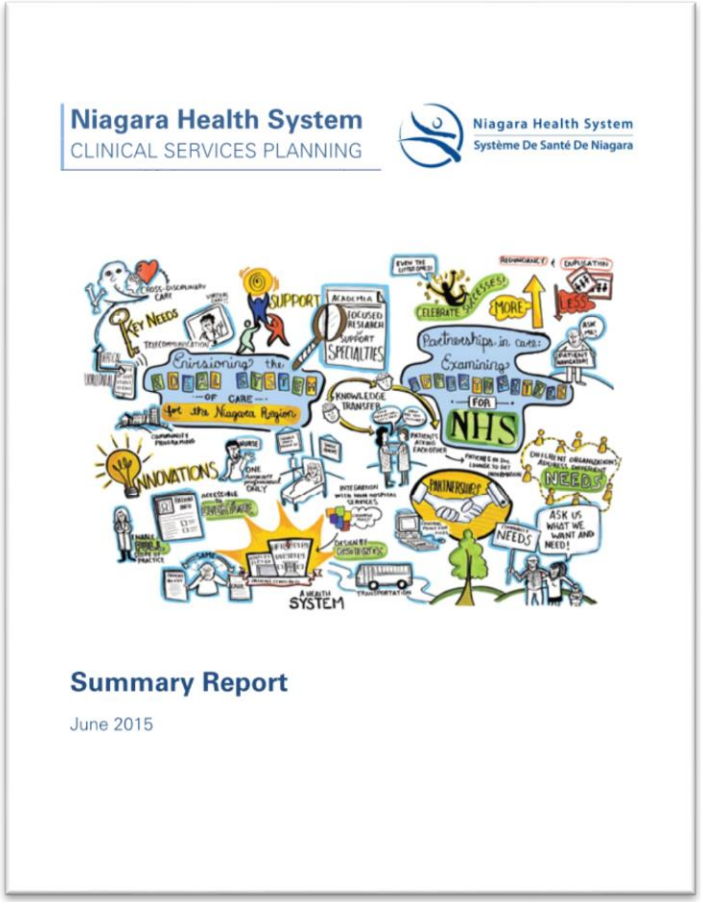


Clinical Design Vision

In 2015, NH completed a clinical services plan that would ensure the organization was able to account for the needs of the Niagara Region for the years to come. The opportunities defined in the plan reflect a robust understanding of the needs of the Niagara population of the future identified through a comprehensive data analysis and stakeholder consultation of NH and community stakeholders.

Opportunities that were identified in the clinical services plan that are relevant for the ICAT Design report include:

1. **Become a hospital of the future that includes**: customer service excellence, tomorrow's care, today's partnerships, navigation through collaboration and construct a hospital without walls.
2. **Develop an Elder-Friendly Strategy**: Develop a formal, well-communicated approach designed to improve access to care for Seniors and their families.
3. **Create a shared IT Strategy**: Working with external partners, NHS should lead the development of a robust IT platform that provides the tools, information and access to information required of right care, right place at the right time.
4. **Best in Show**: Strengthen NHS' reputation as an innovator by creating a strategy to translate knowledge across Canada.



C) Current state analysis

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Current state analysis

Section 3 articulates the key themes stemming from the current state analysis conducted through stakeholder interviews and a comprehensive documentation review. Refer to Appendix C for a full list of completed stakeholder interviews.

The themes have been organized into 3 categories:

Strengths	Challenges	Opportunities
Areas of the organization that are demonstrating maturity and change readiness for the redevelopment project.	*Areas of the organization that represent an opportunity for improvement through the redevelopment project.*	*Specific areas of focus that should be considered in the ICAT Design based on the strengths and challenges identified.*

Collectively, these themes help to form the starting point in which the ICAT Design will be anchored to as components of the design including the vision and strategic approach are defined.

Strengths

Staff are passionate to deliver the best care to the Niagara region: Staff from all areas, clinical and non clinical are passionate about the exciting opportunities to rethink how care can be delivered to the people of Niagara through the redevelopment project.

NH participates in a CIO consortium with other organizations in the broader Niagara region: This positions NH well for partnerships with members of the community and aligns well with the Ministry of Health's renewed focus on regional coordination between providers.

A strong understanding of the role of ICT: It is well understood by clinicians and administrative staff that ICT is a facilitator through the redevelopment process and that ICT solutions are the tool for addressing business problems.

Partnerships and innovation are a priority: NH has invested in exploring opportunities for partnerships and in ICT. This will position NH well as the organization embarks on the SNH redevelopment project to deliver care and services beyond the walls of the hospital.

Central oversight of ICT: ICT is centrally managed across the organization which provides a strong foundation for system integration at SNH. The notion of shadow IT does not exist with the exception of the PACS system that is supported by medical imaging.

A robust process is in place for handling new ICT work: ICT has implemented a robust intake tool and set of processes to manage ICT related initiatives across the organization. This will help the organization manage ICT capacity as redevelopment activities commence.

Challenges

Integration of multi-site processes, infrastructure and systems: NH will need to achieve some form of integration between significantly different systems, infrastructure and processes across multiple sites to form a cohesive technology experience.

Best of breed systems environment: There are multiple systems and applications in NH's current environment. There have been challenges with interoperability as a result of having multiple systems in place.

Significant dependence on paper: NH's adoption of electronic medical records is fairly immature. A plan is in place to proceed with a hospital information system (HIS) transformation that will lay the foundation for ICAT at the new SNH.

Telemedicine capabilities vary by site: Particularly at sites with aging infrastructure, virtual care delivery through OTN (Ontario Telemedicine Network) are limited to specific rooms which can make delivering care remotely difficult.

Wayfinding and parking have been a challenge: Navigating the SCS has been identified as a significant challenge by staff, patients and families. Parking capacity has also been a challenge across sites. Although parking may seem trivial, it has a direct impact on patient experience.

Difficulty in leveraging real time data to inform decision making: Due to limitations in the current HIS and difficulty in creating interoperability between systems, there has been a lack of access to real time data to inform clinical planning and care delivery.

Opportunities (1 of 2)

Establish a vision and brand for the SNH redevelopment enabled by ICAT: Given the increasing scope of redevelopment activities, NH should prioritize the development of a clear anchoring narrative that will describe the influence of ICAT on SNH.

The patient experience supported by ICAT needs to be an area of focus: NH staff unanimously expressed a desire to make a significant impact on patient experience through the redevelopment project including wayfinding, self-scheduling and parking.

SNH's ICAT will enable NH's future role in OHTs: The ICAT design needs to support NH's ability to connect with community providers and primary care to enable seamless care for patients as defined in their OHT strategy .

Implementation of the new HIS needs to be prioritized prior to launching the SNH: Reducing the dependence on paper records and transforming clinical processes will become foundational to enabling other ICAT solutions at SNH.

Opportunities (2 of 2)

Considerations to provide more than "connected care": The uniqueness of NH's demographics and community structure provides an opportunity to think even larger about the role of SNH in a "smart city" context.

Streamlining flow at SNH: The optimization of patient and staff flow between different programs and services will become critical to the physical and ICAT solution design choices at SNH.

ICAT Design solutions will be "age friendly": It will become important to ensure that new processes and workflows supported by ICAT solutions are designed around the varying demographics of the Niagara region.

Providing consistent and effective communication within and across NH sites: As communication tools are considered for SNH, their ability to scale across sites and exchange information with other systems will be closely considered.

D) Lessons learned

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Halton Healthcare

Halton Healthcare underwent significant re-development activities across all their sites beginning in 2013 and ending in 2017. This included redevelopment of the Emergency Department at the Georgetown site, launch of a brand new facility at Oakville-Trafalgar Memorial Hospital and expansion at the Milton District Hospital. Identified below are lessons learned from all of these redevelopment activities:

Pilot new processes and technology at existing sites

Where possible, deploy new solutions at an existing site to test new functionality and workflows. Halton was able to do this given it's multi-site structure and this helped with observing change and making refinements. Pilots can take place in a contained area within an existing site prior to scaling across multiple areas.

Automation through integration

Halton's RTLS (real time location system) is connected through middleware into multiple systems which enabled building automation.

Implement HIS transformations well in advance

Halton also recommends making major investments or changes to the HIS (hospital information system) at minimum 1.5 to 2 years in advance of opening a new facility. This will allow enough time for new processes and technology to become optimized post go-live and minimize change fatigue.

Prioritize re-development efforts

Halton made a significant effort to focus their efforts and investments on initiatives that would have the greatest impact on patients and staff. Lower priority initiatives were postponed.

Future proofing technology investments

Given the multi-stage planning process involved with a redevelopment project, Halton indicated they were unable to account for all changes and advancements in technology. Instead, they focused on investments that would be critical enablers of future technology like their network infrastructure under the assumption that strong bandwidth would be a key enabler for future technologies.

Vendor experience in integration has matured

Many vendors lacked deep experience with building integration/automation. This is no longer the case and NH should communicate these expectations to the vendor community.

Mackenzie Health

Mackenzie Health is currently undergoing a new hospital build in Vaughan that will create two full service acute care hospitals, the Mackenzie Health Richmond Hill Hospital and the Mackenzie Health Vaughan Hospital. The new hospital broke ground in 2016 and is expected to open its doors in 2020. Mackenzie Vaughan Hospital is the first hospital to be built in the city of Vaughan, and will be the first new hospital to be built in the York Region in the last 30 years.

Innovation as a culture and piloting as part of doing business

The Mackenzie Innovation Institute was developed to enable applied innovation and provide the infrastructure to create and propagate sustainable change within the organization. To provide a strong foundation for healthcare technology innovation, Mackenzie Health built partnerships with industry and academia and established an evaluative focus on implementation, usability, adoption and scalability of disruptive innovations, predominately in healthcare technology but also in innovative service delivery and workflow designs.

ICAT planning and deployment

Mackenzie Health worked over a number of years to retain control of the ICAT portion of the redevelopment project. Although this requires major investment in time and money, as well as a increased risk to the project, it allowed Mackenzie to retain control of their vision and how it was implemented.

Implement HIS transformations well in advance

Mackenzie recommends making major investments or changes to the HIS (hospital information system) at minimum 1.5 to 2 years in advance of opening a new facility. Mackenzie went from an EMRAM score of 2.x to 7 with their EPIC implementation, well in advance of their new site go-live.

Smart hospital vs. Digital hospital

Mackenzie Health has designed technology integrations and workflows that go beyond just digital, but those that truly change the way clinicians receive and use information and care for their patients.

Strong Project Governance and aligned vision

Mackenzie credits their strong project governance and a Senior Team completely aligned on the vison with the success of maintaining control of the ICAT project and ultimately of their vision for their new hospital. Detailed roles and responsibilities were clearly laid out with accountabilities for each activity throughout the lifecycle of the project and into the future.

Niagara Health – St. Catherine's Site

In 2013, the St. Catherine's site opened as "one million square feet of care". The new site provided new and enhanced regional programs including cancer care, cardiac care, women's and babies' care, stroke care and mental health and addictions. Identified below are lessons learned from the St. Catherine's Site redevelopment:

Identifying clear operational responsibilities with the DBFM provider

When a redevelopment project transitions to operations, it is important to clearly outline operational roles and responsibilities for the DBFM provider and any supporting vendors. This is critical to ensuring the sustainability and operations of the new facility is well managed and that there are clear handoffs between all entities involved with support.

Ensure ICAT vendors are committed to sustainability and maintenance

Sufficient effort should be invested in developing master agreements and contracts with vendors that outline their role and responsibility for maintaining the sustainable operations of their technology solution. Solutions should age appropriately in accordance to NH's expectations.

Be mindful of capital and operational costs for any investments in ICT

Ensure the ongoing costs of technology solutions are identified upfront at the time of purchase to ensure there is sufficient information to support financial planning and to ensure sustainable operating funding is in place to support the technology on an ongoing basis.

Less emphasis on the technology solutions, more on the new workflows and the impact to patients and staff

Technology solutions should not be at the "forefront" of any redevelopment project. Technology is an enabler for new and innovative solutions that will redefine and revolutionize how care is delivered by care delivery teams.

West Park Healthcare Centre

West Park Healthcare Centre is currently undergoing a significant redevelopment project to build a brand new hospital facility on the campus. Slated to open in 2023, the new 730,000 square foot facility will introduce a world-class hospital facility that re-imagines therapeutic landscapes and design for West Park's patients. In addition to the construction of the hospital, the redevelopment also includes demolition of existing sites and green space renewal.

Be mindful of making critical facility design decisions around technologies that are quickly evolving.

Certain technologies are changing more rapidly than others. It is important to factor this into facility design choices that are impacted by certain technology solutions as it may be more difficult to modify facility design choices at a later stage in the redevelopment process. For example, the amount of space required by IBTs have shifted significantly over the past few years which may create some complexity around how patient rooms are designed.

Ensure there is flexibility built into the ICAT plan

Where possible, build flexibility into the ICAT plan to ensure that any major changes to technology solutions can be accommodated. The development of an overarching set of architectural and infrastructure standards will help with achieving a flexible and responsive design.

Establish a strong working relationship with IO

West Park attributes the success of their redevelopment efforts to date on the strong relationship that has been established with IO (Infrastructure Ontario. The close partnership between West Park and IO has ensured that the redevelopment planning process has occurred without any major issues.

E) Jurisdictional scan of “smart” hospitals

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Commonalities among smart hospitals

Identified below are the common themes that have guided the redevelopment efforts at hospitals in 1) Korea, 2) Norway and 3) Australia. The related ICAT design approach and solutions are explored in greater detail on subsequent slides.

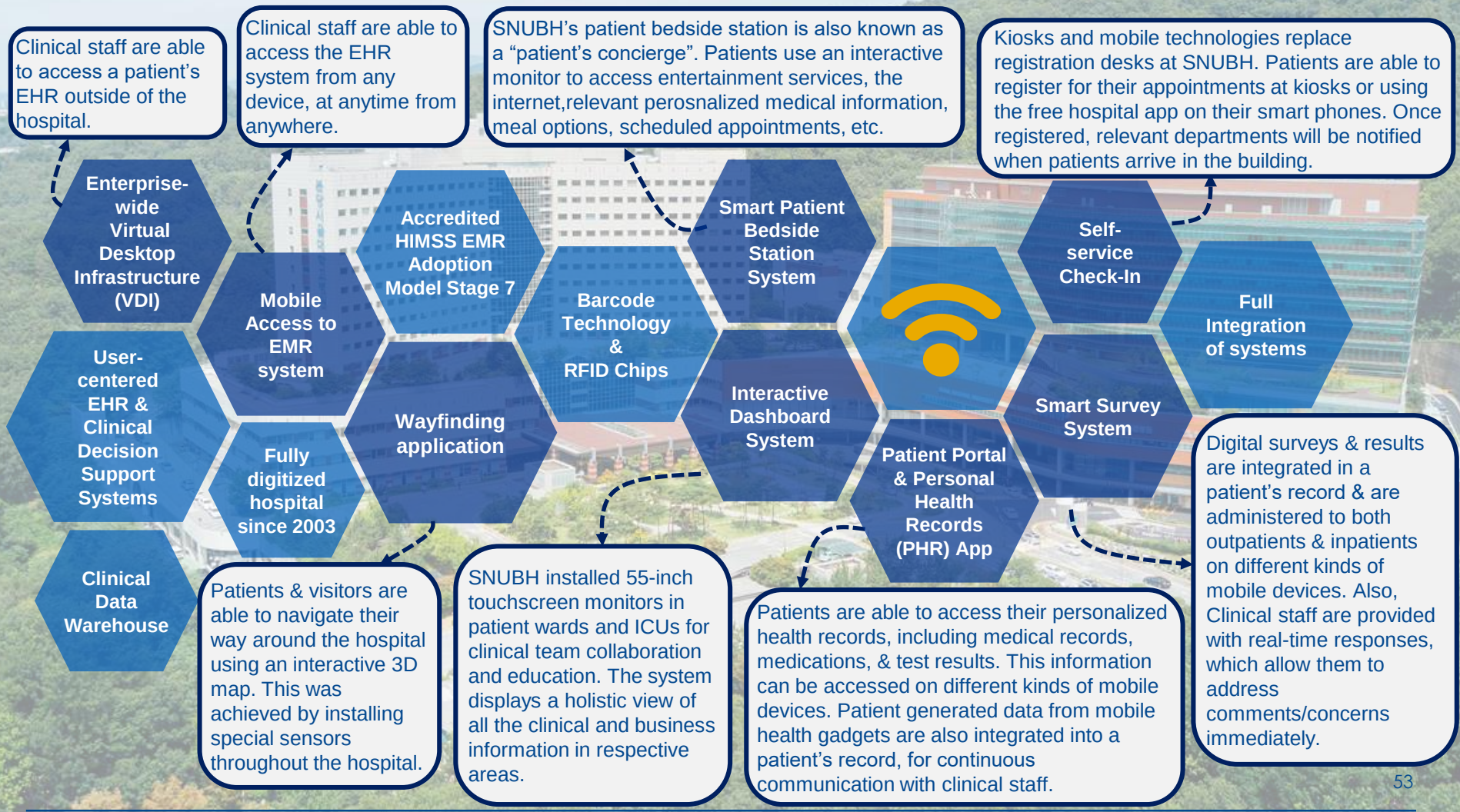
A. Patient Engagement & Empowerment:

- Wayfinding applications
- Patient portals
- Self-service registration/check-in
- Smart satisfaction surveys

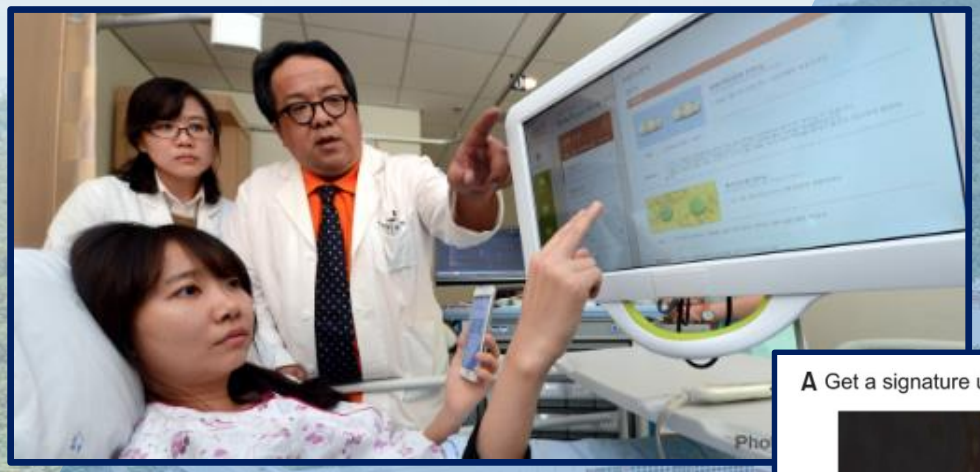
B. Optimization of Hospital Operations

- Interactive dashboard systems
- Automated Guided Vehicles
- Automated ordering systems (e.g. laboratory, pharmacy, inventory)
- Real Time Location Systems

Seoul National University Bundang Hospital (SNUBH), Korea

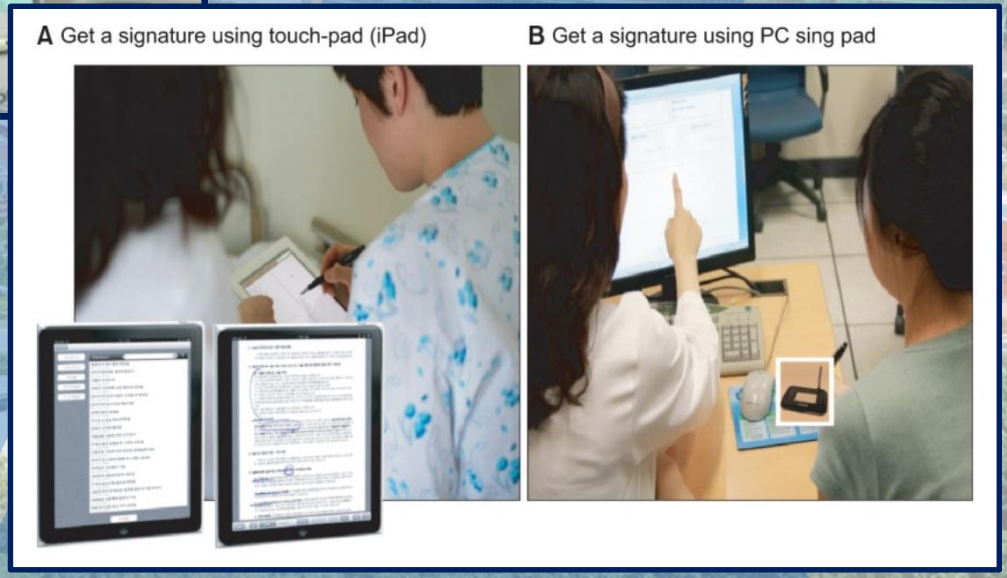


Seoul National University Bundang Hospital (SNUBH), Korea



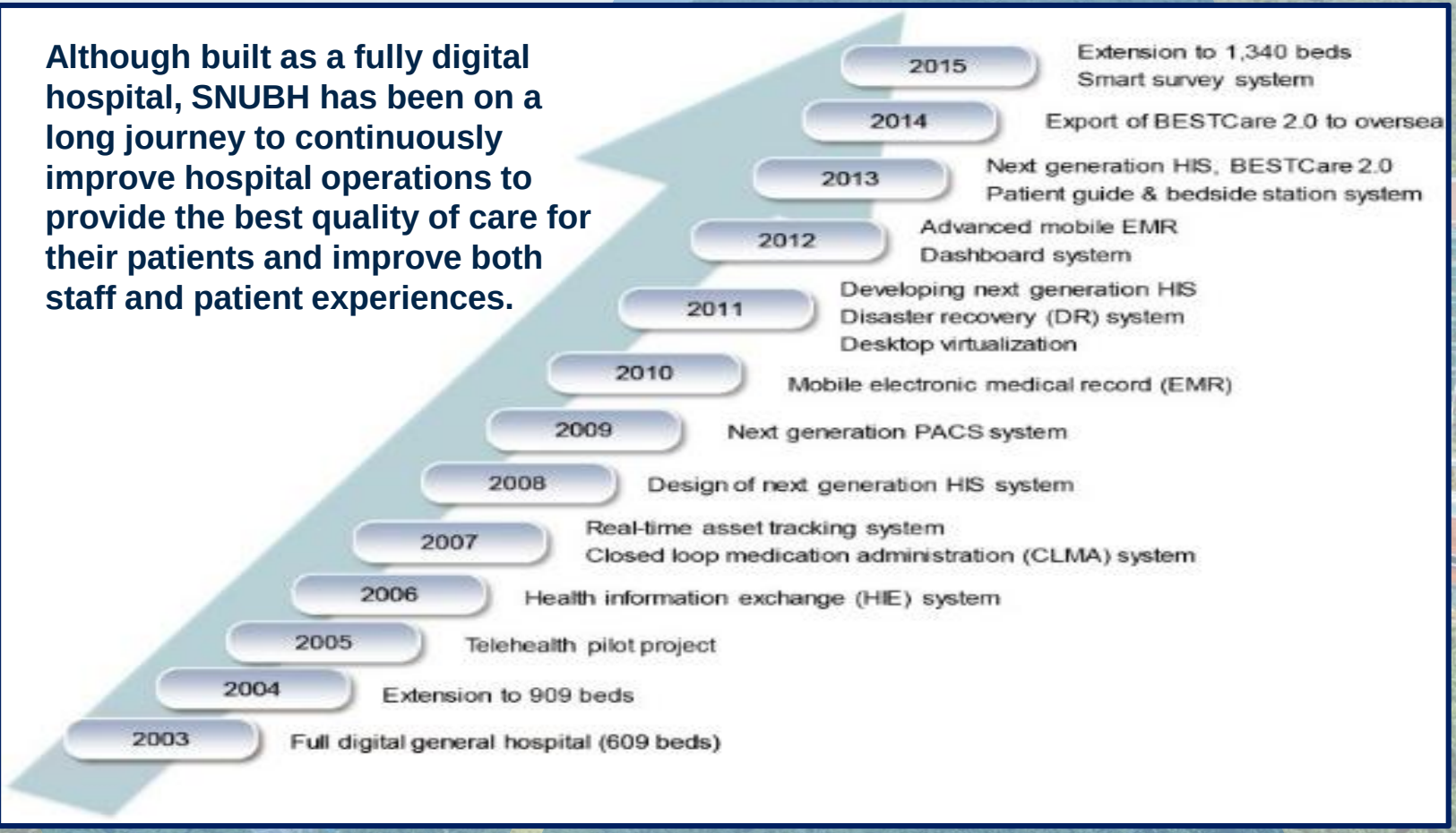
SNUBH clinical staff help a patient navigate through their health records using the interactive patient bedside station.

SNUBH has also integrated an electronic consent system. In the image on the right, hospital staff document a patient's consent using an electronic consent form and either signature pads or iPads.

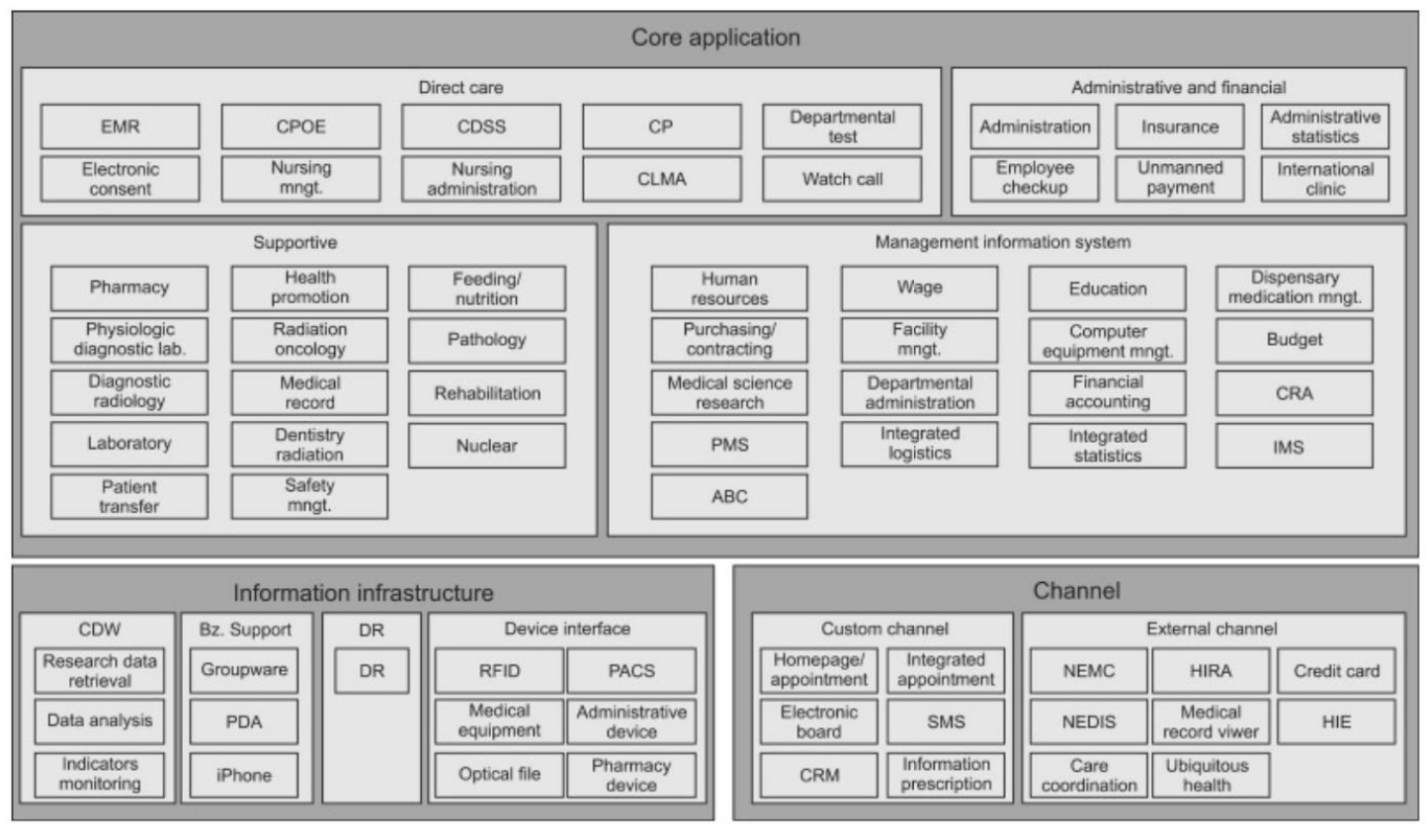


Seoul National University Bundang Hospital (SNUBH), Korea

Although built as a fully digital hospital, SNUBH has been on a long journey to continuously improve hospital operations to provide the best quality of care for their patients and improve both staff and patient experiences.



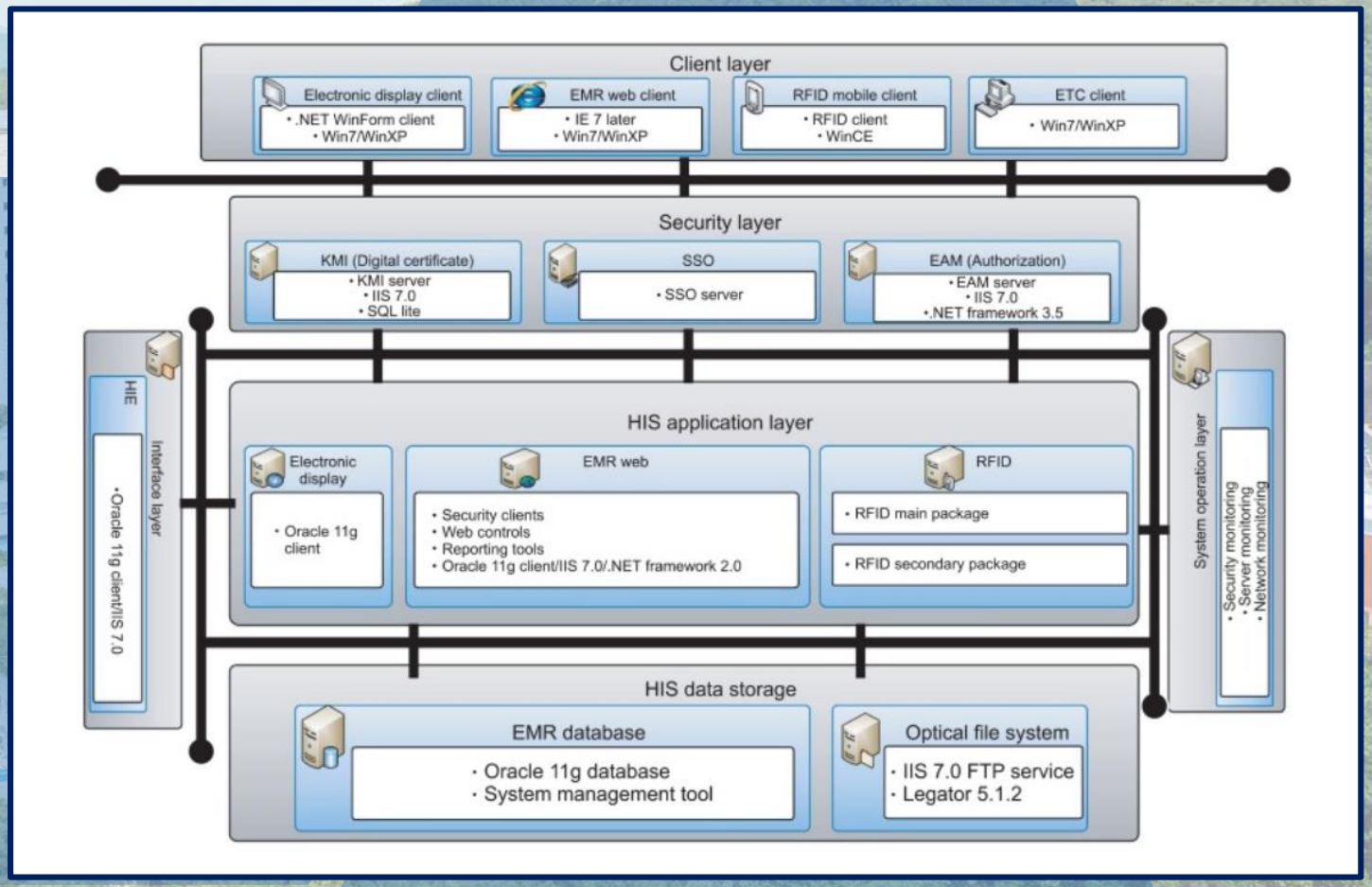
Seoul National University Bundang Hospital (SNUBH), Korea



SNUBH's Hospital Electronic System called BESTCare is fully integrated with all hospital systems.

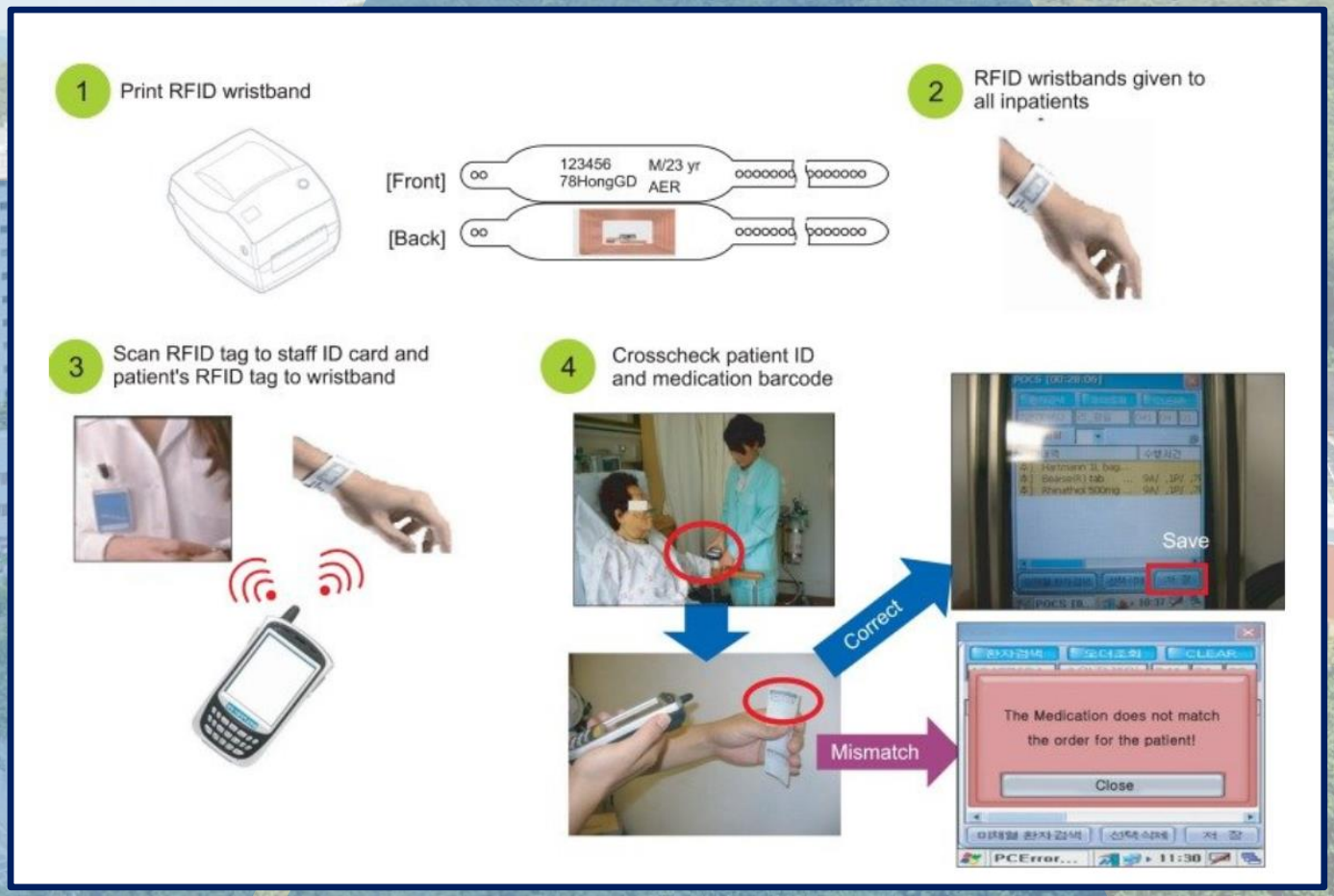
Seoul National University Bundang Hospital (SNUBH), Korea

A depiction of SNUBH's BESTCare system architecture.



Seoul National University Bundang Hospital (SNUBH), Korea

At SNUBH, RFID chips are embedded in patient ID wristbands for quick and easy patient identification and for cross matching with medication barcodes for precise medication management.



Akershus University Hospital (AHUS), Norway

AHUS has implemented an automated system that monitors and logs staff access to all hospital systems, including patient records.

AHUS has 22 AGVs that support the transportation of supplies throughout the hospital. AHUS staff are also able to track the vehicles using a real-time tracker interface. AGVs have improved the overall efficiency of transportation of supplies and reduced staffing costs.

AHUS has leveraged HP's resources to test new technologies prior to implementation & for staff training.

Europe's most modern University Hospital

Wireless Network with 1800 Wireless Access Points

Full Digital Surveillance system

Fully Digital Facility since 2008

Clinical Staff Wireless IP Phones

Wireless handheld PCs

Fully Automated Pharmacy System

One Digital Hospital Infrastructure

Automated Guided Vehicles (AGV)

Staff Smart Cards with RFID Chips

Fully Automated Ordering System

On-site HP Health Center of Excellence

Full Integration of Systems

Utilized Pneumatic Tube Systems

Smart Patient Bedside Station System

Automated Speech Recognition Technology

Storage and dispensing of medications is fully automated at AHUS. A pharmaceutical robot & electronic prescriptions enable immediate packaging of medications & a software that supports the administration and documentation process.

At AHUS, robots are programmed to know what supplies are available and where they are all located in the hospital.

AHUS has handheld voice devices for clinical staff to use for transcribing patient records, thus speeding up the transcription process and saving time for direct patient care.

Akershus University Hospital (AHUS), Norway

AHUS's Fully Automated Drug Management System

- Enables electronic prescriptions and an integrated Clinical Decision Support System.
- Integration with hospital's EMR for automated documentation.
- Full integration with pharmaceutical systems, which allows for information sharing to initiate:
  - ROBOT ("pill picker")
  - Packing and marking (with barcode technology)
  - Automated deliveries (via tube transportation and/or AGV)
  - Automated messages to nurse (IP phone text messages)

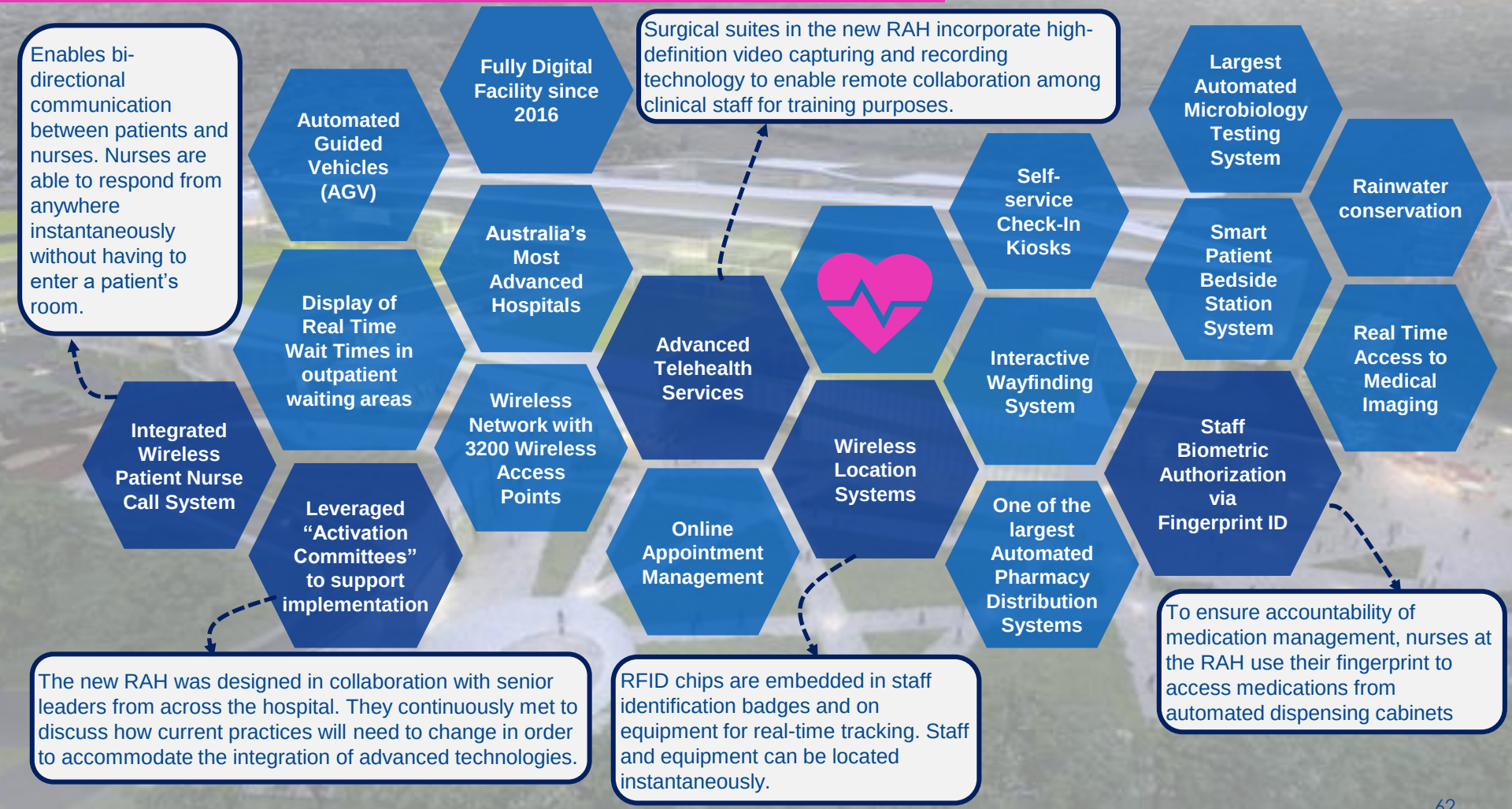
Akershus University Hospital (AHUS), Norway

Staff Smart Cards (RFID Chips)

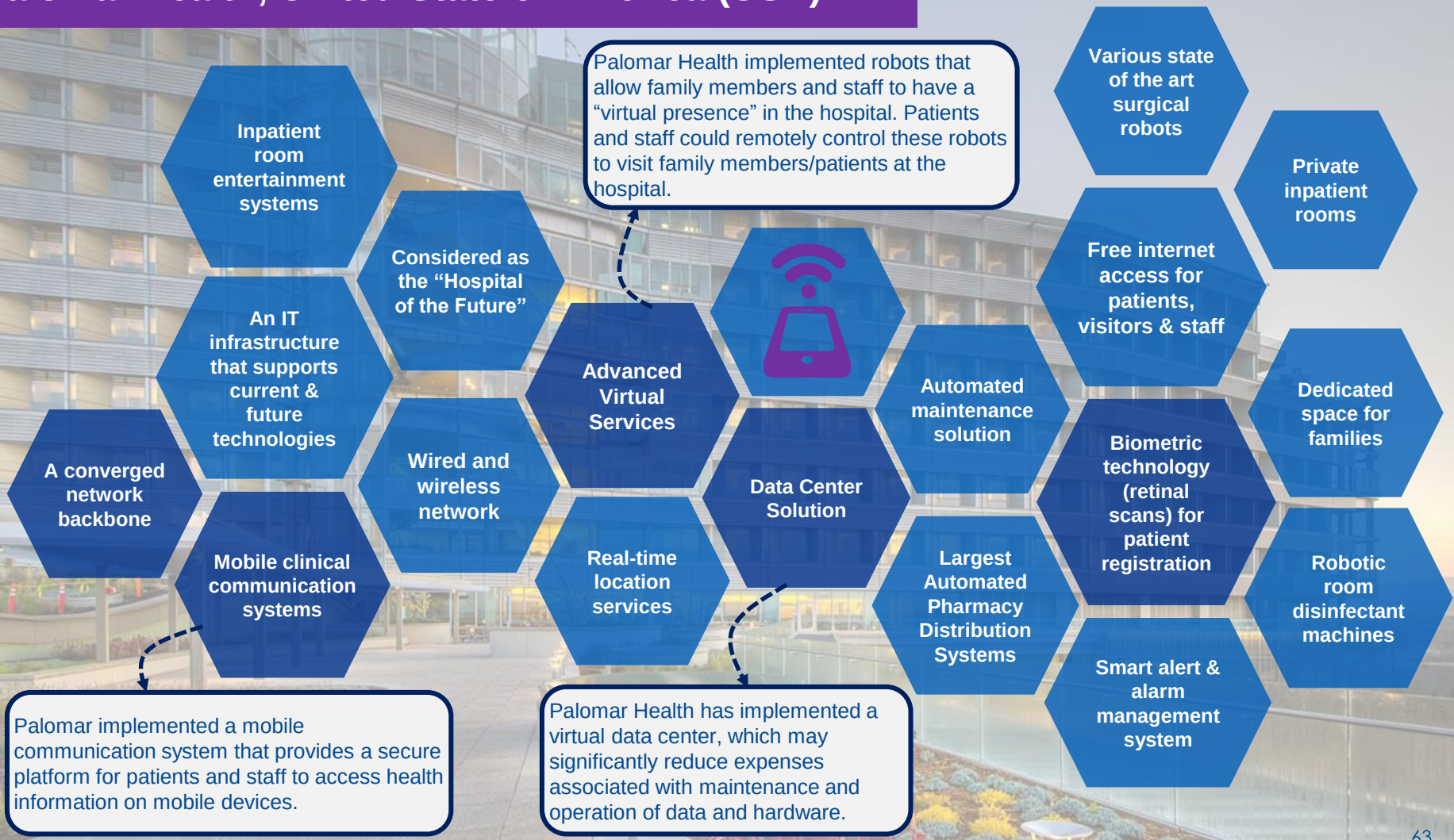
All staff members are registered for a unique smart card. This smart card provides staff with access to:

- **Hospital Parking Lot**
- **Scrub Dispenser**
- **Areas in the hospital**
- **Network Access**
- **Printing (if needed)**
- **Remote Access to hospital information system**
- **“Cantina” Payment**

The New Royal Adelaide Hospital (RAH), Australia



Palomar Health, United State of America (USA)



References

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5009069/
- http://www.koreaherald.com/view.php?ud=20140928000178
- https://www.youtube.com/watch?v=7Ne8hdwFS74
- https://www.researchgate.net/figure/Electronic-consent-system-that-provides-electronic-consent-forms-and-gets-patients_fig4_230586979
- https://smallbusiness.yahoo.com/advisor/south-korea-smart-hospital-offers-services-smartphones-115631109.html
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5009069/
- https://www.researchgate.net/figure/Applications-of-Bundang-hospital-Electronic-System-for-Total-Care-BESTCare-system-ABC_fig1_230586979
- https://www.researchgate.net/figure/Medication-administration-system-using-radio-frequency-identification-RFID-and-barcode_fig5_230586979
- http://www.ehealth.org.hk/downloadables/HP_Digital_hospital_decision_delivers_in_Norway.pdf
- https://www.slideshare.net/sanidadyconsumo/akershus-university-hospital-in-norway-has-implemented-advanced-wireless-solutions-in-their-hospital-why-where-and-what-value-does-it-give
- https://www.emc.com/collateral/customer-profiles/10222-auh-cp.pdf
- https://www.healthcareit.com.au/article/new-royal-adelaide-hospital-opens-cio-talks-clinical-collaboration-and-‘cool’-tech
- https://s3-ap-southeast-2.amazonaws.com/sahealth-rah-assets/general-downloads/New-RAH-Most-Advanced-Hospital_Fact-sheet.pdf
- https://www.cio.com.au/article/626418/futuristic-tech-savvy-royal-adelaide-hospital-set-open-doors/
- https://www.youtube.com/watch?v=Ozl7pDVtClY
- https://www.designbuild-network.com/projects/new-royal-adelaide-hospital-australia/
- https://www.burwood.com/case-studies-archive/palomar-health-creates-hospital-of-the-future
- https://www.prweb.com/releases/palomarhealth/hospitalofthefuture/prweb9756650.htm
- https://www.palomarhealth.org/innovation-and-technology/innovation-and-technology-home

F) Use cases

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1. Parking

Problem Statement

Hospital parking spots are limited and during busy hours patients can spend a lot of time searching for a parking spot. As a result, patients are late for their appointments, which could cause bottlenecks in departmental queues. Patients may also be reluctant to go to their appointments because of the possible challenges with parking at the hospital, which can jeopardize their health if they don't seek medical attention.

Current State

Erica Woods has an appointment at South Niagara Hospital and is running late. She finally arrives at the hospital, but is searching for a parking spot. After 25 minutes of driving around she finds a spot, however, she is 15 minutes late for her appointment.

Future State

Erica Woods has an appointment at South Niagara Hospital this afternoon. She downloads the South Niagara Hospital's free mobile app and by using the "parking" tab within the app, she can see which parking spots are available at the time of her appointment. Erica reserves the parking spot and drives to the hospital to park in her reserved parking spot. Once her car is parked in the spot, the sensor in the parking spot sends a message to the Medical Day Care department notifying them that Erica has arrived. Once Erica's appointment is done, she pays for parking using the mobile app.

Upon leaving the hospital, Erica is informed by a volunteer that South Niagara offers off-site shuttle service to the hospital from the local mall. This is an option she will likely consider for her next appointment.

ICAT solutions & drivers to achieve future state:

- Hospital mobile application
- Mobile devices
- Self-serve parking service
- Motion detecting sensors
- Integrated hospital information system
- Smart parking management system

Most relevant SNH programs

- Parking and security
- Administration services
- Information and communication technology

2. Registration

Problem Statement

Patients find it difficult to navigate their way through the hospital impacting their overall experience.

Current State

Jonathon Kim was referred to the South Niagara Hospital for x-rays of his leg and blood work. He arrives at the hospital and tries to use the navigation signs on the walls to find the Medical Imaging department. After following the lines for 10 minutes they disappear. Jonathon is now frantically roaming around the hallways trying to find hospital staff to help him find the Medical Imaging department.

ICAT solutions & drivers to achieve future state:

- Hospital mobile application
- Mobile devices
- Integrated hospital information system

Future State

Jonathon Kim was referred to the South Niagara Hospital for x-rays of his leg and blood work. Prior to his appointment, Jonathon downloads the South Niagara Hospital's mobile app. When Jonathon arrives at the hospital he uses the app to register and "check-in" to his appointment. Once he has checked in, the system notifies the Medical Imaging department that he has arrived and automatically brings up his x-ray requisition from Dr. John David's office.

Jonathon continues to use the mobile app to find his way to the Medical Imaging department. The app provides him with a real time 3D map and turn-by-turn directions to the Medical Imaging department. When Jonathon arrives at the Medical Imaging department, an x-ray tech greets him and takes his x-rays. Once his x-rays are done the x-ray tech "completes" his appointment in the EMR. This automatically sends a message to Jonathon's phone reminding him that he has to go to the laboratory for blood work. Jonathon uses the app to navigate his way to the laboratory department. Both the x-rays and bloodwork are electronically sent to his physician for review.

Most relevant SNH programs

- Administration services
- Information and communication technology
- Diagnostic Imaging

3. Patient bedside stations

Problem Statement

Inpatients are typically dependent on hospital staff and/or caregivers for day-to-day support during their admission. Due to their complex care plans, most inpatients are visited by a wide range of healthcare professionals who can change on a day to day basis. As a result, inpatients feel uncomfortable and disconnected from their care team.

Current State

Maria Farris is an inpatient at South Niagara Hospital. Today, she is feeling anxious because she is unclear on what appointments she has scheduled for the day and she feels very warm in her room. She patiently waits for a nurse to walk by her room to ask her questions about her appointments and to modify the temperature in her room. So far, no one has walked by her room in the last 25 minutes.

Future State

Maria Farris uses her patient identification wristband to log into her smart patient bedside station. Once she is logged in, she views her appointments for the day and the list of medications she will be taking and at what time. She is unsure about one of the medications and would like to speak to a nurse about it. Maria has the option to either message the nurse from her bedside station or request that the nurse come to her room. Maria chooses to request for the nurse to come to her room. A nurse receives the request and confirms that they are on their way. As Maria waits, she uses her voice to activate the thermostat in her room to lower the temperature and chooses her lunch from the list of options available for her.

Nurse Kelly arrives in Maria's room. The room recognizes that Nurse Kelly has never met Maria before and automatically uploads her picture and profile on Maria's bedside station.

ICAT solutions & drivers to achieve future state:

- RFID chips
- IBTs (Integrated bedside terminals)
- Smart bed stations
- Voice assistance technology

Most relevant SNH programs

- Information and communication technology
- Biomedical engineering services
- Inpatient clinical areas

4. Smart medical devices

Problem Statement

In various departments in the hospital, a “minimum nurse to patient ratio” must be maintained at all times. With the continuous increase in patient volumes, existence of manual administrative processes, and the lack of system integration, nurses are caring for more patients than the minimum and spending most of their time doing administrative work. As a result, nurses are not able to monitor each of their patients at all times.

Current State

Jennifer Robin is an inpatient at South Niagara Hospital. Today, she is light headed and is experiencing chest pain. She is unable to reach the call bell to call the nurse. Her blood pressure drops to dangerous levels, which would be considered a “code blue”. A nurse passing by her room notices and yells “Code Blue”. Another nurse in the hallway runs to the nearest phone to call locating services to initiate a “Code Blue”. Once locating services has initiated this code, all code team members are paged with the patient’s room destination.

Future State

Jennifer Robin is wearing smart medical devices that track her vital signs. Today, Jennifer is feeling light headed and is experiencing chest pain. The medical devices notice a dangerous drop in her blood pressure and automatically initiates a code blue. Once a code blue is initiated, the system automatically sends out a notification to the code blue team on their mobile devices, including the patient’s current vital signs and location. The hospital’s mobile device also informs the code blue team on the fastest route to get to the patient using the real time 3D map of the building . At the same time the initiated code blue informs code blue team members where the nearest crash cart is and automatically holds the elevator doors open for those who are not on Jennifer’s floor. If any medications were used from the crash cart, they will be automatically recorded in Jennifer’s charts by matching Jennifer’s RFID embedded wristband to the barcode labels on medication containers.
The nurse responsible for preparing the medication is able to “scan” Jennifer’s wristband, from a distance, while the code blue team assesses Jennifer’s condition.

ICAT solutions & drivers to achieve future state:

- Smart medical devices
- RFID chips
- Smart phones
- Location tracking/GPS
- Integrated hospital information system
- Smart building management system

Most relevant SNH programs

- Information and communication technology
- Biomedical engineering services
- Inpatient clinical areas

5. Emergency medical services (EMS)

Problem Statement

The transfer of information between EMS and trauma teams are typically done verbally, both by phone and in person. This approach to knowledge transfer may potentially lead to the loss of critical information, which can be detrimental to a patient. Also, prior to a trauma patient arriving, trauma teams are often provided with minimal information and time to prepare. If a patient's injuries and/or condition(s) require access to medical services/supplies/equipment that are not typically in the trauma unit, the trauma team will not know to request for them until the patient arrives, which can be life threatening in a critical situation.

Current State

Olivia Daniels has just witnessed a car accident and calls 911. EMS arrive on the scene and attend to the driver's injuries. The paramedics put the patient in the ambulance and call the Emergency Department (ED) at the Hospital. The paramedic on the phone informs ED staff about the accident and the patient's current condition. However, there is a lot of background noise and ED staff are having difficulty hearing all of the details. An ED staff member activates the "trauma code" and a page is sent to all relevant staff. The following is the page sent to staff *"Level 1 Trauma come to Trauma Bay immediately"*. Once staff arrive at the Trauma Bay, they ask other trauma team members for more information on the patient's condition, but there is no clear information available. The orthopedic surgeon is also stuck on the 15th floor waiting for an elevator.

Future State

EMS respond to a 911 call and pick up the patient. Using voice assistance technology, one of the paramedics call the ED at SNH to initiate a trauma code. In the meantime, the paramedics take the patient's vital signs and enter them into their information system, which is automatically sent to the ED at SNH. The paramedic is able to communicate with ED staff at SNH to provide more information on the patient's condition, including showing ED staff the patient's injuries using the camera on their smart glasses. The Trauma Team at SNH is able to prepare for the patient's condition and directly message (using mobile devices) other specialists within the hospital who would be of value to care for the patient. The Trauma Team is also able to track the ambulance in real-time to see how much time they have to prepare until the patient arrives. The patient arrives to the Trauma Bay and the Trauma Team is able to immediately treat the patient's most critical injuries.

ICAT solutions & drivers to achieve future state:

- Mobile devices
- Integrated hospital information system
- Virtual care platform
- Smart glasses
- Voice assisted technology
- Real time location services
- Smart building management system

Most relevant SNH programs

- Logistics
- Information and communication technology
- Biomedical engineering services
- Emergency Department

6. Virtual care

Problem Statement

Hospitals are continuously challenged with managing the increasing influx of patients with a fixed number of resources. According to the Organization for Economic Co-operation and Development and the Ontario Telemedicine Network, in 2017, 99.75% of all medical visits (i.e., for routine visits, prescription refills, and complaints) took place in person, but can mostly be done virtually. These visits unnecessarily use hospital resources, disrupt patients' schedules, and put patients at risk for injury and/or illness when visiting a hospital.

Current State

Amanda Bell is being discharged after staying at the hospital for three days for a hip replacement surgery. The nurse has provided Amanda with day-to-day instructions on wound care and a list of all the medications she needs to take to avoid infection and to manage pain.

The nurse has scheduled a follow up appointment with Amanda in 3 weeks. Amanda goes home and waits to visit the hospital in three weeks.

Future State

Amanda is being discharged after staying at the hospital for three days. Before she leaves, her nurse helps her to download South Niagara Hospital's mobile app. Once downloaded, Amanda's nurse shows her how she can access all of the necessary information she needs to avoid an infection and to manage her pain. Her nurse also mentions that if she has a question the patient portal in the mobile app will direct her to the orthopedic unit, where a nurse or Chatbot would be able to answer her questions.

Within the patient portal, Amanda is also able to view her scheduled virtual appointments, which was set up by her nurse and orthopedic surgeon, to ensure drug adherence and to examine the surgical area, using the camera on her phone.

ICAT solutions & drivers to achieve future state:

- Virtual care platform
- Mobile device
- Hospital mobile application
- Patient portal
- Chatbot

Most relevant SNH programs

- Ambulatory care
- Hemodialysis unit
- Mental health and addictions ambulatory
- Chronic disease management
- Seniors' wellness services
- Clinical support services

Reference: https://www.baystbull.com/opinion-virtual-healthcare-is-just-what-the-doctor-ordered-for-canadas-ailing-public-health-system/

7. Real time inventory management

Problem Statement

Most hospitals are challenged with high volume inventory and restocking processes. As a result, supplies are often over ordered and/or lost in the process, adding additional costs to the hospital. Hospital staff are also often left spending time searching for items and/or ordering items, which can interrupt workflows and delay patient care.

Current State

Nurse Kelly has noticed that her department has run out of Virox wipes. She visits the stock room hoping to find more. Unfortunately, there are no Virox wipes in the stock room either. So, she fills out the paper order form and scans it to the Materials and Management department in the hospital, who will then order more Virox wipes from the vendor. In the meantime, Nurse Kelly borrows a few bottles from a patient's room. Once a staff member from the Materials and Management office receives the fax, he/she stops what they're doing to enter the order on the computer to fax to the vendor. Another nurse, Nurse Jackie, has also noticed that there are no more Virox wipes in the same department as Nurse Kelly. Nurse Jackie proceeds to fill out the order form to send to the Materials and Management department, thus a duplicate order is created for the same department .

ICAT solutions & drivers to achieve future state:

- Digital inventory management solutions
- RFID chips and smart cabinets
- Automated guides carts/vehicles

Most relevant SNH programs

- Administrative services
- Logistics
- Information & communication technology
- Biomedical engineering services
- Inpatient clinical areas

Future State

Nurse Kelly notices that there are no more Virox wipes on the floor in her department. She visits the stock room hoping to find more. Nurse Kelly identifies the bin where the Virox wipes are supposed to be. She realizes that the first bin is empty, but the bin in the back is full with Virox wipes. Before reaching to the back bin, Nurse Kelly clicks on the "Out of Stock" button on the LogtiTag Restock Tag hung on the empty bin and moves the empty bin to the top shelf of the supply shelf. This notifies Materials and Management (MM) staff that a bin is completely empty of Virox wipes. MM staff are able to extend the notification request from Nurse Kelly to the vendor for replenishment. Nurse Kelly removes three bottles of Virox wipes from the second bin, which triggers a second notification to the MM department that three Virox wipes were removed from the second bin and that 6 are remaining. Another nurse, Nurse Jackie, also notices that her area of the department is low on Virox wipes and also notices that there is one bin left of Virox wipes in the stock room. To make sure another staff member has ordered more supplies, Nurse Jackie logs onto the cloud base platform to view in real-time if an order has been placed.

Once the shipment has arrived, a staff member from the MM department will load the exact number of Virox Wipes onto one of the Automated Guided Carts and program the cart to self-drive to the stock room that Nurse Kelly triggered an "Out of Stock" notification.

8. Real time translation services

Problem Statement

Hospitals staff and care for diverse populations. Most hospitals have access to services that enable a more accommodating environment for both staff and patients. However , the resources for these services are usually sparse and/or manually deployed, which can delay patient care and negatively impact both staff and patient experiences. With the increase in patient expectations for positive experiences, accommodating patients may become more challenging.

Current State

Dr. Natalia is starting her residency today in Medical Surgery and is working under Dr. Ted. She was asked by Dr. Ted to follow up with his patient (Mary) after her kidney transplant surgery. Dr. Natalia visits Mary's room and begins to introduce herself and ask Mary how she is feeling. Mary responds to Dr. Natalia in French. Unfortunately, Dr. Natalia does not speak French and proceeds to ask the nurse in the room how she can call for a translator. The nurse in the room calls the main extension number for Translation services and requests for a Translator to come to Mary's room. After waiting 20 minutes, a translator arrives (Rebecca). As Dr. Natalia speaks, Rebecca translates from English to French and when Mary responds, Rebecca translates from French to English. The overall encounter takes approximately 40 minutes.

Future State

Dr. Natalia is starting her residency today in Medical Surgery and is working under Dr. Ted. She was asked by Dr. Ted to follow up with his patient (Mary) after her kidney transplant surgery. As Dr. Natalia enters Mary's room, her bedside station recognizes that Dr. Natalia has never entered the room before and pulls up her profile onto the screen, which has been translated into French. Dr. Natalia begins to introduce herself and ask Mary how she is feeling. Once Dr. Natalia has finished introducing herself, the voice-assisted and real time translation technology in the room immediately translates English into French out loud. As the patient responds in French, the technology then translates her response into English. As Dr. Natalia and the patient are conversing, the system is also transcribing the conversation directly into the patient's chart. Once their conversation is done, a notification is sent to Dr. Ted, directing him to the conversation log in the patient's chart for review.

ICAT solutions & drivers to achieve future state:

- Real time translation software and accessories
- Voice assisted technology
- Integrated hospital information system
- RFID chips
- Real time location systems

Most relevant SNH programs

- Information & communication technology
- Inpatient clinical areas

9. Patient virtual tours

Problem Statement

Regardless of the type of appointment, patients are often anxious before entering a hospital, which can be detrimental to their health and overall experience.

Current State

David Kirkland has been scheduled for a knee replacement surgery in 3 weeks. The orthopedic nurse at the hospital has also scheduled an information session with David two weeks prior to his surgery. In the information session, David will be provided with more information about the surgery, including a preview of the equipment that will be used during the surgery and details about the procedure. David is struggling to find coverage at work so he can make it to the hospital for the information session.

Two weeks have passed and David is feeling a little nervous and uneasy about his surgery. His surgery is in two days and he is trying to remember what the nurse said during the information session about the equipment that will be used during his surgery and where he would have to go when he arrives at the hospital on the day of his surgery. David has not been sleeping well at night and has been calling in sick at work, to help him mentally prepare for his surgery.

Future State

David Kirkland has been scheduled for a knee replacement surgery in 3 weeks. The orthopedic nurse has scheduled two virtual calls with him; a call two weeks prior to his surgery and three days before his surgery. Since the pre-surgical team provide 24/7 virtual care, David was able to choose a specific date/time that would work best with his schedule.

During the virtual call, David will be provided with more information about the surgery, including a preview of the equipment that will be used during the surgery and a virtual tour of the operating room and post-op room for when he is in recovery. To access the virtual call platform, David will log into the hospital's patient portal, where he can also chat with a nurse online at any time from anywhere .

ICAT solutions & drivers to achieve future state:

- Virtual care platform
- Patient portal
- Online chat

Most relevant SNH programs

- Logistics
- Administration services
- Clinical support services

10. Virtual extracurricular activities

Problem Statement

Patients often struggle with feeling helpless and uncomfortable in hospital environments.

Current State

Janet Hudson is a 45 year old patient, currently undergoing chemotherapy for Stage 4 bone cancer. Before Janet was diagnosed, she worked as the Head Chef at the Ritz Carlton. Unfortunately, due to the side effects from chemotherapy, Janet is being admitted to the hospital and is now an inpatient. Her care team has instructed her to not leave her bed unattended, as she is at high risk for falls.

Janet has been at the hospital for over two months now and is feeling very depressed. She is also refusing to continue with her treatment, so that she can continue to pursue her passion experimenting with new ingredients and creating signature dishes for the guests at the Ritz.

Future State

Janet Hudson is a 45 year old patient, currently undergoing chemotherapy for Stage 4 bone cancer. Before Janet was diagnosed, she worked as the Head Chef at the Rtiz Carlton. Unfortunately, due to the side effects from chemotherapy, Janet is being admitted to the hospital and is now an inpatient. Her care team has instructed her to not leave her bed unattended, as she is at high risk for falls.

Janet has been at the hospital for over two months now. When she is not in treatment or in consultations with her care team, Janet logs into her bedside station using her wristband to activate the Virtual Cooking program. Using Microsoft's HoloLens goggles, Janet is able to feel like she is back in the kitchen and not in her hospital bed. She is able to use her arms and hands to pick out ingredients from the virtual shopping cart and prepare virtual meals using virtual supplies and equipment.

ICAT solutions & drivers to achieve future state:

- RFID chips
- Augmented reality/virtual reality technology
- IBTs (integrated bedside terminals)

Most relevant SNH programs

- Seniors' wellness services

11. Real time location systems

Problem Statement

Most hospitals have systems in place to help improve productivity and efficiency of workflows. However, most of these systems work in isolation and/or are typically used with disabled functions. This causes a lack of visibility through the hospital, which can create unnecessary delays in patient care, miscommunication and/or loss of information among staff, and overall poor patient and staff experiences.

Current State

Anna is an x-ray tech who is primarily responsible for managing the list of inpatient x-ray orders. Typically, inpatients are transferred from their room to the x-ray department, which is on the third floor of the hospital. Anna's first x-ray case is for inpatient, Maria Ray from the 16th floor. Anna calls the department and asks to speak to the nurse looking after Maria to see if now is a good time to have Maria come down for her x-rays. Unfortunately, no one at that extension picks up. Anna waits 15 minutes to call back.
After 15 minutes, Anna calls the department once again to speak to the nurse looking after Maria; this time she was able to get through. Maria's nurse tells Anna that Maria is now able to come to the department for her x-rays. Anna proceeds to request for a porter to pick her up and prepares the room for her arrival.
Anna has been waiting 35 minutes for Maria. Using her username and password, Anna logs into the portering system and sees that Maria was picked up. She calls the department nurse to only learn that Maria had to go to the washroom and that is why she is late.
After 10 minutes, Maria arrives at the x-ray department and Anna completes her x-rays. Midway through the x-rays, Maria's nurse calls Anna to inform her that Maria is on droplet precautions.

Future State

Anna is an x-ray tech who is primarily responsible for managing the list of inpatient x-ray orders. Typically, inpatients are transferred from their room to the x-ray department, which is on the third floor of the hospital. Anna's first x-ray case is for inpatient, Maria Ray, from the 16th floor. Using her ID badge Anna logs into the hospital's tracking system to check if Maria is in her room or if she is busy with either family or in another area in the hospital for an appointment.
Once Anna confirms that Maria is available, using the real time tracker, she clicks on the "Porter" button to request for a porter to bring Maria to the x-ray department. As Anna clicks on "complete porter request" a message pops up notifying her that Maria is on droplet precaution.
Anna proceeds to prepare herself and the room and is actively watching the tracker to see how far Maria is from arriving at the x-ray department.
The portering system also allows bi-directional communication between Anna and the porter.

ICAT solutions & drivers to achieve future state:

- Integrated hospital information system
- Real time location systems and portering services
- RFID chips

Most relevant SNH programs

- Diagnostic Imaging
- Logistics
- Emergency Department
- Biomedical engineering services

12. Virtual patient transitions

Problem Statement

Healthcare organizations struggle with a lack of integration between hospital systems and clinical services, which impacts delivery of care.

Current State

Emily L has been diagnosed with gastrointestinal cancer and is currently an inpatient at Niagara Health. Unfortunately, her condition has worsened and she must be transferred to Hamilton Health Sciences (HHS) to seek specialized care in the critical care unit. Her care team is preparing her chart for her transfer tomorrow afternoon. Since Niagara Health and HHS are not on a shared hospital information system, Emily's clinical information, including reports and imaging, are being printed and copied onto CDs. Emily has bonded very closely with her care team at Niagara Health and is feeling very overwhelmed and nervous to transfer hospitals. She is also afraid that the care team at HHS may not be as friendly as her care team at Niagara Health.

Future State

Emily L has been diagnosed with gastrointestinal cancer and is currently an inpatient at Niagara Health. Unfortunately, her condition has worsened and she must be transferred to Hamilton Health Sciences (HHS) to seek specialized care in the critical care unit. As her care team prepares for her transfer, her nurse schedules an introductory virtual chat with the HHS clinical care team. During the virtual call Emily will be able to meet her new care team at HHS and take a virtual tour of her new room. A nurse from the clinical care team at Niagara Health has also scheduled a virtual call with the HHS care team to hand-off Emily's chart. The HHS care team will be able to access Emily's charts directly from the hospital's EMR.

ICAT solutions & drivers to achieve future state:

- Virtual care platform
- Integrated hospital information system

Most relevant SNH programs

- Logistics
- Administrative services
- Biomedical engineering services

G) Emerging technology trends

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Relevant technology trends

A comprehensive scan was conducted to identify the emerging technology trends associated with hospital redevelopment projects around the world. These trends are shown below and a sampling of these technologies are profiled on the subsequent slides:

Patient Engagement and Experience:

- Hospital Navigation Apps
- Smart Patient Rooms (e.g. Integrated Bedside Terminals (IBTs)
- Interactive/live walls
- Patient Portals
- Smart Parking Space Management Systems (e.g. parking automation and self-service parking)
- Self-Service Check-In Kiosks

Hospital Performance and Operations:

- Artificial Intelligence (AI) Powered Command Centres
- Radio Frequency Identification (RFID) Chips
- Blockchain Technology
- Smart logistics and materials management solutions
- Real-time performance dashboards and corporate performance management solutions

Clinical Care:

- Advanced CPOE
- HIS Integration/Automation
- Nurse Call Systems
- Smart Alerting/Early Warning System
- Telemedicine Technology
- Virtual and Augmented Reality (VR/AR) Technology
- Voice Recognition Technology

Building Automation:

- 5G technology
- Automated Guided Vehicles (AGVs)
- Automated Mobile Security Robots
- Smart Waste Management Systems
- Smart Building Management Systems (including building Internet of Things (BIoT))
- Real Time Location System (RTLS)

Patient engagement & experience

Hospital navigation apps

What is the technology?

An application available on mobile devices to help patients, visitors, & staff find their way around a hospital faster and easier. These applications provide users with turn-by-turn directions and an interactive 3D map.

Why is this important to SNH?

SNH can utilize a navigation app to help streamline operations within the hospital. The app can minimize the possibility of patients being late for their appointments because they had gotten lost trying to find their way around the hospital. It may also improve staff productivity time by reducing the number of times staff are stopped for directions.

Who is adopting this technology?

- **Mackenzie Health, Ontario:** Offer a "free GPS for patients and families" at the Richmond Hill site. The app allows users to follow real-time turn-by-turn directions inside the hospital and to other locations that are part of the Mackenzie Health community.
- **The Aintree Hospital, UK:** One of the first hospitals in the UK to offer a wayfinding app. Patients, visitors, and staff are able to use the interactive map without access to wireless internet or mobile data. The app also provides important information about the hospital (e.g. car parking information).

Reference(s):

- https://www.medicaleconomics.com/practice-management/5-ways-improve-patient-flow
- https://www.merraine.com/8-types-mobile-hospital-apps-3-features-patients-want/
- https://www.mackenziehealth.ca/en/about-us/mackenzie-health-wayfinding.aspx
- https://pdfs.semanticscholar.org/d582/6f48f9dc82d7f7e93f4ac043761b994c45d5.pdf
- https://www.lhsigns.com/importance-wayfinding-hospitals.html
- https://www.dr-hempel-network.com/digital-health-technolgy/hospital-navigation-apps/
- https://www.aintreehospital.nhs.uk/find-us/getting-around-the-hospital/
- https://play.google.com/store/apps/details?id=innovesolutions.co.uk.wayfinding002&hl=en

Smart patient rooms

What is the technology?

An integration of various advanced technologies (e.g. integrated bedside terminals, digital whiteboards, etc.) in one room to enhance patient experiences, improve patient safety, and optimize workflows for more efficient and high quality of care.

Why is this important to SNH?

By designing smart patient rooms, SNH will be able to transform patient experiences by enabling patient engagement and personalization of care .

Who is adopting this technology?

- **Thomas Jefferson University, Philadelphia:** Working with IBM Watson to launch smart hospital rooms, which will incorporate various Internet of Things (IoT). The design is particularly based on enhancing patient experiences by enabling the ability to personalize care.
- **Basset Medical Center, New York:** Built GE based smart patient rooms with the inclusion of multiple-sensing technologies, including tracking of hand hygiene, real-time monitoring of patient movement, determination of whether clinical staff have made their rounds for a patient, provide staff with information to better manage patient flow, etc. This initiative was proposed to achieve optimal patient safety (i.e. To prevent patients from falling).

Reference(s):

- https://www.topmastersinhealthcare.com/30-most-technologically-advanced-hospitals-in-the-world/
- http://info.isabelhealthcare.com/blog/the-medical-internet-of-things-miot-the-top-5-hospital-smart-gadgets
- https://healthtechmagazine.net/article/2017/01/transforming-patient-experience-through-smart-room-technologies
- https://www.hfmmagazine.com/articles/1105-smart-patient-room-monitors-safety-at-n-y-facility
- https://www.fiercehealthcare.com/healthcare/5-hospital-proven-strategies-to-prevent-patient-falls
- https://www.prnewswire.com/news-releases/thomas-jefferson-university-hospitals-plans-cognitive-hospital-rooms-powered-by-ibm-watson-internet-of-things-300338924.html
- https://www.theglobeandmail.com/life/health-and-fitness/health/the-hospital/better-by-design-how-a-hospital-room-can-help-patients-heal/article16748288/
- https://insights.samsung.com/2016/09/01/smart-patient-rooms-how-connected-healthcare-technology-helps-doctors-and-patients-thrive/

Patient portals

What is the technology?

An online platform that is typically integrated with a hospital's Electronic Medical Record (EMR) system. It's main focus is to provide patients access to health information and encourage patients to be more involved in their healthcare journey.

Why is this important to SNH?

People are currently using existing technologies to independently manage various aspects of their lives and will expect the same from the healthcare industry.

Who is adopting this technology?

- **Sunnybrook Hospital, Ontario:** Wanted to transform the way health records were accessed and shared and emphasize patient empowerment. The portal is fully integrated with the hospital's EMR allowing patients to access their medical records, links to relevant disease-specific information, and manage their appointments.
- **Jackson Hospital, Florida:** Offer a secure patient portal for both inpatient and outpatients. These patients are able to access a summary of their clinical record, most recent lab results, personal information, and a secure communication platform with their clinicians.

Reference(s):

- https://www.jackson-hospital.com/patients-visitors/patient-portals/
- https://sunnybrook.ca/content/?page=mychartlogin-learnmore
- https://patientengagementhit.com/features/how-patient-portals-improve-patient-engagement
- https://www.hqontario.ca/Blog/progress-with-patient-portals

Smart parking space management systems

What is the technology?

A cloud based intelligent system that is based on a connected network of sensors that enable real-time notifications about the availability of parking spots. The sensors embedded in parking spots collect and send information to a centralized platform, which is then displayed on either screens installed in parking lots and/or on mobile devices via a mobile app. These systems have been known to improve parking spot utilization, reduce wasted time searching for parking spots, and improve individual experiences. Some of these systems also offer self-service parking reservations and parking payment through mobile apps.

Why is this important to SNH?

Parking has been identified as a key challenge at Niagara Health, these intelligent systems can help improve parking experiences and streamline operations at SNH by reducing wasted time on searching for available parking spots. These systems have also been proven to be user friendly due to its ability to accommodate for various levels of knowledge and experience with technology.

Who is adopting this technology?

- **Suburb of Mosman, Australia:** After a comprehensive study on parking and traffic, which identified that drivers were spending an average of 156 hours per year searching for parking, the city implemented a smart parking management system across various areas (e.g. shopping malls) . The system includes in-ground and overhead sensors that collect, analyze, and display information about parking availability to drivers on dynamic signs throughout a parking lot and on a mobile app. To further advance intelligent parking lots, the city is also installing “smart parking elevators” that operate similarly to vending machines.

Reference(s):

- https://archer-soft.com/en/blog/how-build-real-time-parking-availability-system
- https://www.iotforall.com/benefits-future-smart-parking-systems/
- https://medium.com/predict/intelligent-parking-a-tale-of-five-cities-31b14056261
- https://www.forbes.com/sites/pikeresearch/2017/01/26/smart-parking/#6f2008f262f6
- https://www.youtube.com/watch?v=rXWrpE1Khkk

Self-service check-in kiosks

What is the technology?

- An interactive service provided on electronic terminals. These terminals can be found in various environments including, the airport, restaurants, retail stores, medical centers, parking spaces, etc. Such technology is implemented to improve customer experiences and reduce administration time.

Why is this important to SNH?

Due to the recent pressures in the healthcare industry, such as increased patient volumes and costs, SNH can implement self-service kiosks to enable patients to get more done in less time and help streamline various services and administrative operations in the hospital.

Who is adopting this technology?

- **Health Sciences North, Ontario:** Touchscreen kiosks were installed in selected departments, including the Diabetes, Bariatric and Nutrition Counselling departments. When patients arrive at the hospital they are able to swipe their health card at the kiosk, where they will be prompted to answer a few relevant questions for their appointment and can proceed to the waiting room. Volunteers were also hired to help patients feel more comfortable with using the kiosks.
- **Mackenzie Health, Ontario:** Installed on-site self-service kiosks and offer online pre-registration through a patient portal. Self-service registration channels were implemented to reduce the time it takes for patients to register when they arrive at the hospital.

Reference(s):

- https://www.cbc.ca/news/canada/sudbury/health-sciences-north-tests-automated-patient-registration-kiosk-1.3063346
- https://www.mackenziehealth.ca/en/patients-visitors/patient-registration.aspx?_mid_=23285
- https://www.advantech.com/iretail-hospitality/solutions/detail/self-service-patient-information-kiosks
- https://www.healthcareitnews.com/blog/convenient-truth-self-service-works-healthcare

Hospital performance& operations

AI – Powered command centres (CC)

What is the technology?

A technology solution that enables the integration of various hospital systems and real-time monitoring and management of patient flow, using advanced analytics and predictive analytics. Information generated from this solution can be presented on a main interface for people to coordinate care more efficiently (e.g. on a communal screen).

Why is this important to SNH?

As patient flow has been identified as a current pain point, a CC can help alleviate bottlenecks and barriers. CCs can also support capacity management, which can be helpful especially with the increase in patient volumes and fixed resources. Ultimately, providing better patient and staff experiences.

Who is adopting this technology?

- **Humber River Hospital, Ontario:** Developed Canada's first command centre, which is housed in one room in the hospital. The command centre is powered by GE technology, which allows staff to monitor and manage patient flow in real-time. The CC initiative was proposed to improve access and patient flow, clinical safety and quality, and most recently to enable community and home monitoring. To date, the CC has reduced the wait time for an inpatient bed to be cleaned by 45% and the time a patient has to wait in the Emergency Department for an inpatient bed by 33%.

Reference(s):

- https://www.hrhfoundation.ca/blog/humber-river-hospitals-command-centre-has-created-23-virtual-beds/
- https://www.healthleadersmedia.com/innovation/move-over-star-wars-hospital-command-centers-take-spotlight
- https://emea.gehealthcarepartners.com/case-studies/133-care-design-and-delivery/command-centre-woa/559-command-centres-in-healthcare
- https://www.genewsroom.com/press-releases/bradford-announces-ai-powered-hospital-command-center-first-its-kind-europe
- http://newsroom.gehealthcare.com/is-this-command-center-the-way-all-hospitals-will-soon-run/

Radio frequency identification (RFID) chips

What is the technology?

An electronic chip that is able to exchange information with RFID readers via radio waves. This technology can be used for various reasons in the healthcare industry, including patient identification (wristbands), drug identification & medication management, surgical instruments identification, etc.

Why is this important to SNH?

SNH can utilize RFID chips to support real-time location systems and further improve hospital logistics.

Who is adopting this technology?

- **Mayo Clinic's Saint Marys Hospital, Minnesota:** In 2013, launched a fully integrated RFID system in the Emergency Department. Patients and equipment are given a unique RFID chip; embedded in patient wristband and installed or attached to equipment. As a result, the technology has improved the efficiency and costs of care processes.
- **Aarhus University Hospital, Denmark:** Is known as the largest hospital facility in Northern Europe and for the largest deployment of an RFID system. RFID chips were attached to over 350, 000 items and ID tags for patients and staff and approximately 2,500 RFID readers were installed. This initiative was proposed to help streamline care and business processes for a more efficient facility.

Reference(s):

- https://hbr.org/2015/12/how-rfid-technology-improves-hospital-care
- https://www.himss.org/library/benefits-and-barriers-rfid-technology-healthcare
- http://www.imedpub.com/articles/using-rfid-technology-for-managing-patient-medical-file.php?aid=22831
- https://www.techopedia.com/definition/24273/radio-frequency-identification-tag-rfid-tag
- https://rainrfid.org/wp-content/uploads/2018/03/3-CS-Healthcare-Worlds-Largest-RFID-based-Hospital-installation.pdf
- https://globalhealthi.com/2016/11/17/denmark-plans-largest-hospital-deployment-of-rfid-tracking/

Clinical care

Telemedicine technology

What is the technology?

A service that allows real-time bi-directional communication between healthcare professionals and patients, at a distance. The service is enabled by mobile devices, internet connection, and a communication platform.

Why is this important to SNH?

SNH can utilize telemedicine technology to optimize both inpatient and outpatient environments by reducing the number of patients visiting the hospital for appointments that can be done virtually (e.g . follow up appointments after a patient is discharged from surgery). Also, telemedicine enables a service that would support the seniors' wellness program by providing seniors with 24/7 access to healthcare services in the comfort of their own homes.

Who is adopting this technology?

- **UCLA Medical Center, California :** Offers virtual robotic telemedicine in surgical rooms, which allow for students and physicians located anywhere around the world to communicate with staff in Los Angeles . **Mercy San Juan Medical Center, California:** Introduced "doctor on wheels", which is a robot that is placed in a room with a patient and allows doctors to remotely control using an iPad. This technology has particularly been used for patients to access specialists, wherever they are.
- **Mayo Clinic Cancer Center, Arizona:** Implemented a remotely controlled "V-Go" robot, where patients are able to receive real-time assessments from a remote specialist. This technology was initially used for treating college football players diagnosed with potential concussions, where players would receive assessments from remote neurologists.

Reference(s):

- https://mobidev.biz/blog/technology-trends-healthcare-digital-transformation
- https://www.tmcnet.com/topics/articles/2018/08/24/439267-top-5-technologies-being-used-hospitals-clinics-today.htm
- https://www.healthcareitnews.com/blog/understanding-smart-hospitals-and-why-most-arent-there-yet
- https://chironhealth.com/telemedicine/what-is-telemedicine/
- https://www.topmastersinhealthcare.com/30-most-technologically-advanced-hospitals-in-the-world/

Virtual & augmented reality technology

What is the technology?

Technology that is based on computer generated simulations of the real world that can be interacted with by a person using special devices and equipment, such as headsets, helmets, gloves, screens, etc. This technology can be used for various reasons in the healthcare industry including, training & education, therapy & treatment, and overall enhancement of patient & staff experiences.

Why is this important to SNH?

By implementing VR & AR technologies, SNH has the opportunity to fully revolutionize the delivery of care for patients and staff.

Who is adopting this technology?

- **Maplewood Senior Living, Connecticut:** With the launch of their "Centre of Aging Innovation and Technology", Maplewood implemented virtual reality (VR) headsets to enhance senior living. The VR headsets provided "outside world" experiences to individuals with cognitive and physical impairments. For example , an individual who loves horses was able to be "virtually placed" in a "360 degree world of horses". The headsets were able to reduce anxiety and agitation among senior residents and put them in a more calm and positive mental state.
- **Masonic Children's Hospital, Minnesota:** Clinicians are taking advantage of VR technologies to preplan for complex surgical cases. Using VR glasses, clinicians are able to look "inside" patients and identify any problem areas and plan how to avoid them prior to surgery.

Reference(s):

- https://mobidev.biz/blog/technology-trends-healthcare-digital-transformation
- https://www.vrfocus.com/2017/09/maplewood-using-vr-to-enhance-senior-living/
- https://blogs.voanews.com/techtonics/2017/10/06/virtual-reality-helps-seniors-with-dementia-get-back-on-track/
- https://www.nbcnews.com/mach/science/3-ways-virtual-reality-transforming-medical-care-ncna794871
- https://thedoctorweighsin.com/why-virtual-reality-is-the-future-of-healthcare/

Voice recognition technology

What is the technology?

A technology that is used to authenticate and identify individuals using a person's voice. These technologies can be used for a variety of reasons, including activation of digital assistants (e.g. Amazon's Alexa, Apple's Siri) and Internet enabled devices (e.g. thermostats, alarm sensors, Hospital EMR, etc.).

Why is this important to SNH?

SNH can further streamline and improve staff productivity and staff and patient experiences. Staff would be able to use their voice to complete tasks while their hands are preoccupied and patients would have the opportunity to feel more in control of some aspects of their hospital experience.

Who is adopting this technology?

- **Boston Children's Hospital, Massachusetts:** Piloted its own voice software, which is based on Amazon's Alexa technology. The software is available through a mobile app that can be downloaded onto mobile devices. The app allows parents/caregivers/patients to ask 'Alexa' questions about common illnesses and discharge instructions. Direct instructions can also be given to 'Alexa'. For example, a patient can ask 'Alexa' to dim the lights in their room or a surgeon can ask 'Alexa' to take an x-ray of a patient in the operating room.
- **Cedars- Sinai Medical Center, California:** Integrated 'Alexa' in hospital inpatient rooms. The technology allows patients to make 'hands-free' requests (e.g. to call a nurse for support with going to the washroom, for medication, information about food options, to play music, etc.).

Reference(s):

- https://spectrum.ieee.org/the-human-os/biomedical/devices/koreas-new-futuristic-hospita
- http://www.rightpatient.com/blog/voice-assistants-technology-healthcare/
- http://www.healthcarebusinesstech.com/voice-apps-hospital/
- https://www.beckershospitalreview.com/healthcare-information-technology/the-future-of-voice-recognition-in-healthcare-key-thoughts-from-7-cmios.html
- https://www.digitalauthority.me/resources/alexa-in-healthcare/
- https://www.nurse.com/blog/2019/04/19/cedars-sinai-debuts-alexa-in-hospital-rooms-improve-care/

Building automation

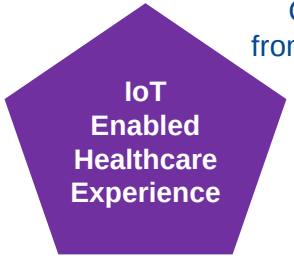
5G Technology

An IoT enabled healthcare experience

Hospital redevelopment projects from the last 5-10 years have shifted a tremendous focus on creating an IoT enabled health experience for patients. An IoT enabled health experience is where smart “things”, like medical devices and software applications, connect together to create an ecosystem that supports patients, medical staff and hospital personnel. Ultimately, this ecosystem provides a more seamless, efficient, and positive experience for everyone. **Looking ahead into the future, 5G technology will be a key enabler for continuing the advancement of an IoT health experience for patients.**

Patient

Provides and consumes information from the smart things that are made available through the 5G connection



Providers

Consume and evaluate information from both the patient and smart things to help the patient efficiently

Smart Devices

Collect information from the physical world, related to the patient, medical personnel and the infrastructure around them

5G Technology

Enables the data collected to be shared and consumed by all the stakeholders, as well as other devices

Hospital Management

Consume and evaluate information provided from Smart Devices via 5G to efficiently run the hospital

5G Technology

What is the technology?

5G is described as the next major iteration of mobile internet connectivity which will provide users with faster data download and upload speeds, wider coverage and more stable connections. 5G will utilize radio spectrum in a more efficient manner enabling more devices to access the internet.

Why is this important to SNH?

5G connectivity will become mainstream in the next 3-5 years and will enable a new set of use cases related to the connectivity of medical devices and hospital facilities.

Who is adopting this technology?

- **Rush University Medical Center, Illinois**: The Chicago based organization is embarking on a major installation of 5G infrastructure with the hopes of moving to a truly “wireless” infrastructure. The organization is moving away from a wired infrastructure to a modern wireless infrastructure. Together with AT&T, the network is being rolled out to an existing campus building but a redevelopment project will soon commence for a new 11-story outpatient building. The hope is that the 5G infrastructure put in place will enable the opportunity to offer a complete “digital” experience to patients. It is envisioned that patients will be able to use mobile apps to navigate their visits and access remote services.

Reference(s):

- https://www.bbc.com/news/business-44871448
- https://assets.kpmg/content/dam/kpmgblogs/xx/pdf/04/unlocking-the-benefits-of-5g-for-enterprise-customers.pdf
- https://www.lightreading.com/mobile/5g/this-hospital-is-installing-5g-for-one-big-reason-getting-rid-of-wires/d/d-id/749125

What does upscaling business to 5G mean?

Business As Usual

- ✓ Multiple networks to manage, each challenging and complex
- ✓ Each network with different equipment and not interoperable
- ✓ Numerous resources / multiple skillsets required to maintain

Network	Challenges
▪ **Wi-Fi**	Congested networks, spotty coverage and variable throughput
▪ **Carrier cellular**	Coverage, In-building service, throughput
▪ **Ethernet fiber**	Plugged in mode only and not available everywhere to everyone. No mobility.
▪ **PAN/LAN/WAN**	Network management, system connectivity, performance
▪ **Custom networks**	Networks to support sensors, and other communication needs

5G Private Network

- ✓ **A single network** that you own and control for your enterprise. It can replace multiple legacy networks.
- ✓ Enable and support the newest 5G technologies available today and for the years ahead of commercial deployments

5G Solutions

- ▪ One network that can be spilt up for different needs
- ▪ Interoperable
- ▪ All services run off same network equipment and infrastructure
- ▪ Indoor / outdoor network solutions
- ▪ Secure
- ▪ Reliable
- ▪ Non-constraining, flexible

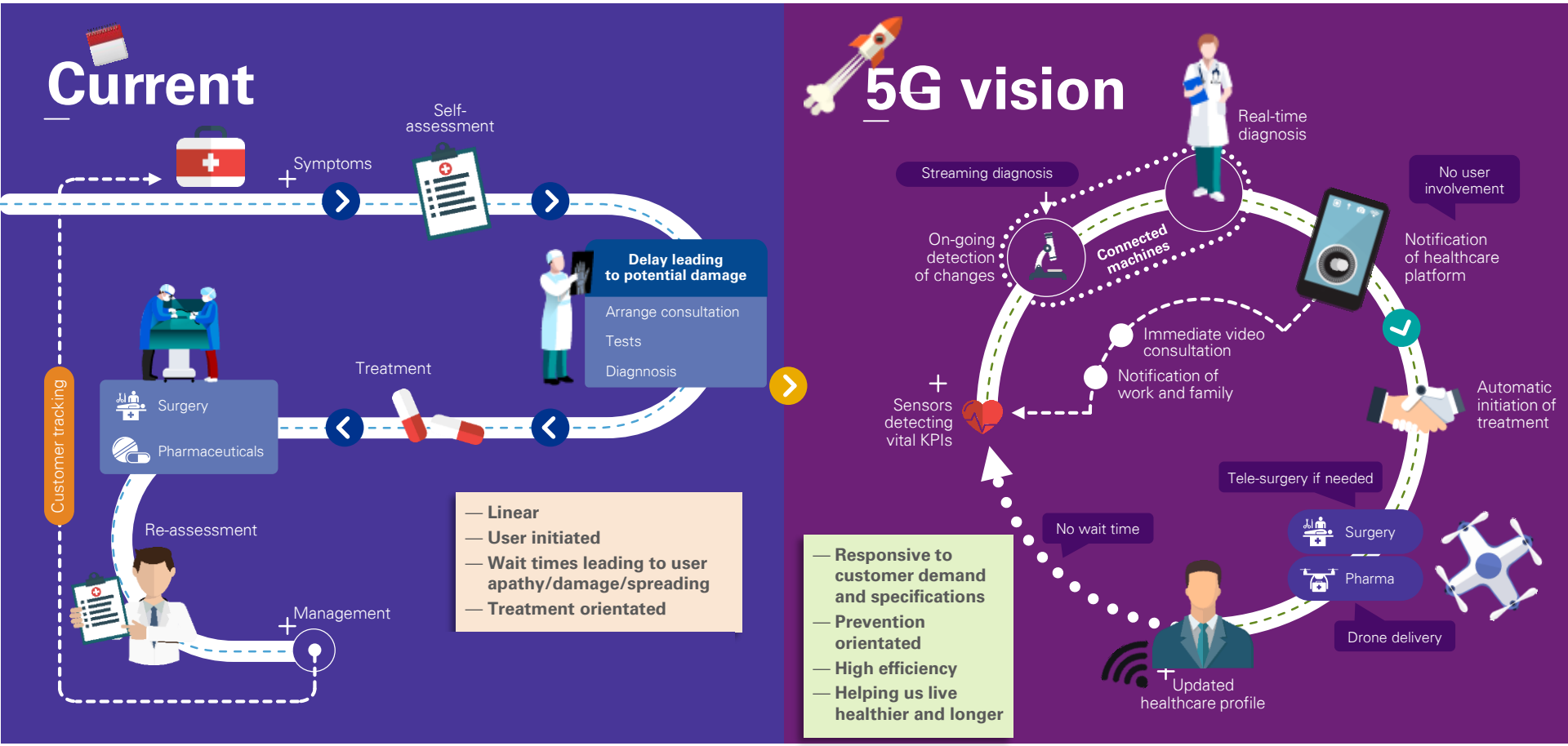
What advanced capabilities does 5G offer?

	5G Feature	Value
1	**Mobile broadband**	Very fast bandwidth up to 10 Gbps peak data rates
2	**Latency**	<1ms to support instantaneous instructions
3	**Mobility**	Untethered communications for people and mobile devices
4	**Sensors and Machine Comms**	Support up to 1M simultaneous device connections in a 0.5 mile radius.
5	**Battery Life**	Enhanced battery life up to 10 years
6	**mMIMO**	Advanced antennae for connection speed and spectrum efficiency
7	**Edge Computing**	Increased computing power closer to the end user
8	**Network Slicing**	Divide the network into configurable slices
9	**Network Security**	Security wrapper around all services

Benefits			
Productivity	**Innovation**	**Control**	**Efficiency**

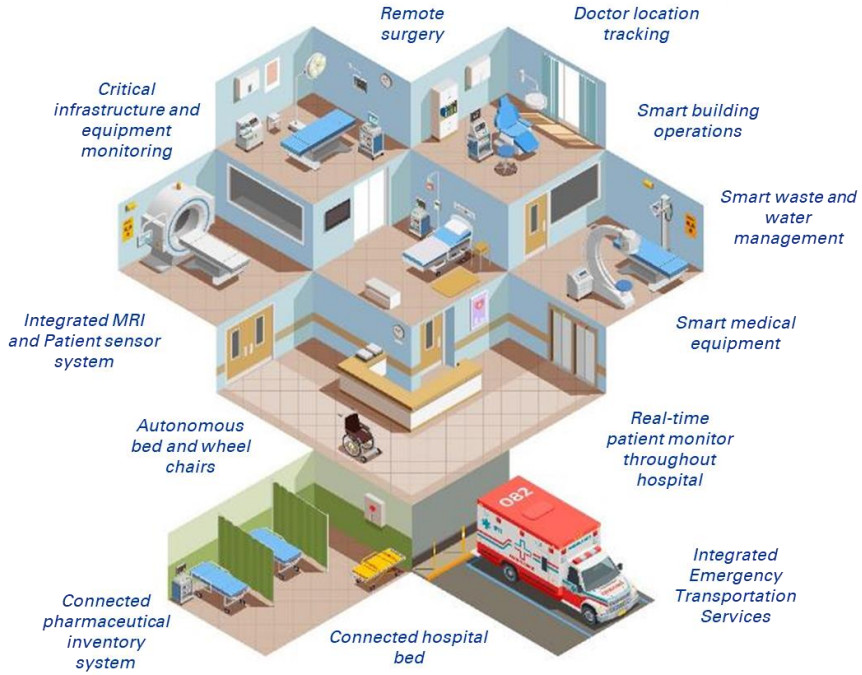
What does “5G enabled healthcare” look like?

Depicted in the graphic below is a sample patient journey that 5G can enable in the healthcare setting:



5G enabled smart hospital campus

- Better patient experience before arriving at the hospital using smart applications and patient portals to interact with the all aspects of the hospital.
- Hospital's continue to grow and are more commonly becoming campuses that required secure and reliable communication solutions for effective patient care and hospital operations.
- A well-integrated Electronic Medical Record (EMR) connected to medical devices and investigation equipment will make patient data accessible anytime and anywhere.
- Smart Hospitals will emerge as critical infrastructure for cities as populations continue to grow and the demand efficient patient care becomes an expectation.
- Secure and resilient 5G capabilities will be a critical requirement for enabling the Smart Hospital Campus.



Automated guided vehicles (AGVs)

What is the technology?

An intelligent system using small battery powered robotic carts to organize and manage the delivery of hospital supplies, including linens, food trays, pharmaceuticals, supplies, & medical waste and trash, etc. Using the AGV system interface, hospital staff are able to select the destination for delivery and track the cart in real-time. AGV systems can be easily integrated as they use existing hospital carts.

Why is this important to SNH?

SNH can utilize AGVs to streamline operations and maintain continuous flow and productivity of both hospital staff and delivery of patient services.

Who is adopting this technology?

- **Humber River Hospital, Ontario:** AGV/AC systems use self-guided carts to transport non-narcotic medication from the pharmacy department, food, supplies, and linens. These robots can also call elevators & open doors.
- **The New Royal Adelaide Hospital, Australia:** Has the largest hospital AGV fleet in Australia and New Zealand with 25 AGVs . As a result of implementing AGVs, the hospital has experienced greater efficiency & traceability of supplies and equipment , increased safety, reduced costs, less damage to hospital equipment, and reallocation of time to direct patient care.

Reference(s):

- https://www.agvsystems.com/wp-content/uploads/2012/10/AGV_hospital_br.pdf
- https://www.hrhfoundation.ca/blog/automated-guided-vehicles-at-humber-river-hospital/
- https://www.cbc.ca/news/health/is-this-the-future-of-hospitals-in-canada-1.1393280
- http://www.roboticautomation.com.au/case-studies/hospital-pharmacy/agv-deliveries-tending-hospital

Autonomous mobile security robots

What is the technology?

A surveillance machine that combines artificial intelligence, robotic technology, and security technology. These machines are battery-powered and are equipped with multiple high-definition cameras (including license plate and facial recognition cameras), microphones, GPS, and weather & temperature sensors to maintain areas secure and safe. These machines are also based on a wireless platform that allow for real-time communication with other security robots and remote security teams.

Why is this important to SNH?

Mobile Security robots are a cost effective addition to existing human security teams, such that robots can provide 24/7 surveillance without the need to take breaks and/or get distracted.

Who is adopting this technology?

- **Golden 1 Center Arena, California:** An indoor arena located in downtown Sacramento that hosts various sporting events, concerts, and conventions. In 2016, the Knightscope K3 (security robot) was implemented to support the security team by roaming around the arena ensuring that the building is safe and secure for everyone. The robot uses its 30 sensors, including 5 cameras to monitor and identify anything unsafe and notify the security team at the Golden 1 Center Arena.
- **Shenzhen Airport, China:** The 5-foot-tall robot in China's airport was implemented in 2017 to monitor the departures terminal. The robot is able to take pictures of people's faces and send them to airport security teams for further analysis.

Reference(s):

- https://www.golden1center.com/news/detail/knightscope-k3
- https://www.mcclatchydc.com/news/nation-world/national/article181343981.html
- https://www.npr.org/2017/02/26/517336420/new-robot-patrols-chinese-airport
- https://www.tssbulletproof.com/blog/%E2%80%8Bautonomous-security-robots-monitoring-safety/
- https://www.technologyreview.com/s/532431/rise-of-the-robot-security-guards/

Smart waste management systems

What is the technology?

A cloud-based platform that integrates waste bins equipped with wireless sensors that automatically notify collection teams in real-time when waste bins are full and ready for pick up. This intelligent system has been known to improve sanitation in various environments, provide wider Wi-Fi coverage as smart waste bins can act as Wi-Fi hotspots, and optimize the planning for waste collection by collecting and analyzing volume capacities of bins.

Why is this important to SNH?

This system can help keep the SNH environment clean and safe for patients, staff, and visitors. It can also improve experiences at SNH by providing free Wi-Fi hotspots. This system also has the potential to cut operational costs by reducing resource requirements in the waste collection process, and provide opportunities to generate extra revenue from advertisements on smart bins.

Who is adopting this technology?

- **New York City's Times Square, New York:** Installed close to 200 solar-powered "smart" bins in the heart of the city. The smart bins are equipped with "fill-level" sensors and a compactor that sense capacity levels and push garbage down. Sensors also send real-time notifications to collection teams (via email) informing them on the level of "fullness" of the bins, when they will be ready for emptying, and when bins smell. Since the installation, collection teams spend 50% less time in collecting bins as time is not spent collecting partially filled bins. The smart bins also act as free Wi-Fi hotspots for pedestrians and are paid by advertising revenue (i.e., company advertisements displayed on smart bins).

Reference(s):

- https://www.digitaltrends.com/cool-tech/bigbelly-new-york-city-trash-cans-wi-fi-hotspots/
- http://info.bigbelly.com/case-study/times-square-new-york-city?hsCtaTracking=d54600cd-ac5b-49cb-996b-acebd11f61b8%7C788204a1-59ff-44a8-b8e2-cf81267b9e62
- http://bigbelly.com/platform/
- https://hub.beesmart.city/solutions/en/smart-environment/smart-waste-management-solutions-in-smart-cities
- https://www.rfwireless-world.com/Terminology/Advantages-and-Disadvantages-of-Smart-Waste-Management-System.html

Smart building management systems (BMS)

What is the technology?

A computer-based control system that monitors various building services in real-time using a connected network of sensors, meters, appliances, and other gadgets that are able to collect and send information. These building services can include management of lighting, heating, cooling, security, & equipment maintenance. With generation of rich data and advanced analytics, smart BMSs allow organizations to understand if the building is operating as efficiently as possible and enable people to personalize their experiences within the building.

Why is this important to SNH?

An opportunity for SNH to have immediate and direct control over their facility maintenance costs and to create an environment that personalizes patient, staff, and visitor experiences.

Who is adopting this technology?

- **The Edge Building, Netherlands:** Known as the "smartest building in the world", the building connects with its employees using a mobile app to optimize employee efficiency, productivity, and comfort. In addition to the app directing employees to a parking spot upon arrival, the app also knows employee preferences for light and temperature and will make adjustments to their environments to accommodate these preferences.
- **Siemens City Building, Austria:** Implemented the "Siemens building management system" that connects 10,000 sensors located throughout the building which enable control over lighting, room temperature and ventilation. For example, when sensors in an office signal that all staff have left, the heating and lighting systems in the office are automatically shut down.

Reference(s):

- https://www.buildings.com/news/industry-news/articleid/21603/title/iot-smart-building-technology
- https://www.enocean.com/fileadmin/redaktion/pdf/perpetuum/en_2017_02/index.html#6
- http://advancedcontrolcorp.com/blog/2016/11/smart-building-management-systems-south-florida/
- http://hospital-tech.com/solutions/hospital-building-management-system-bms/
- https://www.fromthegrapevine.com/innovation/smart-buildings-from-around-the-world *(refer to for more examples of smart buildings)*
- https://www.comfyapp.com/blog/top-8-smart-buildings-from-around-the-world/ *(refer to for more examples of smart buildings)*
- https://www.greenbiz.com/article/10-companies-moving-smart-buildings *(refer to for examples of companies involved with "smart building" development)*

Real time location services (RTLS)

What is the technology?

RTLS is an intelligent system that combines both hardware and software to track in real-time hospital assets (i.e., medical equipment, supplies, staff, etc.). The hardware used as part of this system can be either carried or worn by staff and/or installed or attached to equipment.

Why is this important to SNH?

SNH can further utilize their RTLS system by fully integrating it into the hospital systems and using all available functions to provide staff with complete visibility of day-to-day activities within the hospital. This can support the planning for seamless patient flow (i.e., logical sequencing of patient flow with minimal barriers).

Who is adopting this technology?

- **John Hopkins Hospital (JHH), Maryland:** Adopted a RTLS system to track equipment in the hospital and ensure optimal levels of in certain areas in the hospital (e.g. wheelchairs). JHH fully integrated the RTLS system to activate more functionalities including, automation of food delivery process, tracking of nurses, and real-time metrics on patient & staff activities and equipment use.
- **Humber River Hospital, Ontario:** Integrated a RTLS system for real-time emergency department patient flow management across multiple locations (i.e., Weston & Downsview Ontario).

Reference(s):

- https://www.medicaleconomics.com/practice-management/5-ways-improve-patient-flow
- https://www.theverge.com/2019/2/25/18239860/microsoft-kinect-azure-dk-hands-on-mwc-2019
- https://www.centrak.com/products/real-time-location-services/
- http://www.engaugeinc.net/life-and-fire-safety-blog/what-is-rtls-real-time-locating-systems-defined
- https://www.healthitoutcomes.com/doc/humber-selects-rtls-from-versus-for-improved-0001
- https://www.iotforall.com/real-time-location-systems-rtls-hospitals/
- https://www.airfinder.com/hospital-rtls
- http://www.versustech.com/pdf/SS%20130128%20Johns%20Hopkins%20Hospital.pdf

Part 2: Analysis

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H) Functional Program analysis

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Functional Program analysis

The Functional Program (Section H) analysis encompassed a detailed review of the 36 programs/services identified for the new SNH in the Capital Project Stage 2 submission to the MOH in March 2019. Observations regarding the analysis have been summarized in the points below:

Critical ICAT components are absent: Although ICAT areas of priority development are defined in ICT (Section 25) portion of the Functional Program, these ICAT areas are not consistently tied back to any of the programs or services described throughout the document. Individual programs and services are described in detail with information regarding their high level workflow, projected staffing and workload volumes and spatial considerations. However, there is missing information around how the future of these workflows may be impacted by ICAT solutions.

ICAT will be a prevalent enabler to all of the programs and services at the new SNH. The analysis in this report will help NH work towards understanding the types of workflows and processes that ICAT may enable at the new SNH.

An overarching vision for the SNH redevelopment is missing: A strategic narrative for the SNH redevelopment will be critical for future planning activities and decision making. The ICAT design elements should influence the overall SNH redevelopment vision given the increasing importance of ICAT as an enabler for enhancing the patient experience and enabling care delivery.

Program specific ICAT considerations

To articulate how ICAT will enable the 1) front, 2) middle 3) back office functions and of SNH, the following section identifies ICAT considerations across all 36 program/service areas (see next slide) identified in the stage 2 Functional Program.

The program/service areas have been organized into the four major categories as defined in the stage 2 Functional Program. Each section representing the four categories are colour-coded in this report:

Ambulatory care Services

In-Patient Services

Clinical, Diagnostic and Therapeutic Services

Support & Administrative Services

These program specific ICAT considerations account for program specific workflows or processes that may be uniquely enabled by ICAT solutions. The ICAT considerations were developed from the following inputs:

- *Jurisdictional scan of smart hospitals*
- *Emerging technology trends*
- *Stakeholder interviews*
- *Lessons learned from peer organizations*

In addition, detailed case studies have been created for each of the four category areas to illustrate the following:

- The sequence of steps in the conceptual patient journey between programs and services at the future SNH
- How ICAT will enable the workflows and processes in this journey
- The impact of these conceptual workflows on clinical design efficiencies and facility spatial choices

ICAT Considerations: Summary

Indicates ICAT consideration

Identified in the table below is a summary of the most common ICAT considerations across the 36 SNH programs/services highlighted in Section H – Functional Program Analysis of this report. The table does not reflect the comprehensive list of all ICAT considerations.

	1A. Amb .Care: Clinics	1B. Amb. Care: APU	2. Hemodialysis Unit	3. MH&A Amb. Serv.	4. Chronic Disease Mgt.	5. Pre-surgical Clinic	6. Seniors' Wellness	7. Complex Care IP	8. Critical Care Unit	9. Med/Surg. IP Units	10. Cardio-Resp. DI	11. DI	12. Emergency	13. Laboratory	14. Pharmacy	15. Resp. Therapy	16. Surgical Services	17. Admin. Services	18. Biomed. Eng.	19. Clinical Supp. Ser.	20. Eng. Services	21. Env. Services	22. Foundation	23. HIM	24. Human Resources	25. ICT	26. Interprofess. Edu.	27. Logistics	28. MDR	29. Med. Staff Facilities	30. Nutrition and Food	31. Parking & Security	32. Planning & Dev.	33. Public Areas	34. Registration	35. Spiritual Care	36. Volunteer/Aux. Ser.
5G	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■																		
ADCs	■	■	■	■		■		■	■	■			■		■		■																				
AGVs	■	■	■			■		■	■	■			■	■			■											■	■								
AR/VR			■	■				■	■	■																	■										
Barcode Tech./Biometric	■	■	■	■		■		■	■	■	■	■	■	■	■	■	■															■			■		
Collab./Hotelling																		■		■				■	■	■				■			■				■
Integrated HIS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■					■					■		■				■	
Navigator App	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■										■				■			■	■		
RTLS/RFID	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■		■									■	■								
Self-service Kiosks	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■										■											
Smart Glass								■	■	■			■																					■	■			
Smart HVAC	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■																				
Smart Lights	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Smart Security	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■															■					
Speech Recognition	■	■	■	■	■	■					■	■	■	■	■	■																					
Touchscreen Monitors	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■																				
Wearables	■	■			■																																

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Ambulatory Care Services

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Ambulatory Care Services Overview

ICAT Vision: ICAT will help to expedite and enhance the patient experience across the various ambulatory care programs at the SNH. Patients will gain access to valuable information that allows them to plan and prepare for their ambulatory visits from their homes before stepping into the hospital.

Sampling of Expected Outcomes:

- Patients will be able to manage their appointments in advance on their mobile devices. They will also be able to prepare for their appointments by accessing online education material.
- Patients will be able to take a virtual tour of the hospital
- Patients will be prompted with smartphone or email reminders to ensure they are made aware of their scheduled appointment. This will help to reduce the number of “no shows”.

Case Study Description: A detailed case study for a hemodialysis outpatient clinic is described on subsequent slides to depict the conceptual future state of ambulatory outpatient workflows at SNH. Highlighted in the case study are the efficiency and spatial optimizers that will help to improve upon the current state enabled by ICAT solutions.

ICAT Case Study: *Ambulatory Care Services*

Efficiency optimizer
Spatial optimizer
Transformational opportunity

Hemodialysis outpatient workflow

Step 1: eReferral, self-scheduling, & online consultations

1.1 A patient visits the pre-dialysis team at the St. Catharine's site (SCS). One of the nurses on the team explains to the patient that they will be receiving dialysis treatment at the South Niagara Hospital (SNH). However, before the patient can receive dialysis treatment, they must first schedule a consultation with the dialysis team at the SNH.

1.2 The nurse uses their tablet to search for the next available consultation appointment at the SNH. The nurse confirms a date/time that works best for the patient and books the consultation. Once the patient has their consultation with the dialysis team at the SNH, the patient will be able to schedule dialysis treatment sessions on their own and have the option to reserve a preferred treatment pod in the unit.

1.3 The nurse informs the patient that the consultation has been booked and that it could be held either in-person at SNH or online via the Niagara Health Navigator App.

1.4 After the consultation is booked, the nurse uses their tablet to send all of the required electronic forms to the patient, which need to be completed and sent to the dialysis team at the SNH prior to their consultation. The patient is able to access these forms in the Niagara Health Navigator App.

1.8 The patient sent all of the required documentation electronically to the dialysis team at the SNH. They have also decided to conduct their consultation appointment online.

1.7 The patient decides to complete the pre-consultation electronic forms at home. The forms will be sent directly to the dialysis team at the SNH, when completed through the Navigator App .

1.6 The dialysis team members at the SNH, receives the notification and plan to meet to discuss a plan for the patient's consultation appointment. The team visits a workstation, in the hemodialysis unit, to access the patient's electronic medical record.

1.5 In the hemodialysis unit at the SNH, the flow coordinator receives a notification at the command centre, that a patient from the SCS has booked a dialysis consultation. The flow coordinator approves the request and extends the notification to the dialysis team members who are scheduled to work that day.

In future instances, consider delivering hemodialysis treatment at home, where supplies could be delivered to a patient's home by drones and nurses could virtually support patients using online platforms.

A Optimize staff productivity and streamline operations by enabling full visibility into respective systems.

B Save wasted time and hospital resources by providing patients with the option for online appointments/consultations.

C Save wasted time by reducing the number of manual processes, including filling out paper requisitions and faxing orders to hospitals.

D Optimize staff productivity and streamline operations in the region by connecting systems and services between hospitals.

Integrated enabling technologies:
- eReferral platform
- Niagara Health Navigator App
- Online cloud-based fully integrated HIS

ICAT Case Study: *Ambulatory Care Services*

Efficiency optimizer
Spatial optimizer
Transformational opportunity

Hemodialysis outpatient workflow

Step 2: Self-check in registration

2.1. The patient had their consultation appointment online and has scheduled their first dialysis treatment session at the SNH.

2.2. Upon arrival the patient has the option to check-in to their appointment using the Niagara Health Navigator App. The patient is also able to use this app to navigate their way from their current location to the closest entrance at the SNH. They are also prompted a message about whether they would like to reserve a parking space, a locker to store their personal belongings during treatment, and if they require any mobility aids (e.g. wheelchair) prior to their arrival.

2.3. Once the patient enters the SNH, they proceed to a registration kiosk in the main lobby. The patient could also use the mobile app's wayfinding capabilities for turn-by-turn directions to an available kiosk.

2.4 At the kiosk, the patient scans their unique patient identification barcode via the Navigator App. The kiosk automatically pulls up their information and asks the patient to scan a government issued photo ID (e.g. passport or a driver's license) to validate their identity. This process will only happen if it is the patient's first time visiting the SNH. If the patient has visited the hospital before (given they have validated their identify) the patient would only need to scan their patient identification barcode, which is accessed from the "digital wallet" of the Navigator App.

In future instances, kiosks could use biometric technology (e.g. retinal scans, fingerprint scans, or facial scans etc.) to validate patient identification.

2.7 When the patient arrives at the hemodialysis unit, a message is sent to their phone via the Niagara Health Navigation App, reminding them of the treatment pod they had previously reserved. As the patient walks into the treatment area, the smart technology in the room recognizes the patient and lights up the reserved pod. The patient takes a seat.

2.6 After the check-in process is complete, an automatic message is also sent to the dialysis team on hemodialysis unit. The dialysis team is able to track in real-time the location of the patient as they arrive in the unit for their scheduled appointment .

2.5. Once the patient has validated their identify, a patient identification wristband is provided to the patient with an embedded RFID chip. The check-in process is complete and a message is sent to the patient's mobile phone via the Niagara Health Navigator App directing them to the hemodialysis unit for treatment.

In future instances, consider enabling direct access to transportation services from the Niagara Health Navigator App. For example, a patient could use the Navigator App to request a taxi to drive them to the SNH for an appointment.

In future instances, outpatients may no longer need patient identification wristbands but could use their mobile phones to "tap" on electronic readers throughout the hospital to identify themselves and be tracked .

A Save wasted time completing administrative tasks when a patient arrives at the hospital.

B Reduce registration desk area by implementing kiosks in the main lobby of the hospital. Saved space could be used for larger and more comfortable patient waiting areas.

C Save wasted time searching for available parking and correct entrances at the hospital.

D Save wasted time having patients get lost looking for their destination within the hospital.

E Save wasted time directing patients to various areas in the hospital.

Integrated enabling technologies:

- 5G Network
- Adjustable touchscreen monitors as a command centre and staff workstations
- Hospital mobile devices
- Niagara Health Navigator App
- Online cloud-based fully integrated HIS
- RTLS & RFID technology
- Self-service Kiosks
- Smart digital lockers
- Smart lighting system

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ICAT Case Study: *Ambulatory Care Services*

Efficiency optimizer
Spatial optimizer

Hemodialysis outpatient workflow

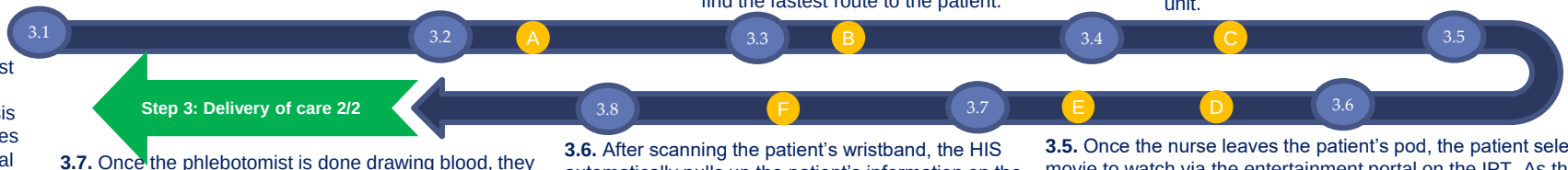
Step 3: Delivery of care 1/2

3.1. As the patient sits in the pod chair (i.e., the treatment chair), sensors around the chair identify the patient, from the RFID embedded wristband, which automatically displays a personal greeting on the integrated pod terminal (IPT).

3.2. While the dialysis team is preparing the patient for their treatment, the patient uses their RFID wristband to log onto the IPT. Meanwhile, the physician on the dialysis team orders routine pre and post-dialysis blood tests via CPOE, using their hospital mobile device.

3.3. Once the lab tests have been ordered, the system allocates and notifies an available phlebotomist near the hemodialysis unit. The phlebotomist receives the notification and proceeds to visit the patient with their supply-filled carts, to draw their blood. The phlebotomist can use the wayfinding feature on their hospital mobile device to find the fastest route to the patient.

3.4. While the phlebotomist is on their way, the nurse on the dialysis team provides the patient with a vital sign tracker, which is warn on the patient's wrist. This tracker wirelessly tracks the patient's vital signs and electronically sends the information to mobile devices of respective staff and CCs (command centres) in the hemodialysis unit.



3.5. Once the nurse leaves the patient's pod, the patient selects a movie to watch via the entertainment portal on the IPT. As the patient watches the movie, the phlebotomist arrives. The phlebotomist introduces themselves to the patient and scans their RFID embedded wristband using their hospital mobile device. Once the patient's wristband is scanned, the phlebotomist's "status" changes to "Unavailable – bloodwork" on the online phlebotomy staff platform to route other pending lab orders to only available phlebotomists.

3.6. After scanning the patient's wristband, the HIS automatically pulls up the patient's information on the phlebotomist's hospital mobile device and prints the patient's labels on the mobile label printer, which is on the phlebotomists cart. As the phlebotomist prepares the sample tubes for the pre-dialysis blood test, the pod chair (i.e., the chair the patient is sitting on) weighs the patient and automatically updates the information in the patient's electronic medical record.

3.7. Once the phlebotomist is done drawing blood, they package the sample tubes into a sealed capsule and send it to the laboratory department for testing via pneumatic tubing system. The phlebotomist then completes the patient's order in the system using their hospital mobile device. This automatically updates the phlebotomist's status to "Available". Once the phlebotomist's status changes, the system automatically assigns another patient to them.

3.8. The phlebotomist leaves the hemodialysis unit and uses their hospital mobile device to navigate their way to the next patient.

- A Save wasted time by reducing the number of manual processes, including filling out paper requisitions and faxing orders to hospitals.
- B Streamline care by integrating services to strategically utilize available resources (e.g. phlebotomists).
- C Save time having to travel to patient rooms to monitor and check patient vitals.
- D Save wasted time doing administrative tasks by integrating barcode & RFID technology (i.e., enabling quick patient registration).
- E Improve efficiency of staff workflows by reducing the number of steps required to perform and complete tasks (e.g. using mobile label printers on phlebotomist's carts instead of stationary printers).
- F Improve efficiency of staff workflows by utilizing pneumatic tubing systems to transport products throughout the hospital.

Integrated enabling technologies:
- 5G Network
- Adjustable large touchscreen monitors as workstations
- Barcode technology
- Integrated digital nurse call systems
- Smart laboratory management systems
- Integrated bedside (or pod) terminals
- Online cloud-based fully integrated HIS
- RTLS & RFID Technology
- Smart medical devices for real-time monitoring of vitals

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ICAT Case Study: *Ambulatory Care Services*

Efficiency optimizer
Spatial optimizer

Hemodialysis outpatient workflow

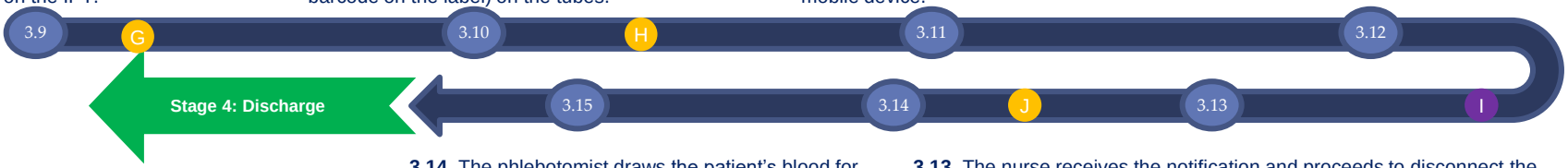
Step 3: Delivery of care 2/2

3.9. Once the phlebotomist completes the patient's order (for bloodwork) in the system, a notification is automatically sent to the dialysis nurse. The dialysis nurse receives the notification and proceeds to connect the patient to the dialysis machine. The patient selects and watches a movie on the IPT.

3.10. The laboratory department receives the capsule with the patient's bloodwork. A staff member in the department empties the capsule and places the filled sample tubes onto the conveyer belt, where the tubes will be sent through various machines for testing. The automated process begins by scanning the unique patient identification label (i.e., the barcode on the label) on the tubes.

3.11. As the patient continues to watch their movie, the automated laboratory system has tested the patient's blood sample. The results are automatically updated in the patient's EMR and a notification is sent to the physician's hospital mobile device.

3.12. The central CC (command centre) in the hemodialysis unit displays in real-time the status of all treatment sessions (e.g. when a treatment starts and ends) in the unit. When a patient's treatment session is complete, a notification is automatically sent to the closest available phlebotomist and the dialysis nurse.



3.15. The physician receives the notification on their hospital mobile device. The physician uses the wayfinding application on their device to locate the patient, who is sitting in one of the private rooms in the hemodialysis unit. .

3.14. The phlebotomist draws the patient's blood for the post-dialysis blood test. The blood samples are then sent to the laboratory department for testing via pneumatic tubing system. Once the blood samples have been tested, the results are automatically updated in the patient's EMR, which trigger a notification to the patient's physician.

3.13. The nurse receives the notification and proceeds to disconnect the patient from the dialysis machine. The nurse then "completes" the patient's treatment session in the system, which automatically notifies environmental services to clean the treatment pod for the next incoming patient. In the meantime, a phlebotomist has arrived in the hemodialysis unit to take the patient's blood for post-dialysis tests. The patient's post-dialysis weight is also automatically measured, by the pod chair, and updated in the patient's EMR. The patient is moved to a private room.

Note: Staff workstations are touchscreen monitors installed on walls throughout the Hemodialysis unit. Staff could also use their hospital mobile devices to access or update patient information.

G Save wasted time waiting for staff to check on pending orders and results by enabling real-time notifications to hospital mobile devices.

H Save wasted time and improve efficiency of workflows by automating manual processes (e.g. automated laboratory processes)

I Minimize space needed for "WOWs" (workstations on wheels) by hanging adjustable touchscreen monitors on walls.

J Streamline patient workflows by fully integrating services onto one platform.

Integrated enabling technologies:
- 5G Network
- Adjustable large touchscreen monitors as workstations
- Barcode technology
- Integrated bedside (or pod) terminals
- Integrated digital nurse call systems
- Online cloud-based fully integrated HIS
- RTLS & RFID Technology
- Smart laboratory management systems
- Smart medical devices for real-time monitoring of vitals

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ICAT Case Study: *Ambulatory Care Services*

Hemodialysis outpatient workflow

- Efficiency optimizer
- Spatial optimizer
- Transformational opportunity

Step 4: Discharge

4.1. As the physician is conversing with the patient, the conversation is being recorded and automatically transcribed directly into the patient's record.

4.2. The physician has confirmed that the patient is stable and tells the patient that they are able to go home. The physician stops the recording and clicks on "close", which closes the patient's treatment session of the day. This automatically updates the patient's status, in the system, to "discharged".

4.3. This status change automatically sends a complete report of the patient's treatment session to their family physician and any authorized caregiver on file. Patient's caregivers are able to access this information from the caregiver portal in the Niagara Health Navigator App.

4.5. The patient uses the Niagara Hospital Navigator App to pay for parking and navigate their way to their parking spot.

4.4. If the patient is receiving a series of treatments, the system will automatically schedule the next treatment session and notify the patient via the patient portal in the Niagara Health Navigator App. The patient will have the option to confirm the pre-scheduled appointment or reschedule based on their availability. The patient decides to confirm the pre-scheduled appointment.

Note: After the patient left the hospital, they remembered that they had to pick up a couple of books from the library. Using the Niagara Health Navigator App, the patient reserves the books at the closest library. The patient is then able to use the app to navigate their way to the library. When the patient arrives at the library, they can immediately walk up to the "mobile orders" area and pick up their books.

A Save wasted time by reducing the number of manual processes (e.g. typing reports).

B Optimize staff productivity and streamline operations by enabling multi-notifications to respective services.

Integrated enabling technologies:
- 5G Network
- Adjustable large touchscreen monitors as workstations
- Barcode technology
- Integrated bedside (or pod) terminals
- Integrated digital nurse call systems
- Online cloud-based fully integrated HIS
- RTLS & RFID Technology
- Smart laboratory management systems
- Smart medical devices for real-time monitoring of vitals

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Program specific ICAT considerations

The subsequent section identifies ICAT considerations for each of the programs and services under “Ambulatory Care Services” as identified in NH’s stage 2 Functional Program.

These scope of programs included in this area are:

- *1A. Ambulatory Care: Clinics & Medical Day Care*
- *1B. Ambulatory Care: Ambulatory Procedures Unit*
- *2. Hemodialysis Unit*
- *3. Mental Health & Addictions Ambulatory Services*
- *4. Chronic Disease Management, including Outpatient Rehabilitation*
- *5. Pre-surgical Clinic, Orthopaedic/Fracture Clinic and Regional joint Assessment Program*
- *6. Seniors’ Wellness Services*

1. Ambulatory Care: Clinics, Medical Day Care, & Procedures Unit ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**ADCs (Automated dispensing cabinets)**	Front Office	Consider implementing ADCs in “staff only” areas throughout all ambulatory care units. ADCs would be stocked with the most commonly used medications at point of care, avoiding the need to order and wait for medications to be transported from the pharmacy and/or found in other units. ADCs and accompanying systems could also improve medication management across ambulatory care units by managing medication access and usage.
3	**Adjustable touchscreen monitors as CCs (command centres) and staff workstations**	Front Office	Consider installing adjustable large touchscreen monitors as both central CCs & staff workstations throughout ambulatory care units. Central CCs could be used as the primary hub for collaboration and communication in each unit. For example, the central CC in the procedures unit could offer bi-directional communication and full visibility of patient flow and tracking of procedures with the satellite MDR (medical device reprocessing) area (i.e., scope processing area) to inquire about equipment needed for scheduled procedures. Flow coordinators & staff in ambulatory care units could also use these monitors to continuously manage both patient and staff flow.
4	**AGVs & advanced pneumatic tubing system**	Back Office	Consider utilizing AGVs and expanding a hospital pneumatic tube system to ambulatory care units to support with the transportation of various products (e.g. specimens, medical and nursing supplies, linen, etc.). Both AGVs and pneumatic tubing systems could reduce staff requirement for transportation of products and increase delivery time of products.
5	**Barcode technology for patient valuables**	Front Office	Barcode technology could be used to label patient belonging bags. This technology could provide a more accurate and efficient way to match patients to their belongings when discharged and reduce the risk for misidentifying personal items.

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1. Ambulatory Care: Clinics, Medical Day Care, & Procedures Unit ICAT considerations

	ICAT consideration		Description
6	**CPOE enabled fully integrated HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. laboratory information system, radiology information system, surgical information system, portering system, etc.). A fully integrated modern HIS could support ambulatory clinics by enabling seamless access and sharing of patient health information among healthcare professionals within the hospital and in the Niagara region (e.g. patient medical history, previous medical imaging, etc.). Improving access to patient health information may attribute to quicker diagnoses and treatment plans for patients. Cloud-based online platforms, could further improve the efficiency and quality of care by enabling mobile access to information/tools with the use of mobile devices. Providing respective clinicians with a CPOE process, could also improve workflow efficiency by automating manual processes throughout ambulatory care units (e.g. filling out and faxing paper-based orders). It is also more likely for a modern HIS to expand its primary function, as a hospital system, to collect and display in real-time, patient information from wearable health/mobile devices. Thus, providing clinicians with the opportunity to remotely monitor a patient's condition (e.g. a patient uses their mobile device at home to upload pictures of the incision site after a minor procedure, which could automatically populate in the patient's EMR for the physician to assess).
7	**Drones**	Back Office	Consider implementing drones in areas providing ambulatory care services in the SNH. Drones could be used as an alternative method for transporting various products (e.g. medical supplies, meals, etc.) throughout the hospital.
8	**Electronic communication system**	Front Office	Consider implementing an electronic communication system to enable bi-direction communication throughout all ambulatory care units, including procedure rooms, exam rooms, observation rooms, hallways, and other areas providing relevant services. These systems could be integrated at central CCs and/or accessible via hospital mobile devices. Ambulatory care units could benefit from this system by speeding up the process to communicate with staff and service areas, thus streamlining operations and improving the efficiency of delivering care.

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1. Ambulatory Care: Clinics, Medical Day Care, & Procedures Unit ICAT considerations

	ICAT consideration		Description
9	**Gown dispenser**	Front Office	Consider installing a gown dispenser near self-service kiosks in the main lobby or near ambulatory care units that offer services that require patients to be in gowns. Gown dispensing machines could enable a more organized approach to managing gowns in the hospital. Patients could use their health cards or another specific patient identifier (possibly through the Niagara Health Navigator App) to sign out/return a gown. These dispensers could also save space, such that gowns will no longer need to be stored in departments/change rooms.
10	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to all staff in ambulatory care units. These mobile devices could be equipped with various 'apps' (e.g. Niagara Health Navigator app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, electronic assessment tools, etc.), which could help improve the efficiency of patient workflows and communication among staff. Mobile devices could also allow clinicians to conveniently share information with patients (e.g. procedure plans). Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.
11	**Niagara Health Navigator App (including a patient portal) & virtual technology**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for patients to independently manage their own care journey. Patients could use the app to reserve parking spots, "check-in/register" for their appointments prior to arriving at the hospital, schedule their own appointments, and navigate their way to and around the hospital. The app could also provide patients with access to educational materials and enable an online platform for virtual appointments (e.g. online follow-up appointments for patients who are part of the stroke prevention program).

1. Ambulatory Care: Clinics, Medical Day Care, & Procedures Unit ICAT considerations

	ICAT consideration		Description
12	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS throughout all ambulatory care units. A RTLS could be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment. This system could provide respective staff with a holistic view of patient and staff flow across all units. By providing this level of visibility, staff could instantaneously locate patients and colleagues, thus saving wasted time searching for either.
13	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to "check-in/register" for their appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks and could contribute to empowering patients, as patients would be able to independently manage their own care journey. To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.
14	**Smart digital lockers**	Front Office	Consider installing smart digital lockers for patients to store their valuables, instead of having to carry them. These lockers may put patients at ease, as they would know that their valuables are safely secured. Patients could rent these lockers upon arrival at the hospital, using either interact or a credit card. Patients could also use the Niagara Health Navigator App to reserve a locker before arriving at the hospital.
15	**Smart security system & touchless technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system in and around all ambulatory care units to monitor the environment 24/7 and provide highly secure and safe areas for both patients and staff. Smart security systems also could work with other smart technologies (e.g. biometric technology, RTLS & RFID embedded staff badges, facial recognition, etc.) to manage access to secure areas. Touchless technology could also enable easy maneuvering throughout the hemodialysis unit (e.g. if a patient's hands are full, if a surgeon is sterile and needs to either enter or leave a procedure room during an x-ray, etc.) and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.

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1. Ambulatory Care: Clinics, Medical Day Care, & Procedures Unit ICAT considerations

	ICAT consideration		Description
16	**Smart HVAC system & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout all ambulatory care units to create a more personalized environment for both patients and staff.
17	**Smart lighting system & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout all ambulatory care units to create a more inviting and personalized environment for patients and staff. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.
18	**Smart vending machines**	Front & Back Office	Consider implementing smart vending machines, which would be stocked with supplies for day-to-day tasks (e.g. gloves, needles, tubes, etc.), in areas that provide ambulatory care services. These smart vending machines could provide staff with a more unique and customizable experience when accessing supplies and could optimize inventory management by enabling real-time tracking of products and automatic replenishment notifications.
19	**Speech recognition technology**	Front Office & Enabler	Consider making speech recognition technology available to all clinicians, in ambulatory care units, who are required to document patient information. This technology could help improve the efficiency of workflows by automating documentation processes.
20	**Wearable health devices & "prescribed" mobile apps**	Front Office & Enabler	Consider implementing wearable health devices & mobile apps in patient care plans to support the continuity of care. The information generated from these health devices & mobile apps could allow clinicians to continuously monitor patients remotely without having to see them, thus eliminating the burden for patient's to travel to the hospital. For example, high risk stroke patients wearing health devices could be monitored and tracked by their healthcare team at the hospital.

2. Hemodialysis Unit ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**ADCs (Automated dispensing cabinets)**	Front Office	Consider implementing ADCs in "staff only" areas in the hemodialysis unit. ADCs would be stocked with medications required as part of dialysis sessions, avoiding the need to order and wait for medications to be transported from the pharmacy and/or found in other units. ADCs and accompanying systems could also improve medication management in the hemodialysis unit by tracking and controlling medication access and usage.
3	**Adjustable touchscreen monitors as CCs (command centres) and staff workstations**	Front Office	Consider installing adjustable large touchscreen monitors as both central CCs & staff workstations throughout the hemodialysis unit. Central CCs could be used as the primary hub for collaboration and communication in the unit and other relevant areas (e.g. hemodialysis unit at the St. Catharine's Site). Flow coordinators & staff in the hemodialysis unit could use these monitors to continuously track and manage both patient and staff flow. For example, the central CC in the hemodialysis unit could be used to track in real-time and display the progress of a patient's treatment session (e.g. how much long a patient has until their treatment is done).
4	**AGVs & advanced pneumatic tubing system**	Back Office	Consider utilizing AGVs and expanding a hospital pneumatic tubing system to the hemodialysis unit to support with the transportation of various products (e.g. specimens, medical and nursing supplies, linen, etc.). Both AGVs and pneumatic tubing systems could reduce staff requirement for transportation of products and increase delivery time of products.
5	**Barcode technology for patient valuables**	Front Office	Barcode technology could be used to label patient belonging bags. This technology could provide a more accurate and efficient way to match patients to their belongings when discharged and reduce the risk for misidentifying personal items.

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2. Hemodialysis Unit ICAT considerations

	ICAT consideration		Description
6	**CPOE enabled fully integrated HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. laboratory information systems with internal and external labs, radiology information system, surgical information system, portering system, etc.). A fully integrated modern HIS could support the hemodialysis unit by enabling seamless access and sharing of patient health information among healthcare professionals within the hospital and in the Niagara region (e.g. pre-dialysis team at the St. Catharine's site). Improving access to patient health information may attribute to quicker diagnoses and treatment plans for patients. Cloud-based online platforms, could further improve the efficiency and quality of care by enabling mobile access to information/tools with the use of mobile devices. Providing respective clinicians with a CPOE process, could also improve workflow efficiency by automating manual processes throughout the hemodialysis unit (e.g. filling out and faxing paper-based orders). It is also more likely for a modern HIS to expand its primary function, as a hospital system, to collect and store generated data from home dialysis units.
7	**Electronic communication system**	Front Office	Consider implementing an electronic communication system to enable bi-direction communication throughout the hemodialysis unit, including treatment pods, hallways, and other areas providing relevant services. These systems could be integrated at central CCs and/or accessible via hospital mobile devices. The hemodialysis unit could benefit from this system by speeding up the process to communicate with staff and service areas, thus streamlining operations and improving the efficiency of delivering care.

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2. Hemodialysis Unit ICAT considerations

	ICAT consideration		Description
8	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to all staff in the hemodialysis unit. These mobile devices could be equipped with various 'apps' (e.g. Niagara Health Navigator app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, etc.), which could help improve the efficiency of staff and patient workflows. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.
9	**Integrated "pod" terminals & video conferencing**	Front Office	Consider implementing integrated terminals for each treatment pod in the hemodialysis unit. Patients could use these terminals during their treatment session to access important information about their care (e.g. educational materials, treatment schedule, etc.), an entertainment portal to watch movies and/or TV shows during treatment, and access to communication platforms to enable bi-directional communication with staff and/or individuals outside of the hospital (e.g. a family member).

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2. Hemodialysis Unit ICAT considerations

	ICAT consideration		Description
10	**Niagara Health Navigator App (including a patient portal) & virtual technology**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for patients to independently manage their own care journey. Patients could use the app to reserve parking spots, "check-in/register" for their appointments prior to arriving at the hospital, schedule their own appointments, and navigate their way to and around the hospital. The App could also provide patients with access to educational materials and enable an online platform for virtual appointments (e.g. virtual hemodialysis treatment consultations). The App could also include applications that could help patients manage their health. For example, a medication management application could help patients keep track of their medications and provide healthcare teams with visibility to a patient's medication adherence. These applications could also be used to share information with community healthcare facilities, for example, a community pharmacy. Community pharmacies could take advantage of this visibility to know exactly when a patient would run out of medication, thus allowing pharmacists to prepare prescription refills in advance to avoid patients having to wait in long lineups at the pharmacy.
11	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS throughout the hemodialysis unit. A RTLS could be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment (e.g. code blue crash cart). This system could provide respective staff with a holistic view of patient and staff flow throughout the unit. By providing this level of visibility, staff could instantaneously locate patients and colleagues, thus saving wasted time searching for either.

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2. Hemodialysis Unit ICAT considerations

	ICAT consideration		Description
12	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH (and/or at the entrance of the hemodialysis unit), instead of building a large area for registration. Patients will be able to "check-in/register" for their appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks and could contribute to empowering patients, as patients would be able to independently manage their own care journey. To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.
13	**Smart digital lockers**	Front Office	Consider installing smart digital lockers for patients to store their valuables, instead of having to carry them. These lockers may put patients at ease, as they would know that their valuables are safely secured. Patients could rent these lockers upon arrival at the hospital, using either interact or a credit card. Patients could also use the Niagara Health Navigator App to reserve a locker before arriving at the hospital.
14	**Smart HVAC systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout the hemodialysis unit to create a more personalized environment for both patients and staff.
15	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the hemodialysis unit to create a more inviting and personalized environment for patients. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.

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2. Hemodialysis Unit ICAT considerations

	ICAT consideration		Description
16	**Smart medical devices (e.g. portable dialysis machines & wearable vitals tracker)**	Front Office & Enabler	Consider incorporating smart medical devices, like portable dialysis machines and wearable vital sign trackers, in patient workflows. Portable dialysis machines allow patients to receive dialysis treatment remotely in the comfort of their own homes. Thus, minimizing the burden of travelling to the hospital for treatment and freeing-up treatment capacity at the hospital. For patients who prefer to receive treatment at the hospital, wearable vital sign trackers could be warn on a patient's wrist to enable continuous real-time monitoring, without the need for multiple nurse visits and wired connections.
17	**Smart security systems & touchless technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system (e.g. remotely controlled motion detector cameras), throughout the hemodialysis unit to create a safer environment for both patients and staff. Touchless technology could also enable easy maneuvering throughout the hemodialysis unit (e.g. if a patient's hands are full) and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.
18	**Smart refrigeration system**	Back Office & Enabler	Consider installing a smart refrigeration system equipped with "smart refrigerators" to have full control and visibility of storage temperatures and medication inventory. This could help reduce the risk for spoiled and expired products by automating the management of "first in/first out" inventory.
19	**Smart scales**	Front Office & Enabler	Measuring and documenting a patient's weight is common practice in hemodialysis units to monitor and manage fluid volumes. Smart scales that are integrated with the HIS, could improve staff efficiency and save wasted time by reducing manual tasks involved with weighing a patient. For example, once a patient steps onto a smart scale the patient's weight could be automatically uploaded to the patient's medical record.

2. Hemodialysis Unit ICAT considerations

	ICAT consideration		Description
20	**Smart trash bins**	Back Office & Enabler	Consider including smart trash bins at each “treatment pod” in the hemodialysis unit. These bins could help create a clean and safe department for both patients and staff by eliminating overflowing of bins and removing foul smelling trash in a timely manner.
21	**Smart vending machines**	Front & Back Office	Consider implementing smart vending machines, which would be stocked with supplies for day-to-day tasks (e.g. gloves, needles, tubes, etc.), in the hemodialysis unit. These smart vending machines could provide staff with a more unique and customizable experience when accessing supplies and could optimize inventory management by enabling real-time tracking of products and automatic replenishment notifications.
22	**Smart water system** *(Building automation systems)*	Back Office & Enabler	Consider implementing a smart water system at the new SNH, as water is an essential component to many services provided (e.g. hemodialysis treatment). An IoT enabled water management system could improve the process of water maintenance at the SNH. With a smart water system, water quality could be measured more accurately and efficiently. Communication of water quality could also be improved by enabling real-time notifications.
23	**Speech recognition technology**	Front Office & Enabler	Consider making speech recognition technology available to all clinicians, in the hemodialysis unit, who are required to document patient information. This technology could help improve the efficiency of workflows by automating documentation processes.
24	**VR/AR technology**	Front Office & Enabler	Consider providing patients with access to virtual and/or augmented reality technology. These technologies could enhance patient care by enabling virtual experiences, which could help reduce a patient’s anxiety and stress.

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2. Hemodialysis Unit ICAT considerations

	ICAT consideration		Description
25	**Wireless vital signs monitoring system & nurse call system**	Front Office & Enabler	Consider implementing a wireless vital signs monitoring system in the hemodialysis unit. This system could monitor a patient's vital signs in real-time and provide continuous connections between patients and clinicians. This system could also be integrated with building automation systems to enhance the efficiency of workflows. For example, the system identifies a dangerous drop in a patent's vitals and initiates a code blue alert, which automatically notifies all code blue team members and holds elevator doors open on their respective floors.

3. Mental Health & Addictions Ambulatory Services ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**ADCs (Automated dispensing cabinets)**	Front Office	Consider implementing ADCs in "staff only" areas where mental health & addictions ambulatory care services are provided. For example, ADCs in the medication clinic. These ADCs could be stocked with medications for clients with psychiatric illnesses requiring anti-psychotic injections and clozapine management. ADCs and accompanying systems could also improve medication management by tracking and controlling medication access and usage.
3	**Adjustable touchscreen monitors as CCs (command centres) and staff workstations**	Front Office	Consider installing adjustable large touchscreen monitors as both central CCs & assigned staff workstations throughout areas where mental health & addictions ambulatory care services are provided. Central CCs could be used as the primary hub for collaboration and communication between all areas providing mental health and addictions ambulatory care services. Flow coordinators & staff could also use these monitors to continuously track and manage both patient and staff flow.
4	**Barcode technology for patient valuables**	Front Office	Barcode technology could be used to label patient belonging bags. This technology could provide a more accurate and efficient way to match patients to their belongings when discharged and reduce the risk for misidentifying personal items.
5	**CPOE enabled fully integrated HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. laboratory information systems, radiology information system, surgical information system, portering system, etc.). A fully integrated modern HIS could support areas providing mental health and addictions ambulatory care services by enabling seamless access and sharing of patient health information among various professionals within the hospital and in the Niagara region (e.g. community based referring physicians, teachers, librarians, etc.). Cloud-based online platforms, could further improve the efficiency and quality of care by enabling mobile access to information/tools with the use of mobile devices.

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3. Mental Health & Addictions Ambulatory Services ICAT considerations

	ICAT consideration		Description
6	**Drones**	Front Office	Consider implementing drones in areas providing mental health & addictions ambulatory services in the new SNH. Drones could be used as an alternative method for transporting various products (e.g. medical supplies, meals, etc.) throughout the hospital and to individuals who are unable to travel to the hospital.
7	**Electronic communication system**	Front Office	Consider implementing an electronic communication system to enable bi-directional communication between all areas that provide mental health and addictions ambulatory care services, including patient rooms, central areas, hallway, etc. This service could benefit from this system by speeding up the process to communicate with other staff and service areas.
8	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to all staff who provide mental health and addictions ambulatory care services. These mobile devices could be equipped with various 'apps' (e.g. Niagara Health Navigator app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, electronic assessment tools, etc.), which could help improve the efficiency of patient workflows and communication among staff. Mobile devices could also allow clinicians to conveniently share information with patients at point of care. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.
9	**Niagara Health Navigator App (including a patient portal) & virtual technology**	Back Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for patients to independently manage their own care journey. Patients could use the app to "check-in/register" for their appointments prior to arriving at the hospital, schedule their own appointments, and navigate their way to and around the hospital. The app could also offer patients and caregivers with 24/7 access to online support services (i.e., online one-on-one counselling, group counselling, etc.) and educational materials.

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3. Mental Health & Addictions Ambulatory Services ICAT considerations

	ICAT consideration		Description
10	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS throughout all areas where mental health and addictions ambulatory care services are provided. A RTLS can be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment. This system could provide respective staff with a holistic view of patient and staff flow in the hospital. By providing this level of visibility, staff could instantaneously locate patients and colleagues, thus saving wasted time searching for either.
11	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to “check-in/register” for their appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks and contribute to empowering patients, as patients could be able to independently manage their own care journey. Self-service kiosks could also be used as a primary channel for support services. For example, a patient suffering from a mental illness is having a hard time coping in the middle of the night. The patient could visit the SNH and immediately scan their health card on one of the self-service kiosks. This could trigger an automatic notification to the Mental Health & Addictions Team, who could enable the camera on the kiosk and interact with the patient in real-time. ‘ To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.
12	**Smart HVAC systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout all areas providing mental health & addictions ambulatory care services to create a more personalized environment for both patients and staff.

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3. Mental Health & Addictions Ambulatory Services ICAT considerations

	ICAT consideration		Description
13	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout areas in the hospital that provide mental health and addictions ambulatory care services to create a more personalized environment for patients and staff. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.
14	**Smart security systems, touchless technology, & security robots** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system and utilizing security robots in and around areas in the hospital that provide mental health and addictions ambulatory care services. These systems could monitor environments 24/7 and provide highly secure and safe areas for both patients and staff. To further enhance staff safety, consider integrating a panic alerting system, which is a wireless call function for help integrated in staff ID badges. Mobile security robots could also be implemented as an alternative to built in smart security systems. These robots are devices that could be put anywhere to enable continuous remote monitoring. Touchless technology could also enable easy maneuvering throughout areas providing mental health & addictions ambulatory services and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.
15	**Speech recognition technology**	Front Office & Enabler	Consider making speech recognition technology available to all clinicians, providing mental health and addictions ambulatory care services, who are required to document patient information. This technology could help improve the efficiency of workflows by automating documentation processes.
16	**VR/AR technology**	Front Office & Enabler	Consider providing patients with access to virtual and/or augmented reality technology. These technologies could enhance patient care by enabling virtual experiences (e.g. a quiet space/room) which could help reduce a patient's anxiety and stress.

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4. Chronic Disease Management (including Outpatient Rehabilitation) ICAT considerations

	ICAT consideration		Description
1	**CPOE enabled fully integrated HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. laboratory information systems, radiology information system, surgical information system, portering system, etc.). A fully integrated modern HIS could support the chronic disease management program by allowing all clinicians providing single disciplinary outpatient services, including physiotherapy, occupational therapy, speech language pathology services, with a single platform to optimize communication and knowledge sharing of patient information. Enabling seamless access to patient health information among healthcare professionals within the hospital and in the Niagara region (e.g. community based partners) could attribute to quicker diagnoses and treatment plans for patients. Cloud-based online platforms, could further improve the efficiency and quality of care by enabling mobile access to information/tools with the use of mobile devices. It is also more likely for a modern HIS to expand its primary function, as a hospital system, to collect and store generated data from wearable health devices (e.g. smart watches) which could be used to help manage certain chronic diseases.
2	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to all staff providing services to manage chronic diseases. These mobile devices could be equipped with various ‘apps’ (e.g. Niagara Health Navigator app, instant messaging, a “scanner” app, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, electronic assessment tools, etc.), which could help improve the efficiency of both staff and patient workflows. Instead of providing staff with mobile devices, the SNH could also consider a “Bring Your Own Device (BYOD)” approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.

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4. Chronic Disease Management (including Outpatient Rehabilitation) ICAT considerations

	ICAT consideration		Description
3	**Niagara Health Navigator App (including a patient portal), virtual technology & chronic disease management apps**	Back Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for patients to independently manage their own care journey. Patients could use the app to reserve parking spots, "check-in/register" for their appointments, schedule their own appointments, rent or purchase mobility aids (e.g. crutches, heartrate monitors, etc.) to expedite discharge processes, and navigate their way to and around the hospital. The app could also provide patients with access to chronic disease management apps, which could help patients manage their illnesses outside of the hospital. The Niagara Health Navigator App, could also enable an online platform to offer patients with online educational courses and/or follow-up and exercise sessions.
4	**RTLS & RFID Technology**	Back Office & Enabler	Consider utilizing a RTLS in areas that offer chronic disease management services. A RTLS can be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment. This system could provide respective staff with a holistic view of patient and staff flow throughout the hospital. By providing this level of visibility, staff could instantaneously locate patients and colleagues, thus saving wasted time searching for either. This technology could also speed up patient identification processes prior to starting an appointment by "scanning" a patient's RFID embedded wristband.
5	**Self-service Kiosks & mobile service applications**	Front Office & Enabler	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to "check-in/register" for their appointments from the moment they step foot into the hospital, without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks. Self-service kiosks could also contribute to empowering patients, as patients could independently manage their own care journey. To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.

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4. Chronic Disease Management (including Outpatient Rehabilitation) ICAT considerations

	ICAT consideration		Description
6	**Smart HVAC systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout all areas in the hospital that offer chronic disease management services to create a more personalized environment for both patients and staff
7	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout areas in the hospital that offer chronic disease management services to create a more personalized environment for patients and staff. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.
8	**Speech recognition technology**	Front Office & Enabler	Consider making speech recognition technology available to all clinicians, providing chronic disease management services, who are required to document patient information. This technology could help improve the efficiency of workflows by automating documentation processes.
9	**VR/AR technology for rehabilitation**	Front Office & Enabler	Consider providing patients with access to virtual and/or augmented reality technology. These technologies could enhance patient care by enabling virtual experiences (e.g. walking in a forest) which could help motivate patients during rehabilitation sessions and reduce anxiety and stress levels.
10	**Wearable health devices & "prescribed" mobile apps**	Front Office & Enabler	Consider implementing wearable health devices & mobile apps in patient care plans to support the continuity of care. The information generated from these health devices & mobile apps could allow clinicians to continuously monitor patients remotely without having to see them, thus eliminating the burden for patient's to travel to the hospital.

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5. Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & Regional joint Assessment Program ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital. For example, with a faster downloading speed orthopedic surgeons could access imaging files quicker, thus improving the efficiency of patient workflows.
2	**ADCs (Automated dispensing cabinets)**	Front Office	Consider implementing ADCs in "staff only" areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program. ADCs would be stocked with commonly used medications at point of care, avoiding the need to order and wait for medications to be transported from the pharmacy and/or found in other units. ADCs and accompanying systems could also improve medication management in respective areas by tracking and controlling medication access and usage.
3	**Adjustable touchscreen monitors as CCs (command centres) and staff workstations**	Front Office	Consider installing adjustable large touchscreen monitors as both central CCs & staff workstations throughout areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program. Central CCs could be used as the primary hub for collaboration and communication in the unit and other relevant areas. Flow coordinators & staff could use these monitors to continuously track and manage both patient and staff flow.
4	**AGVs & advanced pneumatic tubing system**	Back Office	Consider utilizing AGVs and expanding a hospital pneumatic tubing system to areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program to support with the transportation of various products (e.g. specimens, medical and nursing supplies, linen, etc.) throughout the hospital. Both AGVs and pneumatic tubing systems could reduce staff requirement for transportation of products and increase delivery time of products.
5	**Barcode technology for patient valuables**	Front Office	Barcode technology could be used to label patient belonging bags. This technology could provide a more accurate and efficient way to match patients to their belongings when discharged and reduce the risk for misidentifying personal items.

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5. Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & Regional joint Assessment Program ICAT considerations

	ICAT consideration		Description
6	**CPOE enabled fully integrated HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. laboratory information systems, radiology information system, surgical information system, portering system, etc.). A fully integrated modern HIS could support the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program by enabling seamless access and sharing of patient health information among healthcare professionals within the hospital and in the Niagara region. Improving access to patient health information may attribute to quicker diagnoses and treatment plans for patients. Cloud-based online platforms, could further improve the efficiency and quality of care by enabling mobile access to information/tools with the use of mobile devices. Providing respective clinicians with a CPOE process, could also improve workflow efficiency by automating manual processes (e.g. filing out and faxing paper-based orders).
7	**Drones**	Back Office	Consider implementing drones in areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program in the new SNH. Drones could be used as an alternative method for transporting various products (e.g. medical supplies, meals, etc.) throughout the hospital and between other healthcare facilities in the Niagara region.
8	**Electronic communication system and video conferencing**	Front Office	Consider implementing an electronic communication system, including video-conferencing to enable bi-direction communication between all areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program, including treatment rooms, hallways, and other areas providing relevant services. These services could benefit from this system by speeding up the process to communicate with other staff and service areas. It could also enhance student/staff learning by enabling remote surgical training to view procedures from anywhere around the world.

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5. Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & Regional joint Assessment Program ICAT considerations

	ICAT consideration		Description
9	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to all staff providing services in the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program. These mobile devices could be equipped with various 'apps' (e.g. Niagara Health Navigator app, instant messaging, a "scanner" app, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, electronic assessment tools, etc.), which could help improve the efficiency of both staff and patient workflows. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.
10	**Niagara Health Navigator App (including a patient portal) & virtual technology**	Back Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for patients to independently manage their own care journey. Patients could use the app to reserve parking spots, "check-in/register" for their appointments, schedule their own appointments, rent or purchase mobility aids (e.g. crutches) to expedite discharge processes, and navigate their way to and around the hospital. The app could also provide patients with access to online counselling and assessments, educational materials for home care, and enable an online platform for online discharge follow up appointments.
11	**RTLS & RFID Technology**	Back Office & Enabler	Consider utilizing a RTLS in all areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program. A RTLS can be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment. This system could provide respective staff with a holistic view of patient and staff flow throughout the hospital. By providing this level of visibility, staff could instantaneously locate patients and colleagues, thus saving wasted time searching for either. This technology could also speed up patient identification processes prior to starting an appointment by "scanning" a patient's RFID embedded wristband.

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5. Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & Regional joint Assessment Program ICAT considerations

	ICAT consideration		Description
12	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to "check-in/register" for their appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks and could contribute to empowering patients, as patients would be able to independently manage their own care journey. To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.
13	**Smart HVAC system & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout all areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program, to create a more personalized environment for both patients and staff.
14	**Smart lighting system, sensors, & voice assisted technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout all areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program, to create a more personalized environment for patients and staff. A smart lighting system could also be integrated with voice assisted technology to allow patients and staff to use their voice to turn lights on and off, instead of walking to light switches. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.

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5. Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & Regional joint Assessment Program ICAT considerations

	ICAT consideration		Description
15	**Smart security system & touchless technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system in all areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program. These systems could monitor environments 24/7 and provide highly secure and safe areas for both patients and staff. Smart security systems could also work with other smart technologies (e.g. biometric technology, RTLS & RFID embedded staff badges, facial recognition, etc.) to manage access to secure areas. Touchless technology could also enable easy maneuvering throughout these areas (e.g. if surgeon is sterile during a procedure) and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.
16	**Smart vending machines**	Front & Back Office	Consider implementing smart vending machines, which would be stocked with supplies for day-to-day tasks (e.g. gloves, needles, tubes, etc.). These smart vending machines could provide staff with a more unique and customizable experience when accessing supplies and could optimize inventory management by enabling real-time tracking of products and automatic replenishment notifications.
17	**Speech recognition technology**	Front Office & Enabler	Consider making speech recognition technology available to all clinicians working in all areas providing the following ambulatory care services, Pre-surgical Clinic, Orthopaedic/Fracture Clinic, & the Regional joint Assessment Program, who are required to document patient information. This technology could help improve the efficiency of workflows by automating documentation processes.

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6. Seniors' Wellness Services ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**CPOE enabled fully integrated HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. laboratory information systems, pharmacy information system, radiology information system, surgical information system, portering system, etc.). A fully integrated modern HIS could support the Seniors' Wellness Team, including geriatricians, geriatric psychiatrists, nurse clinicians, occupational therapists, physiotherapists, speech-language pathologists, social workers, clinical nutritionists, pharmacists, and other health professionals with a single platform to optimize communication and knowledge sharing of patient information. Enabling seamless access to patient health information could also attribute to quicker diagnoses and treatment plans for patients and support a patient's continuity of care. Cloud-based online platforms could further improve the efficiency and quality of care by enabling mobile access to information/tools with the use of mobile devices. It is also more likely for a modern HIS to expand its primary function, as a hospital system, to collect and store generated data from wearable health devices (e.g. smart watches), which could be used to help manage an individuals' health outside of the hospital.
3	**Drones**	Back Office	Consider implementing drones in areas providing Seniors' Wellness services. Drones could be used as an alternative method for transporting various products (e.g. medical supplies, meals, etc.) throughout the hospital, between healthcare facilities in the Niagara region, and to individuals who are unable to travel to the hospital.
4	**Electronic communication system**	Front Office	Consider implementing an electronic communication system to enable bi-directional communication between all areas that provide Seniors' Wellness services, including patient rooms, exam rooms, central areas, hallway, etc. This service could benefit from this system by speeding up the process to communicate with other staff and service areas.

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6. Seniors' Wellness Services ICAT considerations

	ICAT consideration		Description
5	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to all staff who provide seniors' wellness services. These mobile devices could be equipped with various 'apps' (e.g. Niagara Health Navigator app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, electronic assessment tools, etc.), which could improve the efficiency of patient workflows and communication among staff. Mobile devices could also allow clinicians to conveniently share information with patients at point of care. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.
6	**Integrated bedside terminals (IBTs), large screen patient monitors, and tablets in areas for seniors**	Front Office	Consider implementing integrated bedside terminals for each inpatient. These terminals could help empower patients by allowing them to manage their own experiences in the hospital. Patients could use these terminals for various reason, including to access important information about their (e.g. view their care plan, schedule of appointments, etc.), choose and order meals, control lighting and temperatures in their room, watch movies and/or TV shows, communicate with hospital staff and the outside world, and virtually tour the hospital. For example, a patient could use the terminal to request for a nurse, video-chat with family/friends, and/or watch communal eating areas on the unit (if they are not well enough to join). Also consider providing tablets to outpatient seniors. These tablets could be programmed to function similarly to integrated bedside terminals.
7	**Niagara Health Navigator App (including a patient portal) & virtual technology for home care**	Back Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for patients to independently manage their own care journey. Patients could use the app to reserve parking spots, "check-in/register" for their appointments, schedule their own appointments, rent or purchase mobility aids (e.g. crutches), and navigate their way to and around the hospital. The app could also enable online platforms for online appointments, including follow-up appointments, assessments, and consultations. Family and friends of loved ones could also use the app to follow their loved one's care journey and access educational materials on how to care for them at home.

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6. Seniors' Wellness Services ICAT considerations

	ICAT consideration		Description
8	**RTLS & RFID Technology**	Back Office & Enabler	Consider utilizing a RTLS in all areas providing Seniors' Wellness services. RTLS can be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment. This system could provide respective staff with a holistic view of patient and staff flow throughout the hospital. By providing this level of visibility, staff could instantaneously locate patients and colleagues, thus saving wasted time searching for either. This technology could also speed up patient identification processes prior to starting an appointment by "scanning" a patient's RFID embedded wristband. This technology could also enable more seamless "staff to patient" introductions. For example, a RFID reader in a patient's room recognizes a staff member from their RFID embedded ID badge and automatically displays their information on the patient's IBT.
9	**Self-service Kiosks & mobile service applications**	Back Office & Enabler	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to "check-in/register" for their appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks and could contribute to empowering patients, as patients would be able to independently manage their own care journey. Self-service kiosks could also be used as a primary channel for support services for senior patients. For example, a senior patient is experiencing extreme joint pain. Instead of visiting the emergency department, the patient could scan their health card at one of the kiosks in the main lobby. This could trigger a notification to the Seniors' Wellness Team, in which case a team member could either "invite" the patient into a Seniors' Wellness outpatient clinic or enable the camera on the kiosk to interact with the patient in real-time. To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.

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6. Seniors' Wellness Services ICAT considerations

	ICAT consideration		Description
10	**Smart HVAC systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout areas in the hospital that provide Seniors' Wellness services to create a more personalized environment for both patients and staff.
11	**Smart lighting systems, sensors, voice assisted technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout areas in the hospital that Seniors' Wellness services to create a more personalized environment for patients and staff. A smart lighting system could also be integrated with voice assisted technology to allow patients and staff to use their voice to turn lights on and off, instead of walking to light switches. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.
12	**Smart security system, security robots, & touchless technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system and utilizing security robots in and around areas in the hospital that Seniors' Wellness services. These systems could monitor environments 24/7 and provide highly secure and safe areas for both patients and staff. Mobile security robots could also be implemented as an alternative to built in smart security systems. These robots are devices that could be put anywhere to enable continuous remote monitoring. Touchless technology could also enable easy maneuvering throughout the hospital and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.
13	**Smart vending machines**	Front & Back Office	Consider implementing smart vending machines, which would be stocked with supplies for day-to-day tasks (e.g. gloves, needles, tubes, etc.). These smart vending machines could provide staff with a more unique and customizable experience when accessing supplies and could optimize inventory management by enabling real-time tracking of products and automatic replenishment notifications.

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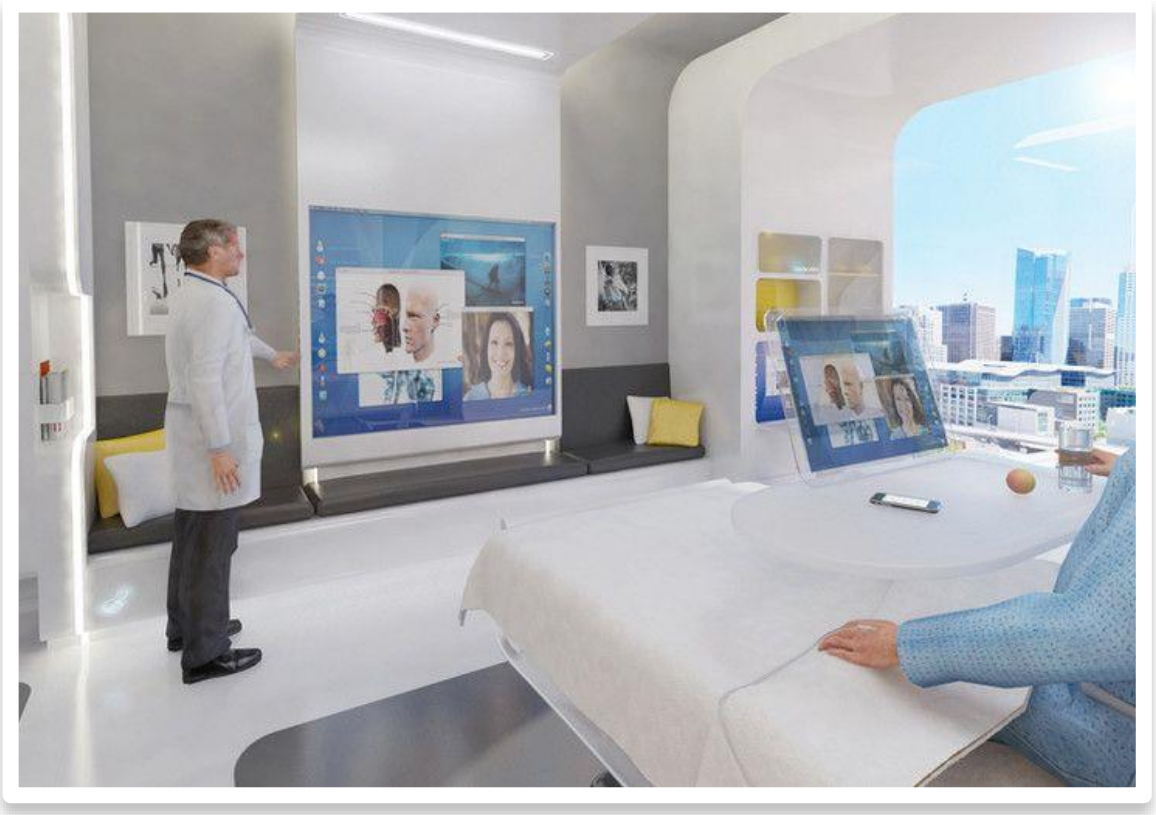
6. Seniors' Wellness Services ICAT considerations

	ICAT consideration		Description
14	**VR/AR technology**	Front Office & Enabler	Consider implementing VR/AR technology to enhance patient care and patient safety in the new SNH. These technologies could be implemented in inpatient units for high risk falls patients (e.g. frail senior patients) and could prevent falls by virtually programming patient rooms with virtual bed zones, virtual bed rails, etc. If a patient were to cross these zones, visual alerts will trigger and notify respective hospital staff. AR/VR technology could also be used to enhance patient care by enabling virtual experiences that could help reduce a patient's anxiety and stress.
15	**Wearable health devices & "prescribed" mobile apps**	Front Office & Enabler	Consider implementing wearable health devices & mobile apps in patient care plans to support the continuity of care. The information generated from these health devices & mobile apps could allow clinicians to continuously monitor patients remotely without having to see them, thus eliminating the burden for patient's to travel to the hospital.

Inpatient Units



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Inpatient Units Overview

ICAT Vision: ICAT will help to enhance the patient experience during their stay at the SNH. Patients will have access to information at their fingertips to ensure they are informed and well communicated throughout their patient journey. Building automation will help enable workflows for staff to reduce wasted time on manual processes.

Sampling of Expected Outcomes:

- Patients will be able to access information relevant to their stay in the hospital. This information may include access to their patient chart, information about their care team, and information about any appointments or consultations they have scheduled. This information will also be readily accessible for family members and caregivers to ensure that members of the patient's care team are able to stay informed.
- Patients will be able to adjust elements of their room including lighting, temperature and accessing entertainment at their bedside without calling for assistance from hospital staff.
- Staff will be able to monitor patients centrally on a dashboard-like view at the nursing station and will have the ability to track the physical location of patients as they navigate around the hospital for diagnostics or consultations through RFID tagging and RTLS.

Case Study Description: A detailed inpatient workflow is described on subsequent slides to depict the conceptual future state of workflows at SNH. Highlighted in the case study are the efficiency and spatial optimizers that will help to improve upon the current state enabled by ICAT solutions.

ICAT Case Study: *Inpatient Units*

Efficiency optimizer
Spatial optimizer

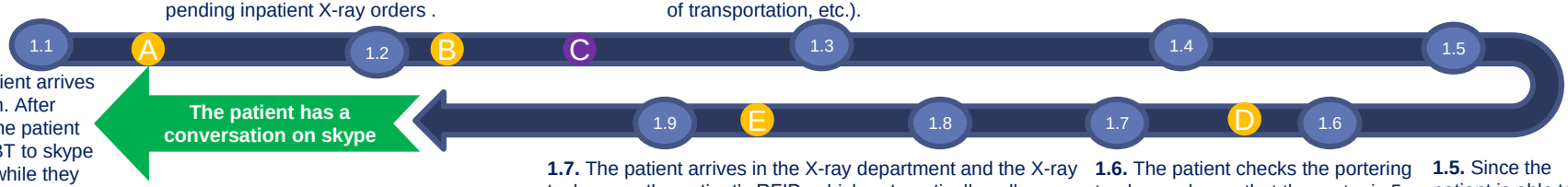
Inpatient workflow

1.1. A physician orders a chest X-ray for their inpatient via CPOE. This automatically notifies the X-ray tech on their hospital mobile device.

1.2. The X-ray tech reviews the order. Using the patient tracker on their hospital mobile device, the X-ray tech checks whether the patient is available to come to the X-ray department for their X-rays (i.e., if the patient is in their room and not preoccupied with other healthcare professionals) to request for a porter. If a patient is not available, the X-ray tech could continue to manage other pending inpatient X-ray orders .

1.3. The patient tracker has confirmed that the patient is available to come to the X-ray department. Using the patient tracker, the X-ray tech clicks on "request porter" on the patient's profile page. This automatically sends a notification to a porter who is closest to the patient's location. The notification sent to the porter, displays all of the necessary information about the patient that could be helpful with transporting the patient (e.g. any isolation precautions, mode of transportation, etc.).

1.4. Once the porter "accepts" the porter request, a notification is automatically sent to the X-ray tech and to the patient's IBT. The patient is notified that a porter is on their way to take them for X-rays.



1.9. The patient arrives in their room. After settling in, the patient uses their IBT to skype their friend while they eat their lunch.

1.8. The nutrition and food services department receive the notification. The patient's meal is prepared and placed in an AGV for delivery. The AGV travels to the patient's unit. Upon arriving in the unit, a notification is sent to staff on the unit, informing them that a delivery has arrived on the unit. Staff retrieve the meals from the cart and deliver the meal to the patient.

1.7. The patient arrives in the X-ray department and the X-ray tech scans the patient's RFID, which automatically pulls up their X-ray order onto X-ray console. Once the patient's X-ray exam is complete, the X-ray tech uses their hospital mobile device to "complete" the exam and request for a porter, to return the patient back to their room. Once the exam is completed a notification is sent to the nutrition and food services department to prepare and deliver the patient's meal.

1.6. The patient checks the portering tracker and sees that the porter is 5 minutes away from their room. The patient pauses their TV show and selects a meal option to be delivered after they return from the X-ray department. The patient is picked up and taken to the X-ray department.

1.5. Since the patient is able to track the porter, in real-time, the patient continues to watch their favorite TV show until the porter arrives.

A Save wasted time by reducing the number of manual processes (e.g. filling out and faxing paper-based referrals).

B Optimize staff productivity and streamline operations by enabling multi-notifications to respective services and providing full visibility of staff and patient flow.

C Optimize space by providing staff with mobile devices to access and update patient information, instead of stationary central computers.

D Save wasted time having to search for patients and/or staff by utilizing RTLS and RFID technology and a wayfinding application.

E Improve staff productivity and efficiency of operations by utilizing automated guided vehicles to transport products throughout the hospital (e.g. patient meals).

Integrated enabling technologies:
- 5G Network
- AGVs
- Adjustable large touchscreen monitors as workstations (e.g. to access PACS in the X-ray department)
- Hospital mobile devices
- Integrated bedside terminals
- Online cloud-based fully integrated HIS
- RTLS & RFID Technology

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Program specific ICAT considerations

The subsequent section identifies ICAT considerations for each of the programs and services under “Inpatient Units” as identified in NH’s stage 2 Functional Program.

These scope of programs included in this area are:

- *7. Complex Care Inpatient Units*
- *8. Critical Care Unit*
- *9. Medical/Surgical Inpatient Units*

7. Complex Care, (8) Critical Care, & (9) Medical/Surgical Inpatient Units: ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**ADCs**	Front Office	Consider implementing ADCs in "staff only" areas in complex care, critical care, and medical/surgical inpatient units. ADCs would be stocked with the most common medications used at point of care, avoiding the need to order and wait for medications to be transported from the pharmacy and/or found in other units. ADCs and accompanying systems could also improve medication management by tracking and controlling medication access and usage.
3	**Adjustable touchscreen monitors as CCs (or "communication centres" in critical care) and staff workstations**	Front Office	Consider installing adjustable large touchscreen monitors as both central CCs & staff workstations throughout complex care, critical care, and medical/surgical inpatient units. Central CCs could be used as the primary hub for collaboration and communication in the unit and other relevant areas (e.g. integration of patient monitoring system and security). Flow coordinators & staff in these units could also use these monitors to continuously track and manage both patient and staff flow.
4	**Adjustable touchscreen monitors outside of patient rooms**	Front Office	Consider installing small touchscreen monitors outside of each private inpatient room. These monitors could display important information regarding a patient's care (e.g. falls risk, contact precaution, preferred language, etc.) to inform or remind staff before entering the patient's room. These monitors could also be connected to smart medical devices (e.g. smart medication pumps) for staff to manage outside of the patient's room, to minimize the number of disturbances to the patient.
5	**AGVs & advanced pneumatic tubing system**	Back Office	Consider utilizing AGVs and expanding a hospital pneumatic tubing system throughout complex care, critical care, and medical/surgical inpatient units to support with the transportation of various products (e.g. specimens, medical and nursing supplies, linen, etc.). Both AGVs and pneumatic tubing systems could reduce staff requirement for transportation of products and increase delivery time of products.

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7. Complex Care, (8) Critical Care, & (9) Medical/Surgical Inpatient Units: ICAT considerations

	ICAT consideration		Description
6	**CPOE enabled fully integrated HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. laboratory information systems, radiology information system, surgical information system, portering system, etc.). A fully integrated modern HIS could support complex care, critical care, and medical/surgical inpatient units by enabling seamless access and transfer of patient health information among healthcare professionals within the hospital and in the Niagara region (e.g. easier transfer of patient information and medical history when patients are transferred between departments in the hospital or between hospitals in the region). Improving access to patient health information could also attribute to quicker diagnoses and treatment plans for patients. Cloud-based online platforms, could further improve the efficiency and quality of care by enabling mobile access to information/tools with the use of mobile devices. Providing respective clinicians with a CPOE process, could also improve workflow efficiency by automating manual processes (e.g. electronic referral and admission processes).
7	**Electronic communication system and video conferencing**	Front Office	Consider implementing an electronic communication system, including video-conferencing to enable bi-direction communication between all inpatient areas, including inpatient rooms, hallways, and other areas providing relevant services (e.g. shared therapy areas). Inpatient units could benefit from this system by speeding up the process to communicate with other staff and service areas.
8	**Electronic Intensive Care Unit (eICU)**	Front Office & Enabler	Consider implementing an “eICU” at the SNH. An “eICU” is a centralized program that combines augmented/virtual technology, predictive analytics, data visualization and advanced reporting capabilities to offer remote patient monitoring of patients in intensive care units. This technology could support ICU staff by offering a “second set of eyes” and enabling proactive delivery of care to enhance patient safety.

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7. Complex Care, (8) Critical Care, & (9) Medical/Surgical Inpatient Units: ICAT considerations

	ICAT consideration		Description
9	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to all staff in inpatient units to support daily rounds and other day to day tasks. These mobile devices could be equipped with various 'apps' (e.g. Niagara Health Navigator app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, electronic assessment tools, etc.), which could help improve the efficiency of patient workflows and communication among staff. Mobile devices could also allow clinicians to conveniently share information with patients at point of care. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.
10	**Integrated bedside terminals (IBTs) & large screen patient monitors**	Back Office & Enabler	Consider implementing integrated bedside terminals in all inpatient rooms. These terminals could help empower patients by allowing them to manage their own experiences in the hospital. Inpatients could use these terminals to access important information about their care (e.g. view their care plan, schedule of appointments, etc.), choose and order meal plans, control lighting and temperatures in their room, watch movies and/or TV shows, communicate with hospital staff and the outside world, and virtually tour the hospital. For example, a patient could use the terminal to request for a nurse, video-chat with family/friends, or watch communal eating areas on the unit, if they are not well enough to join.
11	**Niagara Health Navigator App**	Back Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for family/friends to connect with their loved one in an inpatient unit. The app could be used to reserve parking spots, order and send gifts to inpatients, navigate to and around the hospital (e.g. to the inpatient's room), message or call an inpatient, and access important information about an inpatient's care.

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7. Complex Care, (8) Critical Care, & (9) Medical/Surgical Inpatient Units: ICAT considerations

	ICAT consideration		Description
12	**RTLS & RFID Technology**	Back Office & Enabler	Consider utilizing a RTLS in all inpatient units. RTLS can be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment. This system could provide respective staff with a holistic view of patient and staff flow throughout the hospital. By providing this level of visibility, staff could instantaneously locate patients and colleagues, thus saving wasted time searching for either. This technology could also speed up patient identification processes prior to starting an appointment by "scanning" a patient's RFID embedded wristband. This technology could also enable more seamless "staff to patient" introductions. For example, a RFID reader in a patient's room recognizes a staff member from their RFID embedded ID badge and automatically displays their information on the patient's IBT.
13	**Self-service Kiosks for visitors only**	Back Office & Enabler	Consider implementing self-service kiosks for visitors near the main entrance of the hospital. Visitors could use these kiosks to "check-in/register" as a visitor, which could automatically notify inpatient units on central CCs and respective inpatients on their IBTs.
14	**Smart HVAC systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout all inpatient units to create a more personalized environment for both patients and staff.
15	**Smart lighting systems, sensors & voice assisted technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout all inpatient units to create a more personalized environment for patients and staff. A smart lighting system could also be integrated with voice assisted technology to allow patients and staff to use their voice to turn lights on and off, instead of walking to light switches. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.

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7. Complex Care, (8) Critical Care, & (9) Medical/Surgical Inpatient Units: ICAT considerations

	ICAT consideration		Description
16	**Smart medical devices (e.g. smart medication pumps, wearable vital signs monitors, etc.)**	Front Office & Enabler	Consider implementing smart medical devices, like smart medication pumps, in all inpatient units. These smart medical devices, when programmed correctly, could enhance patient safety by effectively preventing errors of medication administration.
17	**Smart security system, security robots, & touchless technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system and utilizing security robots in and around all inpatient units. These systems could monitor environments 24/7 and provide highly secure and safe areas for both patients and staff. Mobile security robots could also be implemented as an alternative to built in smart security systems. These robots are devices that could be put anywhere to enable continuous remote monitoring. Touchless technology could also enable easy maneuvering throughout the hospital (e.g. if a nurse's hands are full) and help reduce the spread of infectious diseases on door knobs and push-buttons on walls
18	**Smart vending machines**	Front & Back Office	Consider implementing smart vending machines, which would be stocked with supplies for day-to-day tasks (e.g. gloves, needles, tubes, etc.). These smart vending machines could provide staff with a more unique and customizable experience when accessing supplies and could optimize inventory management by enabling real-time tracking of products and automatic replenishment notifications.
19	**Switchable smart glass**	Enabler	Consider installing switchable smart glass as "dividers" in shared spaces (e.g. inpatient pod rooms, shared therapy rooms, etc.). This technology may be a "hygienic alternative" to traditional hospital curtains, such that glass is easier to clean. It could also provide patients with increased privacy at a flick of switch.

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7. Complex Care, (8) Critical Care, & (9) Medical/Surgical Inpatient Units: ICAT considerations

	ICAT consideration		Description
20	**VR/AR technology**	Front Office & Enabler	Consider implementing VR/AR technology to enhance patient care and patient safety in the new SNH. These technologies could be implemented in inpatient units for high risk falls patients (e.g. frail senior patients) and could prevent falls by virtually programming patient rooms with virtual bed zones, virtual bed rails, etc. If a patient were to cross these zones, visual alerts will trigger and notify respective hospital staff. AR/VR technology could also be used to enhance patient care by enabling virtual experiences that could help reduce a patient's anxiety and stress.
21	**Wireless vital signs monitoring system & nurse call system**	Front Office & Enabler	Consider implementing a wireless vital signs monitoring system in all inpatient units. This system could monitor a patient's vital signs in real-time and provide continuous connections between patients and clinicians. This system could also be integrated with building automation systems to enhance the efficiency of workflows. For example, the system identifies a dangerous drop in a patent's vitals and initiates a code blue alert, which automatically notifies all code blue team members and holds elevator doors open on their respective floors.

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Clinical, Diagnostic, & Therapeutic Services

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Clinical, Diagnostic, & Therapeutic Overview

ICAT Vision: ICAT will help to enable a more seamless experience for patients who are interacting with diagnostic and therapeutic programs at the SNH. Staff will have the right tools to revolutionize their interaction with patients and how information is shared with patients regarding their diagnostic results.

Sampling of Expected Outcomes:

- Patients will be able to manage their appointments in advance on their mobile devices and prepare for their diagnostics through online education material and instructions on how to navigate to their appointment.
- Patients who are transported from other parts of the hospital for their diagnostics , their journey as a patient will be documented and accessible by staff to reduce the amount of information that is repeated.
- Patients will feel enabled to take ownership of their health information. Results for diagnostics will be made available to patients and staff remotely and on mobile devices.

Case Study Description: A detailed diagnostic imaging outpatient workflow is described on subsequent slides to depict the conceptual future state of imaging workflows at SNH. Highlighted in the case study are the efficiency and spatial optimizers that will help to improve upon the current state enabled by ICAT solutions.

ICAT Case Study: *Clinical, Diagnostic, & Therapeutic Services*

Diagnostic Imaging outpatient workflow

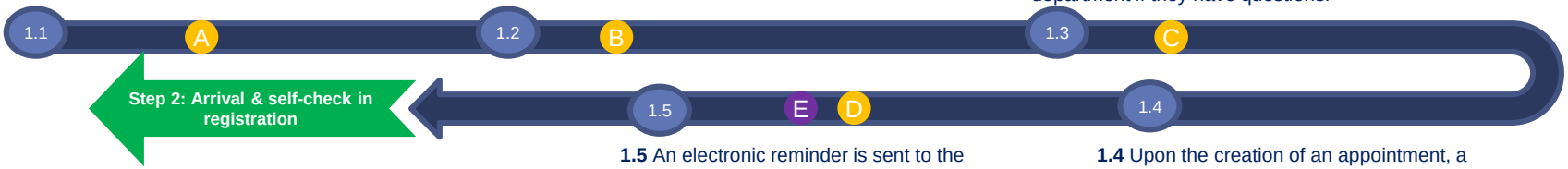
- Efficiency optimizer
- Spatial optimizer

Step 1: eReferral & self-scheduling

1.1 At point of care, the referring physician order diagnostic images services using an eReferral platform. The order is automatically sent to the DI Central service at the St. Catharine's Site (SCS). The order is automatically sent to the patient and visible on the regional Niagara Health Navigator App. Using this app, the patient is able to track the status of their order as it gets scheduled.

1.2 The Centralized DI service at the SCS receives the order and routes the patient's order to the most appropriate hospital for imaging services. The intelligent routing logic makes the decision based on patient requirements, hospital imaging capabilities, and wait times across all hospital.

1.3 Once an order is routed to a hospital (e.g. SNH), a notification is sent to the patient. The patient will then use the Regional Niagara Health Navigator app to select a date/time for their appointment that works best with them from a number of options provided by the hospital. Once the appointment has been scheduled, the patient will be provided options (text, email, automated voice, chat) to communicate with the department if they have questions.



1.5 An electronic reminder is sent to the patient 1 week, 48 hours, and 24 hours prior to their appointment. The notification will also include instructions on preparing for their appointment. (e.g. clothing that should be avoided for radiology exams).

1.4 Upon the creation of an appointment, a notification is sent to the referring physician confirming the scheduled appointment. Education material will be made available to the patient to prepare for their appointment.

A Save wasted time by reducing the number of manual processes, including filling out paper requisitions and faxing orders to hospitals.

B Improve access to diagnostic imaging services via intelligent routing

C Save wasted time by reducing the time taken to coordinate and schedule appointments at various hospitals in Niagara.

D Save wasted time when patients arrive at the hospital by avoiding patients having to change for their appointment.

E Optimize space by reducing the space needed for change rooms, as some patients will no longer have to change prior to their appointment.

Integrated enabling technologies:
- Centralized routing logic for diagnostic imaging services
- eReferral platform
- Fully integrated HIS
- Niagara Health Navigator App

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ICAT Case Study: *Clinical, Diagnostic, & Therapeutic Services*

Diagnostic Imaging outpatient workflow

- Efficiency optimizer
- Spatial optimizer
- Transformational opportunity

Step 2: Arrival & self-check in registration

2.1 Upon arrival the patient has the option to check-in to their appointment using the Niagara Health Navigator App. The patient is also able to use this app to navigate their way from their current location to the closest entrance of the hospital. They are also prompted on whether they would like to reserve a parking space and any equipment (e.g. wheelchair) prior to their arrival.

2.2 Once the patient enters the hospital, the mobile app on their phone alerts them to visit a registration kiosk in the main lobby of the hospital. Using the mobile app's wayfinding capabilities, the patient is provided with turn-by-turn directions to the kiosk.

2.3 At the kiosk, the patient scans their unique patient identification barcode and the kiosk automatically pulls up their information and asks the patient to scan a government issued photo ID (e.g. passport or a driver's license) to validate their identity. This process will only happen if it is the patient's first time visiting the hospital. If the patient had visited the hospital before (given they have validated their identify) the patient would only need to scan their patient identification barcode.

In future instances, kiosks can use facial recognition technology to validate patient identification.

2.6 After the check-in process is complete, an automatic message is sent to DI staff in the appropriate modality. DI staff are able to track in real-time the location of the patient as they arrive for their scheduled appointment .

2.5 After the patient takes a mask from the side of the kiosk, a patient identification wrist band is provided to the patient with an embedded RFID chip. The check-in process is complete. A message is sent to the patient's mobile phone via the Niagara Health Navigator App directing them to the DI department for their x-rays.

2.4 Once the patient has validated their identify, the kiosk will ask the patient questions to identify if they need to change for their appointment and if they are currently experiencing a cough with a fever. In this case, the patient has worn the appropriate clothing for their x-ray appointment and do not need to change. The patient has also answered "Yes" to experiencing a cough with a fever. The kiosk notifies the patient to take a mask, that is hanging on the side of the kiosk, and wear it.

- A Save wasted time completing administrative tasks when a patient arrives at the hospital.
- B Saved wasted time trying to find accessibility equipment for patients. When a patient arrives at the hospital all necessary requirements should be addressed to get the patient to their appointment immediately.
- C Save wasted time searching for available parking and correct entrances to the hospital.
- D Save wasted time when patients are lost and looking for their destination within the hospital.
- E Save wasted time directing patients over to various areas in a department/hospital.
- F Reduce registration desk area by implementing kiosks in the main lobby of the hospital. Saved space can be used for larger and more comfortable patient waiting areas.

Integrated enabling technologies:
- Fully integrated HIS
- Niagara Health Navigator App
- RTLS and RFID chips and readers
- Self-service kiosks

In future instances, outpatients may no longer need patient identification wristbands but could use their mobile phones to "tap" on electronic readers throughout the hospital to identify themselves and be tracked .

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ICAT Case Study: *Clinical, Diagnostic, & Therapeutic Services*

Diagnostic Imaging outpatient workflow

Efficiency optimizer

Spatial optimizer

Step 3: Patient preparation & delivery of care

3.1 The Niagara Health Navigator app brings the patient to the DI waiting room. When the patient enters the waiting room a notification is sent to DI staff informing them that the patient has arrived.

3.2 As patients wait in the DI waiting room, digital screens on the wall provide patients with educational materials, introductory information on current DI staff in the department, and real-time wait times in the department. Patients are able to identify their wait time by finding their unique patient identification number on the screen (i.e., the number found in the mobile app and/or on the patient's wristband). These wait times are also accessible via the Niagara Health Navigator app.

3.3 In DI staff areas, dynamic whiteboards are installed, which display real-time patient and DI staff locations. DI staff use this whiteboard to ensure seamless patient flow. DI staff are also able to access this platform on their staff mobile device .

3.4 The patient and DI staff tracker also intelligently prioritizes patients based on their arrival, but prioritizes patients with other x-ray dependent appointments in the hospital (e.g. a patient who needs pre-fracture clinic x-rays prior to their Ortho consultation).

3.1 → 3.2 → A → 3.3 → 3.4 → 3.5 → B → 3.6 → 3.7 → 3.8 → Step 4: Reporting & patient information sharing

3.5 The X-ray tech brings the patient in X-ray Room B, where the lights automatically turn on as the patient and staff member enter the room. The digital monitor outside of the x-ray unit also automatically lights up when a patient enters the room with a DI staff member to inform those in the hallway that x-rays are in use. The X-ray tech uses his/her ID badge to log onto the X-ray unit, where the patient's requisition/order is automatically uploaded on the screen, as it is associated with the staff's ID.

3.6 The X-ray tech uses their staff mobile device to track the equipment they need to conduct the x-ray exam (e.g. tracking the location of translucent sponges through RFID chips). The X-ray positions the patient and takes the X-rays. The x-ray room door automatically locks when x-rays are in use.

3.7 The x-ray exam is complete and the X-ray tech sends the images directly to the hospital's PACS, which is also available on the patient portal. This automatically sends the completed exam to the centralized Radiologist worklist across all NH for review/reporting.

3.8 Once the X-ray exam is complete, a notification is sent to the patient via the Niagara Hospital Navigator app that reminds them that they have another appointment in the hospital for bloodwork. The app directs the patient to the laboratory department.

A Save wasted time from patients asking about the approximate wait time.

B Save wasted time looking and waiting for available x-ray rooms

Integrated enabling technologies:

- 5G Network
- Command centres – dynamic whiteboards
- Digital screens/monitors
- Fully integrated HIS
- Niagara Health Navigator App
- RTLS and RFID chips and readers
- Self-service kiosks

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ICAT Case Study: *Clinical, Diagnostic, & Therapeutic Services*

Diagnostic Imaging outpatient workflow

Efficiency optimizer
Spatial optimizer

Step 4: Reporting & patient information sharing

4.1 From the HIS, a radiologist from any site across Niagara Health selects the completed imaging case. The RIS platform also displays in real-time the status of the exam and by whom it is being reported by.

4.2 A radiologist who is currently working off-site, views the images via the HIS. The radiologist searches in the regional diagnostic imaging repository (DIR) for any previous imaging that that the patient has had, to compare it with the current images. The radiologist compares the two imaging cases and generates a report using voice-recognition technology.

4.3 Once the report has been generated, the Radiologist sends the report and images directly to the referring physician.

4.5 Once the patient receives the notification, he/she is able to call their referring physician to make a follow up appointment. Once the patient has consulted the referring physician, the report and image(s) will be available to the patient via the Niagara Health Navigator app.

4.4 Once the report and images have been sent to the referring physician the status of the exam will be changed to "reported" and drop off the centralized Radiologist work list. A notification is also sent to the patient via the Niagara Health Navigator app that their images have been reported and sent to their referring physician.

A Optimize reporting turnaround time by centralizing reporting services.

B Reduce the need for radiologist workstations

C Save transcription time by using voice recognition technology

D Save wasted time waiting for referring physicians to receive confirmation that a report is completed and ready for review.

E Save administrative time coordinating and scheduling a follow up appointment with patients and optimize the continuum of care.

Integrated enabling technologies:
- Fully integrated EMR
- Patient portal via Niagara Health Navigator app
- Remote reporting enabling technology
- Voice enabled transcription

Program specific ICAT considerations

The subsequent section identifies ICAT considerations for each of the programs and services under “Clinical, Diagnostic & Therapeutic Services” as identified in NH’s stage 2 Functional Program.

These scope of programs included in this area are:

- *10. Cardio-Respiratory Diagnostics*
- *11. Diagnostic Imaging (DI)*
- *12. Emergency*
- *13. Laboratory*
- *14. Pharmacy*
- *15. Respiratory Therapy*
- *16. Surgical Services*

10. Cardio-Respiratory Diagnostics: ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital. For example, with a faster downloading speed radiologists could access imaging files quicker, thus improving the efficiency of the reporting process.
2	**Adjustable touchscreen monitors as central workstations**	Front Office	Consider installing touchscreen monitors as central workstations in the DI department. Flow coordinators and other DI staff members could use these central workstations for collaboration, educational purposes, and to continuously control and manage both patient and staff flow.
3	**Barcode technology for patient valuables**	Front Office	Barcode technology could be used to label patient belonging bags. This technology could provide a more accurate and efficient way to match patients to their belongings when discharged and reduce the risk for misidentifying personal items.
4	**CPOE enabled fully integrated HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. radiology information system, ECG management system, portering system, etc.). A fully integrated modern HIS could support the cardio-respiratory diagnostics program by enabling seamless access and sharing of patient health information among healthcare professionals in the hospital and in the Niagara region (e.g. patient medical history, previous medical imaging, etc.). Improving access to patient health information could also attribute to quicker diagnoses and treatment plans for patients. Cloud-based online platforms of the HIS, could further improve functionality by enabling mobile access to information/tools with the use of mobile devices. A CPOE enabled HIS could also improve the efficiency of workflows by automating manual processes in the department (e.g. filling out and faxing paper-based orders).

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10. Cardio-Respiratory Diagnostics: ICAT considerations

	ICAT consideration		Description
5	**eReferral solution**	Front & Back Office	Consider implementing an eReferral solution in the region to allow referring physicians to directly send electronic referrals (e.g. requests for cardio-respiratory diagnostic tests) to respective healthcare facilities. This platform could also improve the efficiency of referral processes in the region by replacing manual processes, like filling out and faxing paper-based order forms. An eReferral solution could also support the future vision of centralized booking for all DI services in the Niagara region.
6	**Facial recognition technology**	Front Office & Enabler	Consider implementing facial recognition technology as a method to verify a patient's identity (e.g. installed as part of the self-service kiosk and/or installed as a feature on hospital mobile devices to use when a patient enters an X-ray room). Facial recognition technology could reduce the possibility of performing diagnostic tests on the wrong patient and improve efficiency of patient workflows by saving wasted time asking for multiple patient identifiers (patient's full name, birthdate, address, etc.) before an exam.
7	**Gown dispenser**	Front Office	Consider installing a gown dispenser near self-service kiosks in the main lobby or near the DI department. Gown dispensing machines could enable a more organized approach to managing gowns in the hospital. Patients could use their health cards or another specific patient identifier (possibly through the Niagara Health Navigator App) to sign out/return a gown. These dispensers could also save space, such that gowns will no longer need to be stored in departments/change rooms.

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10. Cardio-Respiratory Diagnostics: ICAT considerations

	ICAT consideration		Description
8	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to staff providing cardio-respiratory diagnostic services. These mobile devices could be equipped with various "apps" (e.g. Niagara Health Navigator app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, etc.), which could help improve the efficiency of patient workflows and communication among staff. Mobile devices could also allow clinicians to conveniently share information with patients at point of care. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.
9	**Niagara Health Navigator App (including a patient portal)**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator app as a platform for patients to independently manage their own care journey. Patients could use the app to "check-in/register" for their appointments prior to arriving at the hospital, schedule their own DI appointments, and navigate their way to and around the hospital (e.g. to find the DI department and/or the nearest change room). The app could also be used to educate patients about their DI exam and provide instructions on how to prepare. In addition, the app could help provide information to patients about the status of their overall journey in the health system. For example, the status of their requisition could be shown to help them track the progress.
10	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS in the DI department. A RTLS can be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment (e.g. positioning equipment for DI exams, mobile x-ray units, etc.). This system could provide DI staff with a holistic view of patient and DI staff flow within the hospital. By providing this level of visibility to DI staff, DI staff could instantaneously locate patients and colleagues, thus saving wasted time searching for either.

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10. Cardio-Respiratory Diagnostics: ICAT considerations

	ICAT consideration		Description
11	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to "check-in/register" for their DI appointments from the moment they step foot into the hospital, without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks. Self-service kiosks could also contribute to empowering patients, as patients could be able to independently manage their own care journey. To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.
12	**Smart digital lockers**	Back Office & Enabler	Consider installing smart digital lockers for patients to store their valuables, instead of having to carry them. These lockers may put patients at ease, as they would know that their valuables are safely secured. Patients could rent these lockers upon arrival at the hospital, using either interact or a credit card. Patients could also use the Niagara Health Navigator App to reserve a locker before arriving at the hospital.
13	**Smart HVAC systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout the DI department, including all exam rooms to create a more personalized environment for both patients and staff.
14	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the DI department, including all exam rooms to create a more inviting and personalized environment for patients. Motion detector lighting systems could also help with ensuring lights are not left on which could also help reduce energy consumption.

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10. Cardio-Respiratory Diagnostics: ICAT considerations

	ICAT consideration		Description
15	**Smart security systems & touchless technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system (e.g. remotely controlled motion detector cameras) in the DI department to create a safer environment for both patients and staff. Touchless technology could also enable easy maneuvering throughout the DI department (e.g. if a patient's hands are full) and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.
16	**Smart vending machines**	Front & Back Office	Consider implementing smart vending machines, which would be stocked with supplies for day-to-day tasks (e.g. gloves, needles, tubes, etc.), in the DI department. These smart vending machines could provide staff with a more unique and customizable experience when accessing supplies and could optimize inventory management by enabling real-time tracking of products and automatic replenishment notifications.
17	**Speech recognition technology**	Front Office & Enabler	Consider making speech recognition technology available to all clinicians, in the DI department, who are required to document patient information (e.g. radiologists). This technology could help improve the efficiency of workflows by automating documentation processes.

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11. Diagnostic Imaging: ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital. For example, radiologists at the SCS currently experience slow connectivity when retrieving DI exams to report. With 5G connectivity, radiologists would be able to access and download these DI exams (including large imaging files) without having to wait.
2	**Barcode technology for patient valuables**	Front Office	Barcode technology could be used to label patient belonging bags. This technology could provide a more accurate and efficient way to match patients to their belongings when discharged and reduce the risk for misidentifying personal items.
3	**Bluetooth enabled C-arm machines**	Front & Back Office	Consider utilizing Bluetooth enabled C-arm X-ray machines. These machines allow X-ray techs to automatically send images (usually at the end of an operation in the OR) to the local PACS from the operating room, as opposed to having to transport the machine to a local Ethernet port. This technology may improve the efficiency and productivity of X-ray techs, such that wasted time moving the machine to an Ethernet port to send images may be saved and X-ray techs could attend to other pending x-ray cases in the hospital. This technology also allows healthcare teams to have faster access to patient information (i.e., medical imaging), thus allowing them to make diagnoses and develop treatment plans in a more timely manner.
4	**CPOE enabled fully HIS and a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. radiology information system, PACS, portering system, etc.). A fully integrated modern HIS could support the diagnostic imaging program by enabling seamless access and sharing of patient health information among healthcare professionals within the Niagara region (e.g. patient medical history, previous medical imaging, etc.). Improving access to patient health information could also attribute to quicker diagnoses and treatment plans for patients. Cloud-based online platforms of the HIS, improve the efficiency and quality of care by enabling mobile access to information/tools with the use of mobile devices. A CPOE enabled HIS could also improve the efficiency of workflows by automating manual processes in the department (e.g. paper-based orders and faxing of orders).

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11. Diagnostic Imaging: ICAT considerations

	ICAT consideration		Description
5	**eReferral solution**	Front & Back Office	Consider implementing an eReferral solution in the region to allow referring physicians to directly send electronic referrals (e.g. requests for cardio-respiratory diagnostic tests) to respective healthcare facilities. This platform could also improve the efficiency of referral processes in the region by replacing manual processes, like filling out and faxing paper-based order forms. An eReferral solution could also support the future vision of centralized booking for all DI services at the SCS, with the exception of booking interventional radiology procedures which will take place at the new SNH. An eReferral solution may also include functionality to support clinical decision making to provide radiologists with information to guide the prescription of imaging tests.
6	**Facial recognition technology**	Front Office & Enabler	Consider implementing facial recognition technology as a method to verify a patient's identity (e.g. installed as part of the self-service kiosk and/or installed as a feature on hospital mobile devices to use when a patient enters an X-ray room). Facial recognition technology could reduce the possibility of performing diagnostic tests on the wrong patient and improve efficiency of patient workflows by saving wasted time asking for multiple patient identifiers (patient's full name, birthdate, address, etc.) before an exam.
7	**Gown dispenser**	Front Office	Consider installing a gown dispenser near self-service kiosks in the main lobby or near the DI department. Gown dispensing machines could enable a more organized approach to managing gowns in the hospital. Patients could use their health cards or another specific patient identifier (possibly through the Niagara Health Navigator App) to sign out/return a gown. These dispensers could also save space, such that gowns will no longer need to be stored in departments/change rooms.

11. Diagnostic Imaging: ICAT considerations

	ICAT consideration		Description
8	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to DI staff. These mobile devices can be equipped with various "apps" (e.g. Niagara Health Navigator app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, radiology information system, etc.), which could help improve the efficiency of patient workflows and communication among staff. Also consider connecting mobile devices to the hospital Wi-Fi, as most areas in a DI department are "dead zones" for cellular service due to the leaded walls. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would be compatible with various types of mobile devices.
9	**Niagara Health Navigator App (including a patient portal)**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator app as a platform for patients to independently manage their own care journey. Patients could use the app to "check-in/register" for their appointments prior to arriving at the hospital, schedule their own DI appointments, and navigate their way to and around the hospital (e.g. to find the DI department and/or the nearest change room). The app could also be used to educate patients about their DI exam and provide instructions on how to prepare (e.g. what not to wear to an x-ray exam). In addition, the app could help provide information to patients about the status of their overall journey in the health system. For example, the status of their requisition could be shown to help them track the progress.
10	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS in the DI department. A RTLS can be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment (e.g. positioning equipment for DI exams, mobile x-ray units, etc.). This system could provide DI staff with a holistic view of patient and DI staff flow within the hospital. By providing this level of visibility to DI staff, DI staff could instantaneously locate patients and staff, thus saving wasted time searching for either.

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11. Diagnostic Imaging: ICAT considerations

	ICAT consideration		Description
11	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to "check-in/register" for their DI appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks. Self-service kiosks could also contribute to empowering patients, as patients would be able to independently manage their own care journey. To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.
12	**Smart digital lockers**	Front Office	Consider installing smart digital lockers for patients to store their valuables, instead of having to carry them. These lockers may put patients at ease, as they would know that their valuables are safely secured. Patients could rent these lockers upon arrival at the hospital, using either interact or a credit card. Patients could also use the Niagara Health Navigator App to reserve a locker before arriving at the hospital.
13	**Smart HVAC systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout the DI department to create a more personalized environment for both patients and staff. X-rays rooms are typically colder than other public spaces in a hospital, because of the fear of overheating of the X-ray units in the room. Smart HVAC systems could automatically adjust the temperature in X-ray rooms to both a manageable temperature for individuals and a safe temperature to avoid overheating of X-ray units.

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11. Diagnostic Imaging: ICAT considerations

	ICAT consideration		Description
14	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the DI department to create a more inviting and personalized environment for patients. Lights in an X-ray room are typically turned off, which often make patients feel uncomfortable and afraid when walking into the room. Smart lighting systems could be programmed to automatically turn on room lights when a patient enters a room, slowly dim lights when an exam is starting, and turn off lights when a patient exits the room.
15	**Smart security systems & touchless technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system in the DI department to create a safer environment for both patients and staff. X-ray room doors facing public hallways, typically have signs posted on them to inform individuals that X-rays are being used and that it is unsafe to enter. Sometimes, these signs are overlooked and doors are opened during exams. This not only puts individuals entering the room at risk of unnecessary radiation exposure, but also causes delays in workflows as the exam being performed in the room is interrupted. Smart security systems could automatically lock doors when a patient enters an x-ray room, eliminating all possibilities of someone walking in. Touchless technology could also enable easy maneuvering throughout the DI department and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.
16	**Speech recognition technology**	Front Office & Enabler	Consider making speech recognition technology available to all clinicians, in the DI department (e.g. radiologists), who are required to document patient information. This technology could help improve the efficiency of workflows by automating documentation (or reporting) processes.
17	**Touchscreen monitors as central workstations**	Front Office	Consider installing large touchscreen monitors as central workstations in the DI department. Flow coordinators and other DI staff members could use these central workstations for collaboration, educational purposes, and to continuously control and manage both patient and staff flow.

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12. Emergency Department: ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital. For example, 5G connectivity could enable remote monitoring (i.e., broadcasting live over a 5G network) of patients in ambulances while travelling to the hospital.
2	**ADCs (automated dispensing cabinets)**	Front Office	Consider implementing ADCs in "staff only" areas in the ED. ADCs would be stocked with the most commonly used medications at point of care, avoiding the need to wait for medications to be ordered and transported from the main pharmacy. ADCs and accompanying systems could also improve medication management within the ED by tracking and controlling medication usage.
3	**Adjustable touchscreen monitors as central & nurse workstations**	Front Office	Consider installing adjustable large touchscreen monitors as both central workstations & nurse workstations in the ED. Flow coordinators and other ED staff members could use these central workstations for collaboration, educational purposes, and for continuous control and management of both patient and staff flow. ED nurses/physicians could use the adjustable touchscreen monitors as an alternative to their hospital mobile devices to access and update patient information. Adjustable touchscreen monitors could be mounted on walls to maximize hallway space in the ED.
4	**AGVs & advanced pneumatic tubing system**	Back Office	Consider utilizing AGVs and expanding a hospital pneumatic tubing system to the entire ED to support with the transportation of various products to and from the ED (e.g. food, medical supplies, some medications, linens, etc.). Both AGVs and pneumatic tubing systems could reduce staff requirement for transportation of products and increase delivery time of products.
5	**Barcode & biometric Technology**	Front Office & Enabler	Consider utilizing barcode technology to speed up manual processes including, verification of a patient's identity and tracking of materials (e.g. medications). Biometric technology (e.g. Fingerprint ID) could be used to speed up manual login processes (i.e., using a username and password) and maximize accuracy and security of staff access to various systems/equipment in the ED (e.g. automated dispensing cabinets) .

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12. Emergency Department: ICAT considerations

	ICAT consideration		Description
6	**Barcode technology for patient valuables**	Front Office	Barcode technology could be used to label patient belonging bags. This technology could provide a more accurate and efficient way to match patients to their belongings when discharged and reduce the risk for misidentifying personal items.
7	**CPOE enabled fully integrated modern HIS & a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. portering system, diagnostic imaging, etc.). A fully integrated modern HIS could support the ED by enabling seamless access and sharing of patient health information among healthcare professionals in the hospital and in the region. Improving access to patient health information could attribute to quicker diagnoses and treatment plans for patients. Cloud-based online platforms of the HIS could further improve access to patient health information by making patient health information available at anytime and from anywhere with the use of mobile devices. A CPOE enabled HIS could also improve the efficiency of workflows by automating manual processes in the department (e.g. filling out and faxing paper-based orders).
8	**Drones**	Back Office	Consider implementing drones in the ED, as an alternative method for transporting various products (e.g. medical supplies, meals, etc.) throughout the hospital. Drones could also be used to transport additional medical supplies to on-site emergencies.
9	**Drug dispensing kiosks**	Front & Back Office	Consider implementing drug dispending kiosks in the ED to improve patient access to common medications, especially during after hours with no local 24/7 pharmacies in the area.
10	**Electronic communication system**	Front Office	Consider implementing an electronic communication system to enable bi-direction communication throughout the entire ED, including waiting rooms, patient rooms, hallways, central workspaces and other areas providing relevant services (e.g. inpatient units, surgical department, etc.). These systems could be integrated at central CCs and/or accessible via hospital mobile devices. The ED could benefit from this system by speeding up the process to communicate with staff, thus streamlining operations and improving the efficiency of delivering care.

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12. Emergency Department: ICAT considerations

	ICAT consideration		Description
11	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to ED staff. These mobile devices could be equipped with various "apps" (e.g. Niagara Health app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, etc.), which could help improve the efficiency of patient workflows and communication among staff. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would be compatible with various types of mobile devices.
12	**Niagara Health Navigator app (including a patient portal)**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator app as a platform for patients to independently manage their own care journey within the ED. Patients could use the app to reserve parking spots, navigate their way to and around the ED, view real-time wait times in the ED and receive progress updates about their test results. The Niagara Health Navigator App could also be used to connect an emergency patient with their caregivers and other community-based healthcare professionals (e.g. family physicians). For example, the app could send a patient's caregiver an update about the patient's current state (e.g. location) and send a patient's discharge report to their family physician on file.
13	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS in the ED. A RTLS can be used by either installing, attaching, or embedding RFID chips into patient wristbands, staff badges, and on various equipment (e.g. positioning equipment for DI exams, mobile x-ray units, etc.). This system can provide ED staff with a holistic view of patient and ED staff flow. By providing this level of visibility to ED staff, ED staff could instantaneously locate patients and staff, thus saving wasted time searching for either. The RTLS could also provide visibility of patient discharges (i.e., when the patient leaves) to environmental services to understand when rooms should be cleaned, thus improving bed turnover and potentially reducing ED overcrowding.

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12. Emergency Department: ICAT considerations

	ICAT consideration		Description
14	**Self-service Kiosks & smart triaging system (or advanced queuing systems)**	Front Office	Consider implementing self-service kiosks near the main entrance of the ED, instead of building a large area for registration. Patients will be able to "check-in/register" in the ED from the moment they arrive. Implementing self-service kiosks may improve efficiency of patient workflows by reducing administrative tasks. Self-service kiosks could also be used to monitor patients in the waiting room. For example, patients could scan their wristbands at a kiosk and be prompted with a list of questions. If the patient's answers indicate that their condition has worsened, a notification is sent directly to a triage nurse. Self-service kiosks could also be equipped with tools that automate the triaging process (e.g. etriage). This tool could improve ED patient flow by speeding up the triaging process and optimizing identification of priority patients.
15	**Smart digital lockers**	Front Office	Consider installing smart digital lockers for patients to store their valuables, instead of having to carry them. These lockers may put patients at ease, as they would know that their valuables are safely secured. Patients could rent these lockers upon arrival at the hospital, using either interact or a credit card. Patients could also use the Niagara Health Navigator App to reserve a locker before arriving at the hospital.
16	**Smart HVAC system, sensors, & smart pressure monitoring system** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout the entire ED, including all patient rooms and staff areas. This technology could help to create more comfortable and healthy environments for patients and staff. Smart pressure monitoring systems could also help to improve patient and staff safety in the ED by alerting respective staff when pressures fluctuate in negative pressure patient rooms.
17	**Smart lighting system, sensors, & voice assisted technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the entire ED, including all patient rooms. Sensors installed throughout the ED could recognize staff/patient movement to automatically turn lights on and off. A smart lighting system could also be integrated with voice assisted technology to allow staff and patients to use their voice to turn lights on and off, instead of walking to light switches.

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12. Emergency Department: ICAT considerations

	ICAT consideration		Description
18	**Smart ambulances & advanced telemetry technology**	Front & Back Office	Continue to partner with Niagara paramedics to enhance patient safety and streamline care. Ambulances equipped with advanced telemedicine technologies and smart medical devices could automatically capture patient information, including videos and pictures, and share it instantaneously with relevant ED staff. These advanced systems could enable live support from clinical staff and allow paramedics to make better decisions on-site, which could reduce the number of ambulance visit to the ED. Providing clinical staff (e.g. ED staff) with real-time patient information could also allow them to prepare for patients in advance while the ambulance is driving to the ED. For example, a paramedic video-calls an ED clinician to assess a patient's wounds on-site of the emergency. Based on the severity of the patient's wounds, the ED clinician confirms that the patient will need to go straight into surgery. In this case, the ED coordinates with the surgical team to prepare an operating room before the patient arrives at the ED.
19	**Smart security systems, touchless technology, & security robots** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system and utilizing security robots in and around the ED (e.g. the parking lot). These systems could monitor environments 24/7 and provide highly secure and safe areas for both patients and staff. To further enhance staff safety, consider integrating a panic alerting system, which is a wireless call function for help integrated in staff ID badges. An alternative to built in smart security systems, are mobile security systems, which are devices that could be put anywhere to enable continuous remote monitoring. Touchless technology could also enable easy maneuvering throughout the ED and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.
20	**Smart vending machines**	Front & Back Office	Consider implementing smart vending machines in the ED. This technology could provide hospital staff with unique customizable experiences and enhance the efficiency and organization of inventory management with real-time tracking of products and automatic replenishment notifications.

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12. Emergency Department: ICAT considerations

	ICAT consideration		Description
21	**Switchable smart glass**	Enabler	Consider installing switchable smart glass for all patient rooms in the ED, including doors and windows. This technology may be a "hygienic alternative" to traditional hospital curtains, such that glass is easier to clean. It could also provide patients with increased privacy at a flick of switch and protect hospital staff and patients from cross-contamination of contagious infectious diseases by avoiding the need to enter a patient's room to observe their condition. This technology could also help save money by eliminating the need to purchase curtains and could reduce air conditioning bills, such that switchable glass can block almost all light coming into a room.
22	**Touchscreen monitors outside of patient rooms**	Front Office	Consider installing small touchscreen monitors outside of each patient room in the ED. These monitors could display important information regarding a patient's care (e.g. falls risk, contact precaution, preferred language, etc.) to inform or remind staff before entering the patient's room. These monitors could also be connected to smart medical devices (e.g. smart medication pumps) for staff to manage outside of the patient's room, to minimize the number of disturbances to the patient.
23	**Wireless vital signs monitoring system & nurse call system**	Front Office & Enabler	Consider installing a wireless vital signs monitoring system equipped with wireless medical devices in the ED to automatically monitor patient vital signs and provide continuous connections between patients and clinicians. This system keeps patient's safe by enabling continuous monitoring of vital signs, as opposed to the traditional manual process of measuring patient vitals at specific intervals. Also, this system allows clinicians to better manage their patients, such that a clinician is often assigned to multiple patients and could remotely monitor patients from mobiles devices.

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13. Laboratory: ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**AGVs, advanced pneumatic tubing system, and automated tracks**	Back Office	Consider utilizing AGVs and expanding a hospital pneumatic tubing system to laboratories at the SNH to support with the transportation of various products (e.g. blood and non-blood specimens, empty specimen tubes, etc.) to and from the laboratory. Both AGVs and pneumatic tubing systems could reduce staff requirement for transportation of products and increase delivery time of products. There is also a possibility of connecting pneumatic tubing systems between facilities in the region (i.e., the St. Catharine's Site & Welland), to no longer depend on courier services. Also, consider installing automated tracks, which could support transportation of products within the laboratory department, These tracks could increase the efficiency of lab processes in the department by reducing the number of steps staff would be required to take to transport products.
3	**Automated diagnostic laboratory system/robots**	Front Office	Consider implementing an automated diagnostic laboratory system equipped with lab robots. These systems could provide 24/7 testing of samples and reduce the number of resources needed to execute tasks, thus increasing testing efficiency and accuracy.
4	**CPOE enabled fully integrated modern HIS & a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas. A fully integrated modern HIS could support the centralization of laboratory services by enabling seamless access to patient health information among healthcare providers within the hospital and in the region. Modern HIS' could also support other automated systems, like a wireless mobile specimen collection system, which allow staff to collect and manage patient specimen at the bedside. This system could improve the efficiency of specimen management by using mobile devices to scan patient wristbands and automatically print specimen tube labels at the bedside. Cloud-based online platforms of the HIS could further improve access to patient health information by making patient health information available at anytime and from anywhere with the use of mobile devices. A CPOE enabled HIS could also improve the efficiency of workflows by automating manual processes in the department (e.g. filling out and faxing paper-based orders).

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13. Laboratory: ICAT considerations

	ICAT consideration		Description
5	**Drones**	Back Office	Consider implementing drones as an alternative to courier services for transportation of lab samples between hospitals in the Niagara region.
6	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to staff in the laboratory department. These mobile devices could be equipped with various "apps" (e.g. Niagara Health app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, etc.), which could help improve the efficiency of patient workflows and communication among staff. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would be compatible with various types of mobile devices.
7	**Smart HVAC system & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system in the laboratory department. This technology could help to create more comfortable and healthy environments for patients and staff.
8	**Smart lighting system, sensors, & voice assisted technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the laboratory department. Sensors installed throughout the department could recognize staff/patient movement to automatically turn lights on and off. A smart lighting system could also be integrated with voice assisted technology to allow staff and patients to use their voice to turn lights on and off, instead of walking to light switches.

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13. Laboratory: ICAT considerations

	ICAT consideration		Description
9	**Smart refrigeration system (for specimen storage)**	Back Office & Enabler	Consider installing a smart refrigeration system equipped with “smart refrigerators” to have full control and visibility of storage temperatures and medication inventory. This could help reduce the risk for spoiled specimens and having to withdraw blood again.
10	**Smart security system, touchless technology, & security robots** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system and utilizing security robots in and around the laboratory department to monitor the environment 24/7 and provide highly secure and safe areas for patients and staff. Smart security systems could also work with other smart technologies (e.g. biometric technology, RTLS & RFID embedded staff badges, facial recognition, etc.) to manage access to secure areas. Touchless technology could also enable easy maneuvering throughout the department and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.
11	**Speech recognition technology**	Front Office & Enabler	Consider implementing speech recognition technology in pathologist workstations. This technology can help improve the efficiency of the reporting process by eliminating the need to type reports.
12	**Telepathology technology**	Front Office & Enabler	Consider implementing Telepathology technology at the new SNH. This technology could provide pathologists with remote real-time access to pathology images for faster and easier sharing and diagnosis of pathology cases. This technology could also support outsourcing of lab services to community partners, which could further improve the efficiency of reporting turnover of pathology cases.

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14. Pharmacy: ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**Adjustable large touchscreen monitors & smart trash bins for pharmacy receiving staff**	Front Office	Consider installing adjustable large touchscreen monitors as primary workstations in the receiving area of the pharmacy department. These workstations could be used for collaboration, educational purposes, and for easy management of pharmaceutical supplies (e.g. processing of receipts in the HIS). These workstations and other relevant tracking systems could improve the efficiency of departmental operations and save space by utilizing wall space instead of work space. Since receiving areas usually produce mass of amounts of waste, consider implementing smart trash bins in the area, which could eliminate overflowing of bins and unsafe environments.
3	**AGVs & advanced pneumatic tubing system**	Back Office	Consider utilizing AGVs and expanding a hospital pneumatic tubing system to the pharmacy department at the SNH to support with the transportation of various products to and from the pharmacy (e.g. medications). Both AGVs and pneumatic tubing systems could reduce staff requirement for transportation of products and increase delivery time of products.
4	**CPOE enabled fully integrated modern HIS (including medication related clinical decision support system, electronic medication administration record, barcoded medication administration & verification, etc.)**	Front & Back Office	Consider implementing a CPOE enabled modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. pharmacy information system, CDSS tools, and other technologies) for consistency and to reduce risk for human errors. A fully integrated CPOE enabled HIS could also support electronic prescriptions that could be used to initiate automated workflows (i.e., dispensing and packaging of medication) in the central pharmacy department of the new SNH.

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14. Pharmacy: ICAT considerations

	ICAT consideration		Description
5	**Drones**	Back Office	Consider implementing drones for home delivery of pharmaceuticals, which could improve access to medications and medication adherence.
6	**E-prescribing technology**	Front & Back Office	Consider implementing e-prescribing technology at the new SNH. This technology enables physicians to electronically prescribe medications in a single workflow, which could improve the speed of the medication reconciliation process and could extend prescription orders to community partners (e.g. retail pharmacies).
7	**Mobile devices as pharmacist & pharmacy technician workstations (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing pharmacy staff with mobile devices, instead of stationary workstations in patient care units (PCUs) to support their roles (e.g. medication order verification, best possible medication history, etc.) when visiting PCUs. These mobile devices could be a more flexible and space saving alternative to stationary workstations, as they allow staff to move freely while having access to patient information and other relevant systems/tools at all times. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would be compatible with various types of mobile devices.
8	**Niagara Health Navigator App (including a patient portal)**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for patients to independently manage their own care. Patients could use the app to order their medications at the pharmacy in the hospital and track in real-time the progress of their order. This could improve patient experiences by avoiding long lineups at the pharmacy.

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14. Pharmacy: ICAT considerations

	ICAT consideration		Description
9	**Robotic prescription dispensing system or "pill pickers" (e.g. BoxPicker) and other technologies (e.g. vertical carousels, robotic compounding technology, etc.)**	Front & Back Office	Consider installing an automated dispensing machine or "pill picker" in the pharmacy department. These systems receive electronic prescriptions from various patient areas in the hospital and are instructed by a pharmacist to dispense the medications, including packaging and printing labels. These systems eliminate the potential for human error and speeds up the dispensing process.
10	**RTLS & RFID technology**	Back Office & Enabler	Consider implementing a RTLS in the pharmacy department. A RTLS could be used to track assets, including staff, equipment, and medication. RTLS is enabled by RFID chips that could be either installed, attached, or embedded into staff badges, on various equipment, and/or on medication packages. This system could provide pharmacy staff with a holistic view of patient, staff, and product flow in the hospital. By providing this level of visibility, pharmacy staff could instantaneously locate patients, staff, and/or products (e.g. medication, equipment, etc.) and thus save wasted time searching for either.
11	**Smart HVAC system & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system in the laboratory department. This technology could provide staff with a more comfortable and healthy environment by allowing them to have more control. Smart HVAC systems could also provide continuous automatic modification to the environment to avoid risk for spoiled specimens and other laboratory products that are stored in the department.

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14. Pharmacy: ICAT considerations

	ICAT consideration		Description
12	**Smart inventory management system/automated purchasing system (& "Just-in time" inventory management)**	Back Office & Enabler	Consider implementing a smart inventory management system and automated purchasing system. These systems could improve efficiency and productivity of pharmacy related operations and minimize costs by reducing risks for over ordering and lost items. These smart systems could also help to support the coordination of inventory across multiple facilities in the region. To further enhance pharmaceutical inventory management, consider implementing a "just-in-time" inventory management system. The SNH could benefit from this system by no longer needing to maintain large spaces for product storage and save costs by minimizing over ordering of products.
13	**Smart lighting system, sensors, & voice assisted technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the entire pharmacy department. A smart lighting system could also be integrated with voice assisted technology to allow patients and staff to use their voice to turn lights on and off, instead of walking to light switches. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.
14	**Smart refrigeration system (for drug/vaccine storage)**	Back Office & Enabler	Consider installing a smart refrigeration system equipped with "smart refrigerators" to have full control and visibility of storage temperatures and medication inventory. This could help reduce the risk for spoiled and expired products by automating the management of "first in/first out" inventory.
15	**Smart security system, touchless technology, & security robots** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system and utilizing security robots in and around the pharmacy department to monitor the environment 24/7 and provide highly secure and safe areas for staff. Smart security systems could also work with other smart technologies (e.g. biometric technology, RTLS & RFID embedded staff badges, facial recognition, live stream video recording, etc.) to manage access to secure areas. Touchless technology could also enable easy maneuvering throughout the pharmacy department and help reduce the spread of infectious diseases on door knobs and push-buttons on walls.

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14. Pharmacy: ICAT considerations

	ICAT consideration		Description
16	**Smart vaults & biometric technology**	Back Office & Enabler	Consider installing a smart vault to store all controlled medications. Smart vaults are typically found in banks and offer a highly secure process to access anything stored in it. The system could use biometric technology to verify individuals who'd like to request for an item from the vault and robotic technology to retrieve and deliver the requested item. Thus, eliminating any human interaction with highly valuable items

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ICAT Case Study: *Clinical, Diagnostic, & Therapeutic Services*

Efficiency optimizer
Spatial optimizer

Inpatient Pharmacy Workflow

1.1. A physician receives their patient's urine sample results on their hospital mobile device. The results indicate that the patient has a urinary tract infection.

1.2. The physician uses their hospital mobile device to put in a CPOE order for antibiotics. The physician puts the order in, which automatically triggers a notification at the central pharmacy in the SNH.

1.3. The pharmacist working in the central pharmacy is alerted on their central workstation. The pharmacist reviews and confirms the CPOE order, which automatically sends a message to the dispensing robot.

1.4. The dispensing robot uses its intelligent system to review the patient's order. The robot arm then picks the exact medication and dosage requested by the physician. The robotic arms places the pills into a medication bag. In the meantime, the intelligent system prints a label with the patient's unique identifier, which is presented by a barcode).

1.1 → 1.2 → A → 1.3 → 1.4 → B → 1.5 → C → 1.6 → 1.7 → 1.8 → 1.9 → The patient's urinary tract infection cured.

1.5. Once the pills have been placed into the medication bag, the dispensing robot then puts the printed label on the bag. The prescription is then dropped into the "finished" pile. The pharmacist is notified that the prescription is ready to transport to the patient. The patient picks up the bag and puts it in an automated guided vehicle (AGV).

1.6. The pharmacist programs the AGV to travel to the patient's unit. The pharmacist is also able to track the AGV in real-time. As the AGV enters the patient's unit, RFID readers in the unit recognize that an AGV has arrived and sends a notification to staff on the unit.

1.7. The nurse on the unit reads the notification and proceeds to pick up the medication in the AGV. A notification is sent to the pharmacy department, informing the pharmacist that the medication has been retrieved from the AGV. As the nurse picks up the medication they scan the barcode on the medication bag to confirm who it's for. Once confirmed, the nurse takes the bag to the patient's bedside.

1.8. The RFID readers in the patient's room recognize that the nurse has entered the room and displays their information on the patient's IBT.

1.9. The nurse scans the patient's RFID embedded wristband and the barcode on the medication bag. This automatically updates the patient's record in the HIS. The patient takes the antibiotics.

A Save wasted time by reducing the number of manual processes, including filling out and faxing paper orders throughout the hospital.

B Improve staff productivity and efficiency of operations by utilizing robots to complete labour intensive and repetitive tasks.

C Improve staff productivity and efficiency of operations by utilizing automated guided vehicles to transport products throughout the hospital (e.g. patient medication).

Integrated enabling technologies:
- Automated guided vehicles (AGVs)
- Barcode technology
- CPOE enabled fully integrated HIS
- Hospital mobiles devices
- Integrated bedside terminals (IBTs)
- RTLS and RFID chips and readers
- Robotic prescription dispenser "pill picker"

15. Respiratory Therapy: ICAT considerations

	ICAT consideration		Description
1	**Adjustable large touchscreen monitors as command centres in the primary respiratory therapy "hub" in the SNH**	Front Office	Consider installing adjustable large touchscreen monitors as central command centres in the primary respiratory therapy "hub" in the hospital. These command centres could be used for collaboration, educational purposes, and for continuous control and management of both patient and staff flow. These command centres and other relevant tracking systems could improve the efficiency of departmental operations, staff and patient flow, optimize resource utilization, and save space by utilizing wall space instead of room space.
2	**CPOE enabled fully integrated modern HIS & hospital mobiles devices (e.g. tablets, smartphones, etc.)**	Front & Back Office	Consider implementing a CPOE enabled modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. respiratory therapy). A fully integrated CPOE enabled HIS allows for electronic ordering of respiratory therapy services, thus eliminating manual processes and saving wasted time doing administrative work. Also, consider providing respiratory therapists with mobile devices, instead of a stationary workstation located in the respiratory therapy "hub" to support their roles delivering care at a patient's bedside in inpatient care areas and/or the ED. These mobile devices could be a more flexible and space saving alternative to a stationary workstation, thus allowing staff to move freely while having access to patient information and other relevant systems/tools at all times. Instead of providing staff with mobile devices, the SNH could also consider a "Bring Your Own Device (BYOD)" approach, where staff would use their personal mobile device to perform day-to-day tasks at work. If the SNH decides to follow through with a BYOD approach, there needs to be clear policies and provisions in place for use of personal devices, as well as a comprehensive clinical tool kit that would have to be compatible with various types of mobile devices.

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15. Respiratory Therapy: ICAT considerations

	ICAT consideration		Description
3	**RTLS & RFID Technology**	Back Office & Enabler	Consider enabling a hospital's RTLS for respiratory therapy services. A RTLS could be used to track assets, including patients, staff and equipment. RTLS is enabled by RFID chips that could be either installed, attached, or embedded into patient wristbands, staff badges and on various equipment. Considering that respiratory therapists will have decentralized working areas, this system could provide respiratory therapists with visibility of their patient, staff, and equipment location in the hospital.
4	**Speech recognition technology**	Front Office & Enabler	Consider implementing speech recognition technology either at workstations and/or as a feature on mobile devices. This technology could help improve the efficiency of the reporting process by eliminating the need to type reports.
5	**Wireless vital signs monitoring system & nurse call system** *(with integration of building automation systems)*	Front Office & Enabler	Consider implementing a wireless vital signs monitoring system throughout all areas providing respiratory therapy services. This system could monitor a patient's vital signs in real-time and provide continuous connections between patients and clinicians. This system could also be integrated with building automation systems to enhance the efficiency of workflows. For example, the system identifies a dangerous drop in a patent's vitals and initiates a code blue alert, which automatically notifies all code blue team members and holds elevator doors open on their respective floors.

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16. Surgical Services: ICAT considerations

	ICAT consideration		Description
1	**5G network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**ADCs (automated dispensing cabinets)**	Front Office	Consider implementing ADCs in surgical suites for surgical staff. ADCs would be stocked with the most commonly used medications during surgery, avoiding the need to wait for medications to be ordered and transported from the main pharmacy. ADCs and accompanying systems could also improve medication management by tracking and controlling dispensing of medication.
3	**Adjustable large touchscreen monitors as command centres in entry control stations**	Front Office	Consider installing adjustable large touchscreen monitors as central command centres in entry control stations in the surgery department. Flow coordinators and other surgical staff could use these command centres for collaboration, educational purposes, and for continuous control and management of both patient and staff flow. For example, electronic tracking boards could be displayed on these monitors to provide staff with real-time status updates (e.g. whether a surgery has started or stopped and minimize the need for phone calls). These command centres and other relevant tracking systems could improve the efficiency of departmental operations, staff and patient flow, and optimize operating room utilization.
4	**AGVs**	Back Office	Consider utilizing AGVs to support with the transportation of various surgical equipment and supplies to and from surgical areas and the medical device reprocessing department. AGVs could reduce staff requirement for transportation of products and increase delivery time of products.
5	**Barcode technology for patient valuables**	Front Office	Barcode technology could be used to label patient belonging bags. This technology could provide a more accurate and efficient way to match patients to their belongings when discharged and reduce the risk for misidentifying personal items.

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16. Surgical Services: ICAT considerations

	ICAT consideration		Description
6	**CPOE enabled fully integrated modern HIS & a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas (e.g. surgical information system, portering system, etc.). This could improve access to patient information among healthcare professionals and improve the efficiency of workflows by automating manual processes (e.g. filling out and faxing paper-based orders).
7	**Electronic communication system and video conferencing**	Front Office	Consider implementing an electronic communication system, including video-conferencing to enable bi-direction communication between all areas in the surgery department, including all operating rooms, hallways, and other areas providing relevant services (e.g. medical device reprocessing department). Surgical services could benefit from this system by speeding up the process to communicate with other staff and service areas, thus streamlining operations. It could also enhance student/staff learning by enabling surgical training to view procedures remotely.
8	**Hospital mobile devices (e.g. tablets, smartphones, etc.)**	Front Office	Consider providing mobile devices to all surgical staff, including physicians, nurses, etc. These mobile devices could be equipped with various 'apps' (e.g. Niagara Health app, instant messaging, etc.) and other relevant systems available in the hospital (e.g. online HIS platform, real-time tracking systems, surgical schedules, electronic assessment tools/checklists, etc., which could help improve efficiency of patient workflows and communication among staff. Mobile devices could also allow physicians to conveniently share information with patients before and after their surgery.
9	**Niagara Health Navigator app (including a patient portal and smart track technology for real time notifications to family/friends) and virtual technology**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator App as a platform for patients to independently manage their own care journey. Patients could use the app to reserve parking spots, day lockers, & navigate their way to surgical waiting areas and other areas in the hospital. The app could also include a patient portal, which could provide patients with access to informative material about their scheduled surgery and a continuous communication channel with their healthcare team. Virtual technology could also be used to enable "online pre-surgery consultations" and/or "online discharge follow up appointments", which could minimize the burden of patients having to travel to the hospital. While a patient is undergoing surgery, the app could also be used to connect surgical teams to a patient's family/friends with real-time notifications about the progress of the surgery.

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16. Surgical Services: ICAT considerations

	ICAT consideration		Description
10	**Robotic surgery**	Front Office	Consider implementing robotic surgical tools to provide aid and guidance to surgeons when performing procedures. Robotic surgical tools help to increase the level of precision associated with performing certain procedures. They have also proven to enable remote capabilities for observation or performing procedures and in certain scenarios may also be beneficial to patients when they are able to reduce the invasiveness of the procedure and the amount of blood loss.
11	**RTLS & RFID technology**	Back Office & Enabler	Consider implementing a RTLS in the surgery department. A RTLS could be used to track assets, including staff, patients, and equipment. RTLS is enabled by RFID chips that could be either installed, attached, or embedded into a patient's wristband, staff badges and on various equipment. This system could provide surgical staff with a holistic view of their patients and staff flow, which could help streamline departmental operations.
12	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to "check-in/register" for their appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks and could contribute to empowering patients, as patients would be able to independently manage their own care journey. To further enhance patient experiences and streamline patient workflows, consider enabling multiple channels for patients to check-in/register, such as mobile service applications. These applications could provide patients with the option to check-in/register on their mobile devices prior to arriving at the hospital.
13	**Smart digital lockers**	Front Officer	Consider installing smart digital lockers as an alternative to storing personal belongings either under or near a patient's bed while they are in surgery. These lockers may put patients at ease, as they would know that their valuables are safely secured. Patients could rent these lockers upon arrival at the hospital, using either interact or a credit card. Patients could also use the Niagara Health Navigator App to reserve a locker before arriving at the hospital.

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16. Surgical Services: ICAT considerations

	ICAT consideration		Description
14	**Smart HVAC system & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart HVAC system throughout the entire surgery department, including all surgical suites, preparation and recovery rooms to create a more personalized environment for both patients and staff.
15	**Smart lighting system, sensors, & voice assisted technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the entire surgery department, including all surgical suites, preparation and recovery rooms to create a more personalized environment for patients and staff. A smart lighting system could also be integrated with voice assisted technology to allow patients and staff to use their voice to turn lights on and off, instead of walking to light switches. Motion detector lighting systems could also help with ensuring lights are not left on which could help reduce energy consumption.
16	**Smart security system, touchless technology** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart security system in and around the surgery department. These systems could monitor environments 24/7 and provide highly secure and safe areas for both patients and staff. Smart security systems could also work with other smart technologies (e.g. biometric technology, RTLS & RFID embedded staff badges, facial recognition, etc.) to manage access to secure areas. Touchless technology could also enable easy maneuvering throughout these areas (e.g. if surgeon is sterile during a procedure) and help reduce the spread of infectious diseases on door knobs and push-buttons on walls

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16. Surgical Services: ICAT considerations

	ICAT consideration		Description
17	**Smart scheduling system**	Back Office	Consider implementation of a smart scheduling system that can leverage AI technologies to automatically create optimized surgical schedules based on a variety of inputs which may include: surgeon availability, surgeon preferences, patient availability, procedure type, instruments and support staff required. This may help with improving the efficiency of the scheduling process and ensuring ORs are optimized for utilization.
18	**VR/AR technology**	Enabler	Consider implementation of VR/AR technology in surgical services. This technology could help to provide surgeons with training for surgical procedures in a simulated environment. This would enhance a surgeon's ability to practice and develop their skills in a meaningful way without posing any harm to a patient. VR/AR technology may also be used to enable the use of robotic surgery by allowing surgeons to have the ability to control robotic tools remotely without the requirement for direct physical control/contact of the surgical instrument.

ICAT Case Study: *Clinical, Diagnostic, & Therapeutic Services*

ED Patient Surgical workflow

Efficiency optimizer

Transformational opportunity

In future instances, drones could provide real-time coverage of on-site emergencies, which could help emergency response teams to better prepare for emergencies by providing them with information before arriving to the scene .

Step 1: Emergency dispatch & patient transportation

1.1. There has been a car accident on the highway and a witness calls 911. The Niagara Emergency dispatcher receives the call. This call also triggers a notification to regional police and fire fighting services. Using an intelligent dispatching system, the location of the call is identified and an ambulance closest to the scene is notified. These notifications include a recording of the conversation between the witness and the emergency dispatcher.

1.2. The ambulance closest to the scene of the accident, receives the notification. The paramedic uses an intelligent system to map the fastest route to the scene of the accident. Once a route is identified, the paramedic uses the system for turn-by-turn directions.

1.3. The emergency dispatcher stays on the phone with the witness. In the meantime, they track the ambulance, police car, and fire truck in real-time as it drives to the scene of the accident.

1.1 — A — 1.2 — 1.3 — 1.4

Step 2: patient arrival & delivery of care

1.5 — B — 1.6 — 1.7 — 1.8 — C

1.4. The ambulance arrives at the scene of the accident. The paramedics grab their smart medical devices and attend to the injured individual. After getting a glimpse of the patient's injuries, the paramedics confirm that the patient must be taken to the closet trauma unit. One of the paramedics uses a mobile device to initiate a "trauma code" to the nearest trauma unit. In the meantime, other paramedics connect the individual to smart medical devices and carry the patient into the ambulance.

1.5. As the ambulance is driving to the nearest trauma unit, the emergency clinician at the trauma unit video calls the paramedics. The paramedic picks up the call using their voice.

1.6. The emergency clinician is receiving the patient's vital signs in real-time. They are also viewing the patient's injuries on camera and directly speaking to the paramedics. After seeing the individual's injuries, the emergency clinician confirms that they will need to go straight into surgery.

1.7. The emergency clinician uses their hospital mobile device to initiate an emergency operation. This notification is sent to the trauma team, including surgical staff. The individuals who received the notification are able to view the patient's vitals (in real-time) and injuries from photos the emergency clinician took while on camera with the paramedics. Trauma team members are also instructed to meet in the surgical department instead of the trauma bay.

1.8. The "emergency operation" notification is also extended to the surgical flow coordinator. The flow coordinator receives the notification and uses the smart scheduling system to identify an available room. Once the room is booked, surgical staff are notified to prepare the room.

A Improve the efficiency of emergency dispatching services by enabling electronic notifications to paramedics.

B Streamline clinical workflows by enabling real-time access to patient information with the use of smart medical devices and mobile devices.

C Improve the efficiency of surgical bed turnover by implementing smart scheduling systems, that are integrated with relevant information systems (e.g. environmental services).

Integrated enabling technologies:

- Automated guided vehicles (AGVs)
- Electronic communication systems
- RTLS & RFID chips and readers
- Fully integrated CPOE enabled HIS
- GPS navigation
- Hospital mobile devices
- Smart medical devices
- Smart OR scheduling system
- Video-conferencing technology
- Voice-assisted technology

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ICAT Case Study: *Clinical, Diagnostic, & Therapeutic Services*

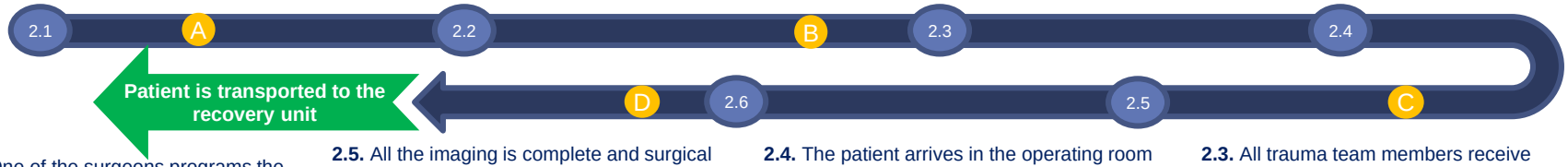
ED Patient Surgical workflow

- Efficiency optimizer
- Spatial optimizer
- Transformational opportunity

Step 2: Patient arrival & delivery of care

2.1. Once an operating room is identified, the flow coordinator sends the room location to all respective staff. In the meantime, surgical staff are preparing the room by coordinating equipment and supply orders. All equipment and supplies needed for the surgery are ordered via CPOE and delivered to the operating room via AGVs and the advanced pneumatic tubing system.

2.2. As the ambulance pulls up to the emergency entrance of the hospital, emergency staff are notified on their hospital mobile devices. One of the staff members is part of the emergency administration team. Using their hospital mobile device, they quickly scan the patient's face and register the patient. Once the patient is registered, the patient's information is available to all respective staff.



2.6. One of the surgeons programs the "automated stitching" robot to close the small incision made into the patient's abdomen. Once completed the patient is moved to the recovery room. When the patient is transported out of the operating room, the RTLS triggers a notification to environmental services

2.5. All the imaging is complete and surgical staff begin to operate on the patient. Using the multi-monitor console in the operating room, surgeons are able view and modify all of the images taken. Surgeons are also able to instantly communicate with radiologists who are on-call, by simply using the voice-assisted technology in the operating room.

2.4. The patient arrives in the operating room and paramedics leave. The trauma and surgical team assess the patient and use advanced imaging technology in the operating room to scan the patient prior to surgery. The surgeons in the room use their voice to activate the imaging machines. Since, everyone in the room is wearing leaded aprons, staff continue to assess and the patient's injuries.

2.3. All trauma team members receive the notification that the patient has arrived. Automated building systems enable quicker access to the surgical department for trauma team members who are currently in other areas of the hospital.

A Save wasted time by automating manual processes, including filling out and faxing of paper-based orders.

B Improve the efficiency of registration processes by minimizing manual tasks with the use of facial recognition technology.

C Improve staff productivity by allowing staff to multitask with the use of voice-assisted technology.

D Improve the efficiency of surgical procedures by automating manual tasks with the use of robotic surgical equipment.

Integrated enabling technologies:

- Advanced imaging technology
- Automated building systems
- Electronic communication systems
- RTLS & RFID chips and readers
- Facial recognition technology
- Fully integrated CPOE enabled HIS
- GPS navigation
- Hospital mobile devices
- Smart medical devices
- Smart OR scheduling system
- Surgical robots
- Video-conferencing technology
- Voice-assisted technology

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Support & Administrative Services

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Support & Administrative Services Overview

ICAT Vision: ICAT will revolutionize how certain areas of the organization provide administrative support to the hospital. It will also enable new solutions for how staff may collaborate internally with NH colleagues and externally with community partners in Niagara.

Sampling of Expected Outcomes:

- Staff will have greater access to a patient's record when appropriate to support administrative functions such as case costing and sharing patient records.
- The patient experience will be enhanced by offering modern solutions for patients to register at the hospital, find parking and having the ability to select their own nutritional meals.
- Staff will see improvements through building automation particularly for certain administrative functions in the hospital including environmental services and engineering services.
- Hospital administration and support staff will have the ability to monitor the capacity of the enterprise and other aspects of performance to drive decision making based on insights. Inputs may include the number of patients admitted, to the number of staff on shift, and accounting for environmental factors such as weather and community outbreaks.

Case Study Description: A detailed workflow from the staff perspective is described on the subsequent slide to depict the conceptual future state of the staff experience at SNH. This particular case study describes the experience for a radiologist in the hospital. Highlighted in the case study are the efficiency and spatial optimizers that will help to improve upon the current state enabled by ICAT solutions.

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ICAT Case Study: *Support & Administrative Services*

Multi-program hospital staff perspective

Efficiency optimizer
Spatial optimizer
Transformational opportunity

In future instances, drones could deliver products to staff and patients in the hospital (e.g. pre-ordered coffee from the cafeteria in the hospital).

1.1 A radiologist is late for their shift at the SNH. Using the Niagara Health Navigator App, the radiologist enables the wayfinding feature to help guide them, using the fastest route to the hospital.

1.2. The radiologist arrives at the parking lot gate. The smart parking and security system scans the radiologist's license plate and opens the gate. This automatically triggers a notification to the Diagnostic Imaging unit, that they have arrived.

1.3. The radiologist exits their car and walks towards the main entrance of the hospital.

1.4. As the radiologist is walking to the hospital's main entrance, the radiologist notices that there is an unread notification on their phone from the Niagara Health Navigation App. The radiologist clicks on the notification. It turns out that the radiologist has parked in a "patients only" parking space. As the radiologist parked their car, the smart parking and security system scanned the license plate and cross matched it with staff license plates on file.

1.8. Since the radiologist was in a rush getting to work, they had forgotten to pick up breakfast. Using the Niagara Health Navigation App, the radiologist orders a coffee and food from the café in the hospital. The radiologist is able to continue to report on exams until notified to pick up their order from the café.

1.7. As the radiologist approaches their workstation, the RFID sensors recognize their presence and automatically turn on the computers. As the radiologist sit in their chair, the chair automatically morphs into the radiologist's preferred agronomical position.

1.6. The radiologist walks to the Diagnostic Imaging department. As they enter the radiology reporting room, the monitor on the door greets the radiologist with a personal message, "Good morning, Dr. Alex!". The camera above the monitor scans the radiologist's face and authorizes entry into the reporting room.

1.5. The radiologist walks back to their car to park in another parking spot. The radiologist had forgotten that they could reserve a parking space using the Niagara Health Navigation App. As the radiologist gets into their car, they use the app to reserve a parking spot. The radiologist then drives to this parking spot and enters the SNH.

- A Save time by enabling wayfinding features to help guide individuals to their destinations using shortest routes possible.
- B Save wasted time registering and paying for parking by enabling vehicle license plate monitoring and self-service payments via the Niagara Health Navigation App
- C Save wasted time by searching for available parking spots by enabling self-service parking reservation via the Niagara Health Navigation App
- D Save wasted time waiting in long line ups in the public cafes by enabling self-service ordering and pick-up via the Niagara Health Navigation App.

Integrated enabling technologies:
- Niagara Health Navigator App
- Parking information management system
- Parking guidance system
- Vehicle license plate monitoring
- RTLS and RFID Technology
- Building automation systems

Program specific ICAT considerations

The subsequent section identifies ICAT considerations for each of the programs and services under “Support & Administrative Services” as identified in NH’s stage 2 Functional Program.

These scope of programs included in this area are:

- *17. Administrative Services*
- *18. Biomedical Engineering*
- *19. Clinical Support Services*
- *20. Engineering Services*
- *21. Environmental Services*
- *22. Foundation*
- *23. Health Information Management*
- *24. Human Resources (& Occupational Health & Safety and Staff Facilities)*
- *25. Information & Communication Technology (ICT)*
- *26. Interprofessional Education & Learning*
- *27. Logistics*
- *28. Medical Device Reprocessing (MDR)*
- *29. Medical Staff Facilities*
- *30. Nutrition and Food Services*
- *31. Parking & Security*
- *32. Planning & Development*
- *33. Public Areas*
- *34. Registration*
- *35. Spiritual Care*
- *36. Volunteer & Auxiliary Services*

17. Administrative Services: ICAT considerations

	ICAT consideration		Description
1	**Boardroom technology**	Back Office & Enabler	Consider implementing modern technology solutions to enhance boardroom meetings. Solutions may include: multiple large widescreen televisions, wide-angle video cameras for video conference, acoustically friendly speakers, wireless connectivity across all devices, interactive whiteboards, scheduling chatbots and multiple microphones. These technologies will help to enhance in-person meetings but also facilitate communications that may be conducted with individuals who are remote.
2	**Board management software**	Front Office & Enabler	Consider implementing end-to-end software that will manage all tasks related to operating a Board. Functions that may be included in the software include: a board portal to allow board members to access files, meeting minutes and meeting schedules, the ability to annotate and take notes electronically during meetings, the ability to send messages and communicate in real time with other board members and hospital management, and virtual options for attending board meetings.
3	**Collaboration spaces**		Consider implementing office space for administrative staff to collaborate. Collaboration spaces are typically furnished to allow multiple individuals to sit and collaborate. Solutions that help to enable these workspaces include, large interactive whiteboards that also function as large monitors, wide angle video cameras for video conferences and power outlets. Collaboration spaces are more flexible than meeting rooms and may be configured for different functions/purposes. Collaboration spaces are sometimes less costly to construct compared to meeting rooms.
4	**“Hoteling” enabled solutions**	Back Office	Consider implementing solutions that will enable a “hoteling” environment. Given NH’s multi-site structure, it is likely that some administrative staff will require travel between sites to attend meetings. Hoteling spaces will provide temporary spaces for staff to work out of. ICAT solutions that help to enable hoteling may include IP phones, widescreen monitors and smart lockers to store personal items.

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17. Administrative Services: ICAT considerations

	ICAT consideration		Description
5	**Patient relations software**	Front Office & Enabler	Consider implementing an electronic solution to support patient relations to capture patient experience information in a more real-time fashion. An electronic solution may also help with achieving greater scale in the number of patients who are surveyed on their experience. This also creates opportunities for reporting.
6	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the administrative services area to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

18. Biomedical Engineering: ICAT considerations

	ICAT consideration		Description
1	**5G Network**	Enabler	Consider implementing a 5G network to enable ubiquitous high speed connectivity for a large number of devices and for faster transmission of data throughout the hospital.
2	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS in the biomedical engineering department. RTLS can be used by either installing, attaching, or embedding RFID chips into medical equipment to help track the location of the devices within the hospital. This technology may also have the capability to determine when devices require maintenance/servicing and may be operated remotely (shut down or turned on).
3	**CPOE enabled fully integrated modern HIS & a cloud-based online version for mobile access**	Front Office & Enabler	Consider implementation of an integrated hospital information system to connect biomedical devices to for testing. Biomedical devices have the ability to capture information such as vitals and where possible this information should be included in the patient record. Medical devices should have a point of integration with the HIS for uploading real time telemetry data.
4	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the biomedical engineering areas to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.
5	**Sufficient wired and wireless infrastructure**	Back Office	Consider implementing a particularly robust wired and wireless infrastructure environment for the biomedical engineering program to ensure medical device connectivity is not an issue for testing and maintenance of medical devices.

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19. Clinical Support Services: ICAT considerations

	ICAT consideration		Description
1	**Automated solutions**	Back Office & Enabler	Consider implementing automated solutions for cleaning and disinfection. Other tools that may be helpful include ATP meters or UV light reactive fluorescent markers to verify the cleanliness of a particular area. Automated or semi-automated disinfection tools are not intended to replace personnel, but help to ensure a certain quality standard is maintained.
2	**Collaboration spaces**		Consider implementing office space for IPAC, hospitalists or general internists to collaborate or hold emergency meetings. Collaboration spaces are typically furnished to allow multiple individuals to sit and collaborate. Solutions that help to enable these workspaces include, large interactive whiteboards that also function as large monitors, wide angle video cameras for video conferences and power outlets. Collaboration spaces are more flexible than meeting rooms and may be configured for different functions/purposes. Collaboration spaces are sometimes less costly to construct compared to meeting rooms.
3	**"Hoteling" enabled solutions**	Back Office	Consider implementing solutions that will enable a "hoteling" environment. Given NH's multi-site structure, it is likely that some IPAC, hospitalists or general internists staff will require travel between sites to attend meetings. Hoteling spaces will provide temporary spaces for staff to work out of. ICAT solutions that help to enable hoteling may include IP phones, widescreen monitors and smart lockers to store personal items.
4	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the administrative services area to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

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20. Engineering Services: ICAT considerations

	ICAT consideration		Description
1	**Intelligent preventative maintenance system**	Front & Back Office	Consider implementing an intelligent preventative maintenance system to optimize building performance by minimizing deferred maintenance visits and reactive repairs . This system is equipped with sensors that are installed and/or attached to various equipment. These sensors connect equipment to engineers (or technicians). This system enables remote real-time monitoring of systems and equipment and automatic notifications to report any issues.

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21. Environmental Services: ICAT considerations

	ICAT consideration		Description
1	**Automated solutions**	Back Office & Enabler	Consider implementing automated solutions for cleaning and disinfection. Other tools that may be helpful include ATP meters or UV light reactive fluorescent markers to verify the cleanliness of a particular area. Automated or semi-automated disinfection tools are not intended to replace personnel, but help to ensure a certain quality standard is maintained.
2	**Bed tracking solution**	Front & Back Office	Consider implementing a bed tracking solution that will centrally manage the status of beds across the hospital and streamline communications between different departments. This type of electronic solution will help to reduce the amount of time wasted on manually communicating the status of beds (dirty or clean) between housekeeping and clinical staff across the hospital.
3	**Innovative training solutions**	Front & Back Office	Consider implementing training solutions that help to provide insightful education to housekeeping staff. Examples of innovative training may include VR/AR solutions. Hospital environment hygiene is complex due the potential for infections from the presence of bacteria. Providing insightful education through innovative means around the complexity of hospital hygiene may help to establish a stronger culture around the importance of hospital cleanliness. Recent studies have shown the correlation between strong hospital hygiene and reducing safety risks for patients.
4	**Smart waste management system including smart "trash bins"**	Front & Back Office	Consider implementing a smart waste management system, including smart "trash bins" in and around the new SNH. This system could help keep environments clean and safe for patients, staff, and visitors. The system also provides the SNH with an opportunity to reduce waste management costs, by potentially reducing resource requirements for collection processes.

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22. Foundation: ICAT considerations

	ICAT consideration		Description
1	**CRM solution**	Front & Back Office	Consider implementing a CRM (customer relationship management) information system to manage donors at Niagara Health. An industry grade CRM system could help with managing donors on a larger scale and provide tools to diversify funding efforts and enhance outreach capabilities. CRM tools can improve donor retention and provide relevant reporting and trending on donors that may help to inform planning and decisions around future fundraising ideas and events.
2	**Mobile/automated check-out**	Front & Back Office	Consider implementing self-service kiosks/check-out counters to enable customers at the Foundation storefront to pay for items using a kiosk. This could help reduce the number of volunteers or staff needed to operate the Foundation storefront.
3	**Mobile wallet/payment solutions**	Front & Back Office	Consider implementing a mobile wallet functionality as part of the Niagara Health Navigator App. This would enable customers of the Foundation storefront to make payments from their mobile device which could help to improve the efficiency of making payments for items from the storefront. Mobile payment solutions (tap to pay, contactless cards) are another worthwhile consideration as they are quickly becoming the standard for point of sale transactions. Mobile payment solutions help to improve the security authentication for purchases and also help to expedite the check-out process.

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23. Health Information Management: ICAT considerations

	ICAT consideration		Description
1	**Blockchain technology**	Enabler	Consider implementing blockchain technology and applications for patients as a form of authentication and creating a distributed framework for assessing patient digital identities. Private and public identifiers could be secured using cryptography technology which may help with protecting patient identifies as patient records become more widely accessible by multiple healthcare providers and community partners.
2	**Collaboration spaces**		Consider implementing office space for staff in Health Information Management to collaborate. Collaboration spaces are typically furnished to allow multiple individuals to sit and collaborate. Solutions that help to enable these workspaces include, large interactive whiteboards that also function as large monitors, wide angle video cameras for video conferences and power outlets. Collaboration spaces are more flexible than meeting rooms and may be configured for different functions/purposes. Collaboration spaces are sometimes less costly to construct compared to meeting rooms.
3	**CPOE enabled fully integrated modern HIS & a cloud-based online version for mobile access**	Front & Back Office	Consider implementing a modern HIS across all sites in the Niagara region and fully integrating it with all relevant program areas. A fully integrated modern HIS could alleviate the efforts needed to collect, complete, assemble and maintain patient records. Currently, the process is paper based which creates many manual processes to support. Once patient information is captured electronically in an integrated HIS, the process will be much more streamlined which will enable the Health Information Management function to respond more quickly to requests to access or obtain patient records. Cloud-based online platforms of the HIS could further improve access to patient health information by making patient health information available at anytime and from anywhere with the use of mobile devices.

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23. Health Information Management: ICAT considerations

	ICAT consideration		Description
4	**Release of information system**	Front & Back Office	Consider implementing a secure web-based release of information system that provides online access for patients and family members to submit requests to access historical patient data. The scope of this system should provide patients and family members with historical data that is not captured electronically in the HIS which may include scanned records.
5	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the Health Information Management area to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

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24. Human Resources: ICAT considerations

	ICAT consideration		Description
1	**Collaboration spaces**		Consider implementing office space for HR staff to collaborate. Collaboration spaces are typically furnished to allow multiple individuals to sit and collaborate. Solutions that help to enable these workspaces include, large interactive whiteboards that also function as large monitors, wide angle video cameras for video conferences and power outlets. Collaboration spaces are more flexible than meeting rooms and may be configured for different functions/purposes. Collaboration spaces are sometimes less costly to construct compared to meeting rooms.
2	**"Hoteling" enabled solutions**	Back Office	Consider implementing solutions that will enable a "hoteling" environment. Given NH's multi-site structure, it is likely that some HR staff will require travel between sites to attend meetings. Hoteling spaces will provide temporary spaces for staff to work out of. ICAT solutions that help to enable hoteling may include IP phones, widescreen monitors and smart lockers to store personal items.
3	**Smart enabled wellness and fitness equipment**	Front Office	Consider implementing wellness and fitness equipment in the proposed staff wellness area that is smart technology enabled. This would allow staff to connect their mobile devices, fitness trackers and other sensors to gather information and data around wellness and fitness exercises such as time spent exercising, heart rate information and distance travelled. This information may be used to help inform planning wellness programs and defining wellness goals for staff.
4	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the HR services area to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

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25. Information & Communication Technology (ICT): ICAT considerations

	ICAT consideration		Description
1	**Collaboration spaces**		Consider implementing office space for ICT staff to collaborate. Collaboration spaces are typically furnished to allow multiple individuals to sit and collaborate. Solutions that help to enable these workspaces include, large interactive whiteboards that also function as large monitors, wide angle video cameras for video conferences and power outlets. Collaboration spaces are more flexible than meeting rooms and may be configured for different functions/purposes. Collaboration spaces are sometimes less costly to construct compared to meeting rooms.
2	**"Hoteling" enabled solutions**	Back Office	Consider implementing solutions that will enable a "hoteling" environment. Given NH's multi-site structure, it is likely that ICT staff will require travel between sites to attend meetings. Hoteling spaces will provide temporary spaces for staff to work out of. ICAT solutions that help to enable hoteling may include IP phones, widescreen monitors and smart lockers to store personal items.
3	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks for the proposed resource centre. Self-service kiosks could be used to manage the patients, families, visitors and community partners who require support from the resource centre. The kiosk could help to regulate a queue of people if needed and would help manage flow within the resource centre. Although requests for support are to be submitted through an electronic requisitions, this may not be available for non-staff members.
4	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the ICT area to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

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26. Interprofessional Education & Learning: ICAT considerations

	ICAT consideration		Description
1	**Niagara Health Navigator app**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator app as means for staff to access education materials for learning and professional development offered through the Interprofessional Education & Learning program. By providing education material on mobile devices, staff have the option to review education materials remotely.
2	**Smart auditorium solutions**	Back Office & Enabler	Consider implementing smart enabled auditorium solutions to create a more interactive experience for audience members. Examples of solutions that can enable a more interactive experience include utilizing modern multimedia technology including large screens and capable video conference capabilities, providing the ability for audience members to broadcast information to the audience through their personal device or mobile phone, greater deployment of microphones which enable members of audience to speak to the rest of the auditorium.
3	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the Interprofessional, education and learning area to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.
4	**VR/AR education tools**	Middle Office & Enabler	Consider utilizing VR/AR technology solutions to enhance the education experience for nursing, medical, allied health, regulated health professional students and other professionals (including administrative staff). For example, VR/AR technologies can be used to simulate environments for professionals to test and practice their skills. VR/AR technologies also enable video capture to help individuals understand what they did well and how they could improve.

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27. Logistics: ICAT considerations

	ICAT consideration		Description
1	**AGVs**	Back Office	Consider utilizing AGVs throughout logistics to support with the transportation of large shipments within the logistics area but also to other parts of the hospital. AGVs could reduce staff requirement for transportation of products and increase delivery time of products.
2	**Automated receiving**	Back Office & Enabler	Consider implementing automation to receive shipments and packages from self-driving trucks in the future. Self-driving technology is still in its infancy, but should become more mainstream in the next 3-5 years. Barcode reading technology can be used to automate the receiving process of shipments from trucks which may help to free up capacity on some teams
3	**Digital inventory management solutions**	Back Office & Enabler	Consider implementing a digital inventory management solution to streamline and automate the inventory tracking and fulfillment process of supplies throughout the hospital. Automated bins are able to detect low supply and automatically place orders for additional supplies and can be programmed to automatically fulfill orders depending on the particular needs of a specific product or supply. This information is captured electronically in an information system and provides reporting capabilities that help to monitor trends in inventory volumes to inform future planning.
4	**Mobile workstations**	Front Office	Consider implementing mobile workstations for staff in the logistics program. Given the nature of work in logistics, it is helpful for staff to be able to carry their workstations with them as they physically travel around the area. This helps to reduce the potential for errors when labelling and scanning packages.
5	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS in logistics to track important shipments and packages on crates as they move around the logistics department and other parts of the hospital. This will help with reducing the chances for items getting lost or unaccounted for as they are delivered to different areas of the hospital.
6	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the biomedical engineering areas to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

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28. Medical Device Reprocessing: ICAT considerations

	ICAT consideration		Description
1	**AGVs**	Back Office	Consider utilizing AGVs throughout medical device reprocessing to support the transportation of medical devices in carts from the appropriate areas of the hospital. This could help streamline some of the processes involved with transporting medical devices from surgical/operating units to the reprocessing areas.
2	**Digital inventory management solutions**	Back Office & Enabler	Consider implementing a digital inventory management solution to streamline and automate the inventory tracking and fulfillment process of supplies in medical device reprocessing. Automated bins are able to detect low supply and automatically place orders for additional supplies and can be programmed to automatically fulfill orders depending on the particular needs of a specific product or supply. This information is captured electronically in an information system and provides reporting capabilities that help to monitor trends in inventory volumes to inform future planning.
3	**Instrument tracking system**	Back Office	As defined in the stage 2 functional program, consider implementation of an instrument tracking and sterile processing information system to manage all medical device reprocessing activities. This system should interface with other critical information systems in the surgical/operating units including the ORIS (operating room information system) and HIS (hospital information system). The instrument tracking system should also include the necessary hardware required in medical device reprocessing including terminals for scanners and printers.
4	**Operating room information system (ORIS)**	Back Office & Enabler	As defined in the stage 2 functional program, consider implementation of an ORIS to capture and streamline how information relating to surgeon preference lists, procedure pick lists and operating room (OR) scheduling is relayed to staff in the medical device reprocessing department. This will help reduce wasted steps associated with manually communicating this information.
5	**RTLS & RFID Technology**	Back Office & Enabler	Consider implementing a RTLS in medical device reprocessing to track important instrument packages within the surgical/operating units of the hospital. This will help with reducing the chances for items getting lost or unaccounted for as they are travelling back and forth between departments between use and cleaning.

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29. Medical Staff Facilities: ICAT considerations

	ICAT consideration		Description
1	**Collaboration spaces**		Consider implementing office space for medical staff to collaborate. Collaboration spaces are typically furnished to allow multiple individuals to sit and collaborate. Solutions that help to enable these workspaces include, large interactive whiteboards that also function as large monitors, wide angle video cameras for video conferences and power outlets. Collaboration spaces are more flexible than meeting rooms and may be configured for different functions/purposes. Collaboration spaces are sometimes less costly to construct compared to meeting rooms.
2	**"Hoteling" enabled solutions**	Back Office	Consider implementing solutions that will enable a "hoteling" environment. Given NH's multi-site structure, it is likely that medical staff will require travel between sites to attend meetings. Hoteling spaces will provide temporary spaces for staff to work out of. ICAT solutions that help to enable hoteling may include IP phones, widescreen monitors and smart lockers to store personal items.
3	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the medical staff facilities to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

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30. Nutrition and Food Services: ICAT considerations

	ICAT consideration		Description
1	**Automated inventory management**	Back Office & Enabler	Consider implementing an automated inventory management system to track food and ingredients in the patient food services area. Automated inventory management systems can help to facilitate sustainability of food as it helps to reduce waste and spoilage. These systems can also be used to help streamline purchases of additional food supplies from vendors.
2	**CPOE enabled fully integrated modern HIS & a cloud-based online version for mobile access**	Front Office & Enabler	Consider implementation of an integrated hospital information system to document and integrate into the patient food services area information regarding a patients diet including dietary restrictions, allergies and drug interactions. The hospital information system would also be accessible by dieticians who are planning nutrition for patients and have access to the relevant information needed from the patient's record to recommend safe and valuable nutritional plans.
3	**Mobile menus**	Back Office & Enabler	Consider implementation of a mobile menu to enhance the nutritional experience for patients and to also provide staff in nutrition and food services to connect more directly with patients around their nutritional preferences. Mobile menus can take the form of interactive televisions, modern integrated bedside terminals and mobile applications on smartphones. Mobile menus can also provide educational material around nutrition and also streamline the process to update nutritional information when changes/updates occur.
4	**Personalized food experience**	Back Office & Enabler	Consider implementing a personalized food experience for patients, similar to personalized medicine. Food preferences and allergies are automatically accounted for in patients and food is delivered to patient rooms based on these preferences. Food may also be delivered to patient homes in partnership with grocery stores once patients have been discharged from the hospital and on a remote patient monitoring program.
5	**Smart refrigeration**	Back Office & Enabler	Consider implementation of smart refrigerators to enhance the management of food storage in nutrition and food services. Smart refrigerators are able to detect the items stored and track important information relating to those items including weight, size and the expected expiration of certain foods. Some smart refrigerators also come equipped with barcode scanners or RFID systems to collect additional attributes relating to certain foods and ingredients.

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30. Nutrition and Food Services: ICAT considerations

	ICAT consideration		Description
6	**Digital food café or "vending machine café"**	Back Office & Enabler	Consider implementing a digital food café (e.g. chef-in-box vending machines) that provides staff, patients, and visitors with both hot and cold meals at any time of the day. Individuals could order food without having to depend on hospital staff and could feel less restricted to purchase food only during business hours.

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31. Parking & Security: ICAT considerations

	ICAT consideration		Description
1	**Automated parking lot**	Back Office & Enabler	Consider implementing a fully enabled smart and automatic parking lot that will automate the entire parking process and also support automated self-driving vehicles. Lasers are used to scan vehicle sizes and a robotic valet provides assistance to park the vehicles. The robotic valet is powered by a robotic dolly that lifts and transfers vehicles to storage racks. These types of systems can increase the capacity (due to better space management by the robotic dolly) and efficiency of parking lots.
2	**Biometric access**	Back Office & Enabler	Consider implementing biometric access throughout the hospital or in sensitive areas to implement stricter access control. Biometric access may involve facial or iris recognition to permit access for hospital staff. Biometric access also helps to decrease the spread of infectious germs by limiting physical contact.
3	**Distributed panic devices**	Back Office & Enabler	Consider implementing distributed panic devices throughout the entire hospital or in particular areas of the hospital where violence and safety are significant concerns. Panic devices create a decentralized network of access points for staff to alert security immediately of a safety or security concern without the need to travel back to a central location (such as the nursing unit) to create the notification. Distributed panic devices help to reduce the response time for security to address safety or security concerns.
4	**Niagara Health Navigator App**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator app to enable mobile parking features such as: enabling mobile payment for parking, having the ability to reserve parking sports in advance and checking-in to parking spots, and providing information about parking lot occupancy on a dashboard for patients and family members visiting the hospital. All of these features can help to enhance the patient experience for patients and their family members.
5	**Parking demand fluctuation**	Back Office & Enabler	Consider repurposing parking spaces for other uses as the need for parking may be reduced as autonomous vehicles, ride sharing programs and other forms of public transit become more prominent as the Niagara region evolves. For example: parking spaces may be repurposed to house solar panels to harvest solar energy for hospital operations.

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31. Parking & Security: ICAT considerations

	ICAT consideration		Description
6	**Parking guidance system**	Back Office & Enabler	Consider implementation of a parking guidance system. This entails the detection of vehicle presence and utilizing LED coloured indicators to show whether parking spots are vacant or occupied. This information can be aggregated to display total parking spaces available/occupied on digital signage at the entrance of parking lots to help inform patients and family members of the current volume.
7	**Parking management information system**	Back Office & Enabler	Consider implementation of a parking information management system. This would enable greater control and planning around the parking functionality. This may include having the ability to access analytics and reporting around parking revenue, volume of parking and trending, having an ability to adjust parking rates, creating parking passes and coupons and controlling access to the parking lot for high volume customers. Some of the trending that may become available in a dedicated information system include, length of stay and payment methods.
8	**Vehicle license plate monitoring**	Back Office & Enabler	Consider implementing vehicle license plate monitoring to enable greater advanced analytics around the inappropriate utilization of parking spaces by staff and patients. Vehicle license plate monitoring will utilize information about known license plates of staff and patients and actively monitor their parking location.
9	**Video analytics**	Enabler	Consider implementing video analytics for parking and security functions. Video analytics leverages artificial intelligence (AI) technology to provide automated support for analyzing trends in motion detection, facial recognition and license plate monitoring and people counting. This technology is intended to expedite the time and effort that would normally be required to manually survey video recordings. Video analytics performs these functions in a more efficient manner helping organizations to reduce the cost of video surveillance.
10	**Mobile security robots**	Back Office & Enabler	Consider implementing security robots in and around the new SNH. These robots could monitor environments 24/7 and provide highly secure and safe areas for both patients, staff, and visitors.

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32. Planning & Development: ICAT considerations

	ICAT consideration		Description
1	**AR/VR technology**	Enabler	Consider implementing augmented reality and virtual reality solutions to support digital twinning of physical environments to help redevelopment staff and hospital administration with planning and projecting service demand for different areas of the hospital. Artificial intelligence and machine learning tools may help to inform the planning and forecasting that would complement the spatial planning that AR/VR technologies could help enable.
2	**Collaboration spaces**		Consider implementing office space for planning & development staff to collaborate. Collaboration spaces are typically furnished to allow multiple individuals to sit and collaborate. Solutions that help to enable these workspaces include, large interactive whiteboards that also function as large monitors, wide angle video cameras for video conferences and power outlets. Collaboration spaces are more flexible than meeting rooms and may be configured for different functions/purposes. Collaboration spaces are sometimes less costly to construct compared to meeting rooms.
3	**"Hoteling" enabled solutions**	Back Office	Consider implementing solutions that will enable a "hoteling" environment. Given NH's multi-site structure, it is likely that planning & development staff will require travel between sites to attend meetings. Hoteling spaces will provide temporary spaces for staff to work out of. ICAT solutions that help to enable hoteling may include IP phones, widescreen monitors and smart lockers to store personal items.
4	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the planning & development area to allow staff the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

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33. Public Areas: ICAT considerations

	ICAT consideration		Description
1	**Digital signage and dashboards**	Front Office & Enabler	Consider implementing digital signage in the form of large TVs or screens throughout the main hospital lobby at SNH. This digital signage can provide relevant contextual information for patients as they enter the hospital. Information could include directions to key areas of the hospital, information on the date and time, information regarding relevant updates to programs and changes ongoing at the hospital that patients should be aware of and information about where patients can seek help and assistance. In addition, the digital signage may be used to also display the names of individuals and entities who have provided support to SNH through the foundation. There may also be considerations to display relevant dashboard information such as current wait-times in the hospital emergency department, the health of the hospital's bed capacity and any major delays across ambulatory clinics in the hospital.
2	**Mobile wallet/payment solutions**	Front & Back Office	Consider implementing a mobile wallet functionality as part of the Niagara Health Navigator App. This would enable patients and family members in the public areas to make payments from their mobile device which could help to improve the efficiency of making payments for items in the cafeteria, gift shop, parking, outpatient pharmacy and other retail providers. Mobile payment solutions (tap to pay, contactless cards) are another worthwhile consideration as they are quickly becoming the standard for point of sale transactions. Mobile payment solutions help to improve the security authentication for purchases and also help to expedite the check-out process.
3	**Niagara Health Navigator App**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator app as a companion platform for patients as they enter the hospital lobby. The app may automatically notify patients of their arrival in the hospital and display relevant information related to their visit including: updates to a scheduled appointment and wayfinding directions to support the patient in arriving at the desired location within the hospital. The application may also be used to provide other information regarding the hospital such as the location of the cafeteria, gift shop and washrooms.

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33. Public Areas: ICAT considerations

	ICAT consideration		Description
4	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to “check-in/register” for their appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks. Self-service kiosks could also contribute to empowering patients, as patients would be able to independently manage their own care journey.
5	**Smart live wall**	Enabler	Consider implementing a smart live wall that utilizes sensors and artificial intelligence to monitor and manage a living/green wall. Smart live walls have proven to be effective air purifiers and humidifiers through automation for the physical environments surrounding them. The smart technology helps to control the built-in water tanks and lighting on the wall to ensure the natural elements are properly treated and maintained. These technologies are becoming effective choices for creating a welcoming and refreshing environment for patients and family members as they enter hospitals through the lobby.

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34. Registration: ICAT considerations

	ICAT consideration		Description
1	**Biometric registration**	Back Office & Enabler	Consider implementing biometric access as a means to register existing patients for their appointments upon their arrival at the hospital. Biometric access may involve facial or iris recognition to validate a patient's identity. Once patients have registered their biometric identity upon their initial visit, any subsequent visit to the hospital can be expedited through a biometric scan. Patients would not be required to carry another form of identification or registration to the hospital.
2	**Niagara Health Navigator App (including a patient portal)**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator app as a companion platform for patients as they enter the hospital lobby. The app may automatically notify patients of their arrival in the hospital and advise on the registration process for new patients. Functionality could also be developed to enable patients to register remotely prior to arrival at the hospital. This would save patients time. Wayfinding could also be supported through the Niagara Health Navigator app. Turn by turn directions could help patients with finding their way around. Augmented reality would enhance the wayfinding experience for patients.
3	**Self-service Kiosks & mobile service applications**	Front Office	Consider implementing self-service kiosks in the main lobby of the new SNH, instead of building a large area for registration. Patients will be able to "check-in/register" for their appointments without having to wait in registration lines. Implementing self-service kiosks may improve the efficiency of patient workflows by reducing administrative tasks. Self-service kiosks could also contribute to empowering patients, as patients would be able to independently manage their own care journey.
4	**Smart health cards**	Back Office & Enabler	Consider implementing "smart health cards" as a more useful alternative to health cards in the Niagara region. These smart health cards could be used to identify individuals and act as secure carriers for an individual's health records. Individuals could "tap" these smart health cards at various healthcare organizations in the region to automatically share and update their personal health record.

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35. Spiritual Care: ICAT considerations

	ICAT consideration		Description
1	**Niagara Health Navigator App (including a patient portal)**	Front Office & Enabler	Consider utilizing the Niagara Health Navigator app as a companion platform for patients to have online access to pastoral care services. For example, a “Chaplain Chat” feature could be enabled to allow patients easy access to Chaplains and other spiritual care services remotely outside of the hospital.
2	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the spiritual care offices and the spiritual rooms to allow staff the ability to adjust light settings to their liking and to also enable patients and family members to adjust lighting to meet their spiritual needs. Lighting adjustments in the spiritual rooms should be designed to be user friendly to ensure accessibility. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.
3	**Integrated scheduling system**	Back Office & Enabler	Consider implementing an integrated scheduling system for spiritual care staff to manage their appointments with outpatients, families and visitors. Integration of the system of functionality built into the hospital information system (HIS) is preferred to ensure spiritual care appointments and relevant information is captured in the patient record.

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36. Volunteer & Auxiliary Services: ICAT considerations

	ICAT consideration		Description
1	**Collaboration spaces & volunteer's lounge**		Consider implementing space for volunteers to collaborate and creating a designated space for volunteers when they are off duty. Collaboration spaces are typically furnished to allow multiple individuals to sit and collaborate. Solutions that help to enable these workspaces include, large interactive whiteboards that also function as large monitors, wide angle video cameras for video conferences and power outlets. Collaboration spaces are more flexible than meeting rooms and may be configured for different functions/purposes. Collaboration spaces are sometimes less costly to construct compared to meeting rooms.
2	**Smart lighting systems & sensors** *(Building automation systems)*	Back Office & Enabler	Consider installing a smart lighting system throughout the volunteer and auxiliary services area to allow volunteers and auxiliary members the ability to adjust light settings to their liking. Motion detector lighting systems should help with ensuring lights are not left on which would help reduce energy consumption.

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I) ICAT Infrastructure analysis

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Overall infrastructure assessment

The overall infrastructure assessment has been summarized using the SOAR (strengths, opportunities, aspirations and results) framework:

STRENGTHS

- **The overall state of ICT infrastructure is strong**: The SCS redevelopment paired with ICT's leadership has created a strong foundation for ICT infrastructure and operations. There is trust between ICT and the rest of the organization.
- **The current operating model is functioning well**: The ICT team has been organized strategically by function to manage the infrastructure environment but to also interface with the "business" of NH to ensure needs are met.

OPPORTUNITIES

- **Shifting to a cloud-based environment:** NH should consider utilizing IaaS, PaaS and SaaS cloud-based infrastructure and application hosting. Given the expected role that digital solutions will play in the long-term future, this should become a serious consideration for NH
- **The DAS, RTLS and Telemetry roll-out has limitations**: Due to high costs, the current implementation of the DAS at SCS has limited coverage which has impacted the available functionality that clinicians are able to obtain from the RTLS and Telemetry systems.

ASPIRATIONS

- **ICT will play an even greater role in enabling the future of care delivery**: NH as an organization has an ambition to leverage ICT to transform the way care is delivered within the walls of the hospital but also the way care is delivered in the community by external providers.
- **There is a desire to strengthen ICT exponentially**: The level of ICT sophistication in today's environment is relatively low. Across the organization, there is a willingness to leap frog today's ICT capabilities to truly transform care delivery in Niagara.

RESULTS

- **In the future, ICT will be "invisible"**: A high performing ICT goes un-noticed in the day to day operations of the hospital. This collective viewpoint from multiple stakeholders at NH positions the organization well to ensure that ICT becomes a true enabler for the SNH.
- **Solutions will scale across the enterprise**: As new investments are made in ICT solutions, scalability across all NH sites will become a requirement and "one-off" solutions should no longer be permitted unless there are just reasons for doing so.

Additional ICAT infrastructure analysis

In addition to the overall assessment, a high level analysis of NH's infrastructure was conducted across four categories identified below. The analysis was informed by a documentation review and stakeholder interviews.

1

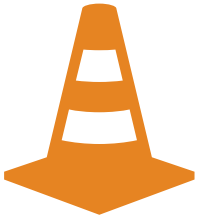
Infrastructure

- *Servers*
- *Storage*
- *Network*
- *Databases*
- *Telecommunication*

2

Applications

- *Application environment*
- *Interfaces*



3

ICT operations

- *Network performance*
- *End-user computing*
- *Data centre operations*

4

Resources

- *People and capabilities*
- *IT policies*
- *IT prioritization framework*

1) Infrastructure

Description:

"Infrastructure" entailed a review of the overall technology infrastructure environment at NH. Included in the scope of this analysis were infrastructure components such as servers, storage, the network, databases and telecommunication components.

Observations:

- **NH is operating a centrally managed infrastructure environment:** The ICT team has strong oversight of the enterprise infrastructure components across multiple sites at NH.
- **NH has implemented modern technology solutions at SCS**: Technologies such as RTLS and DAS have been implemented at SCS and has provided NH with the experience to learn from in defining an approach for these types of technologies at SNH.

Considerations:

- **Initiate wireless/wired network updates**: Ensure updates to the internal wired/wireless and DAS infrastructure are accounted for in the ICT Strategic Plan. As much as possible, the infrastructure should be standardized across all sites. The internal wired network should be updated to ensure the fastest speeds become available.
- **The existing integration engine requires an upgrade**: The integration engine in its existing state will require increased functionality in order to handle the demands of system and data integration. There will likely be an increase in the scope of devices and systems that will be connected in the future.

1) Infrastructure: future data centre

Description:
NH should carefully consider the options of building a data centre on premise at SNH against transitioning to a cloud infrastructure. Given the increasing shift across industries towards cloud infrastructure and the expected role that digital solutions will play in the long-term future, this should become a serious consideration for NH.

Observations:

- **NH has built a robust data centre at SCS:** The data centre built at SCS is modern and meets many safety and quality standards established as leading practices in data centre management including card access, efficient use of rack storage, and water and cooling safety.
  - As described in the stage 2 Functional Program, the SCS is intended to serve as the primary data centre for NH, while SNH will serve as a secondary site.

Considerations:

- **Shifting to a cloud-based environment**: NH should consider utilizing IaaS, PaaS and SaaS cloud-based infrastructure and application hosting.
  - ***Benefits of transitioning to cloud***: Increasing resilience of NH's core services, creating greater flexibility for automation of support services and enabling greater scalability and speed in provisioning particularly as NH looks to make greater investments in ICT. Transitioning to cloud also provides greater options around disaster recovery through managed services.
  - ***Potential risks of transitioning to cloud***: Transitioning to a cloud based infrastructure may pose a risk around unauthorized risk to data and losing some direct control around the provision of server storage.

2) Applications

Description:

"Applications" entailed a review of the current information systems environment at NH. Included in the scope of this analysis were applications currently in use and interfaces that exist between these systems for information exchange.

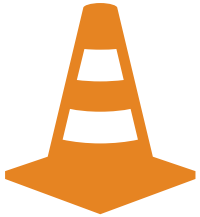
Observations:

- **The current HIS is aging**: There's been some frustrations expressed around the limitations and age of the current HIS system. NH has completed preliminary planning activities to scope out a HIS implementation to replace the legacy system.
- **NH is a best of breed environment**: There are multiple clinical and administrative information systems implemented across NH. The best of breed environment has created a fairly complex application environment which has hindered the ability to easily exchange information between systems. In addition, application support is under pressure to keep up with the knowledge base to operationally support all the applications.

Considerations:

- **Determine which applications will be retired as part of transitioning to a new HIS:** Once the HIS implementation activities begin, NH should create a prioritization framework and needs assessment analysis to determine which of the legacy applications in the current environment may be eligible for retirement if the functionality exists in the new HIS. This will help to alleviate the complexity of application support and could reduce operational costs.
- **Investigate opportunities to expand the scope of functionality in enterprise solutions:** NH is underway with implementing enterprise grade workflows and automation and should leverage all aspects of the platform to get full utilization out of the investment.

3) ICT operations



Description:

"ICT operations" entailed a review of the different processes in place to support ICT solutions throughout the enterprise that enable clinical delivery and hospital operations. Included in the scope of this analysis were network performance, end-user computing and data centre operations.

Observations:

- **Operations of the SCS data centre are aligned with on-premise best practices**: Operations and maintenance of the data centre are aligned to best practices associated with managing on-premise data centres (established card access and entry tracking). NH should consider moving towards cloud-infrastructure best practices for SNH.
- **NH has made an effort not to build solutions internally**: A strategic approach has been defined to limit the amount of internal development of software solutions. Where possible, solutions are obtained as COTS (commercial off the shelf). This approach will position NH well as they begin to consider scaling solutions across other providers.

Considerations:

- **Support provided to patients and staff will evolve in the future**: User support in the ICT program will evolve and likely rely less on providing support for hardware technology and shift towards providing support around software and new patient/staff workflows. Members of the ICT team acknowledge this change is approaching and should start initiating a cultural shift around how support is delivered today. This may include adopting new support models in preparation for the SNH launch.

4) Resources

Description:

"Resources" entailed a brief review of the current operating model of ICT and availability of ICT resources at NH. This review entailed understanding the existing capabilities of the ICT function and the processes in place to support the day to day operations of ICT.

Observations:

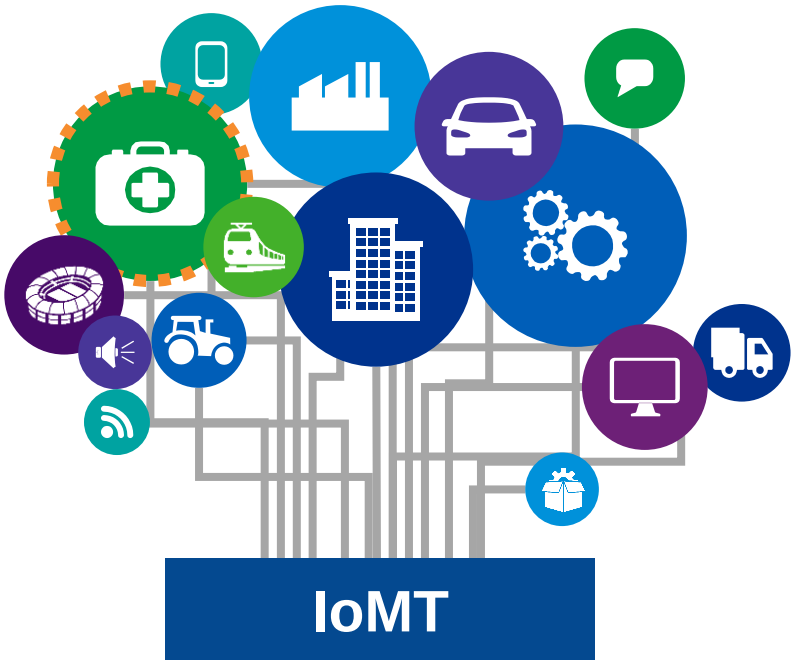
- **The structure of ICT has recently updated**: Recent changes to the ICT structure have created nimbleness and agility for the team allowing them to respond quickly to new requests and changes from the business.
- **ICT staff are typically distributed across sites**: Due to NH's multi-site structure, dedicated space for ICT staff has been a challenge at some sites and has impacted how ICT staff collaborate and interact with each other.
- **The Transformation program is well structured**: The Transformation program within ICT is well linked into the clinical and business programs at NH which has created trust with end users.

Considerations:

- **Explore how the operating model may evolve**: Digital and analytical capabilities will become a standard requirement in order to work in a modern digital focused facility. This may impact HR processes for recruitment, training and communication in the future.
- **Explore opportunities to create a Chief Information Security Officer role**: Assess whether this role is needed given the emergence of data.
- **Create organizational policies in preparation for SNH**: The prevalence of data will continue to grow and NH should create policies to support this shift. Policies for development may include a data and information retention policy, data confidentiality, privacy and security policy and an overall data governance policy.

The emergence of IoMT

The **Internet of Medical Things (IoMT)** refers to a range of medical devices and applications embedded with network-connected electronics that allow for the collection and exchange of data, with the ultimate purpose of using that data to enable better decision making or providing alternate models for care delivery. IoMT will have a profound impact on the future as highlighted in Section H's ICAT considerations.

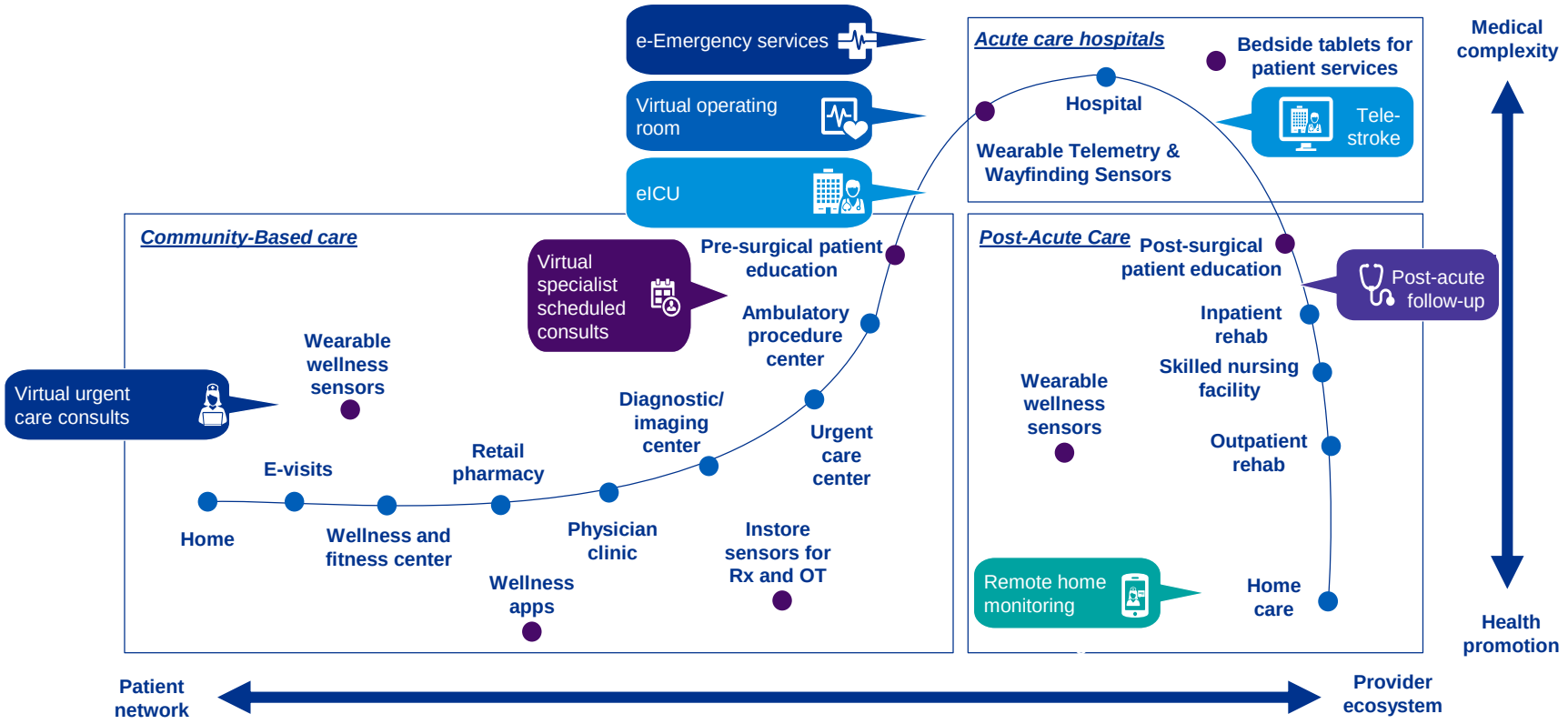


It is recommended that NH upgrade certain elements of their ICT infrastructure to enable the required components to deliver IoMT in the future state.

The subsequent slides describe the emerging role of IoMT in health and the type of infrastructure elements that NH may consider.

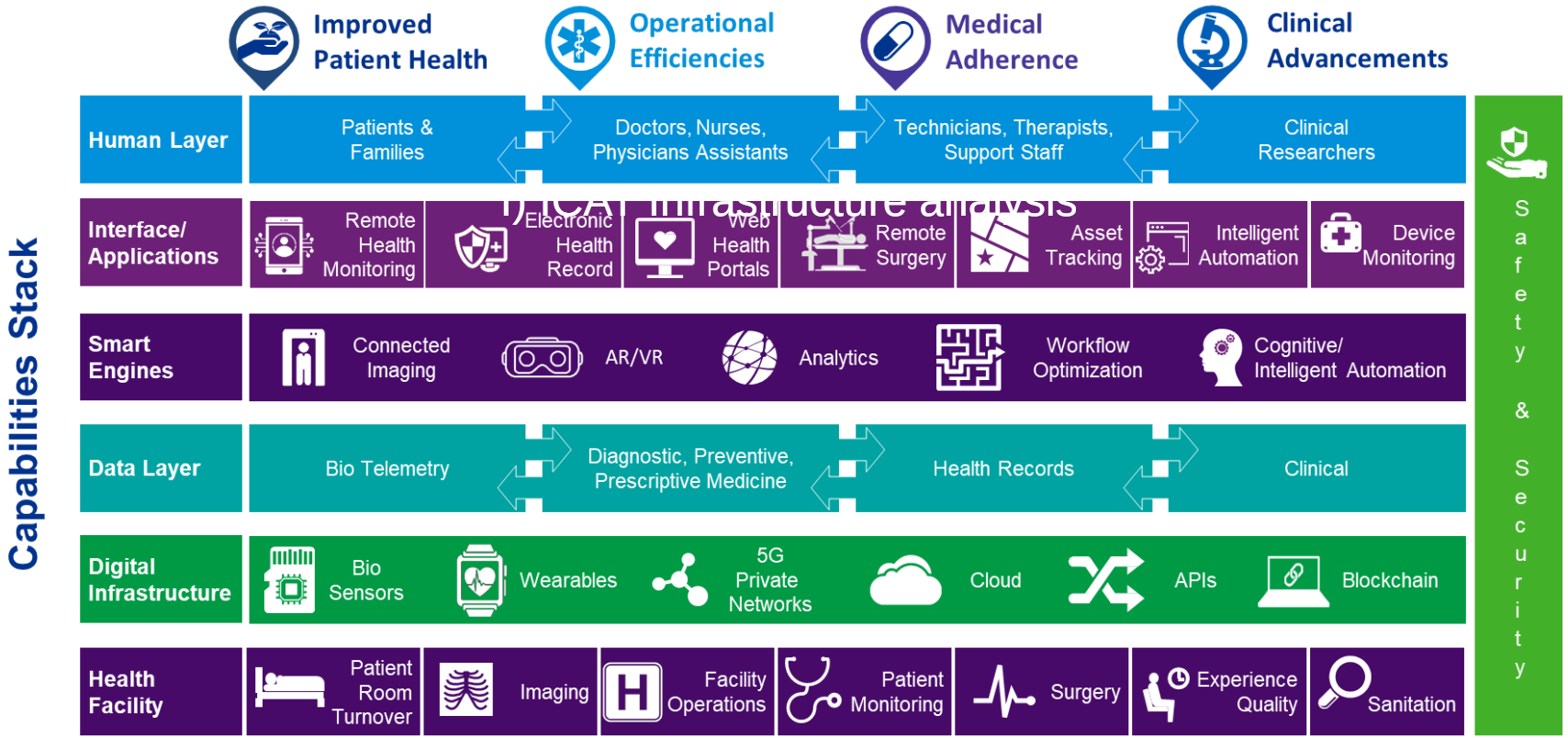
IoMT enabled virtual care and digital health

Virtual care impacts the full care life cycle and encompasses the full care experience, involving patients, providers, facilities and ancillary services.



IoMT enabled health experience architecture

Depicted in the graphic below is a sample “capabilities stack” that identifies the core architecture components to an IoMT enabled health experience.



J) Opportunities & constraints

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Identification of implementation opportunities

The subsequent slides describe 12 implementation opportunities that will address gaps in today's environment and will support NH in it efforts to move forward effectively with the ICAT redevelopment. These opportunities will also inform NH to make investment decisions around ICAT. These opportunities were developed based on the following inputs:

- *Stakeholder interviews with NH staff*
- *Lessons learned from recent hospital redevelopment projects*
- *Jurisdictional scan of emerging technology trends in hospital redevelopment*
- *Analysis of NH's stage 2 functional programming*

A summary of the opportunities have been identified below organized in 2 categories: **foundational** and **transformational**:

Foundational

1. **Refine the vision and develop a brand for SNH.**
2. **Initiate flow planning for SNH.**
3. **Contract ICAT consultant(s) directly.**
4. **Expand the existing program for piloting new solutions.**
5. **Prioritize the implementation of the HIS.**
6. **Update the mobility plan for NH staff.**

Transformational

7. **Define the overall requirements to optimize patient experience.**
8. **Innovate on the concept of "connected" care within the Niagara community.**
9. **Create a transition/retrofit plan for SNH.**
10. **Establish a redevelopment change management program.**
11. **Establish enterprise data governance.**
12. **Develop an ICT operating model for 2026.**

Foundational

#1: Refine the vision and develop a brand for SNH

OPPORTUNITY

Refine the vision and a brand for SNH: NH should prioritize the completion of a clear anchoring narrative that will serve as the cohesive vision for the SNH redevelopment. This vision should account for all relevant components of the redevelopment process including ICAT design, clinical design and facility design.

POTENTIAL CONSTRAINT(S)

- ***Different views on the positioning of the brand and vision***: There will be various ideas and differing opinions on the vision. Not all will be incorporated into the final vision statement.
- ***Balancing the need for consensus with making progress***: Niagara Health should set out a realistic timeline to achieve a vision that accounts for the steps needed to co-design and create the vision but also stay on track with the redevelopment process.
- ***Sensitivities around the redevelopment***: Additional communication for certain audiences may be needed to address any concerns around the redevelopment project.

IMPLEMENTATION ANALYSIS

- ✓ **Leverage existing work completed with the facility design vision**: Niagara Health has existing content from the facility design vision and this ICAT Design report that can be leveraged to create an overarching vision that incorporates the influence of ICAT.
- ✓ **A vision and brand will help rally support**: The sooner NH is able to articulate an overarching vision for the redevelopment project, the more likely buy-in can be obtained from stakeholders including staff, patients, caregivers, government and other members of the Niagara community.
- ✓ **Provide some opportunities for feedback and co-design**: Engage stakeholders through the development process to ensure participation from diverse perspectives.

Foundational

#2: Initiate flow planning for SNH

OPPORTUNITY

Initiate flow planning for SNH: The optimization and appropriate sequencing of patient and staff flow between different programs and services will become critical to the final facility design and ICAT solution design choices at SNH. This will be an iterative process as some of the flow planning may be influenced by ICAT solutions and facility design decisions.

POTENTIAL CONSTRAINT(S)

- ***Timing of vendor solutions identified through the Project Consortium****:* Solutions based on vendor choices may not be known until later in the redevelopment process which may impact the overall timing of when workflows and processes should be adjusted to optimize for flow.
- ***Resistance to change****:* Changes in workflows and processes may be difficult for some staff and patients to adjust to depending on the severity of change.
- ***Impact of HIS implementation****:* The HIS implementation will likely have a significant impact on flow which may add complexity to modifying workflow in preparation for SNH.

IMPLEMENTATION ANALYSIS

- ✓ **Start with bottle-neck areas at existing sites:** Assess whether there are any opportunities to optimize flow in challenging areas at existing sites. Recommended areas to begin assessing: emergency department, diagnostic areas, and in-patient discharges.
- ✓ **Conduct a deep dive on workflows for SNH:** Workflows have been described at a high level in the stage 2 planning documentation. NH should map out detailed future state workflows in critical program areas/services at SNH to ensure workflows and processes account for spatial layouts and ICAT solutions.
- ✓ **Identify opportunities for automation:** As part identify future workflows at SNH, NH should look at opportunities for RPA (robotic process automation).

Foundational

#3: Contract ICAT consultant(s) directly

OPPORTUNITY

Contract ICAT consultant(s) directly: NH should work with Infrastructure Ontario (IO) to contract the ICAT Design and Implementation consultant(s) directly to the hospital rather than contracting them through ProjectCo. This will provide NH with greater control and autonomy over the ICAT components of the SNH redevelopment.

POTENTIAL CONSTRAINT(S)

- ***Increased risk for NH**:* Holding the contract directly with ICAT consultant(s) will expose NH to greater risk. A proper legal review should be conducted to ensure the terms are acceptable based on the organization's tolerance for risk exposure.
- ***IO may want to retain the contract**:* Infrastructure Ontario may want to retain the contract with ICAT consultant(s) through the ProjectCo. to minimize risk exposure to NH and to retain control as part of their overall redevelopment process.

IMPLEMENTATION ANALYSIS

- ✓ **Socialize with IO**: Initial discussions have taken place between NH and Infrastructure Ontario. It is recommended that NH finalize an approach that can be mutually agreed upon by all parties involved in the near future . If needed, develop a business case to articulate the benefits of contracting the ICAT consultant(s) directly to NH .
- ✓ **Conduct due diligence**: Conduct an industry scan and speak with other public sector peers to gather the relevant information and identify the appropriate requirements needed to issue a RFP for contracting ICAT consultant(s) for the redevelopment project directly to NH .

Foundational

#4: Expand the existing program for piloting new solutions

OPPORTUNITY

Expand the existing program for piloting new solutions: NH should invest in expanding its current "pilot" program that tests new workflows and processes in preparation for the SNH. NH's multi-site structure provides flexibility and options for testing and observing new solutions enabled by ICAT. This will become increasingly relevant as the scope of redevelopment activities increase.

POTENTIAL CONSTRAINT(S)

- ***Limitation in NH resources****:* Certain pilots may require dedicated resources to support in order to ensure new processes and workflows are tracked and tested thoroughly. This will help to ensure that new behaviour is monitored for gaps and areas for improvement are defined .
- ***Difficulty in selecting the right solutions to pilot****:* SNH may introduce several new solutions to pilot at existing sites . Given the resource limitations to pilot all solutions, a prioritization exercise may be required to identify pilots with the greatest impact to patients.

IMPLEMENTATION ANALYSIS

- ✓ **Create a prioritization process to determine which new workflows/processes to test**: Upon completion of the ICAT equipment and application list, NH should create a prioritization process to identify the solutions to pilot. These priority solutions should be mapped onto a timeline that will create a schedule for the organization to work towards prior to opening the SNH.
- ✓ **Leverage the SCS simulation lab**: Where appropriate, leverage the existing simulation lab at the St. Catherine's site to pilot new solutions. This space is available and has been designed for the purposes to simulate new workflows. The lab may be better suited for new solutions that are not ready to test in an environment with real patients.

Foundational

#5: Prioritize the implementation of the HIS

OPPORTUNITY

Prioritize the implementation of the HIS: It is recommended that NH initiate HIS implementation activities at least 1-2 years in advance of the launch of SNH. This will allow enough time for system optimization and refinements to workflows. Reducing the dependence on paper records and transforming clinical processes will become foundational to enabling other ICAT solutions at SNH.

POTENTIAL CONSTRAINT(S)

- ***Challenges with funding****:* The HIS implementation has received approval from NH's Senior Team and Board of Directors but requires a funding approach to launch the initiative. The HIS implementation will require significant funding and this may be difficult for NH to obtain given financial pressures in the Ontario health sector.
- ***Change fatigue****:* Depending on the timing of the HIS implementation, NH staff and patients may experience some change fatigue alongside preparation and planning activities for the SNH.

IMPLEMENTATION ANALYSIS

- ✓ **Explore funding options**: In collaboration with MOH, determine whether there is an opportunity to fund a portion of the HIS implementation through the redevelopment project.
- ✓ **Initiate HIS pre-planning activities**: There are a series of pre-planning activities that NH can start now in preparation for the HIS implementation. Some of the suggested workstreams include:
  - *Change management*: Establish the organization's baseline change readiness.
  - *Governance*: Create a future state HIS governance structure to guide planning.
  - *Workflow, process and procedures*: Create an inventory of current workflows.
  - *Data migration*: Initialize planning around system data to migrate, archive or retire.

Foundational

#6: Update the mobility plan for staff

OPPORTUNITY

Update the mobility plan for staff: As the prevalence of mobile devices continues to grow, NH should review their existing mobility plan and define a re-occurring review and refresh process of the plan every 1-2 years. This will help to ensure the plan is kept relevant and applicable to the quickly changing landscape of mobile devices and their applications in the health setting.

POTENTIAL CONSTRAINT(S)

- ***Limitation of resources****:* Funding may limit NH's ability to provide mobile devices directly to staff. A BYOD (bring your own device) policy should be created to allow the option for staff to connect their own mobile devices to NH's infrastructure and applications.
- ***Demand for support will increase***: As the number of mobile devices increase in the enterprise environment , there will be an increased demand for support that will need to be managed.
- ***Increased load on the network***: As the number of mobile devices connected to NH's infrastructure grow, there will be greater pressure on the capacity of the network.

IMPLEMENTATION ANALYSIS

- ✓ **Identify the gaps with the existing plan**: Begin by defining and addressing the gaps that exist with the existing mobility plan. This may include increasing communications, creating greater awareness and providing clear instructions to staff.
- ✓ **Develop a mobility plan for patients**: In alignment with the proposed patient support desk, a defined mobility plan/policy should be created to define how patients and their family members may obtain mobile devices or connect to NH's infrastructure.
- ✓ **Investigate partnership opportunities with telecommunication providers**: NH should explore whether there is interest among the telecommunication providers to partner and provide special offers around mobile devices to staff and patients.

Transformational

#7: Define the overall requirements to optimize patient experience

OPPORTUNITY

Define the overall requirements to optimize patient experience: NH should establish a working group to define the specific requirements for the ideal patient experience which may encompass multiple elements that impact SNH and existing sites including: parking, wayfinding, self-check in, virtual visits, patient portals and expanding the scope of the NH Navigator mobile application.

POTENTIAL CONSTRAINT(S)

- ***The implementation of certain solutions will take time and resources to get right****:* Once standards have been defined, new solutions should be developed for implementation for SNH and existing sites where possible . Certain solutions may be more difficult to implement depending on their scope and complexity.
- ***Limited funding****:* Certain solutions may require additional operational funding to support on an on-going basis. Identify and prioritize opportunities that create cost-savings where possible.
- ***Inability to measure benefits of investments****:* Justification of investments may be difficult to obtain without the ability to measure outcomes and track benefits of solutions.

IMPLEMENTATION ANALYSIS

- ✓ **Begin by prioritizing solutions that are feasible and impactful**: There are likely many options available to improve patient experience. Solutions that are easy to implement and have the potential to make a strong impact should be sequenced first.
- ✓ **Leverage the patient engagement network**: Utilize the perspectives and insights from patients and other members of the community to help co-design the requirements for the optimal patient experience at NH.
- ✓ **Implement changes and solutions now**: Do not wait until the SNH launch to implement changes to enhance the patient experience. Where possible, trial and pilot solutions at existing sites and scale across sites and at SNH when appropriate.

Transformational

#8: Innovate on the concept of "connected" care within the Niagara community.

OPPORTUNITY

Innovate on the concept of "connected" care within the Niagara community: As part of NH's efforts to establish a OHT, explore opportunities for further integration with the community. This may include: smart city integration, establishing a centre of excellence as an attraction for tourists in the region, academic partnerships and establishing Niagara as a retirement destination.

POTENTIAL CONSTRAINT(S)

- ***Lack of stakeholder and government support****:* Some of the innovative ideas that are pursued may be too "futuristic" from the perspective of the NH stakeholders and funders which may be difficult to achieve buy-in and support.
- ***Multiple stakeholders and partners to manage****:* Integrating into the community will mean entering into partnerships with multiple entities which may prove to be difficult given the legal terms that would need to be agreed upon.
- ***Willingness of community partners****:* Entities in the community with a more traditional mindset may not be interested in partnering with NH on innovative "futuristic" solutions.

IMPLEMENTATION ANALYSIS

- ✓ **Leverage the redevelopment as an opportunity for the OHT formation**: The SNH will be a core partner in the OHT and as such will need to support a future vision for an integrated care system in the Niagara region. This should consider the role of SNH in the municipality: such as schools, retailers, government social services etc.
- ✓ **Identify partners and collaborators who share the same innovative approach**: Where possible, establish relationships with individuals and organizations who share the same passion and sense of innovation to creating a more connected community. Conduct a jurisdictional scan to determine if similar organizations have achieved similar innovative ideas globally.

Transformational

#9: Create a transition/retrofit plan for SNH

OPPORTUNITY

Create a transition/retrofit plan for SNH: NH should initiate planning activities to determine the process for transitioning existing programs and services to the new SNH. This process will help to inform opportunities for how ICAT solutions may be retrofitted to existing sites to ensure there is a level of ICT standardization and consistency across all sites once the SNH is open.

POTENTIAL CONSTRAINT(S)

- ***Not all ICAT solutions may be appropriate for retrofitting****:* Existing sites may have infrastructure limitations that make it difficult to implement a new ICAT solution.
- ***Limited time and availability of resources to conduct planning****:* Other redevelopment activities and organizational priorities may compete for people's time needed to develop this transition/retrofit plan.
- ***Having the relevant ICAT solution information to make timely decisions****:* Depending on the stage of redevelopment, the necessary information to inform some of this planning may not be readily available. For example, vendor information.

IMPLEMENTATION ANALYSIS

- ✓ **Initiate planning activities sooner than later**: To ensure sufficient time is allocated for developing a transition/retrofit plan, it is recommended to begin this work as soon as possible. Once the stage 3 submission has been completed, this work can begin.
- ✓ **Identify lessons learned from other multi-site redevelopment projects**: NH should consider reaching out to Halton Healthcare and Mackenzie Vaughan to under in greater detail their approach to retrofitting new technology to existing sites.
- ✓ **Prioritize the transition/retrofit plan with the ICAT consultant(s)**: Ensure the development and validation of this plan is brought forward to the scope of work defined for the ICAT consultant for the redevelopment.

Transformational

#10: Establish a redevelopment change management program

OPPORTUNITY

Establish a redevelopment change management program: As part of developing the transition/retrofit plan reference in opportunity #9, NH should develop a change management program dedicated to the redevelopment project to ensure staff and patients are supported through the significant change. The program will become more critical to setup as the launch of the SNH is 1-2 years away.

POTENTIAL CONSTRAINT(S)

- ***Scope of upcoming change is significant*:** The SNH redevelopment could introduce significantly different ways of delivering care to patients through new workflows and processes. This change may impact many areas of SNH.
- ***Limited resources**:* The redevelopment team may not have sufficient resources to dedicate to a fully operating change management program. Identify whether there are opportunities to leverage existing resources from other departments at NH.
- ***Lack of buy-in and support for program**:* Some stakeholders may not understand the importance of establishing such a program for the redevelopment.

IMPLEMENTATION ANALYSIS

- ✓ **Leverage the HIS change management program**: Assuming the HIS implementation takes place 1-2 years prior to launch of the SNH, the redevelopment change management program could be a natural continuation of the HIS change management program. The scope of work may be similar in terms of providing guidance around changes to clinical workflows and processes.
- ✓ **Identify priority areas to focus**: Determine the areas impacted most significantly by the redevelopment as areas to prioritize for change management support.
- ✓ **Invite patients to participate**: Create an opportunity for patients to get involved with providing input and supporting change management activities where appropriate.

Transformational

#11: Establish enterprise data governance

OPPORTUNITY

Establish enterprise data governance: NH should create a data governance function to help manage the process of data collection and utilization of data in the organization. As NH contemplates a more "connected" future, a data governance function will play a significant role around managing data sources, data attributes and critical data needed to inform future decision making.

POTENTIAL CONSTRAINT(S)

- ***Data governance is a relatively new concept for Ontario hospitals****:* The concept of data governance is not a commonly mature function across the province. Many individuals in the sector are unfamiliar with the concept and therefore require sufficient knowledge and support to implement effectively.
- ***Frequent communication and education will be required****:* Data governance is intended to encourage desirable behaviours around how data is created, stored and used. Staff may need frequent reminders on new processes and workflows.
- ***Sufficient leadership buy-in and support***: Data governance requires strong leadership to implement effectively.

IMPLEMENTATION ANALYSIS

- ✓ **Begin by creating a strategic data governance function**: This function will provide strategic oversight on data management and should include a cross functional membership. The mandate of the committee will evolve over time as organizational needs change for data governance.
- ✓ **Develop relevant policies**: Data governance and data management policies should be created to provide guidance to NH staff on any defined processes and workflows related to managing data. Examples of policies: data retention policy and data confidentiality.
- ✓ **Embed data governance processes into the organization**: Ensure any new policies created are communicated to other relevant governance committees in the organization.

Transformational

#12: Develop an ICT operating model for 2026

OPPORTUNITY

Develop an ICT operating model for 2026: As NH prepares for the launch of the SNH, the organization may need to revisit the current ICT operating model to ensure it is structured and staffed appropriately to deliver on the needs of patient workflows and processes in the future. Areas of the target operating model that should be analyzed may include: capabilities, processes, and governance.

POTENTIAL CONSTRAINT(S)

- ***Determining the right time to create the future operating model****:* Given the amount of time until the SNH launches, it may be difficult to determine the right time to design the future operating model. The most appropriate time may be when there is clarity around future workflows and processes impacted by ICAT solutions.
- ***Concerns from staff around a new operating model****:* Staff may be sensitive around a changing operating model. Sufficient communication should be provided around the purpose of the change and the expectations for the new operating model to ensure transparency and awareness.

IMPLEMENTATION ANALYSIS

- ✓ **The operating model should account for NH's future role in OHTs**: Given NH will be working more closely with community partners as OHTs are established, the operating model should also account for any external facing support that ICT may be providing in the context of OHTs.
- ✓ **The operating model design should be guided by agility and flexibility:** Across different industries, IT operating models are shifting to become more agile and flexible in order to quickly respond to changes in technology and an increasing amount of digital transformations taking place across enterprises of all sizes.

K) Evaluation criteria

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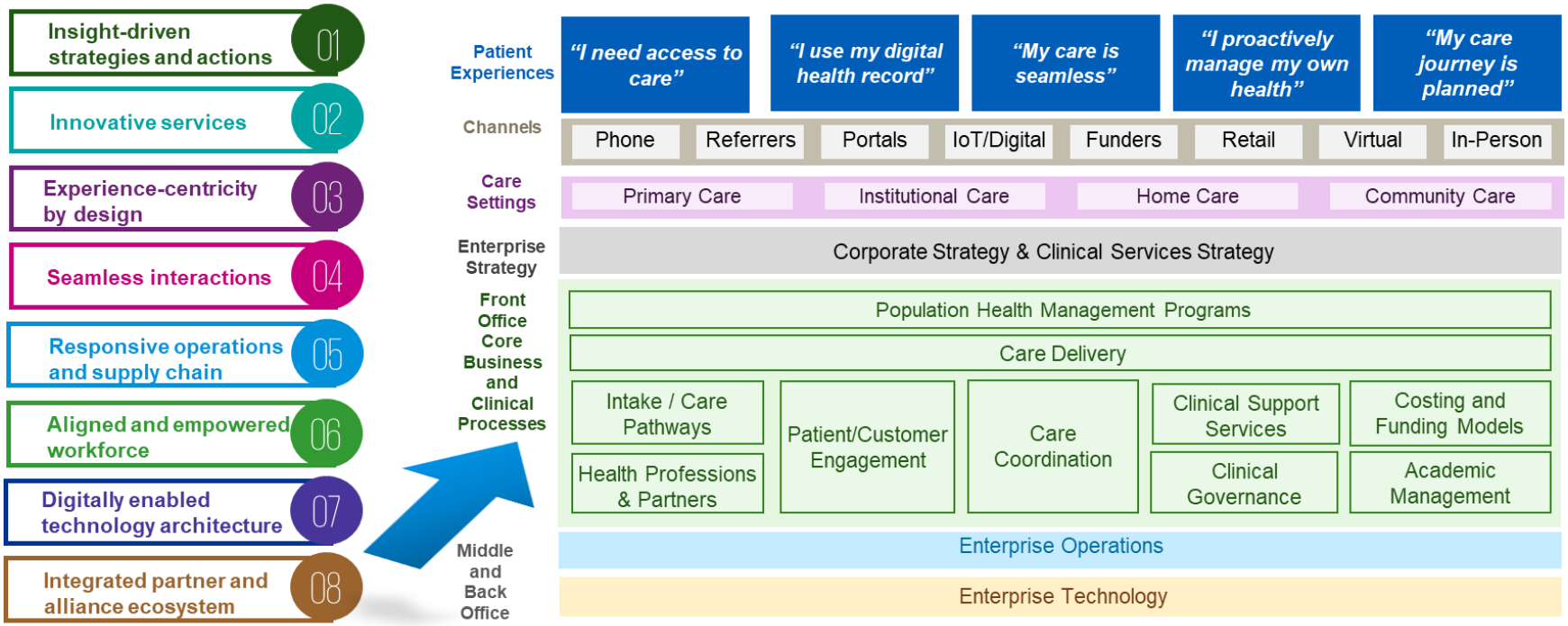
Connected Health Framework

The Connected Health Framework is a digital transformation framework that helps organizations deliver on their promise to patients, citizens and staff by aligning core business practices, enterprise operations and back office functions.

The framework is comprised of eight enterprise capabilities that describe how to integrate front-middle-back core business practices and functions.



Leveraging the Connected Health Framework

The eight capabilities described in the Connected Health framework may be utilized to define the evaluation criteria for the ICAT Design. The eight capabilities assess an enterprise's ability to integrate front-middle-back core business practices and functions enterprise technologies through digital transformation. These eight capabilities can help to evaluate the ICAT Design elements for the new SNH by evaluating them against the expected clinical and administrative outcomes that the ICAT Design elements will help to enable.

Each of the eight capabilities are described on the subsequent slides and for each capability, a series of five diagnostic statements are provided that may be used to evaluate the maturity of NH within that particular capability.

- 01 Insight-driven strategies and actions
- 02 Innovative services
- 03 Experience-centricity by design
- 04 Seamless interactions
- 05 Responsive operations and supply chain
- 06 Aligned and empowered workforce
- 07 Digitally enabled technology architecture
- 08 Integrated partner and alliance ecosystem

Conducting the evaluation

Described in the steps below are how the Connected Health capabilities could be used to evaluate the ICAT Design:

1. **Establish a baseline:** For each capability, review the five diagnostic statements and perform a self-assessment to capture the current maturity level. Each diagnostic statement may be ranked on a 5-point maturity scale from Level 1 (low) to Level 5 (high).

2. **Identify the ideal future state maturity:** Upon completing the current maturity level, NH can begin to identify specific capabilities that are critically important to their strategic priorities and aligned to their desired future state when SNH opens.

3. **Perform a gap analysis:** Once these capabilities have been identified, a gap analysis can be performed to determine which capabilities have the greatest opportunity to improve in maturity based on the current state maturity and desired future state maturity.

4. **Determine whether the proposed ICAT elements will help to address the gaps:** NH can determine whether the clinical and administrative outcomes enabled by the ICAT considerations and case studies described in this report are sufficient to raising the maturity level of a capability to the desired state.

5. **Assess the feasibility of the proposed ICAT solutions:** A final step for evaluating the ICAT Design should involve completing an assessment of the feasibility of implementing the ICAT solutions based on a variety of inputs including: cost, technical and operational impact.

A sample evaluation is described on the subsequent slide to demonstrate the application of the steps described.

An electronic version of the Connected Health diagnostic tool is available to assess the overall maturity of capabilities based on the self-assessment inputs.

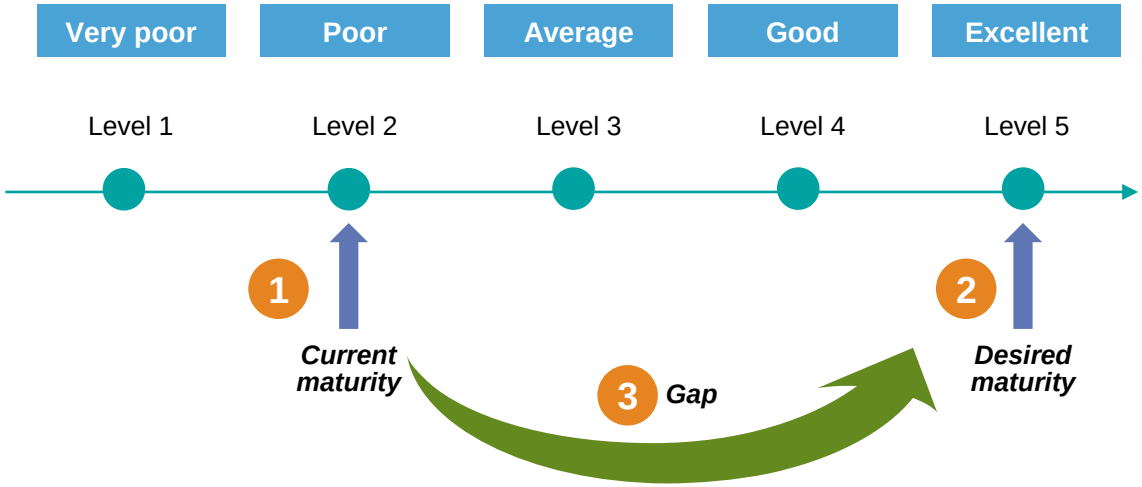
Sample evaluation

For Illustrative purposes only

The sample evaluation described below is for illustrative purposes only and does not reflect an accurate assessment of NH's current state capabilities:

STATEMENT 1

"Our organization offers high quality (e.g integrity, completeness, timeliness, accuracy) information in real time to our employees (as well as patients and families) to ensure data-driven decisions are made, allowing for greater transparency with faster and more informed decision making."



4 *Assessment*

Today, NH offers very little information in real time to employees and patients to ensure data driven decisions are made. Looking ahead into the future, NH would like to raise the maturity level of this capability. To do this, the organization will need the following ICAT solutions to enable this capability:

- *5G*
- *Building automation*
- *Integrated HIS*
- *Smart devices*
- *VR/AR*

} *The identified ICAT design elements will help to address the gap in capability maturity.*

5 *Feasibility*

Based on a feasibility analysis that looked at the cost, technical and operational impact, the following ICAT solutions will be in-scope for SNH:

- *5G*
- *Building automation*
- *Integrated HIS*

NH self-diagnostic results

In October 2019, members of the NH Senior Team completed the Connected Health capabilities self-diagnostic based on NH's current state. The mean scores for each of the capabilities is summarized in the table below.

Based on the results, NH can use the areas with lower maturity to prioritize ICAT investments. For example the "seamless interactions" capabilities may help to guide future investment decisions made around ICAT solutions. Other areas of lower maturity will be future proofed at the SNH as the technology evolves.

Capability	Maturity Statements*				
Insight-driven strategies and actions	High quality information in real-time.	D&A Strategy is foundation to running our business.	Effectively manages and influences the collection and utilization of data.	Analytic tools, skills and capabilities are used to deliver timely insights.	Gather and leverage sources of data to drive quality and cost improvements.
Innovative services	Identify and understand the current and future health and care needs.	Design service using available evidence and leading practice.	Planning is dynamic and underpinned by data and evidence.	Clear approach to collecting, monitoring, reviewing and evaluating outputs.	Delivering value-based care throughout the care continuum.
Experience-centricity by design	Holistic patient-centric strategy and continuous accountability.	Designing flawless patient journeys.	Engaging the customer in shared decision making and co-design.	Create the right ecosystem for care delivery.	Patient experience as the basis for continuous improvement.
Seamless interactions	Tailored interaction and channel strategy to support seamless access.	Digitally enabled personalized health recommendations that optimize patient outcomes.	Timely and appropriate intake or referral.	Integrated channel mode has a high degree of flexibility.	Suite of integrated traditional and digital solutions and touch points.
Responsive operations and supply chain	Clinical practices and pathways are based on evidence.	Predict accurately and efficiently the future clinical demand.	Manage the flow of goods and services in an effective and efficient manner.	Effective management of categories.	Approach for improvement that is embedded and engages frontline staff.
Aligned and empowered workforce	Our culture encourages leaders to work across boundaries.	Clearly articulated mission, vision and values with outcome metrics.	Accountability built into job roles and aligned with governance frameworks.	Workforce strategy.	Culture that supports and promoted change.
Digitally enabled technology architecture	IT operating model that promotes the business strategy.	Proactive security program.	Enterprise architecture supports the business strategy.	"Digital first"	People, systems and technology interoperate to deliver integrated services.
Integrated partner and alliance ecosystem	Program for contract management and optimization.	Internal and external capabilities that align to the business strategy.	Effectively engage and manage partnerships, alliances and vendors.	Partner value chains are agile and continuously respond to needs.	Engage in transactions and restructuring to rightly scale our organization.

Legend: 1 – Very Poor | 2 – Poor | 3 – Average | 4 – Good | 5 - Excellent

**Mean scores are represented*
n = 6

#1: Insights-driven strategies and actions

Insight-driven strategies and actions 01

Harness data, advanced analytics and actionable insights with a real-time understanding of patients and the business, to shape integrated business decisions.

STATEMENT 1

"Our organization offers high quality (e.g integrity, completeness, timeliness, accuracy) information in real time to our employees (as well as patients and families) to ensure data-driven decisions are made, allowing for greater transparency with faster and more informed decision making."

STATEMENT 2

"Our D&A Strategy is foundational to running our business, and our D&A capabilities enable a richer understanding about our industry, population, services, patients, risks and partners."

STATEMENT 3

"Our organization effectively manages and influences the collection and utilization of data. We specify decision rights and accountability, and encourage desirable behaviours towards how data is valued, created, stored, used, archived and deleted."

STATEMENT 4

"We use analytical tools, skills and capabilities to deliver timely insights to our stakeholders to inform all decisions."

STATEMENT 5

"We gather and leverage sources of data from across the care continuum to accurately model historical, current and forecasted demand, quality performance and costs which in turn help us drive further quality and cost improvements within our healthcare system and reduce unwarranted clinical variation."

#2: Innovative services

Innovative services 02

Develop compelling value propositions on services for patients and engage them to drive greater satisfaction and improvement.

STATEMENT 1

"We work with our community and stakeholders to identify and understand the current and future health and care needs of our community."

STATEMENT 2

"We design services using available evidence and leading practice which is informed by deep situational, geographic and customer insights. This includes the short, medium and long term health and care needs of the community we serve."

STATEMENT 3

"Our planning is dynamic and underpinned by data and evidence to ensure services intervene early and are needed and warranted."

STATEMENT 4

"We have a clear approach to collecting, monitoring, reviewing and evaluating outputs and outcomes for customers and learning from them to continuously improve and shape future policy and service design, and consult our customers on how we are doing."

STATEMENT 5

"We have both cost efficiency and quality incentives are present in the system and encourage the right behaviors to deliver value-based care (e.g., high quality care that is cost efficient) throughout the care continuum."

#3: Experience Centricity by design

Experience-centricity by design 03

Design seamless, intentional experiences for patients, employees and partners, supporting the patient's expectations and delivering business objectives.

STATEMENT 1

"Creating a holistic patient-centric strategy and continuous accountability as an essential stepping stone to realize healthcare consumer centricity."

STATEMENT 2

"Mapping patient needs and interactions along different processes and scenarios and designing a flawless patients' journeys."

STATEMENT 3

"Engaging the patient in shared decision making, in co-designing of their care pathways and healthcare related activities. Including empowerment of prevention and self-care."

STATEMENT 4

"We create the right ecosystem for care delivery, including care management and delivering integrated care pathways and care continuum."

STATEMENT 5

"We ask all of our patients about their experience as a basis for continuous improvement."

#4: Seamless interactions

Seamless interactions 04 → **Interact with patients and partners across services and achieve measurable results.**

STATEMENT 1

"We have an interaction and channel strategy tailored to the needs of patients/citizens/stakeholders to support seamless access."

STATEMENT 2

"We actively provide digitally enabled personalized health recommendations that optimize patient outcomes."

STATEMENT 3

"Our channels support timely and appropriate intake and or referral."

STATEMENT 4

"The organizations integrated channel model has a high degree of flexibility to expand and contract channels as required."

STATEMENT 5

"We have a suite of integrated traditional and digital solutions and touch points supporting citizen / patient / stakeholder needs, allowing frictionless interactions."

#5: Responsive operations & supply chain

Responsive operations and supply chain 05 → **Operate the business with efficiency and agility to meet patient needs in a consistent way.**

STATEMENT 1

"Our clinical practices and pathways are based on evidence to reduce variability of care provision, standardization where appropriate, improving outcomes for the patients."

STATEMENT 2

"We can predict accurately and efficiently the future clinical demand for products and services in order to manage the supply of these products and services in an right time, right quality and right cost."

STATEMENT 3

"We manage the flow of goods and services in an effective and efficient manner (e.g., housekeeping, portering, workflow and materials management) for patient support and care, optimizing working capital and materials held across the health system."

STATEMENT 4

"We effectively manage our categories through enabling strategic sourcing agreements and formulating group procurement agreements, leveraging process automation and utilizing technology to cost effectively provide products/services."

STATEMENT 5

"We have an approach for improvement that engages our frontline staff and is embedded into the organization. We are an organization that provides the necessary tools, methods, and infrastructure to support improvement."

#6: Aligned and empowered workforce

Aligned and empowered workforce 06 → **Build a patient-centric organization and culture that inspires people to deliver on patient expectations and drive up business performance.**

STATEMENT 1

"Our culture encourages leaders to work across boundaries to promote holistic patient care and demonstrate compassion and a commitment to promoting a positive culture. This flows through into staff engagement, and in how organization values are displayed every day."

STATEMENT 2

"Our organization/health system has a clearly articulated mission, vision and values with outcome metrics that are reviewed and cascaded through the organization. Individual and team performance is aligned with the strategy, and has appropriate metrics set."

STATEMENT 3

"We build accountability into job roles, and align roles with governance frameworks, decision rights and give a clear line of sight from ward to board. Our governance is designed to be streamlined, consider the citizen perspective in decisions and ensure value is created."

STATEMENT 4

"We have a workforce strategy that optimizes current capabilities, plans for future organizational needs, and develops career paths to help manage and retain our talent."

STATEMENT 5

"Our organization has a culture that supports and promotes change."

#7: Digitally-enabled technology architecture

Digitally enabled technology architecture 07

Create intelligent and agile services, technologies and platforms, enabling the patient agenda with solutions that are secure, scalable and cost-effective.

STATEMENT 1

"We have an IT operating model that promotes the business strategy. Our model is designed to be scalable, secure, responsive to users, resilient, measurable (SLAs, KPIs etc), flexible and employs an agile mindset and practices capable of adapting based on care system performance."

STATEMENT 2

"Our organization employs a proactive security program that aligns to recognized industry standard that includes policies and standards."

STATEMENT 3

"Our enterprise architecture supports the business strategy, by aligning the functions of the business with the technology portfolio to meet current and future strategic objectives and needs of the system."

STATEMENT 4

"Digital First" is a guiding principle in the way that we engage with our patients, consumers, stakeholders, clinicians and payers.

STATEMENT 5

"Our people, systems and technology interoperate to deliver integrated services that perform optimally, are resilient and support the customer experience."

#8: Integrated partner & alliance ecosystem

Integrated partner and alliance ecosystem 08

Engage, integrate and manage third parties to increase patient experience, reduce costs, mitigate risk and close capability gaps to deliver on patient needs.

STATEMENT 1

"We have a program for contract management and optimization which maintains quality, continuity of service, manages cost and reduces risk."

STATEMENT 2

"We have a clear understanding of when to use internal or external capabilities that align to the business strategy and citizen/patient/stakeholder operating model."

STATEMENT 3

"We effectively engage and manage our partnerships, alliances and vendors in a collaborative manner to meet patient needs."

STATEMENT 4

"Our partner value chains are agile and continuously respond to the needs of our citizens/patients/stakeholders to drive efficiencies and deliver outcomes."

STATEMENT 5

"We engage in transactions and restructuring to rightly scale our organization to best serve market demands."

Part 3: Synthesis

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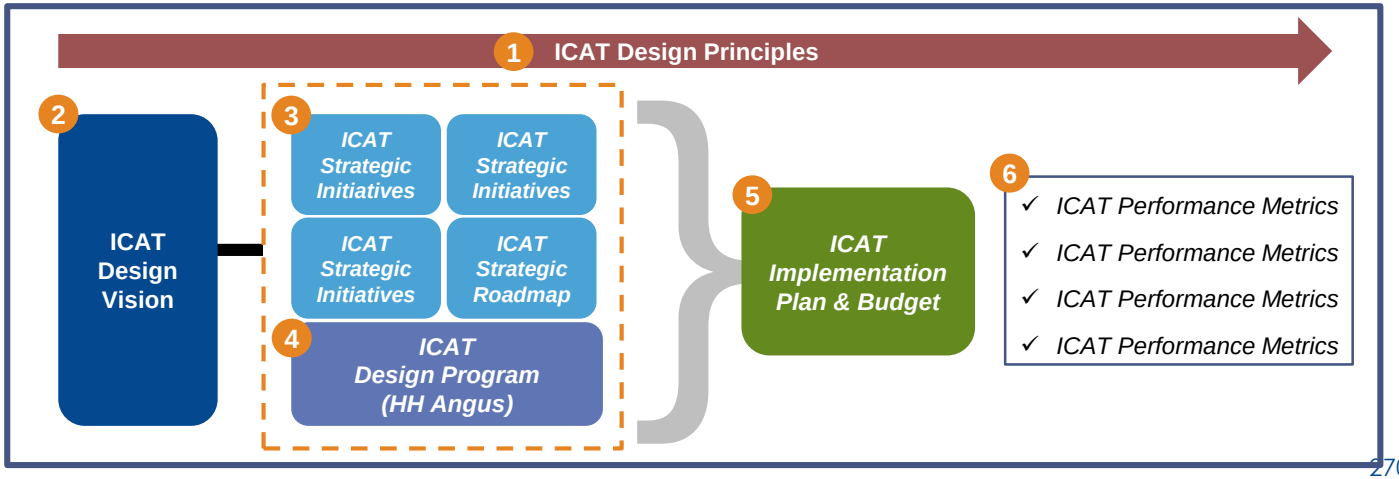
ICAT Design Report Overview

The contents of Part 3: Synthesis of the ICAT Design Report have been organized into 6 components:

1. **ICAT Design principles:** provide strategic guidance to how ICAT investments will be made.
2. **ICAT Design vision:** articulates the future state of how NH envisions ICAT to enable care delivery.
3. **ICAT strategic initiatives & roadmap:** recommended activities outside the scope of the redevelopment process that will help NH prepare their people, processes and technology for the SNH. The strategic initiatives are categorized into four categories including: *ICAT Readiness & Foundation*, *ICAT Innovation & Transformation*, *ICAT Sustainability*, & *Impacting ICAT*. Strategic initiatives in each category are listed on the next slide.
4. **ICAT Design program:** the design scope inclusive of the equipment and application list (prepared by HH Angus).
5. **ICAT implementation plan and budget cost estimate:** additional considerations related to the implementation of the ICAT Design and a high level cost estimate related to the ICAT Design program .
6. **ICAT performance metrics**: will help NH evaluate whether ICAT components meet the desired goals identified in the ICAT Design Vision.

The illustration on the right depicts how the six major components of the ICAT Design Report fit together.



L) ICAT Design principles

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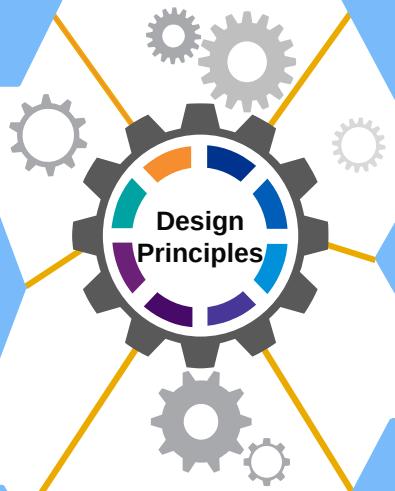
ICAT Design Principles

The ICAT Design Principles will provide strategic guidance to how ICAT investments will be made as part of the redevelopment project and help to future proof SNH. The design principles were based on input gathered throughout the stakeholder engagement process and refined with outputs from the two visioning sessions (Sept 2019).

Safety & user-centred design: ICAT solutions will enhance the safety and experiences of Niagara Health's patients, caregivers and staff and create a positive environment in which to receive care and to work.

Digital first and "frictionless": All ICAT solutions considered for the future SNH will digitally enable care delivery and planning at NH. Solutions will enable enhanced use of data and information to improve predicative and prescriptive decision making. Solutions will be fully adopted in a "frictionless" environment with users.

Aligned with SNH & NH strategy: ICAT solutions will support the vision and strategy for the South Niagara Hospital and more broadly the strategic directions for Niagara Health.



Secure, scalable and flexible infrastructure: Infrastructure built to support ICAT solutions for the SNH will be secure and scalable in order to meet the future demand for consumption, safety and exchange of information while maintaining flexibility to accommodate new future technologies that are unknown at this time.

Accountable and affordable: Investments made in ICAT solutions will be financially sensitive and made with a clear view of how it will become operationalized and sustained for the long-term.

Clear accountabilities and responsibilities: As NH enters into partnerships with other community providers and entities that formulate the Project Co., clear roles and responsibilities will be defined throughout the redevelopment process and beyond to ensure seamless operations of the new SNH for years to come.

M) ICAT Design Vision

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Establishing the ICAT Design Vision

One of the key inputs to developing the ICAT Design Vision were visioning sessions that were held with members of the NH team on Friday September 6, 2019 and Wednesday September 11, 2019.

The objectives of the visioning sessions were to:

1. **Reflect and validate the key themes identified in the analysis of ICAT in NH's current state and the stage 2 planning submission.**
2. **Visualize how the new South Niagara Hospital might operate through the exploration of case studies that incorporate key ICAT design themes.**
3. **Articulate a future state ICAT design vision that is aligned to NH's strategic plan, and ambitions for how care should be delivered in the future.**

This visioning session included participation from members of NH's Board of Directors, NH's Senior Team members, Physician in Chiefs, and Directors. Together these individuals came together to collaborate and brainstorm about the future of how ICAT could enable care at the new South Niagara Hospital. Refer to Appendix A for a full list of attendees.

Establishing the ICAT Design Vision

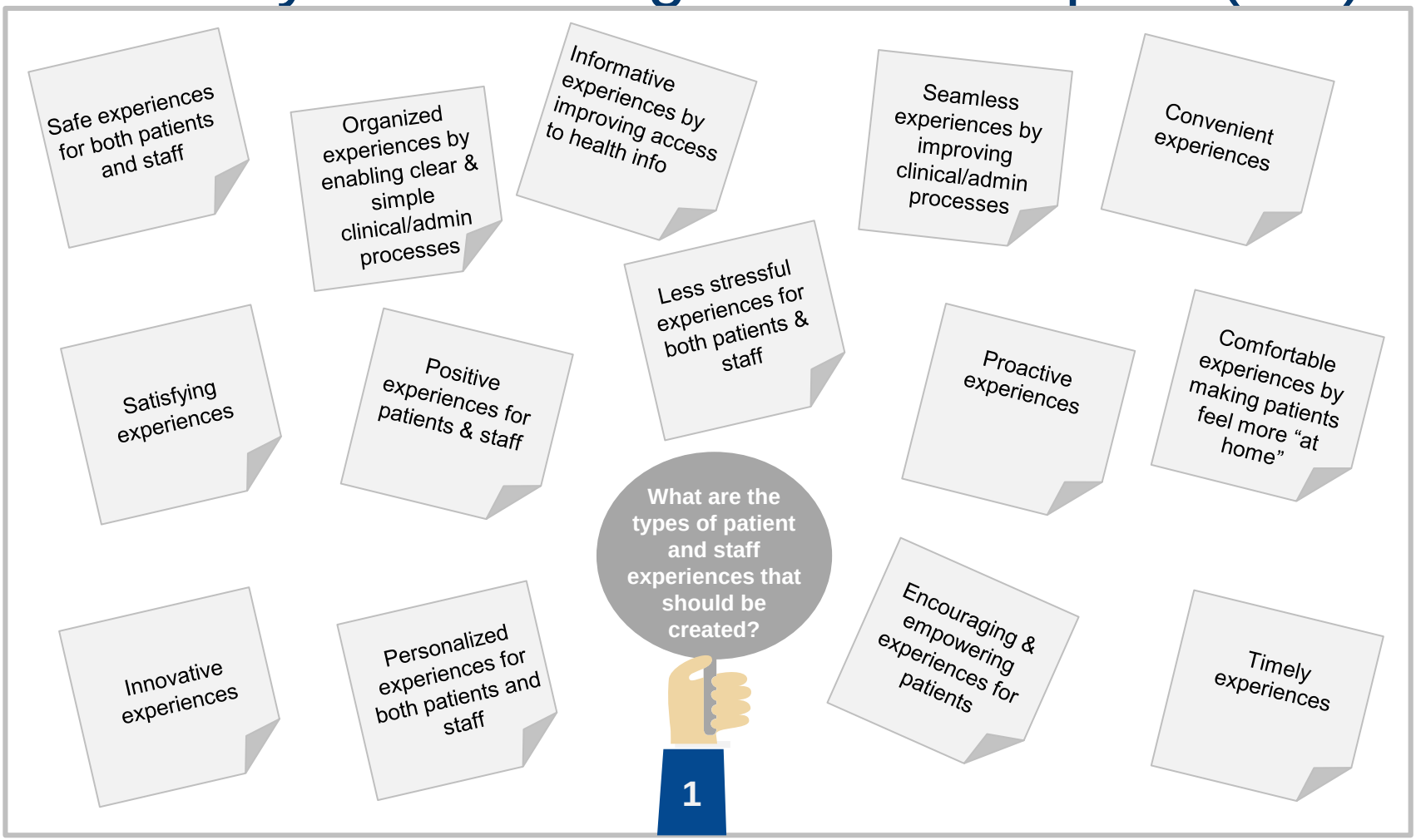
During the visioning session, attendees were divided into four groups and were asked to answer questions based on an assigned topic. The four topics included, ambulatory care services; inpatient services; clinical, diagnostic, and therapeutic services; and support and administrative services. A summary of the outputs from the session are included on subsequent pages. The full outputs are captured in Appendix B.

ICAT visioning session

As part of the visioning sessions, KPMG invited Finger Food Studios, a company that specializes in solving problems across industries by leveraging advanced technologies such as augmented and virtual reality (AR/VR) solutions. Finger Food Studios provided demonstrations to NH leaders on the potential applications of AR/VR solutions in the context of hospital redevelopment.

During each session, participants were provided with a brief introduction about the company followed by an interactive presentation of the “High Acuity Unit Space and Workflow Planning tool” using Microsoft’s HoloLens headsets.

Summary of visioning session outputs (1/4)



Refer to Appendix B for more detailed answers to these questions.

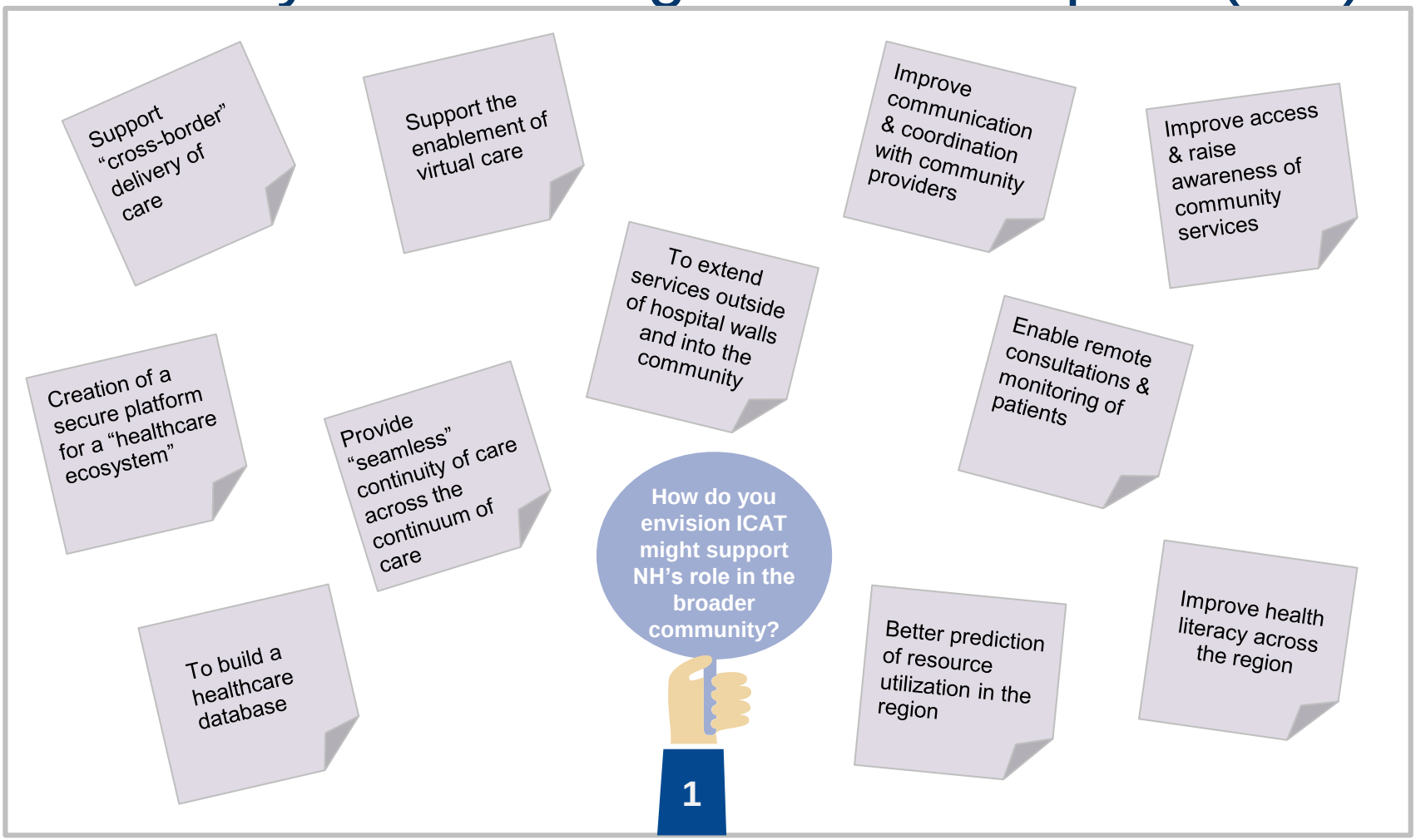
Summary of visioning session outputs (2/4)

Refer to Appendix B for more detailed answers to these questions.

Summary of visioning session outputs (3/4)

Refer to Appendix B for more detailed answers to these questions.

Summary of visioning session outputs (4/4)

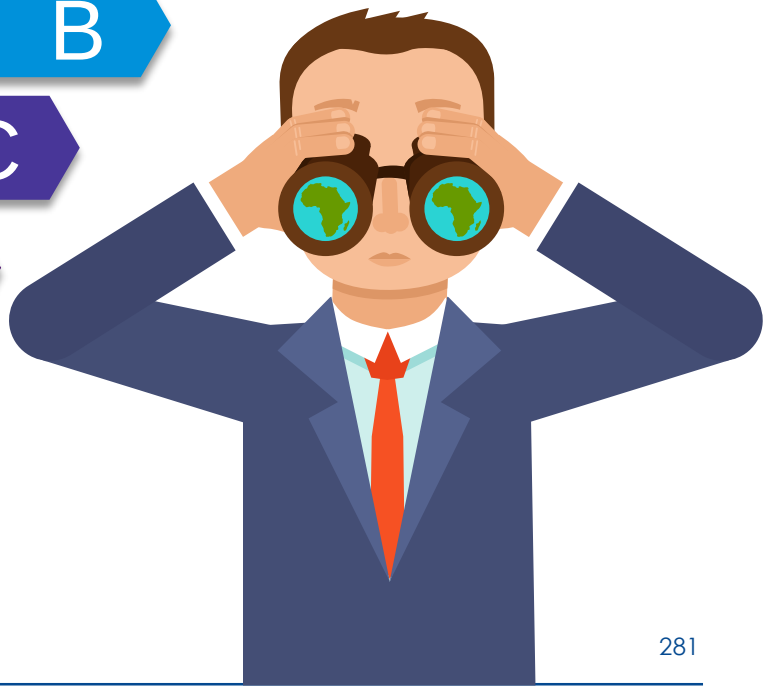


Refer to Appendix B for more detailed answers to these questions.

ICAT Design Vision

An ICAT Design Vision will help to articulate the future state of how NH envisions ICAT enabling care delivery. Based upon the outputs from the visioning sessions and stakeholder engagement sessions, a set of vision statements have been identified below for NH to consider moving forward into the next phase of redevelopment planning:

- **"Enabling connected care".** A
- **"Enabling a connected care campus".** B
- **"Connecting care for the Niagara region".** C
- **"Enabling connected health".** D
- **"Enabling connected care between patients and providers".** E
- **"The health campus of/for the future".** F
- **"A hospital without walls".** G



ICAT Design Vision stakeholder statements

In support of the ICAT Design Vision, a set of stakeholder statements are identified below that describe the specific types of experiences for all of the key stakeholders involved with delivering and receiving care at SNH .

ICAT at SNH will enable:

Patients, families and caregivers *to receive care virtually and have ownership, oversight and access to the right information, where and when they need it to enhance their care experience.*

Providers and staff *to be supported by a modern and safe work environment that creates a positive and fulfilling work experience.*

Leaders *to readily access and apply information to inform evidence-based decisions that improve health system performance.*

Health system partners *to seamlessly exchange information with SNH to support patient-centered, connected care.*

ICT *to deliver secure, resilient, scalable and flexible systems and technology to support all aspects of SNH's role in the health system.*

Supplier and vendor partners *to collaborate and provide innovative leading practice goods and services that will future proof SNH.*

N) Performance Metrics

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Design Vision Outcome Statements (1/2)

The following design vision outcome statements will help NH to evaluate whether the ICAT Design components meet the desired experiences across the different stakeholders identified in the ICAT Design Vision.

Desired experiences

Patients, families and caregivers *to receive care virtually and have ownership, oversight and access to the right information, where and when they need it to enhance their care experience.*

Providers and staff *to be supported by a modern and safe work environment that creates a positive and fulfilling work experience.*

Leaders *to readily access and apply information to inform evidence-based decisions that improve health system performance.*

Measureable outcome statement

Patients, families and caregivers *will have access to health records from a multitude of different providers including NH and other community providers. They will also have the ability to manage appointments and the option to remotely connect with care providers and other support services.*

Providers and staff *will document and chart electronically. They will also have access to communications and automation tools that help to improve the patient experience and enhance the efficiency of care delivery.*

Leaders *will have access to critical organizational and environmental data on a dashboard to make timely decisions.*

Design Vision Outcome Statements (2/2)

The following design vision outcome statements will help NH to evaluate whether the ICAT Design components meet the desired experiences across the different stakeholders identified in the ICAT Design Vision.

Desired experiences

Health system partners *to seamlessly exchange information with SNH to support patient-centered, connected care.*

ICT *to deliver secure, resilient, scalable and flexible systems and technology to support all aspects of SNH's role in the health system.*

Supplier and vendor partners *to collaborate and provide innovative leading practice goods and services that will future proof SNH.*

Measureable outcome statement

Health system partners *will exchange and communicate patient information with a network of providers in the Niagara region.*

ICT *will integrate multiple solutions to create a cohesive environment where interoperability exists between systems to enhance patient and staff experiences.*

Supplier and vendor partners *will provide leading practice insight and create actionable opportunities for NH to leverage ICAT solutions for clinical and/or business programs/services across all sites.*

ICAT Performance Metrics (1/6)

For each of the stakeholder groups identified, performance metrics have been recommended below. These performance metrics are more quantitative and measurable in nature and may be helpful in assessing the performance of ICAT vendors.

ICAT at SNH will enable:

Patients and caregivers…

to receive care virtually and have ownership, oversight and access to the right information, where and when they need it to enhance their care experience.

Performance Metrics

- ✓ Increase in annual patient and caregiver satisfaction scores.
- ✓ Increase in the annual number of appointments booked online by patients and/or caregivers.
- ✓ Increase in the number of patients and caregivers with access to patient records at NH.
- ✓ Increase in the number of virtual care sessions taken by patients and caregivers
- ✓ Increase in the number of patients and caregivers who provided feedback.
- ✓ Increase in the number of patients and caregivers with access to health records from other providers in the region.
- ✓ Increase in the number of patients and caregivers who have downloaded the Niagara Health Navigator App.
- ✓ Increase in the number of messages and/or notifications patients and/or caregivers received from NH via the NH Navigator App and/or other hospital systems.
- ✓ Increase in the number of messages and/or notifications patients and/or caregivers sent to NH via the NH Navigator App and/or other hospital systems.
- ✓ Increase in the number of visits or “check-ins” across all sites by patients and/or caregivers.

ICAT Performance Metrics (2/6)

For each of the stakeholder groups identified, performance metrics have been recommended below. These performance metrics are more quantitative and measurable in nature and may be helpful in assessing the performance of ICAT vendors.

ICAT at SNH will enable:

Providers and staff…

to be supported by a modern and safe work environment that creates a positive and fulfilling work experience.

Performance Metrics

- ✓ Decrease in the number of foot-stops needed to access different communication devices.
- ✓ Increase in the number of programs/services that are documenting electronically.
- ✓ Decrease in the number of mobile devices carried to access different programs/services.
- ✓ Increase in the amount of time saved from workflow/process efficiencies.
- ✓ Increase in the amount of time spent interacting with patients/caregivers.
- ✓ Increase in the annual staff engagement scores related to access to tools to support care delivery.
- ✓ Decrease in the cost of managing paper across the enterprise including processes, printing and storage.
- ✓ Increase in the number of electronic referrals completed.
- ✓ Decrease in the number of CDS overrides initiated by clinicians from respective systems.
- ✓ Increase in the number of warnings triggered to clinicians from respective systems.

ICAT Performance Metrics (3/6)

For each of the stakeholder groups identified, performance metrics have been recommended below. These performance metrics are more quantitative and measurable in nature and may be helpful in assessing the performance of ICAT vendors.

ICAT at SNH will enable:

Leaders…

to readily access and apply information to inform evidence-based decisions that improve health system performance.

Performance Metrics

- ✓ Increase in the number of clinical or administrative indicators prepared electronically.
- ✓ Increase in the number of staff utilizing digital reporting/accessing digital dashboards.
- ✓ Increase in the annual staff engagement scores related to leveraging data to make informed decisions.

ICAT Performance Metrics (4/6)

For each of the stakeholder groups identified, performance metrics have been recommended below. These performance metrics are more quantitative and measurable in nature and may be helpful in assessing the performance of ICAT vendors.

ICAT at SNH will enable:

Health system partners…

to seamlessly exchange information with SNH to support patient-centered, connected care.

Performance Metrics

- ✓ Increase in the number of providers sharing patient information electronically.
- ✓ Increase in the number of partnerships/collaborations established.
- ✓ Increase in the number of electronic referrals made between NH and other providers/partners.
- ✓ Increase in the number of providers in which NH can support an electronic hand-off on behalf of the patient.

ICAT Performance Metrics (5/6)

For each of the stakeholder groups identified, performance metrics have been recommended below. These performance metrics are more quantitative and measurable in nature and may be helpful in assessing the performance of ICAT vendors.

ICAT at SNH will enable:

ICT…

to deliver secure, resilient, scalable and flexible systems and technology to support all aspects of SNH's role in the health system.

Performance Metrics

- ✓ Increase in the number of providers sharing data with NH through the enterprise integration engine.
- ✓ Increase in the number of systems integrated and interfaced to share electronic data.
- ✓ Increase in the number of mobile devices connected to NH's wireless infrastructure.

ICAT Performance Metrics (6/6)

For each of the stakeholder groups identified, performance metrics have been recommended below. These performance metrics are more quantitative and measurable in nature and may be helpful in assessing the performance of ICAT vendors.

ICAT at SNH will enable:

Supplier and vendor partners…

to collaborate and provide innovative leading practice goods and services that will future proof SNH.

Performance Metrics

- ✓ Increase in the number of partnerships established to support ICAT solutions with suppliers and/or vendor partners.
- ✓ Increase in the number of ICAT services or solutions provided by suppliers and/or vendor partners to enhance the patient, caregiver and staff experience.
- ✓ Increase in the number of SLAs met by suppliers and/or vendor partners.
- ✓ Increase in the satisfaction level of NH with regards to their relationships with suppliers and/or vendor partners.
- ✓ Increase in the value for investment obtained from suppliers and/or vendor partners.

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O) ICAT Design Program

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Overview

Purpose

Information, Communication and Automation Technology (ICAT) solutions were discussed with diverse stakeholder groups from the Niagara Health System through a series of working group sessions. These groups provided instrumental feedback, including high level features and functionalities, lessons learned and operational considerations for the solutions planned for the new South Niagara Hospital (SNH).

The information obtained from these working group sessions, along with industry trends, best-practices and peer hospital ICAT directions, formed the development of Niagara Health System's Design Program Report. The purpose of this document is to align the vision with outcomes through the development of technology snapshots which describe: key features, level of alignment with design vision, intended outcomes, requisites & enablers, level of sophistication for approach, operational implications, governance considerations, ICAT design scope, risks & challenges and key outstanding decisions.

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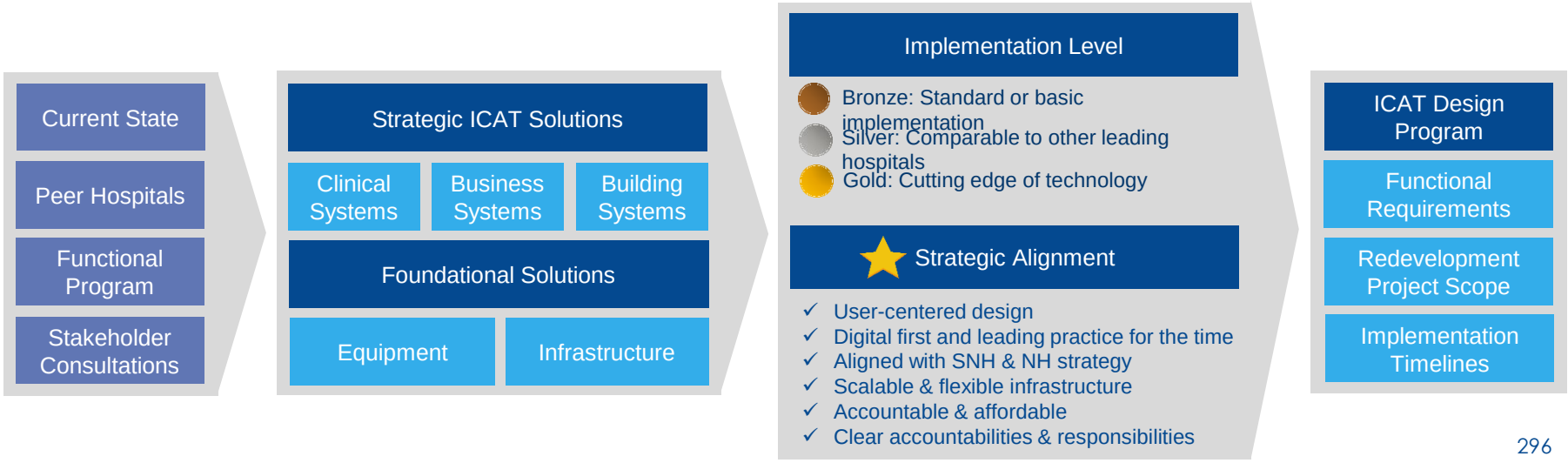
Design Approach

Summary of ICAT Approach

Through a series of user engagement interviews, visioning sessions and a detailed analysis of the Functional Program, a number of technologies were identified as being key to achieving the future state ICAT vision for the South Niagara Hospital (SNH). Of these technology solutions, those with impact across multiple programs were selected for additional review and analysis for consideration in the context of planning and design of the SNH redevelopment project. These solutions were presented to a diverse group of stakeholders at NH, during a series of Working Group Sessions which focused on the use cases, business and clinical objectives, features and functions, business objectives and implementation approach for each technology. The stakeholders included representatives from ICT, operations, transformation, partnerships, engineering, facilities, medical imaging, laboratory, pharmacy, environmental services, security, parking, strategic sourcing, and biomedical.

This report summarizes the results of these meetings, along with additional analysis covering strategic impact, governance and ownership, risk mitigation and key change management strategies.

Finally, a summary of the ICAT infrastructure required to support the ICAT strategic solutions is provided, and forms the basis for the Project Specific Output Specifications (PSOS) for the SNH project.



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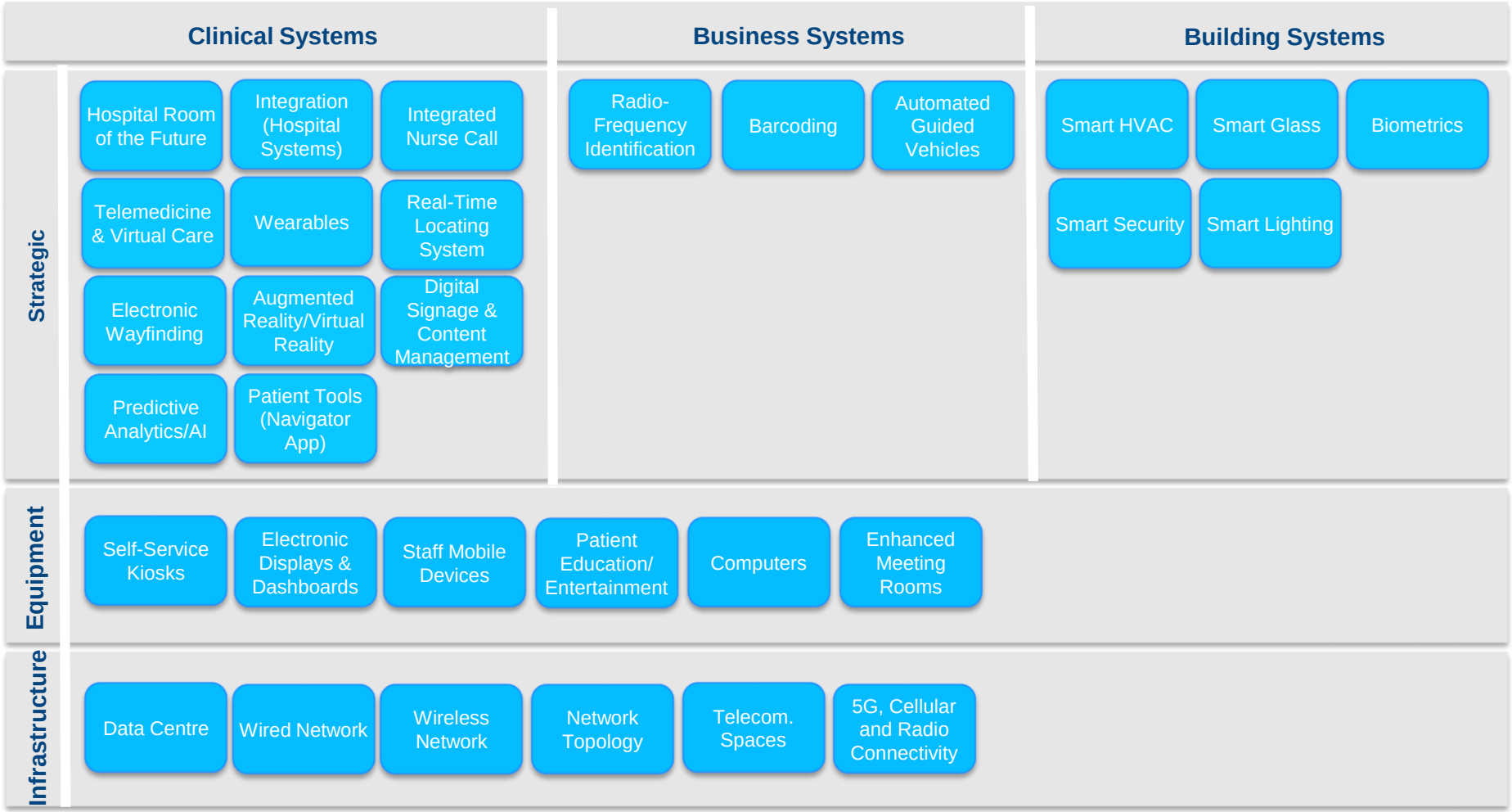
Summary of ICAT Solutions



Implementation Level

An implementation level was assigned to the Clinical, Business and Building Systems in order to briefly describe how the technology might function at different levels of complexity. Through the series of working group sessions, Angus Connect took note of the use-cases outlined by stakeholders and took this into account when recommending implementation levels. Levels assigned range between bronze, silver and gold, with bronze being a fairly established or proven use case and gold being the most advanced and cutting edge. Infrastructure and equipment solutions were not assigned an implementation level, as they are either fundamental to hospital operations or are dependent on the complexity of the implementation level for each ICAT solution. An identified/recommended implementation level for NH's current state, and SNH's opening day (part of Redevelopment Project) and future state (achieved by 2030) have been identified for each ICAT solution within the Options Analysis section. For costing purposes, the implementation of specific solutions have either been deferred completely to the future state (post-opening day), or have been recommended to be partially implemented by opening day with additional features and functions being deferred to the future.

A bronze implementation level includes use cases and related processes that are generally proven and considered fairly mainstream at peer hospital organizations, or have limited scope within the organization. While these use cases may not be complex, they are fundamental to the hospital's operations and staff work requirements. Selecting a bronze implementation level would ensure that NH is in line with both peer hospital organizations and current industry trends.

A silver implementation level includes use cases that may be standard among newly redeveloped or more advanced hospitals, and those which either impact a greater proportion of patients and staff or where the work process approach differs from that typically seen at peer hospitals. Selecting a silver implementation level would allow NH to remain a leader in its adoption of innovative technology, while ensuring investments are proven and demonstrate a track record of success at other institutions.

A gold implementation level includes highly complex and advanced use-cases supported by cutting edge technology. These use-cases are often new, highly innovative approaches to care delivery. Selecting a gold implementation level would place NH at the forefront of the Canadian and/or North American health care industry. These solutions represent a fundamental shift in the delivery of care, and can significantly change the way in which both current and future hospitals are operationalized.

Strategic Alignment

Based on a series of evaluation criteria developed from the ICAT design principles, vision and key performance indicators, each strategic solution was individually evaluated for its alignment with the ICAT Vision. The alignment is represented by a star rating from one to five, with five being the highest level of alignment.

Infrastructure and equipment solutions were not evaluated for alignment with the ICAT Design Principles and NH Strategic Vision, as they are considered fundamental to hospital operations and reliant on the strategic ICAT solutions selected for SNH.

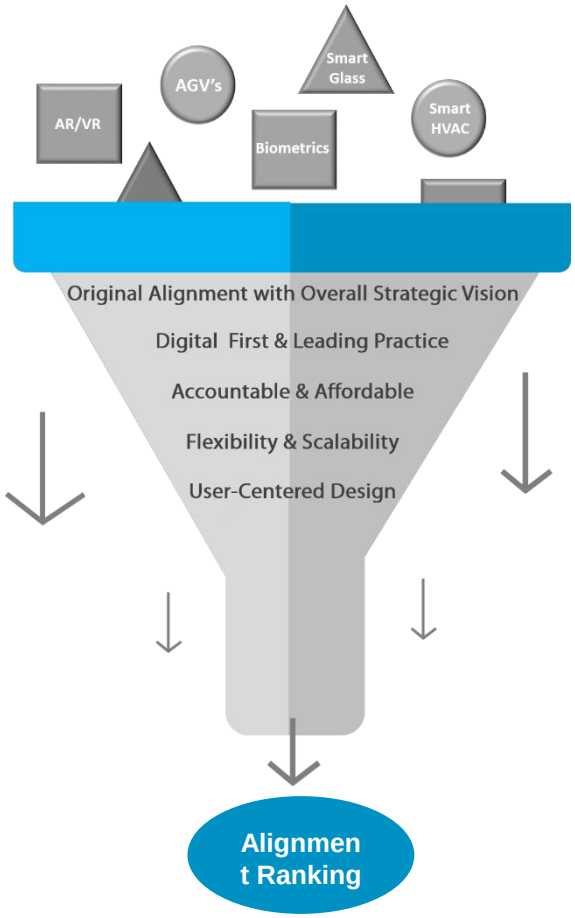
★ Low Alignment

★★ Low-Medium Alignment

★★★ Medium Alignment

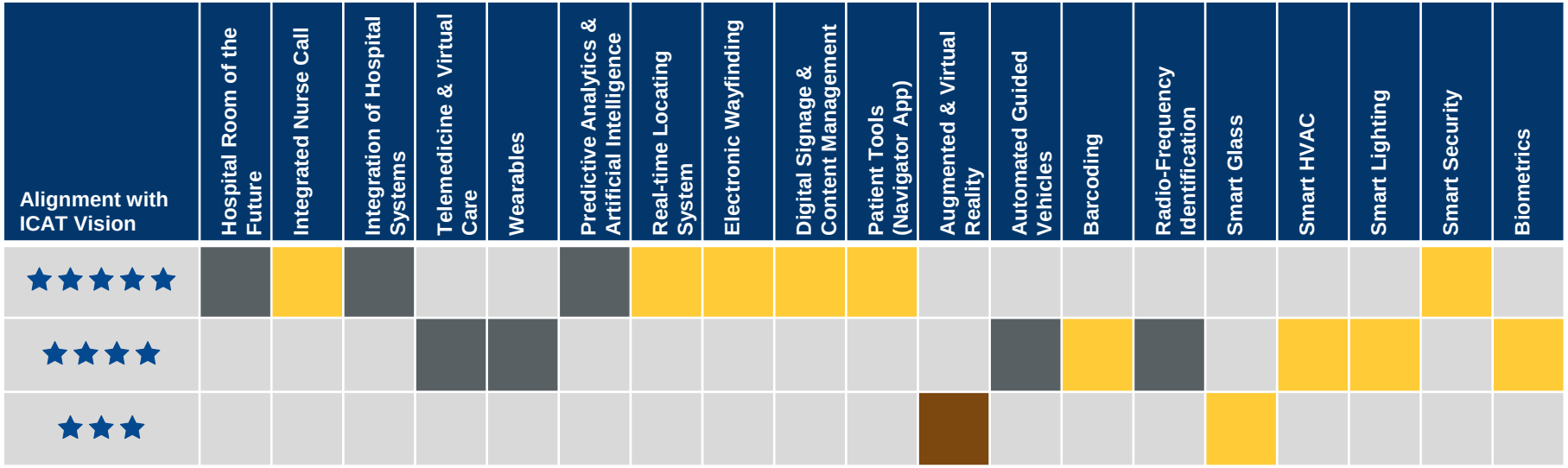
★★★★ Medium-High Alignment

★★★★★ High Alignment



Strategic Impact Scoring

The following chart outlines the strategic impact of each technology solution along with its recommended level of implementation for opening day.



Legend

Alignment with ICAT Principles

★★★ Medium
★★★★ Medium- High
★★★★★ High

Implementation Level

Bronze Silver Gold

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Change Management Strategies

The increasing reliance on technology for the sustainable delivery of care is bringing forth radical changes to processes throughout the health care system and to the workflows of the interdisciplinary teams working within it. As such, to ensure the sustainable adoption of ICAT solutions, it is crucial for health care organizations to develop targeted strategies to minimize staff resistance, optimize infrastructural design, promote user expertise and provide organizational guidance. The following strategies are best-practice, evidence-based approaches that have been proven effective in increasing the likelihood of sustainable ICAT adoption. While all of these strategies should be considered for each ICAT solution, a select number of key strategies have been recommended, based on the amount of impact that each solution has on patients, staff and hospital operations.

Clear Governance & Ownership

In order to support the ongoing success of any ICAT implementation, clear ownership and governance for the system must be established. Governance should include responsibilities for training, maintenance, support, lifecycle/replacement and upgrades, outlining joint responsibilities where required. Implementation planning should include additional ownership-mandated resource requirements for any particular teams.

Consultation with Stakeholders

Stakeholder engagement and communication throughout the project is key to the successful implementation of ICAT solutions. Diversity amongst stakeholder groups is encouraged as doing so brings forth a wealth of knowledge and experience, positively contributing to the planning and design of solutions which are aligned with the unique workflows and requirements of each program.

Champions of Change

It is recommended that organizations enlist local champions to provide front-line support to their peers, particularly when implementing clinical-facing technologies, where patient safety is the highest priority. Champions should be clinically-respected, knowledgeable individuals who are committed to providing ongoing guidance and support to their peers.

Pilot Programs

Pilot programs are particularly important when implementing technologies that are novel, or in situations where the outcomes are dependent on the unique patient population of an organization. Implementation at a smaller-scale allows for assessment of the solution and the opportunity to make changes in advance of the broader implementation. This approach typically results in reduced risks, lower costs and improved long-term success.

Flexible & Adaptable Design

Flexible and adaptable design allows the solution to evolve with changing technologies and workflows, providing a straightforward path towards optimizing the system to best meet users needs. This approach is particularly successful where the specific needs or workflows are not known in advance, where the solution represents a significant change to existing workflows, or where technology is still evolving quickly.

Smart Engagement & Communication

Engagement with users and stakeholders is a key success factor in any new strategic direction. Communication should be transparent, clear and honest, and a communication management plan is recommended to ensure all stakeholders remain informed and engaged. Stakeholders should be provided a forum to easily voice their feedback or concerns, and a process for incorporating this feedback should be established

User Training

In cases where systems are relatively familiar or standard, training may not be required. However many ICAT systems represent a significant change to users' workflows and require specialized knowledge and skills in order to properly use the system. In these cases, the Super User model of training is often most effective, along with standard classroom and/or hands-on training for all users.

Phased Implementation

Particularly in cases where users may be exposed to high levels of change in a short period of time, phased implementation of solutions is associated with positive impacts to behavioral change, patient outcomes and process improvements. It is recommended that the features and functions of the system be reviewed to determine which are required for day one of implementation, and which can be delayed until a later date.

Governance & Ownership

Governance and ownership is a critical component of successful deployment and utilization of technologies. At the technology level, it is necessary to delineate accountability and responsibility for each aspect of the implemented solutions (including items such as training, workflow process changes, auditing and reporting) in order to assure efficient and appropriate use throughout departments.

However, addressing ownership and governance solely at the technology solution level is insufficient, as accountability is only assigned at the individual department level. It is necessary to implement governance at the organizational level (including frameworks, processes, policies and procedures) in order to support the departments in their pursuit of consistent use of all technological solutions and long-term adoption of all solutions, along with a channel to make any major decisions regarding technology use. Hence, it is recommended that NH create an appropriate governing body post-implementation.

Defining appropriate governance and ownership is also necessary at the project level in order to ensure a smooth implementation. There are general divisions of responsibility that are fairly standard for most P3 projects throughout the various phases; the project division of responsibility for NH is as follows:

Sample ownership and governance structure (responsibilities may change depending on the solution):

Phase	Responsible Party (sample)
Planning & Design	NH – Clinical Programs NH – IT
Sign-Off	NH – CIO NH – Clinical Programs
Procurement	Project Co
Installation	Project Co
Support & Maintain	NH – Individual Programs FM

Options Analysis

Clinical Systems

Clinical Systems Include:

- Hospital Room of the Future
- Integrated Nurse Call
- Integration of Hospital Systems
- Telemedicine & Virtual Care
- Wearables
- Predictive Analytics & Artificial Intelligence
- Real-time Locating System
- Electronic Wayfinding
- Digital Signage & Content Management
- Patient Tools (Navigator App)
- Augmented Reality & Virtual Reality

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Hospital Room of the Future

Flexible and secure, technology-enabled inpatient rooms contribute to increased patient comfort, decreased length of stays and superior connection between patients, their family and their care team. A Hospital Room of the Future incorporates a variety of technologies that contribute to an integrated experience and provide patients with control over their environment.

Key Features

- Integrated bedside terminals or mobile app for tablets, with entertainment, information, education, meal ordering, video calls, etc.
- Integrated nurse call system (see page 17)
- Electronic displays outside show key information
- Wirelessly controllable footwall TV for entertainment and for providers to pull up patient record/results
- Pumps/monitors automatically associate to patient
- Staff name and photo automatically appears on footwall television when they walk into the room
- Speech recognition provides control of the patient's environment (lights, temperature, windows etc.)
- Design to include flexibility, security and redundancy

Alignment with Design Vision

★★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Clear accountabilities & responsibilities

Intended Outcomes

- Workflow efficiency
- Patient experience – engaging patient in care process
- Improve clinical outcomes
- Reduced length of stay
- Reduced anxiety

Requisites & Enablers

Dependent on:
- Device/system compatibility
- Content management system
- Real-time locating system
- Integration engine

Enables:
- Data Gathering and Predictive Analytics

Bronze

Integrated bedside terminal with access to entertainment and educational materials, integrated nurse call and electronic displays outside room.

Silver

Bronze + provider access to images and record on footwall TV, additional functionality available on bedside terminal (meal ordering requests, environmental

Gold

Silver + pumps/monitors automatically associate to patient, staff name and photo displays on entry, speech recognition.

Current State Below Bronze → **Opening Day** Silver → **Future State** Gold

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Hospital Room of the Future: Implementation Analysis

Operational Implications

- Consider purchasing ready-made educational content rather than developing this content in-house. Clinical input should be gathered prior to launching content.
- The public affairs/communications group within the hospital should lead the development of informational content and communications.
- Review current processes for clinical documentation and workflows around communication between providers and patients.
- Level 1 support to be provided by IT department.

ICAT Design Scope

- Hospital room of the future will be implemented in all inpatient bedrooms (exact locations to be confirmed).
- Selected technologies (for example, bedside terminals) will also be implemented in areas where patients may receive extended treatment, such as dialysis or chemotherapy.
- Integrated nurse call will be implemented throughout the facility (see page 17).

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: Project Co
- Maintain: to be determined
- Final ownership: to be determined, but should involve IT for support and troubleshooting. Will be dependent on specific technologies and software implemented within the patient room.

Key Outstanding Decisions

- Who will develop educational and informational content?
- What level of survivability is required?
- Confirm that charting will be in alcoves outside the room.
- What are the parameters for patient control over their environment?
- Will entertainment, television and internet services be a paid or free service for patients?
- Confirm compatibility of associated systems with desired workflows (eg. meal ordering)

Potential Risks & Challenges

- A diverse, aging and increasingly acute Niagara population may mean a higher prevalence of language, physical and/or cognitive limitations which can impact patients' ability to use technology.
- Choosing systems which work together seamlessly with each other may conflict with the desire to select "best in breed" systems.
- Locating and tracking of staff members can cause concerns with unions. Keep union involved throughout the planning process to mitigate risk.

Change Management Strategies

Clear Governance & Ownership

Consultation with Stakeholders

Champions of Change

User Training

AngusConnect

Clinical Locations and Key Technologies

Inpatient Rooms
(Medical-Surgical, Complex Care, Critical Care & Geriatrics)

- Integrated Bedside Terminal
- Electronic Room Signage
- Footwall Television
- Dietary Management
- Video Conferencing
- Smart Environmental Control
- Integrated Nurse Call
- Medical Device Integration
- Integration (Hospital System)
- Speech Recognition
- Patient Education & Entertainment
- Barcoding

Group Room

- Electronic Room Signage
- Video Conferencing
- Integrated Nurse Call
- Electronic displays
- Computer

Emergency Bay

- Electronic Room Signage
- Integrated Bedside Terminal
- Smart Environmental Control
- Integrated Nurse Call
- Medical Device Integration
- Integration (Hospital System)
- Speech Recognition
- Patient Education & Entertainment
- Barcoding

Trauma Room

- Electronic Room Signage
- Video Conferencing
- Integrated Nurse Call
- Medical Device Integration
- Barcoding

Prep/Recovery Bays

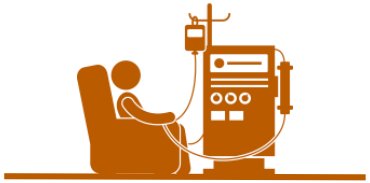
- Integrated Nurse Call
- Medical Device Integration
- Barcoding

Operating Rooms

- VoIP Telephone
- Computer
- AV Integration System
- Electronic Room Signage
- Integrated Nurse Call

Procedure/Exam Room

- VoIP Telephone
- Computer
- Barcoding
- Electronic Room Signage
- Integrated Nurse Call
- Medical Device Integration



Hemodialysis & Chemotherapy Bay

- Integrated Bedside Terminal
- Electronic Room Signage
- Dietary Management
- Video Conferencing
- Integrated Nurse Call
- Medical Device Integration
- Integration (Hospital System)
- Speech Recognition
- Patient Education & Entertainment
- Barcoding

Locations based on peer hospital direction and page 46 of the Niagara Health System (2018) Stage 1 Proposal.

AngusConnect

Integrated Nurse Call

An integrated nurse call system enhances the functionality of a traditional nurse call system by enabling additional functionality and workflows such as escalation and prioritization of calls and integration with other hospital systems, reducing alarm overload for the care team, facilitating efficient workflows, and streamlining patient care.

Key Features

- Interface with medical devices and direct alarms to nurses' handheld devices
- Rounding and workflow capabilities
- Automatically prioritize and escalate calls
- Log call activity and generate custom and standard management reports (e.g., # calls, response times, staff assignments, etc.)
- Marquee lighting to direct emergency code responders
- Integrated with other hospital systems such as RTLS to enable automatic call cancellation when a staff member enters the room where a call was initiated

Alignment with Design Vision

★★★★★

- ✓ User-centered design
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Intended Outcomes

- Workflow efficiency
- Patient experience – engaging patient in care process
- Improve clinical outcomes
- Reduced anxiety and risk
- Patient safety

Requisites & Enablers

Dependent on:

- Mobile Devices
- Real-time locating system
- Integration of Hospital Systems

Enables:

- Data Gathering and Predictive Analytics
- Hospital Room of the Future

Bronze

Standard Nurse Call devices (patient station, washroom station, staff terminal, console, dome & zone lights) present in all clinical locations across the hospital.

Silver

Integrated nurse call with mobile device integration, call escalation/ prioritization and marquee dome/zone lighting features to guide emergency response teams to codes.

Gold

Context-aware integration for enhanced workflow features and automation, including call cancelling and escalation based on staff location, scheduling and assignments.

Current State Bronze-Silver → **Opening Day** Gold

DRAFT FOR REVIEW

AngusConnect

Integrated Nurse Call: Implementation Analysis

Operational Implications

- Review existing processes around patient-provider communications, in both urgent and non-urgent scenarios, and consider how nurse call may relieve some pain points for clinical staff.
- User Group Sessions should be conducted with all clinical programs and the Patient and Family Advisory Council prior to installation.
- Clinical workflows and documentation standards will need to be reviewed to ensure full-utilization of nurse call features/functions

ICAT Design Scope

- Nurse call will be implemented and fully integrated within all inpatient bedrooms and treatment areas.
- Nurse call devices will be located across all clinical programs in both patient and staff areas
- Nurse call will be integrated with: alert & alarm management, mobile devices, RTLS, telephone system, staff scheduling and assignments, HIS, additional systems as required by use cases.

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: Project Co
- Maintain: to be determined
- Final ownership: to be determined, but should involve clinical input in the development and ongoing support for clinical workflows.

Key Outstanding Decisions

- What will the programmed escalation of each program be?
- Determine types of nurse call devices for standard rooms.
- Determine workflows and documentation standards.
- Fully refine use cases, including integrations with other systems.

Potential Risks & Challenges

- Integrated nurse call itself is a relatively proven technology, however some integration use cases can pose challenges if they are not carefully planned and developed with clinical input.
- Reporting feature may cause concerns by unions. Keep unions involved throughout the planning process to mitigate risk.
- Lack of proper training can result in low adoption of new use cases.

Change Management Strategies


Clear Governance & Ownership


Consultation with Stakeholders


Flexible and Adaptable Design


User Training

AngusConnect

Integration of Hospital Systems

The Integration Engine automatically manages and directs the flow of information among clinical and building systems throughout the hospital, reducing manual data transfer and providing context-aware logic and rules processing.

Alignment with Design Vision

★★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Accountable & affordable

Key Features

- Able to connect any system to other systems (provided systems are IP-based/electronic)
- Flexible and scalable architecture that allows for future expansion of use cases and integrations
- Context-aware, with smart logic that is able to flag potential errors
- System can be updated and maintained by hospital resources, independent of system vendor
- Built with reliability and redundancy to support mission-critical applications and use cases
- Day one functionality to be based on a prioritized subset of the overall system capabilities

Intended Outcomes

- Workflow efficiency
- Quicker response times
- Improved access to information
- Enhanced Productivity
- Improved single source of data and redundant entries

Requisites & Enablers

Dependent on:
- Compatible IP-based systems and interfaces
- Wired network

Enables:
- Predictive analytics and artificial intelligence
- Additional functionality within other systems

Bronze

Basic system point to point integration, such as providing room level controls over blinds, or interfacing with the nurse call system.

Silver

Most advanced integration to be implemented in a centralized environment, such as automated sharing of isolation precautions when sending a portering request.

Gold

Full integration between hospital systems with context-aware logic, such as redirecting requests if a nurse is in isolation or a porter is already on a job.

Current State Bronze-Silver → **Opening Day** Silver → **Future State** Gold

AngusConnect

Integration of Hospital Systems: Implementation Analysis

Operational Implications

- Clinical resources will need to be available for consultation during the planning and design stages of this system.
- Training may be required for clinical and support resources who interact with the system.
- Additional IT/informatics resources will be required for development of interface mapping and ongoing support of the licenses and applications

ICAT Design Scope

Key systems to be integrated include:

- Hospital Information System (HIS)
- Medical Devices (i.e. IV pumps, monitors)
- Patient bedside devices
- Nurse Call System
- Real-Time Locating System
- Digital Signage & Wayfinding
- Mobile Devices
- Building Systems (heating/cooling, lighting, security)

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: Project Co
- Maintain: to be determined
- Final Ownership: to be determined, but should involve IT for support and troubleshooting. The system will be managed and supported by the ICT program within NH. Clinical programs will support the development of use cases as required.

Key Outstanding Decisions

- Integration architecture to be determined.
- Responsibilities for planning, procurement, implementation and support (Project Co/FM vs NH).
- Prioritized use cases for opening day implementation vs use cases which will be implemented post-opening day.
- Further development of the specific use cases and information flow required from the system.

Potential Risks & Challenges

- If the integration engine is to be procured through the redevelopment project, there is a risk of the hospital not getting a system which meets all its needs. It is recommended that the hospital procure the system.
- It is very important to clearly articulate roles and responsibilities between the hospital and Project Co, using clear documentation, such as descriptive use cases, system integration responsibility matrix, integration conceptual architecture, project schedules, and approvals is required.

Change Management Strategies

Phased Implementation

Consultation with Stakeholders

Flexible and Adaptable Design

AngusConnect

Telemedicine & Virtual Care

Virtual care systems such as telemonitoring, mobile health and teleconferencing can assist clinicians in coordinating and monitoring patient care remotely, while providing patients with support that extends beyond the walls of the hospital. This supports better patient outcomes, reduces readmissions and improves patient satisfaction.

Alignment with Design Vision

★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy

Key Features

- Dedicated clinician spaces designed for virtual care
- Secure video- and teleconferencing (such as Ontario Telemedicine Network) available in all locations where virtual care services may be delivered
- Secure messaging and patient portal available through the Navigator app
- Additional audio-visual systems and equipment such as screens, cameras and microphones available for clinician use
- Artificial Intelligence and predictive analytics may support streamlined notifications & clinical decision making
- Supports integration of data from consumer wearable devices

Intended Outcomes

- Positive patient experience
- Improved clinical outcomes
- Coordination of care
- Reduced readmission rates
- Shorter length of stay

Requisites & Enablers

Dependent on:
- Audio visual systems
- Secure messaging platform
- Patient portal technology
- Coordination with other community care providers
- Support of funding models

Bronze

Plan infrastructure for widespread implementation; pilot in select clinical programs on opening day.

Silver

Strategically implemented in specific clinical programs with rollout for several patient profiles

Gold

Implement across organization, positioning SNH as a regional center for the delivery of virtual care, impacting a significant percentage of patients.

Current State Bronze-Silver → **Opening Day** Silver → **Future State** Gold

AngusConnect

Telemedicine & Virtual Care: Implementation Analysis

Operational Implications

- Staff and providers will need to be trained on how to use telemedicine and virtual care technologies to deliver care safely and effectively.
- These systems may require additional clinical and IT resource support.
- May require coordination with other community care providers to ensure a seamless patient experience across the continuum.

Governance and Ownership

- Planning and design: NH (Clinical and IT)
- Procure & install equipment: Project Co
- Maintain (equipment): Project Co
- Maintain (software & user support): IT
- Final ownership: to be determined, but should involve IT and clinical input. Governance should be centralized by a designated Virtual Care program to ensure both standardized access across NH and scalability for future growth in virtual care.

ICAT Design Scope

- Flexible audio-visual systems and spaces should support virtual care, including access to electronic health records and data, secure video and teleconferencing, and diagnostic-quality monitors where required.

Key areas where telemedicine will be used:

- Radiology, mental health, oncology (already in place).
- Monitoring of chronic conditions such as diabetes.
- Post-discharge monitoring of surgical patients.
- Prenatal & mother/child groups.

Key Outstanding Decisions

- Define governance model for telehealth and virtual care within NH.
- Determine which programs will be piloted at SCS.
- Determine funding model, if not supported by government funding.

Potential Risks & Challenges

- Due to the significant change in workflows, it is recommended that virtual care be piloted in select programs at SCS prior to moving into the new facility.
- Current government funding models may limit the delivery of virtual care, therefore collaboration with funding organizations may be required if government funding models do not advance sufficiently by the time of implementation.

Change Management Strategies

Wearables

Wearables are becoming increasingly popular for the tracking of activity, heart rate, sleep, and weight. Integrating data from wearables helps provide a more comprehensive picture of a patient's health, and can support more personalized care. Medical-grade devices can be used to remotely monitor patients' health at home, further improving the quality of virtual care.

Alignment with Design Vision

★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy

Key Features

- Interactive wearable devices capable of counting steps, monitoring heart rate, sending notifications and making phone calls (with the future scalability to monitor heart rhythms) will be deployed to a dedicated virtual care program.

Key uses might include:
- Activity "prescriptions" and monitoring
- Remote monitoring of patients' key health stats from their consumer wearable devices
- Assignment of medical-grade monitoring devices for remote monitoring of chronic conditions

Intended Outcomes

- Positive patient experience
- Quality data for enhanced decision-making
- Improved clinical outcomes

Requisites & Enablers

Dependent on:
- Accuracy of data
- Patient compliance
- Ability to easily import data into the patient record

Bronze

Provide "activity prescriptions" which patients could independently track at home via their own consumer wearable devices.

Silver

Allow data from consumer wearables to be uploaded into the patient record for clinicians to reference during patient consultations.

Gold

Assign medical-grade wearable devices to allow patients with chronic illnesses to be monitored remotely.

Current State Silver → **Future State** Gold

Not an Opening Day System

AngusConnect

Wearables: Implementation Analysis

Operational Implications

- Wearable devices should be allocated to specific programs (preferably a virtual care program) as they will require the significant investment to establish new processes and workflows (i.e. Consent procedures, patient education, device allocation, data monitoring, staff decision-making, and device return).
- If medical-grade devices are assigned, they will need to be tracked to prevent theft or loss.

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: NH IT/clinical informatics
- Maintain: NH IT/clinical informatics
- Final ownership: to be determined, but should involve IT for support and troubleshooting. Align with approach taken for virtual care, governance should be allocated to a designated virtual care program, while ownership of wearable devices will be dependent on the virtual care program it is used within.

ICAT Design Scope

- No impact to ICAT design scope.
- Consider space for this program, including storage of the equipment, sign-in/sign-out staffing and reception, as well as space for patient training if this is not housed in the program areas

Key Outstanding Decisions

- Governance and ownership needs to be determined; consider coordination with virtual care.
- What will be the workflows for consent, patient education, device allocation, data monitoring, staff decision-making, and device return?

Potential Risks & Challenges

- Consumer wearable devices are often not FDA approved, which may pose challenges where the intent is to make clinical decisions based on the data obtained by these devices.
- If wearable devices are used by patients and connected via cellular data or in-home wireless networks, risks to data security may be increased.
- Not all patients will have equal access to internet at home; consider access to care as a principle

Change Management Strategies

Clear Governance & Ownership

User Training

Pilot Programs

Champions of Change

AngusConnect

Predictive Analytics & Artificial Intelligence

Predictive analytics and artificial intelligence (AI) process data in order to make sophisticated decisions, recommendations and predictions. Predictive analytics forecasts potential outcomes in real-time by analyzing trends and previous outcomes. AI can include machine learning algorithms that are capable of learning and adapting to new situations, leading to insights that are outside of human capabilities.

Alignment with Design Vision

★★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Clear accountabilities & responsibilities

Intended Outcomes

- Improved clinical outcomes
- Increased patient satisfaction
- Quality insights for enhanced decision-making
- Workflow efficiency

Requisites & Enablers

Dependent on:
- Data Centre & Network;
- Data warehouse & computing power
- In-house data analytics capabilities
- Data sources and system integration capabilities

Key Features

- Predicting patient flow and staffing based on patient acuity, weather, local events and time of year
- Predicting patient deterioration based on physiological data
- Predicting and anticipating staff needs (ie. the system predicts that a clinician will need an IV pump, and automatically identifies the closest available device)
- Predictive and learning building management – Building Automation System (BAS) and electronic security systems (video surveillance, real-time locating system, access controls, intrusion detection)
- Systems will be overseen by humans who will interpret their insights and recommend

Bronze

Predictive analytics engines make recommendations based on a relatively basic set of inputs (such as predicting wait times) in specific business use cases.

Silver

Advanced predictive analytics support a variety of clinical and business use cases, making recommendations based on a complex set of inputs.

Gold

Extensive use of advanced predictive analytics, supported by machine learning algorithms which are capable of learning and adapting to new situations and information.

Current State Bronze → **Opening Day** Silver → **Future State** Gold

Predictive Analytics & Artificial Intelligence: Implementation Analysis

Operational Implications

- Predictive analytics and AI is likely to have a significant impact on provider and support staff work duties– this will require in-depth workflow mapping and training as they transition. Consider the following:
  - Staffing levels and acuity – what processes will change to flux staff?
  - Notifications of changes to patient acuity – who will receive the information and who will be responsible?
- Additional IT resources will be required to maintain, upgrade and support these systems.

ICAT Design Scope

- Consider predictive analytics, artificial intelligence and integration capabilities when specifying and selecting systems for the new hospital.
- Systems should be capable of providing data to a predictive analytics engine, and acting on specific outputs.
- Space for both cross-functional predictive analytics team to work in and large enough for staff to comfortably monitor graphical displays

Governance and Ownership

- Planning and design: NH (IT as well as clinical, support services, operations and administrative stakeholders)
- Procure, install and integrate: NH
- Final ownership: to be determined, but should involve IT (with predictive analytics/AI experience) for support and troubleshooting. A cross-functional and programmatic steering committee and working group should be assembled to address business objectives, clinical flows, data science & services affected.

Key Outstanding Decisions

- Leadership team to identify the business challenges and associated use cases where analytics would be implemented.
- Who will take ownership of the process and the system and guide the implementation?
- What safeguards need to be in place to prevent delays in patient care delivery if analytics are not available?

Potential Risks & Challenges

- Ensure the analytics are supporting future workflows and business goals, not causing redundant workflow processes.
- This is a highly complex system, and as such requires careful planning for implementation and programming. Consider engaging a third party specialist to guide the implementation.
- This technology is still evolving rapidly, adding a factor of risk.
- Consider a phased approach to minimize workflow impact on clinicians.

Change Management Strategies

- Clear Governance & Ownership
- Pilot Programs
- Phased Implementation
- User Training

AngusConnect

Real-Time Locating System (RTLS)

A Real-Time Locating System (RTLS) provides accurate location tracking of tags throughout the facility, along with a graphical user interface and search function. It supports a variety of use cases including patient wandering, infant protection, staff duress and asset tracking.

Alignment with Design Vision

★★★★★
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Key Features

- Room level tracking throughout the facility
- Clear, plain language room names and numbers
- Graphical maps and search function
- Available on a variety of devices, including computers, mobile phones, tablets, and touchscreen dashboards
- Use cases to be implemented:
  - Patient Wandering & Infant Protection
  - Patient Tracking (all patients)
  - Staff Duress
  - Asset & Equipment Tracking, including automatically associating medical equipment with a patient

Intended Outcomes

- Patient and staff safety
- Loss prevention
- Enhanced productivity
- Positive patient experience

Requisites & Enablers

Dependent on:
- Wireless Network
- Integration with other systems

Enables:
- Additional functionality in other systems (location-based actions)

Bronze

Zone-level tracking of tags, capable of supporting nonessential/basic use cases. Generally Wi-Fi based with limited accuracy

Silver

Room level tracking in specific clinical areas to support a variety of use cases, zone level tracking in other areas of the facility.

Gold

Room-level tracking in most or all of the hospital, supporting a variety of critical use cases and integrated with other systems to provide enhanced functionality.

Current State Silver → **Opening Day** Gold

DRAFT FOR REVIEW

AngusConnect

Real-Time Locating System (RTLS): Implementation Analysis

Operational Implications

- Staff already need to carry a number of devices – staff tags should be either small and lightweight, or preferably combined with other devices such as mobile phones or access cards.
- Review operational processes for staff duress, infant protection and patient wandering alerts. These might include such items as: how staff will be notified, what the sequence of events to be followed shall be, and whether there will be secured areas.

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: Project Co
- Maintain: Project Co, with input from NH
- Final ownership: to be determined. Will be dependent on use cases. For staff duress, infant protection & patient wandering devices, security program should have ownership of the devices and related processes. For clinical use cases, the Education & Learning program should have ownership of RTLS related work processes.

ICAT Design Scope

- Ensure compatible wireless network design.
- Coverage to be 100% of the interior of the hospital, floor-to-ceiling in all areas.
- Integrated with nurse call, mobile phones, electronic displays, inpatient bedside devices.
- Consider the capabilities and failure scenarios of various technologies when specifying and selecting systems.
- Equipment to be tracked includes beds, pumps, wheelchairs, bariatric equipment, Staxis chairs, IV poles, and point of care analyzers.

Key Outstanding Decisions

- Clear governance and ownership needs to be determined.
- Further refine use cases and integrations.

Potential Risks & Challenges

- The existing RTLS at SCS is not well-utilized due to some design challenges. To promote adoption, the new system will need to demonstrate a clear improvement over the old system.
- Typically there are concerns regarding the tracking of people (particularly staff members) and concerns around privacy and how this information is used. The hospital should openly address these concerns with key stakeholders.

Change Management Strategies


Clear Governance & Ownership


Consultation with Stakeholders


Smart Engagement & Communication


Phased Implementation

AngusConnect

Electronic Wayfinding

Wayfinding assists patients, staff and visitors in finding their way throughout the hospital. It can be accomplished through a variety of solutions including static signage, interactive electronic displays, and/or mobile apps with indoor, real-time wayfinding that is similar to Google Maps.

Key Features

- Electronic wayfinding supports static and architectural elements of wayfinding – such as use of colours
- All signage should be language-agnostic to the greatest extent possible; consider using icons rather than text wherever possible
- Interactive kiosks available at all major entrances and public spaces to facilitate wayfinding, with printable directions (both to and from destination)
- Electronic displays located in key areas should support wayfinding for emergencies such as code events
- Mobile application which supports real-time indoor wayfinding via Bluetooth beacons or other locating technology

Alignment with Design Vision

★★★★★
- ✓ User-centered design
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Intended Outcomes

- Improved access to information
- Positive patient experience
- Reduced anxiety

Requisites & Enablers

Dependent on:
- Content management
- Bluetooth-compatible RTLS or equivalent
- Patient Navigator app (pre-appointment notifications for patients including directions)

Bronze

Electronic signage located at entrances, elevator lobbies, corridor intersections with information about hospital events, services & directions.

Silver

Electronic signage supplemented with interactive kiosks at entrances to the hospital, with patients able to search for directions to their destination.

Gold

Electronic signage and interactive kiosks, along with a mobile app that supports live indoor wayfinding via Bluetooth beacons.

Current State Bronze → **Opening Day** Gold

AngusConnect

Electronic Wayfinding: Implementation Analysis

Operational Implications

- IT resources will be required to restock paper supplies wherever directions may be printed.
- Volunteers should still be available to assist patients and visitors as required.
- Content will need to be developed and kept updated for the system, as changes to the building occur over time
- Review and analyze flow patterns of patients, staff and visitors throughout the hospital and align wayfinding accordingly.
- Location naming convention needs to be considered early with Project Co and architecture

Governance and Ownership

- Planning and design: NH
- Procure, install and integrate: Project Co
- Maintain: Project Co, with input from NH
- Final ownership: to be determined. Communications/Patient relations will govern the development and updating of content.

ICAT Design Scope

- Plan for electronic displays at key locations (entrances, elevator lobbies, corridor intersections, department entrances) throughout the facility.
- Plan for interactive kiosks at entrances and key public areas such as cafeteria, emergency department and central registration.
- Electronic wayfinding should support the overall wayfinding strategy, which may include aspects such as colours, designs, architecture and static signage.

Key Outstanding Decisions

- Determine the extent of wayfinding (within the facility/campus or to the site as well).
- Determine clear ownership and governance.
  - Who will develop and update content for the system?
  - Who will ensure maps are correct and up to date?

Potential Risks & Challenges

- Physical and cognitive limitations, as well as personal preferences, may impact the usability of these systems.
- Wayfinding design is crucial during emergency events and codes, the wayfinding platforms should be designed in a way that the Emergency and Security stand out from other locations to ensure staff, visitors and patients can make it to these locations in a time-efficient manner.

Change Management Strategies

Clear Governance & Ownership

Flexible and Adaptable Design

Consultation with Stakeholders

AngusConnect

Digital Signage & Content Management

Digital signage is often located in public areas to share information about special events, wayfinding, hospital services, or notifications to staff, patients, visitors and families. This system includes a content management platform which allows SNH staff to develop, control and schedule content for displays located throughout the facility.

Alignment with Design Vision

★★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Intended Outcomes

- Improved access to information
- Enhanced productivity
- Positive patient experience

Requisites & Enablers

Dependent on:
- Electronic information systems
- Content management system
- Development and management of content on an ongoing basis

Key Features

- Dynamic digital signage located in public spaces such as entrances, corridors, elevator lobbies, elevator cabs, eating spaces, and waiting areas
- Interactive touchscreen displays in accessible locations such as entrances and waiting areas.
- Displays will support wireless screen mirroring for authorized users, in order to facilitate ad hoc presentations and collaboration
- Content management system which allows staff to create, control and schedule content
- Displays can be grouped in to zones and controlled independently, so content can be customized to the location of the display

Bronze

Digital signage located in most public spaces throughout the facility, with standard content such as weather, hospital information, events, advertising and fundraising.

Silver

Digital signage located throughout the facility, including within elevator cabs, lobbies and waiting rooms, with customized content based on location & time of day.

Gold

Dynamic and customized digital signage supplemented with touchscreen displays provide an interactive patient and visitor experience.

Current State Bronze → **Opening Day** Gold

Digital Signage & Content Management: Implementation Analysis

AngusConnect

Operational Implications

- Digital signage may be used to notify staff and the public of code or emergency events. Staff should be trained on how to respond.
- Additional resources will be required to manage the system, and to develop and update content.

ICAT Design Scope

- Plan for digital signage in all public areas (entrances, elevator lobbies, corridor intersections, department entrances, waiting rooms) throughout the facility.
- Plan for interactive touchscreen displays at entrances, cafeteria and waiting rooms.
- Include content management system and IPTV/CATV connections for all displays.
- Displays should be sized and mounted appropriately for viewing distances.

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: Project Co
- Maintain: Project Co
- Final ownership: to be determined. The Communications/Patient Relations group to be responsible for developing and updating content.

Key Outstanding Decisions

- Determine clear ownership and governance.
- Who will develop and update content for the system?
- What are the key types of content that will be displayed (events, weather, news, social media, advertisements, traffic, local TV, etc.)?

Potential Risks & Challenges

- The usefulness of the system is directly dependent on the perceived value and relevance of the information it is used to display. If proper thought is not given to the development and update of content, this system may not achieve its intended outcomes.
- This system requires ongoing maintenance and development of content. Responsibilities should be clearly defined.

Change Management Strategies

Clear Governance & Ownership

Flexible and Adaptable Design

User Training

AngusConnect

Patient Tools (Navigator App)

The Niagara Health System Navigator app will provide a portal for patients and families to access information about the hospital, as well as review aspects of their medical record, results, appointments, discharge instructions and educational materials.

Alignment with Design Vision

★★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Clear accountabilities & responsibilities

Key Features

- Booking/rescheduling appointments
- Access to preparation and discharge instructions
- Parking availability, reservations & payment capabilities
- Book supplementary services such as valet parking, wheelchair pickup or other accommodations
- Wayfinding information
- Appointment reminders
- Lab results
- Includes security features such as Digital Identity and validation with banking information

Intended Outcomes

- Positive patient experience
- Reduced anxiety
- Reduced wait times & no-shows
- Improved clinical outcomes

Requisites & Enablers

Dependent on:
- Integrated hospital systems
- Data privacy and security
- Electronic Health Record
- Parking management system
- Appointment booking/scheduling system
- Electronic systems and information

Bronze

Web app with generic hospital information available on website.

Silver

Personalized information available in a portal with basic access to booking services and results.

Gold

Full-service personalized application custom developed for Niagara Health System, with extensive integration to hospital systems and workflows.

Current State Bronze → **Opening Day** Gold

AngusConnect

Patient Tools (Navigator App): Implementation Analysis

Operational Implications

- This application has the potential to profoundly change staff workflows and job requirements– consider a phased implementation along with additional training and resources during the rollout of new features.
- Review the existing processes and workflows around data management and flow.

ICAT Design Scope

- Limited ICAT design scope as the solution will be developed in-house.
- Consider space for the development team
- Ensure data centre and network are designed to accommodate additional systems and data sharing, with robust security and privacy features built in.

Governance and Ownership

- Planning and design: NH (led by IT)
- Procure, install and integrate: NH
- Maintain: NH
- Final ownership: to be determined. Initiative led by NH IT group and will require buy-in and engagement from other programs.

Key Outstanding Decisions

- Determine governance and ownership of the system and its components. Clinical input will be required for some functionalities.
- Further refine specific use cases and functionality.

Potential Risks & Challenges

- Data privacy and security are a significant concern whenever patient health information is being accessed or shared. Ensure the application has robust identify verification, encryption, data security and privacy tools built in.
- This system can represent a significant change to workflow for some users; work closely with users (both providers and patients) throughout development

Change Management Strategies

Clear Governance & Ownership

Consultation with Stakeholders

Phased Implementation

User Training

AngusConnect

Augmented Reality & Virtual Reality

Augmented Reality (AR) and Virtual Reality (VR) technologies provide a safe, immersive, and engaging experience for both patients and staff. Patients may use AR/VR for education, entertainment and treatment, while staff can enhance their skills through AR/VR training. Future uses might include remote robotic surgery.

Alignment with Design Vision

★★★
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy

Key Features

- Educational modules available through virtual reality headsets for select patients
- Training, education and skills development available to clinicians through immersive VR programs
- Tested and proven software which supports the specific use cases to be implemented
- Infrastructure design that supports future expansion of virtual reality and augmented reality technologies
- Future uses of this technology might include augmented reality in the operating room, or advanced virtual reality training programs for skills development

Intended Outcomes

- Improved clinical outcomes
- Increased patient satisfaction
- Reduced anxiety
- Enhanced staff skills & knowledge
- Positive staff experience

Requisites & Enablers

Dependent on:
- Wireless network
- Availability of software to support use cases
- Ability to pilot project with market innovators

Bronze

Relatively basic implementation for specific functions (for example, pre-operative informed consent modules, or patient education).

Silver

Bronze + well-defined scope for patient- centric applications and training (pain management & rehabilitation) across several departments.

Gold

Silver + varied applications and integrations, putting SNH on the leading edge of VR; used extensively throughout the hospital for training, patient care, and entertainment

Current State
Below Bronze

Future State
Bronze +

Not an Opening Day System

AngusConnect

Augmented Reality & Virtual Reality: Implementation Analysis

Operational Implications

- Clinicians administering and/or providing VR education/treatment to patients or staff will need to be trained on the proper use and limitations of the system.
- This technology will require ongoing support and maintenance from IT in order to remain operational.
- Headsets will need to be tracked so they are not lost.

ICAT Design Scope

- Design wireless infrastructure to support high performance connectivity (Wi-Fi 6 and 5G) suitable for VR and AR technologies throughout the hospital.

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: NH
- Maintain: NH
- Final ownership: to be determined, but should involve IT for support and troubleshooting. The Education & Learning Program to provide governance, to prevent departmental siloes where AR/VR can become under utilized. Individual programs, dependent in the use case will have ownership of the devices.

Key Outstanding Decisions

- In which programs will VR be implemented for patients?
- What types of clinician training and/or skills development might make use of VR?
- Who will purchase or develop the content for virtual reality technology?
- Define the governance, management and support for this technology.

Potential Risks & Challenges

- VR and AR technologies are relatively new and evolving rapidly in the current market. There is a risk that the technology might shift dramatically in the coming years, reducing the value of investments made today.
- There is limited availability of clinical-grade software currently on the market, although this may be developed in the coming years.

Change Management Strategies

Clear Governance & Ownership

Pilot Programs

User Training

Champions of Change

AngusConnect

Business Systems

Business systems include:

- Automated Guided Vehicles
- Barcoding
- Radio-Frequency Identification

AngusConnect

Automated Guided Vehicles

Automated Guided Vehicles (AGVs) are portable, self-guided robotic vehicles capable of autonomously delivering non-urgent medications, specimens and other supplies throughout the facility. Typically located in non-patient areas, AGVs are capable of operating doors, calling elevators, and independently navigating to their destination using beacons and sensors.

Alignment with Design Vision

★★★★
- ✓ Aligned with SNH & NH strategy
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Key Features

- Move goods and items throughout the hospital automatically and seamlessly, using back-of-house pathways and service elevators
- Configured to navigate to their destination using beacons and/or Wi-Fi
- Provide an efficient means of transporting non-urgent and non-valuable goods

Uses:
- Routine non-narcotic medication deliveries
- Medical equipment delivery (large and/or heavy items)
- Scheduled lab specimen delivery
- Scheduled laundry pickup

Intended Outcomes

- Workflow efficiency
- Enhanced Productivity
- Just-In-Time delivery

Requisites & Enablers

Dependent on:
- Wireless Network
- Architectural design must accommodate appropriate spaces and pathways (corridor widths, charging locations)

Bronze

Basic AGVs are used to support movement of specific types of goods in specific areas.

Silver

AGVs are used extensively to support the movement and delivery of a variety of goods and items throughout the hospital.

Gold

Sophisticated AGVs automatically detect and respond to needs throughout the hospital, including delivering medication and restocking supplies.

Current State
Below Bronze

Opening Day
Silver

AngusConnect

Automated Guided Vehicles : Implementation Analysis

Operational Implications

- Review existing processes and workflows around medication and supply delivery to align with AGV-supported workflows.
- Closely involve key stakeholders in the process planning (ex. pharmacy, biomed, food services, & facilities).
- Consider resource reallocation to reduce job loss due to automation.

ICAT Design Scope

- Requires additional space and storage. Coordination with other design disciplines is necessary.
- Requires automated control of service elevators and door hardware.
- Guidance beacons may need to be coordinated with ICAT systems.

Governance and Ownership

- Planning and design: NH (Project Co to address requirements in building & systems design)
- Procure, install and integrate: NH
- Maintain: NH
- Final ownership: to be determined. Materials Management department to govern, with specific programs, dependent on use care having ownership of work process (eg. Pharmacy program to have ownership of work processes related to medication delivery).

Key Outstanding Decisions

- Confirm Use Cases & Quantities of AGV's:
  - Medication
  - Laundry
  - Supplies
  - Labs
- Identify location of storage/parking & charging
- Identify location of 24/7 monitoring and support
- The ownership and governance for this system needs to be determined.

Potential Risks & Challenges

- As a costly system, the Hospital should consider pre-qualifying vendors for their specific use cases, on criteria such as: proof of concept, other live sites & references, complete set of capabilities, system support and location
- Choosing systems which work together seamlessly with each other may conflict with the desire to select "best in breed" systems.
- Elevators should prioritize urgent codes and events higher then AGVs to ensure patient safety and response rates are not hindered

Change Management Strategies


Clear Governance & Ownership


Flexible & Adaptable Design


Consultation with Stakeholders


User Training

AngusConnect

Barcoding

Barcoding technology allows for the easy and straightforward identification of people, items, medications and specimens throughout the hospital. This system supports closed loop medication administration, Electronic Medication Administration Record (eMAR), tracking of specimens and lab samples, as well as medical supplies, instruments and other goods. It can also be used for positive patient identification as well as staff identification.

Key Features

- SNH will utilize barcoding across the organization for a variety of clinical and business use cases
- Wired and wireless barcode scanners located at key points throughout the facility
- Label printers where barcodes will be generated

Use cases include:

- Medication administration
- Specimens & lab samples
- Surgical instrument tracking
- Medical device tracking & identification
- Medical supply tracking
- Positive patient identification
- Automated updates to HIS, eMAR, queue management and asset management systems

Alignment with Design Vision

★★★★

- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Accountable & affordable

Intended Outcomes

- Patient safety
- Quality data for enhanced decision-making
- Enhanced Productivity
- Increased patient satisfaction

Requisites & Enablers

Required for:

- Electronic Medication Administration (eMAR)

Bronze

Barcoding used for specific use cases (such as positive patient & medication identification during the medication administration process).

Silver

Bronze + barcoding used for a variety of use cases in a variety of workflows, such as for positive patient identification prior to invasive procedures & tests.

Gold

Silver + barcoding used for a variety of use cases and workflows, including automated discharges, queue management updates & asset management.

Current State Silver → **Opening Day** Gold

AngusConnect

Barcoding: Implementation Analysis

Operational Implications

- Mapping of future processes and workflows around medication preparation and administration to align barcoding locations and complete closed-loop medication delivery.
- Review existing processes for medication and specimen management and tracking.
- Mobile, rechargeable devices should be deployed, particularly in high acuity areas due to the high-capacity of unscheduled patient and medication identification requirements.

ICAT Design Scope

- Barcoding devices will be deployed hospital wide
- Mobile, rechargeable devices in areas that require a high-capacity of unscheduled patient and medication identifications.
- Plan sufficient label printers to support workflows.

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: NH
- Maintain: NH
- Final ownership: to be determined. For medication-related use cases, individual programs will own the bar-coders, but pharmacy will govern the standards and processes related to barcoding.

Key Outstanding Decisions

- Further refine specific use cases and functionality.
- Determine workflow and locations for deployment.
- Wireless versus wired devices?

Potential Risks & Challenges

- It is recommended to work closely with users and stakeholders to determine where barcoding is most useful and what design features are necessary, in order to promote adoption.
- Barcoding use cases are increasingly becoming best-practice within the health care sector. Ensure barcoding devices can be scalable for future advances.

Change Management Strategies

Clear Governance & Leadership

Flexible & Adaptable Design

Smart Engagement & Communication

AngusConnect

Radio-Frequency Identification (RFID)

Radio Frequency Identification (RFID) is a passive system which uses small electronic tags to wirelessly detect when an item passes a sensor. It is typically used for tracking low-value items or consumables such as medications, instruments, linens or clean supplies.

Alignment with Design Vision

★★★★
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Key Features

- Consists of small adhesive tags which can be applied to a variety of items. These tags can be read wirelessly when they move within range of a scanner (typically about 10 feet).
- Already in use in materials management.
- RFID can be used in the operating room to track sponges and instruments, in MDRD to track instruments and carts, in materials management to track receipt and movement of items
- Some suppliers may be able to affix standard RFID tags to deliveries in order to streamline materials management protocols

Intended Outcomes

- Improved clinical outcomes
- Loss prevention
- Enhanced Productivity
- Quality data for enhanced decision-making

Requisites & Enablers

- None

Bronze

RFID used in materials management only (status quo).

Silver

RFID used in specific non-clinical use cases, such as tracking equipment & instruments in MDRD.

Gold

RFID supports a variety of clinical and non-clinical use cases, including tracking of medication, and surgical tools in the operating room.

Current State Bronze → **Opening Day** Silver

AngusConnect

RFID : Implementation Analysis

Operational Implications

- Review processes and workflows around MDRD instrument and equipment processing to ensure the technology design is supportive of current practices.
- Workflows regarding the purchase and arrival of instruments & equipment should be considered as this will impact the process by which tags are assigned.

ICAT Design Scope

- Provide supporting ICAT infrastructure for scanners

Governance and Ownership

- Planning and design: NH (clinical and IT)
- Procure, install and integrate: NH
- Maintain: NH
- Final ownership: to be determined. Allocation of governance is usually based on use case. RFID for equipment processing would be both governed and owner by MDRD. Security related use cases to be governed and owned by the security program.

Key Outstanding Decisions

- Where will RFID be used instead of barcoding?
- What are supplier capabilities to support RFID tagging of items?

Potential Risks & Challenges

- Adhesive RFID tags are prone to both intentional and unintentional removal. Strategies to prevent this should be considered, along with having a process that supports easy and efficient re-assignment and application of tags.

Change Management Strategies

Clear Governance & Ownership

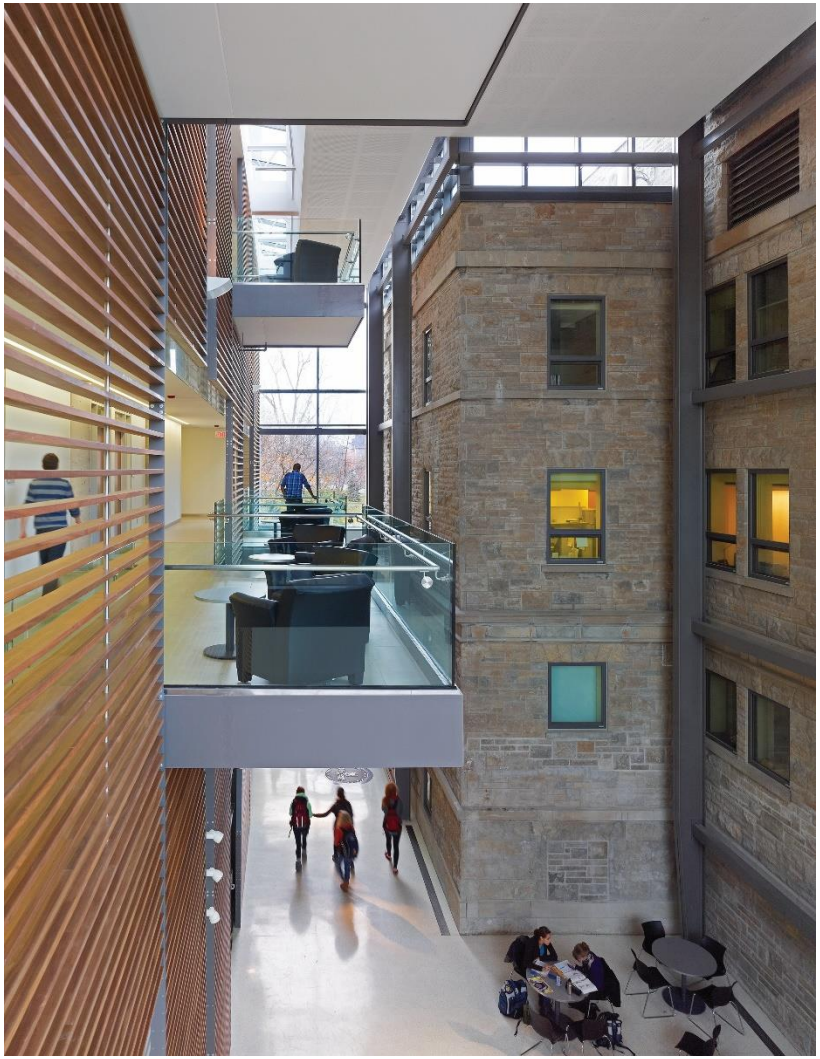
User Training

Consultation with Stakeholders

Building Systems

Building systems include:

- Smart Glass
- Smart HVAC
- Smart Lighting
- Smart Security
- Biometrics



AngusConnect

Smart Glass

Also known as electrochromic glass, Smart Glass enhances the traditional functionality of interior and exterior windows by allowing electronic control of glass opacity, replacing traditional blinds and curtains and providing easy control of privacy. A small voltage or current is applied across the glass to control the opacity.

Alignment with Design Vision

★★★
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Clear accountabilities & responsibilities

Key Features

- Replaces the need for traditional blinds or curtains, reducing infection control and fire risks
- Automatic or manual electronic control of glass opacity
- Available as interior or exterior windows
- Integrated with patient controls in inpatient bedrooms
- Integrated with Building Automation System for centralized scheduling and control, as well as automatic reporting of occupancy, energy savings etc.
- Provides significant energy savings, as 100 windows use approximately as much electricity as one incandescent bulb but can save 20% of peak air conditioning load

Intended Outcomes

- Improved clinical outcomes
- Positive patient experience
- Patient privacy
- Energy efficiency
- Improved infection control

Requisites & Enablers

Dependent on:
- Building automation system
- Integration engine (for patient control)
- Power supply to windows

Bronze

Relatively basic implementation as a pilot in specific departments, primarily with switchable movement functionality.

Silver

Used on south and west sides of the building exterior and on inpatient floors, and for privacy in specific departments.

Gold

Used throughout the interior and exterior of the building, with fully integrated controls and scheduling to maximize energy savings and efficiency.

Current State Below Bronze → **Opening Day** Gold

Smart Glass: Implementation Analysis

Operational Implications

- Review workflows and processes around maintaining patient privacy, and consider how smart glass may enhance other architectural and procedural aspects of privacy.
- Smart glass has the potential to impact patient outcomes, namely preventing delirium. Align glass tinting to support the regular sleep-wake cycle.

Governance and Ownership

- Planning and design: NH facilities
- Procure, install and integrate: Project Co
- Maintain: Project Co
- Final ownership: Project Co, with support from NH for integration support. Smart glass will be governed by facilities, similar to other building elements.

ICAT Design Scope

- Ensure system and needs are coordinated with M/E and architectural planning and design.

Locations:

- All external windows, with integration to Building Automation System for centralized scheduling and control (including daylighting).
- External windows in patient rooms, with integration to patient controls (bedside devices, speech recognition).
- Trauma rooms in Emergency Department for privacy.
- Other locations to be determined.

Key Outstanding Decisions

- Determine which other interior locations will make use of smart glass.
- Define use cases for integrations with Building Automation system and patient controls.

Potential Risks & Challenges

- As with any connected systems security risks are present. In the event of a security breach building operations may become vulnerable to attack. Mitigate risks by implementing thorough security procedures and processes.

Change Management Strategies

Clear Governance & Ownership

User Training

Consultation with Stakeholders

AngusConnect

Smart HVAC

Automated Heating, Ventilation and Air Conditioning (HVAC) features that support maximizing energy efficiency and provide patients and staff with a higher level of autonomy and comfort.

Alignment with Design Vision

★★★★
- ✓ User-centered design
- ✓ Aligned with SNH & NH strategy
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Key Features

- Ability to automatically adjust the temperature with all occupants voting on their comfort level via web-based application
- Automatic temperature control for unoccupied rooms
- Automatic adjustment of base temperature based on outside weather conditions
- Predictive analytics to automatically pre-cool or pre-heat spaces based on anticipated weather or heat load requirements
- Patient control of room temperature from bedside devices (typically 2 degree Celsius range)

Intended Outcomes

- Positive patient experience
- Energy efficiency

Requisites & Enablers

Dependent on:
- Building Automation System
- Hospital Room of the Future (patient-controlled room temperature)
- Availability of sensors and data

Bronze

Implement at a basic level in select high-traffic departments as a pilot. Limited functionality.

Silver

Implemented with full integration of systems and automatic controls based on parameters set by facilities management.

Gold

Implemented throughout hospital with full integration and automation, with learning algorithms which are able to adapt to changing conditions.

Current State Bronze- Silver → **Opening Day** Gold

AngusConnect

Smart HVAC: Implementation Analysis

Operational Implications

- Patient facing Smart HVAC User Interface needs to be designed in consultation with patients.
- Carefully consider the needs of existing processes and operations when designing parameters for HVAC – such as minimum temperature/humidity requirements in unoccupied areas.

ICAT Design Scope

- Building Automation System to include sophisticated algorithms for managing and scheduling HVAC parameters throughout the building.
- Sensors will be installed throughout the building to provide detailed feedback for learning algorithms and facilities managers.
- Foundational design of the Smart HVAC system will allow granular control and automation.
- Mechanical design to include variable speed drives.

Governance and Ownership

- Planning and design: NH facilities
- Procure, install and integrate: Project Co
- Maintain: Project Co
- Final ownership: to be determined. System should be supported and maintained by the facilities management group.

Key Outstanding Decisions

- Who will take ownership of the various systems, and their integrations?
- What level of survivability is required and what strategies will support it?

Potential Risks & Challenges

- Carefully consider parameters programmed into the system, and failure modes of the system (such as changing settings to “occupied” due to a single person walking through an area). Flexible implementation and reviews of settings at 1 month, 6 months and 1 year following implementation will help mitigate this potential issue.

Change Management Strategies

Clear Governance & Ownership

Consultation with Stakeholders

User Training

AngusConnect

Smart Lighting

Smart Lighting improves the functionality of typical lighting, allowing lights to be controlled individually and with a greater range of features than the traditional on/off. Smart lighting can be automated or manually controlled via a switch or mobile app, and can include features such as colour temperature adjustments, dimming and daylighting controls.

Alignment with Design Vision

★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure

Key Features

- Control of dimming, colour temperature, and on/off at the fixture level
- Can include integrated sensors such as occupancy, temperature, humidity, daylight, and even provide wayfinding via smartphones.
- Ability to personalize lighting for patients and staff to maximize comfort and healing
- Colour temperature can be scheduled to change throughout the day to reinforce circadian rhythms
- Colour of zone and dome light changes for emergency codes, to help responses teams quickly locate the event
- Controls available via switches, mobile applications and/or centralized scheduling

Intended Outcomes

- Increased patient satisfaction
- Improved clinical outcomes
- Positive staff & patient experience
- Energy efficiency

Requisites & Enablers

Dependent on:
- Building Automation System
- Robust wired network with sufficient ports (if using Power over Ethernet/POE)
- Integration engine (for additional functionality)

Bronze

Implemented primarily to maximize energy efficiency (motion-sensing).

Silver

Incorporates additional functionality for patient experience, including customizable lighting in some areas of the hospital.

Gold

Extensive use of smart lighting throughout the hospital, incorporating multiple functions including patient comfort, satisfaction and efficiency.

Current State Bronze → **Opening Day** Gold

AngusConnect

Smart Lighting: Implementation Analysis

Operational Implications

- Consider how automatic lighting changes (such as colour temperature) may impact clinical and operational workflows (such as nighttime purposeful rounding).
- Smart lighting may require additional resources for programming, maintaining and supporting the system.

ICAT Design Scope

- Implement smart lighting throughout the building, with integrated controls.
- Design electrical systems and networks to accommodate a variety of technologies including addressable lighting, Wi-Fi connectivity, Power over Ethernet (POE) and low voltage distribution.
- Integrate systems with clear use cases for data and information flow.

Governance and Ownership

- Planning and design: NH (facilities and IT)
- Procure, install and integrate: Project Co
- Maintain: to be determined
- Final ownership: to be determined, but should involve IT for network integration (if required) and facilities for operational maintenance.

Key Outstanding Decisions

- Define clear responsibilities around system ownership and governance.
- Further refine the required functionality and use cases.

Potential Risks & Challenges

- There are a number of technologies in the smart lighting space, each with different infrastructure requirements. The system should be carefully selected for ideal performance, functionality and flexibility.
- Technology is rapidly evolving in this space. Consider pilot programs and flexible design to accommodate future changes.

Change Management Strategies

Clear Governance & Ownership

Consultation with Stakeholders

Flexible & Adaptable Design

AngusConnect

Smart Security

A Smart Security system brings together the electronic security systems (access controls, video surveillance, real-time locating system, intrusion detection, etc.) under a common platform that supports information flow and automated alerts between systems, as well as insights based on trends and performance.

Alignment with Design Vision

★★★★★
- ✓ User-centered design
- ✓ Digital first and leading practice for the time
- ✓ Scalable & flexible infrastructure
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Key Features

- Integrated security systems automatically trigger reactions in other systems based on specified events (i.e. video surveillance recording increases when a door intrusion is detected)
- Analytics such as boundaries, people-counting and loitering, identifying and tracking people/objects
- Smart alerts to staff members, with automatic prioritization and escalation
- User-programmable parameters
- Command and control centre with video wall and data dashboards for comprehensive overview of facility
- Machine learning algorithms able to detect trends and events which may be cause for alarm, and escalate alerts to the appropriate personnel

Intended Outcomes

- Patient and staff safety
- Loss prevention

Requisites & Enablers

Dependent on:
- Video Surveillance System
- Intrusion Detection System
- Access Control System
- RTLS/RFID

Bronze

Implemented across the hospital with specific integration use cases for high-risk events.

Silver

Implemented across the hospital with sophisticated integration of systems to support information flow and prioritized alerts.

Gold

Implemented across the hospital with sophisticated systems integrations and machine learning algorithms to provide the highest level of security.

Current State Bronze → **Opening Day** Gold

DRAFT FOR REVIEW

AngusConnect

Smart Security: Implementation Analysis

Operational Implications

- If safety is prioritized over convenience, a cultural shift must take place in order for staff to comply with the system.
- Additional training may be required for security staff so they can leverage the full features of the system.

ICAT Design Scope

- Ensure electronic security systems (video surveillance, access controls, real-time locating, intrusion detection and perimeter security) are compatible with the uses cases and features of Smart Security.
- Design the video surveillance system for full coverage of the facility and campus, including cameras facing the building exterior.

Governance and Ownership

- Planning and design: NH security, with clinical and IT input
- Procure, install and integrate: Project Co
- Maintain: Project Co
- Final ownership: to be determined. The security group should own and manage the system.

Key Outstanding Decisions

- Further refine use cases and integrations for the systems.

Potential Risks & Challenges

- It is likely that there will be privacy concerns around increased surveillance; leadership should openly address concerns and provide clear processes and security controls to prevent misuse.
- Aspects of this technology are evolving rapidly. Consider a flexible, phased implementation to best leverage new technologies.

Change Management Strategies

Smart Engagement & Communication

Consultation with Stakeholders

User Training

AngusConnect

Biometrics

Biometric identifiers such as fingerprints, palm geometry or facial recognition are becoming increasingly popular on consumer devices such as smartphones, and provide a highly accurate, reliable method for identifying personnel. As biometric identity is a unique identifier, it cannot be mimicked or stolen with the same ease as passwords or RFID devices.

Alignment with Design Vision

★★★★
- ✓ Aligned with SNH & NH strategy
- ✓ Scalable & flexible infrastructure
- ✓ Accountable & affordable
- ✓ Clear accountabilities & responsibilities

Intended Outcomes

- Patient safety
- Loss prevention
- Improved privacy and security
- Quality data for enhanced decision-making

Requisites & Enablers

Dependent on:
- Access Control System
- Single Sign-on (if implemented)

Key Features

- Combine with an access card or pin code for two-factor authentication of staff members in order to control access to secure areas
- Consider using fingerprints, as they are already in use for the majority of staff members in order to track time and attendance
- Other supported biometric identifiers include fingerprint, palm, iris, or facial recognition
- Ensure robust security and data privacy for electronic systems and servers where biometric data may be stored or accessed

Bronze

Implement in high-risk areas (such as pharmacy) for physical access control only.

Silver

Implement in high risk areas and in numerous hospital application systems on supported devices.

Gold

Implement in both clinical and non-clinical areas and applications on supported devices, allowing for staff tracking and providing analytical information.

Current State
Below Bronze
Time & Attendance only

Opening Day
Silver

Future State
Gold

AngusConnect

Biometrics: Implementation Analysis

Operational Implications

- Work closely with staff and physicians to relieve concerns around privacy and security of information.
- Review operational processes around access to spaces and devices to ensure biometrics are deployed consistently with current best practices.
- Consider pilot programs to evaluate usage and anticipate potential issues prior to enterprise-wide implementation.

ICAT Design Scope

- Incorporate biometric devices into systems such as access controls, computer access, mobile devices.
- Robust security for servers and databases where biometric information is stored.

Governance and Ownership

- Planning and design: NH (security & IT)
- Procure, install and integrate: NH
- Maintain: NH
- Final ownership: to be determined. Security should govern the systems, with individual departments (dependent on use case) owning the devices and related processes.

Key Outstanding Decisions

- Further refine the use cases and functionality of the system, including specific locations where biometrics would be used.

Potential Risks & Challenges

- It is likely that there will be privacy concerns around the use and storage of biometric identifiers; leadership should openly address concerns and provide clear processes and security controls to prevent theft/misuse.
- Biometric data is becoming increasingly valuable to hackers, and data breaches more common. Implementation should include robust security systems to prevent theft of sensitive data.

Change Management Strategies

Smart Engagement & Communication

Consultation with Stakeholders

Pilot Programs

Equipment

ICAT Equipment includes the following:

- Electronic Displays & Dashboards
- Staff Mobile Devices & Electronic Communication Systems
- Patient Entertainment & Education
- Self-Service Kiosks
- Enhanced Meeting Rooms
- Computers

As the ICAT equipment list is typically based on room lists and floorplans, other items such as printers and desktop phones may be added as the hospital design progresses. The following section captures high level requirements and typical locations for the major ICAT equipment types.

Electronic Displays & Dashboards

Electronic displays and dashboards allow for enhanced collaboration and communication among staff members, patients and families. Monitors display information updates in real-time, and can be interactive via touchscreen control.

Key Types & Features

- Display material/integrations between clinical displays and systems will vary, depending on the needs of departments and users
- Clinical displays outside of patient rooms will display patient-specific information (eg. room number, allergies, falls, language, infection control precautions) from health information system in a confidential manner
- Displays with confidential patient-information will be located in areas that are not viewable to the public
- Digital signage displays will show content from the Content Management System, including events, advertisements, education, donor recognition, hospital information, weather/traffic, etc.

Locations & Quantities

Possible locations include:

- Nursing stations (HIS, bed board, schedules)
- Patient rooms (care provider names, schedule, etc.)
- Outside patient rooms (indicate falls risk, contact precautions, language, etc.)
- Control desks (track and manage patient and staff flow)
- Support Services areas (request queuing, progress, ticket status, job assignments)
- Ambulatory waiting areas (anonymized information for families regarding patient status, progress)

AngusConnect

Staff Mobile Devices & Electronic Communication Systems

Mobile devices such as smartphones, tablets and mobile computers provide on-the-go access to information, electronic communication and alerts for staff. Electronic communication systems might include care teams, secure texting, email, video calling, and voice, including unifying these services under a single user interface via unified communications.

Key Types & Features

- Mobile devices such as smartphones, tablets and mobile computers provide on-the-go access to information, electronic communication and alerts for staff.
- Clinical staff and physicians will be able to download applications such as Vocera so they are able to use their own devices with clinical systems and patient information.
- iPhones will be provided to key staff members.
- Tablets will be provided to key staff and providers where necessary.
- Wireless network and cellular coverage will support access to information and data/voice throughout the facility.

Locations & Quantities

- Clinical staff will have access to clinical applications on their own devices.
- Key support staff will be provided with touchscreen smartphones (eg. iPhone) where necessary to carry out their work (portering, lab, diagnostic imaging, pharmacy).
- Tablets will be provided to key staff and providers.

AngusConnect

Patient Entertainment & Education

Patient Entertainment and Education systems are integral to the patient experience in most healthcare facilities, particularly where patients are admitted to an inpatient room or waiting for a procedure or loved one.

Key Types & Features

- Interactive displays in inpatient bedrooms, located at the bedside and with access to a variety of features
- Footwall displays in inpatient bedrooms, which create a more home-like environment and allow family members to watch alongside the patient
- Televisions located in waiting rooms, with educational or entertainment content
- Interactive displays with educational or entertainment materials
- Virtual reality or augmented reality displays for education or entertainment

Locations & Quantities

- Interactive bedside devices will be deployed at the bedside of all inpatient beds (approx. 700)
- Extended treatment bays such as dialysis and chemotherapy (quantity TBD)
- Footwall display in all inpatient bedrooms (approx. 700)
- Televisions will be located within all waiting rooms, the cafeteria, and within public corridors (30)

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Self-Service Kiosks

Self-service kiosks allow patients to check-in or register for their appointments without having to wait in registration lines. This solution can improve the efficiency of patient workflows by reducing administrative tasks, and could contribute to empowering patients, as patients would be able to independently manage their own care journey.

Key Types & Features

- Antimicrobial touchscreen, able to withstand regular hospital cleaning
- Accessibility features for those with language, mobility, visual or hearing impairment
- Payment and health card validation features
- Support for multiple languages
- Embedded infection control processes (ex. notifications to housekeeping, surveillance questionnaire and auto shut down feature)
- Time out features to protect patients' confidential health information
- Includes mobile registration access via webapp

Locations & Quantities

- Central registration (5)
- Satellite clinics (3)
- Emergency department (2)

Enhanced Meeting Rooms

Enhanced meeting rooms provide interactive technologies to support streamlined communication and collaboration among teams within the building and external partners. AV systems will be intuitive, easy to use and standardized to enhance the user experience.

Key Types & Features

- Standardized, intuitive user interface for control of systems
- Enables audio and video consultations between providers within the facility, between sites and with external partners
- Audio and video conferencing
- Inputs to support sharing of content via standardized wired and wireless protocols
- Displays and projection devices to display information for meetings
- Audio systems, including built-in speakers and microphones
- User interface with intuitive controls and customized menus

Locations & Quantities

- Basic meeting room (qty 100)
  - TV, laptop inputs, teleconferencing, booking system,
- Standard meeting room (qty 40)
  - TV, interactive smartboard, laptop inputs, videoconferencing, booking system
- Enhanced meeting room (qty 10)
  - TV, interactive smartboard, laptop inputs, videoconferencing, booking system, presentations & recording, live-streaming

Computers

Computers provide access to information systems, documentation, reference information, medication administration and service requests. Many of the functions of computers may be supplemented with mobile devices. Computers may be fixed (desktop or wall mounted) or mobile (workstations on wheels).

Key Types & Features

- Dual-factor sign-in with biometric and/or password
- Single Sign-On allows one login to be used to access multiple applications
- Antimicrobial surfaces which can be cleaned regularly in accordance with hospital guidelines
- Size and quantity of monitors supports work process
- Includes accessories such as barcode scanners, printers where required
- Ability to access the EHR, hospital knowledge resources and other NH information systems
- Ability to position the monitor so that a user is able to share displayed information

Locations & Quantities

- Charting alcoves in hallways (one per two beds)
- Medication administration: at the bedside, in medication rooms (workstations on wheels)
- Administrative areas
- Other locations as required (TBD)

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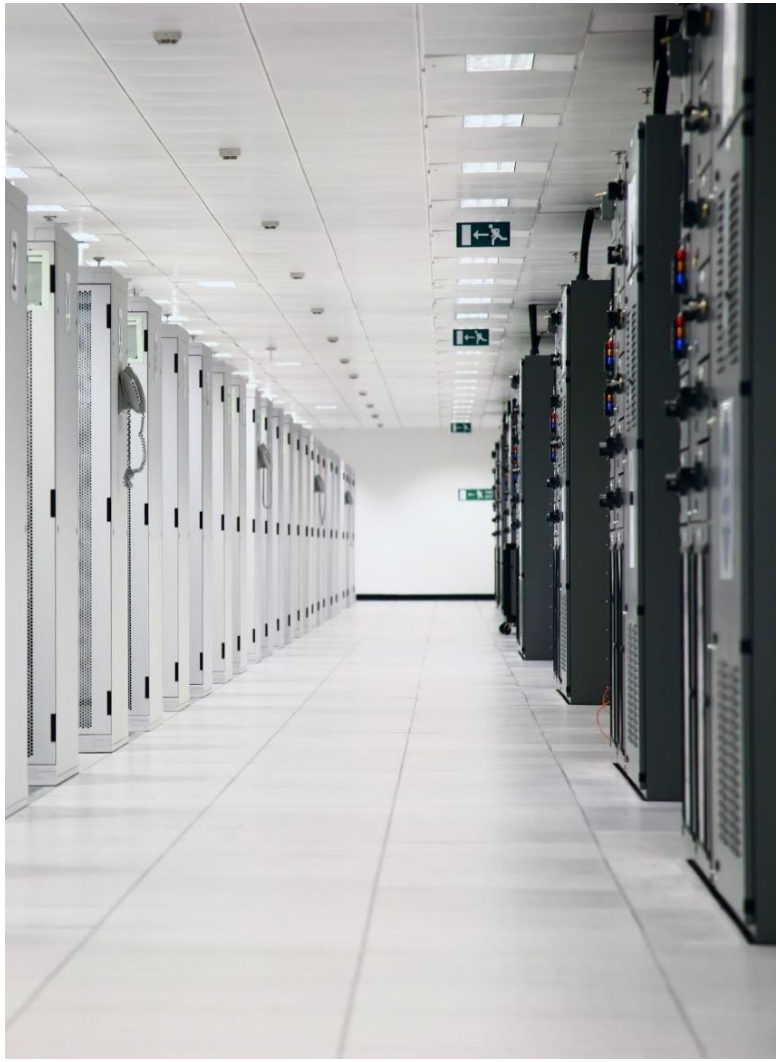
Infrastructure

Infrastructure includes:

- Overview
- Network Topology
- Data Centre
- Telecommunication Spaces
- Wired Network
- Wireless Network
- 5G, Cellular and Radio Connectivity



ICAT Infrastructure Overview

The ICAT infrastructure forms the foundation of all the other ICAT systems in the hospital, and as such is critical to the operation and safety of the facility. A key aspect of the project is to “future proof” the infrastructure, both supporting advances in ICAT technologies as they evolve and to ensure that the physical space supports the related changes to workflow that occur with technology. This section of the Design Program report will provide guidance on the infrastructural requirements that will support the NH design vision and principles. This overview outlines overarching criteria for all ICAT infrastructure.

Key infrastructure priorities are:
- Flexibility and adaptability
- Future-proofing
- Smart investments in technology
- Redundancy and reliability

Summary	All ICAT systems and infrastructure should: • Support flexibility, adaptability and open protocols wherever possible, in order to allow NH to adapt to evolutions in technology over the long term. Is it is impossible to predict future advances in technology with absolute certainty, infrastructure, spaces and pathways should be able to adapt to the changing needs of new technologies. • Integrate with other systems within the NH ecosystem with a high degree of reliability and performance. • Include a high level of redundancy and reliability, with survivability measures in place to protect the ongoing mission-critical operations of an acute care facility. • Incorporate sustainability measures which reduce energy usage and are easily maintainable by NH. • Be designed, installed, tested and/or commissioned following the most current versions of the applicable industry standards and Codes and meet all criteria of the authority having jurisdiction (AHJ). • Consist of proven technologies that have been deployed in similar acute care hospitals in Canada. • Be supported by vendors who are capable of providing support and services local to the Niagara Region to ensure that Service Level Agreement requirements will be satisfied.
Potential Risks & Challenges	• As a result of the ever-changing nature of ICAT technologies, predicting and specifying future requirements can be a challenge. Flexibility is an important risk mitigation factor. • Innovative technologies can be desirable, however they are often unproven in the healthcare industry and therefore it is critical that risks to failure, performance and impacts to safety be assessed.
Key Standards & Guidelines	• Latest versions of all codes, standards and industry best practices available at the time of construction should be followed.

Network Topology

The enterprise network forms the nervous system of the hospital, enabling fast and reliable data transfer from one location to another, as well as access to external networks such as the internet. The network will interconnect all NH sites with redundant links to support reliability in case of damage or failure.

Within the SNH facility itself, a single converged network approach is the preferred design to enable the integration of various systems within the facility. This network will support both hospital and facilities management (FM) operations.

Summary	• All systems will be supported over a single physical network to be provided by Project Co and managed by NH.
	• The converged enterprise network will support the following:
	  • Clinical Systems
	  • Business Systems
	  • Building Systems
	  • Facility Management Systems
	• Cloud solutions will be considered on a system-by-system basis.
	• The hospital network will be connected to other hospital and community based locations via the Niagara Region Broadband Network.
	• Diverse and redundant service entrance facilities for communications service providers.
	• Designed to provide access as authorized by:
	  • Patients
	  • Clinicians
	  • Affiliated Educational Institutions
	  • Between other hospitals and community based care providers
	• Power Over Ethernet (802.3at minimum) switching to be provided at edge devices.

Potential Risks & Challenges	• Integration requirements for multiple systems may pose a challenge. • Cyber security requirements for patient information • Distribution of data centre components across multiple sites increases reliance on the network links. • Network downtime which affects FM systems could result in financial penalties to the hospital or contractual disputes.
Key Standards & Guidelines	• CSA Z8000 Canadian Health Care Facilities • TIA-568.1-D Commercial Building Telecommunications Infrastructure • TIA-1179 Telecommunications Infrastructure Standard for Healthcare Facilities • BICSI Telecommunications Design Methods Manual (TDMM) • BICSI-004 Best Practices for Healthcare Facilities

Data Centre

The data centre is an enclosed, secure and environmentally controlled space which houses centralized servers and data storage & processing equipment. Geographic redundancy and diversity ensures that services remain operational even in the event of a catastrophic failure of environmental controls, power or the physical space.

The redevelopment project at SNH will include a new primary data centre which will support all five NH sites, replacing the existing SCS data centre as primary. The existing primary data centre located at SCS will become the secondary, also supporting the entire NH. Secondary core rooms within SNH will ensure on-site redundancy of core network switches and key servers.

Summary	• Designed to Uptime Institute Tier 3 standards (99.999% availability) and survivability (some requirements of this standard, such as building location and architecture may be subject to feasibility). • Sized to accommodate a minimum of 30 cabinets plus space for future growth as well as UPS and cooling equipment. • Approximately 1500 to 2000 square feet (140 to 185 sq. meters). • Redundant in-row cooling connected to generator power. • Served by a dedicated redundant uninterruptible power supply (UPS) connected to generator power. • Located above grade, and not immediately adjacent to or beneath wet piping, water systems, sources of electromagnetic interference (such as diagnostic imaging equipment or high voltage power distribution) or outside walls. • Secondary core room to be located a minimum of 2 floors and 75m horizontally from the main data centre, and served from a different electrical substation. • Top of rack switching topology. • Room status to be continuously monitored for temperature, humidity, power and access controls, with alerts to IT/facilities staff if settings move outside preset parameters. • Fire suppression to be pre-action.
Potential Risks & Challenges	• It can be difficult to assess future space, cooling and power requirements prior to building construction, as technology needs tend to advance rapidly. It is recommended that the data centre be planned next to soft space such as meeting rooms or offices which can serve as expansion space later on if required.
Key Standards & Guidelines	• BICSI 002 Data Center Design • TIA-942 Telecommunications Infrastructure Standard for Data Centers • Uptime Institute

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Telecommunications Spaces

Telecommunications spaces are physically enclosed, environmentally controlled areas of the building which support dedicated IT equipment and devices. In addition to the data centre, these spaces include Telecommunications Rooms (TRs) which are typically located on each floor and house the network equipment and other local systems such as nurse call and access controls. Entrance Facilities (EFs) house incoming services equipment from external providers such as Bell or Rogers, and serve as a separate, access controlled space for systems not owned by NH.

Telecommunications spaces are typically secured from public access, and supported by robust mechanical and electrical services to support maximum reliability and flexibility.

Summary	Telecommunication Rooms (TRs): • Vertically stacked throughout the building. • House low-voltage systems including edge switches, nurse call, voice/telephony, access control, video surveillance, RTLS and others. • Located such that every space on the floor can be served within 90m. • Sized to accommodate a minimum of 4 racks, plus 100% space for future (total of 8 racks). • Physically separate from the data centre. • Supported by a redundant uninterruptible power supply (UPS). • Fire-rated plywood on minimum 3 walls to support wall-mounted devices. • Environmentally controlled. Entrance Facilities (EFs) • Separate from TR's and the Data Centre. • Located above the lowest level of the building. • Minimum two EFs with at least 75m horizontal separation to support diversity of entrance services. • Supported by a redundant uninterruptible power supply (UPS). • Fire-rated plywood on minimum 3 walls to support wall-mounted devices. • Environmentally controlled.
Potential Risks & Challenges	• Ensuring telecommunication spaces are placed in appropriate locations and with sufficient spacing, while also achieving the functional plan within the various departments can be a challenge. Requirements should be provided to the architect early on in the planning process.
Key Standards & Guidelines	• TIA-569.0-D Telecommunications Pathways and Spaces • ISO/IEC 14763 Information Technology – Pathways and Spaces for Customer Premises Cabling • NEMA VE 2 Cable Tray Installation Guidelines

Wired Network

The wired network supports connected systems throughout the building, and forms the foundation of all other ICAT solutions. Fast, secure and reliable data transfer is critical in an increasingly digital hospital environment, and a high level of flexibility and adaptability is required in order to support future advancements in technology.

The wired network consists of redundant core network switches located in the data centre and secondary core room, with diverse backbone connections to edge switches located in telecommunications rooms on each floor. From the edge switches, horizontal cabling extends connectivity to the end user.

Summary	• Backbone/riser cabling will be a combination of single mode and multimode fiber optic cabling, with pathways sized to allow future advancements in cabling infrastructure.
	• Minimum requirement for horizontal cabling will be Category 6A unshielded twisted pair (UTP), or the latest standard at the time of specification.
	• Quality of Service (QoS) will be provided throughout the facility.
	• Edge switches will provide Layer 2/3 switching, with minimum POE+ (802.3at) on all ports. Consider locations where higher levels of POE should be provided, including up to 100W.
	• Passive Optical Networks (PON) should be considered on a case-by-case basis depending on the application and capabilities of the technology.
	• Redundant and diverse backbone cabling will include:
	  • Between the data centre and the TRs
	  • Between TRs.
	  • Between TRs and critical data connection locations. These locations may be supplied by two TRs on the same floor, or from a TR on the same floor and a TR on an adjacent floor.

Potential Risks & Challenges	• As technology and infrastructural materials evolve, there is a risk that today's most current industry available cabling infrastructure may not meet all future requirements as changes in technology occur. Consider providing additional pathways and spaces to facilitate technology upgrades in the future.
Key Standards & Guidelines	• ANSI/TIA-568.1-D Commercial Building Telecommunications Cabling Standard • ANSI/TIA-568.2-D Balanced Twisted-Pair Cabling Components • ANSI/BICSI N2-17 PoE Installation • ANSI/NECA/BISCI 568 Cabling Installation • TIA-1179 Telecommunications Infrastructure Standard for Healthcare Facilities

Wireless Network

A robust wireless network is required to facilitate mobile connectivity throughout the facility and to ensure the functionality of the various hospital based systems and equipment. The wireless network will be a key component in connecting the patients and the general public to services, enhancing the overall experience within the hospital while also supporting staff workflows by enabling a mobile workforce.

The wireless network supports a wide variety of systems and devices, and as such needs to be designed with flexibility and robustness in mind. Careful consideration should be given to systems such as voice or Real-Time Locating System (RTLS) which may have specific functional requirements.

Summary	• Deploy 802.11ax standard (Wi-Fi 6) with backwards compatibility for previous versions.
	• 100% coverage of the facility, including elevator cabs, mechanical and electrical spaces, service areas, stairwells and indoor parking.
	• Consider RTLS in the design of the wireless network.
	• Dual redundant data drops provided at each Access Point (AP).
	• Guest/visitor/patient Wi-Fi provided free of charge.
	• Robust security and user identification features to prevent unauthorized parties from gaining access to the network (either maliciously or inadvertently).
	• The wireless network will support:
	  • Voice and data services
	  • Patient and visitor Wi-Fi
	  • Clinical systems & equipment
	  • RTLS
	  • Wayfinding
	  • Facilities management

Potential Risks & Challenges	• Current industry trends indicate that Internet of Things technologies will continue to increase in the healthcare market. It is expected that there will be an increase in both wireless devices and users, therefore requiring the need for increased wireless capacity and coverage.
Key Standards & Guidelines	• 802.11ax Wi-Fi 6 Standard • ANSI/BICSI 008 Wireless Local Area Network (WLAN) • ISO/TR 21730 Health Informatics - Use of Mobile Wireless Communication and Computing Technology in Healthcare facilities

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5G, Cellular and Radio Connectivity

As internet of things and mobility requirements increase over the coming few years, 5G connectivity will become increasingly important to the ongoing operations and optimization of NH. The Distributed Antenna System (DAS) extends cellular and emergency radio coverage throughout the building, including interior spaces where external signals cannot penetrate, and supports 5G, 4G/LTE, 3G and radio connectivity. This ensures staff, providers, patients and visitors will be able to remain connected wherever they are located within the facility.

Emergency services radio coverage is required to ensure that emergency responders such as fire and police services are able to communicate when responding to an event on site, promoting the safety and security of building occupants.

Summary	• 100% coverage of the interior of the facility, including elevator cabs, mechanical and electrical spaces, service areas, stairwells and indoor parking. • Fibre backbone and Centralized Radio Access Network (C-RAN) architecture to support future 5G services. • Support for 3G, 4G/LTE, 5G frequencies. • Extended cellular coverage throughout the building to support data and voice for all major local carriers (Rogers, Bell, Telus). • Support for VHF/UHF radios, such as those used by first responders (fire, police).
Potential Risks & Challenges	• Antennas and DAS solutions are designed for certain frequencies; if these frequencies change in the future then the system may not operate as well with the new technology. Given that new cellular standards are released approximately every 10 years, this is unlikely to be a significant issue until later in the lifespan of the building.
Key Standards & Guidelines	• ANSI/BICSI 006-2015 Distributed Antenna Systems (DAS)

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ICAT Design Program Implementation Plan

Pre-Construction 2023-2026	
HIS Implementation 2023	* Tentative depending on decision to implement a new HIS * During the HIS implementation, other ICAT projects should be limited.
Pilot Unit Construction 2024	The Pilot Unit will be constructed within SCS in order to test and train staff on the technologies that will be implemented in the new hospital.
Redevelopment Project 2025-2026	Solutions implemented as part of the Redevelopment project will include infrastructure and basic functionality as a minimum for most solutions.

Post-Construction 2027-2030	
Freeze Period 2027	It is recommended to allow a freeze period of one year post-construction to allow adoption and refinement of the new solutions implemented as part of the Redevelopment Project.
Expansion of Use Cases 2028-2030	After the freeze period has ended, select technologies will be expanded to allow for new use cases. New implementations include Wearables and Augmented Reality/Virtual Reality.

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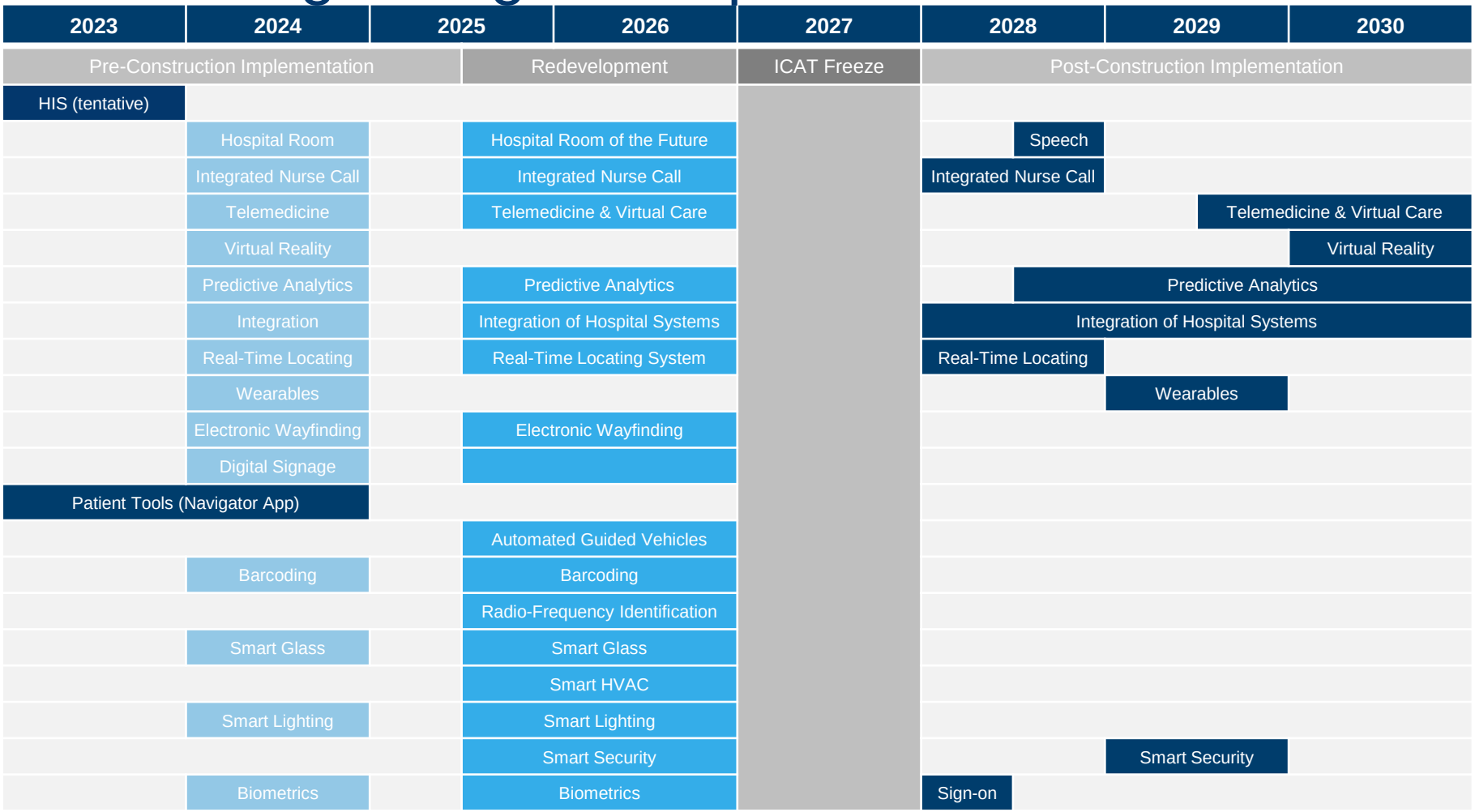
ICAT Design Program Implementation Plan



LEGEND Pilot Unit at SCS | Implementation as part of Redevelopment | Hospital Project (non-Redevelopment)

DRAFT FOR REVIEW

Appendix

Stakeholders

The following stakeholders were engaged in a series of Working Group Sessions held between September 13 and September 17, 2019.

First Name	Last Name	Role
Jessica	Mottola	Interim Design Director
Jeff	Wilson	Director, Operations, ICT
Wes	McLachlin	Supervisor Picture Archive, Communication System Administration
Janet	Wilmot	Manager, Medical Imaging
Philip	Guy	Manager Laboratory
Amir	Gill	Director Engineering/Facilities Management
Alain	Boucher	Manager Engineering Services
Susan	Cubelic	Director Pharmacy Services
Bobby	Alexander	Director Environmental/Security/Parking
Sue	Nedanovic	Director Strategic Sourcing
Michael	Curtiss	Regional Manager, Parking & Security
Frank	Gigliotti	Manager Biomedical
David	Weir	Sr. Procurement Coordinator

P) ICAT strategic project initiatives & roadmap

Return to table of contents

ICAT strategic initiatives

What are the ICAT strategic initiatives?

A series of recommended strategic initiatives have been identified that will help NH with readying their people, processes and technology for the completion of the SNH redevelopment project.

What is the purpose of the ICAT strategic initiatives?

The ICAT strategic initiatives are intended to support and complement the activities that will take place in the next phase of the overall redevelopment project. The strategic initiatives have been organized into 4 categories described below. All strategic initiatives and their respective categories are listed on the next slide.

A) ICAT Readiness & Foundation	Initiatives related to ensuring the fundamental infrastructure and system requirements for the ICAT design of SNH are in place to enable future workflows and processes.
B) ICAT Innovation & Transformation	Initiatives related to innovating and transforming the way care is delivered in the future that may become enabled by the ICAT design at SNH.
C) ICAT Sustainability	Initiatives related to ensuring that ICAT investments can be maintained and embedded into the day to day operations.
D) Impacting ICAT	Initiatives related to other areas of the redevelopment including clinical design and facility design that have a significant downstream impact on ICAT investment choices.

Summary of ICAT strategic initiatives

The following table lists all of the recommended strategic initiatives intended to help guide and prepare NH for the SNH redevelopment project. Each initiative is labelled with a unique identifier and mapped on a prioritization matrix, which illustrates the level of effort required to achieve an initiative and the level of impact it has on NH. This prioritization matrix is included on the following slide.

A. ICAT Readiness & Foundation

- A1 Prioritize the implementation of the new HIS.
- A2 Conduct wireless/wired network upgrades.
- A3 Develop an integration platform and specifications.
- A4 Adopt a cloud first strategy including future data centre needs assessment.
- A5 Complete an inventory of current state information systems and capabilities.
- A6 Establish an enterprise change management program.

B. ICAT Innovation & Transformation

- B1 Continue piloting new technology solutions at existing sites.
- B2 Assess the impacts of the changing health system on NH's hospital design and partner ecosystem.
- B3 Explore opportunities related to tourism in the Niagara region.

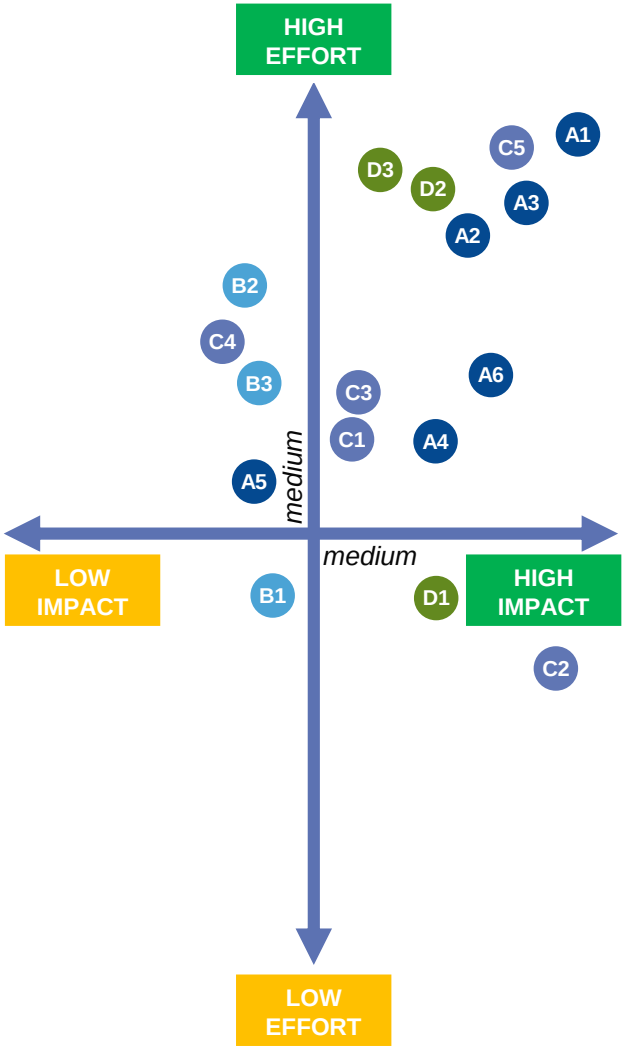
C. ICAT Sustainability

- C1 Re-evaluate the mobility plan and strengthen cyber security.
- C2 Define the comprehensive requirements to optimize patient & staff experience.
- C3 Establish an enterprise data governance model to support digital transformations across NH.
- C4 Re-evaluate the current ICT operating model to ensure applicability for SNH in 2026.
- C5 Create an ICAT retrofit plan for existing programs and services across existing NH sites based on the new SNH.

D. Impacting ICAT

- D1 Refine the redevelopment project vision and develop a brand for SNH.
- D2 Re-evaluate business and clinical workflows for SNH.
- D3 Create a transition/migration plan for SNH.

Prioritization of strategic initiatives



A	ICAT Readiness & Foundation	B	ICAT Innovation & Transformation	C	ICAT Sustainability	D	ICAT Sustainability
A1	Confirm direction and build business case for implementation of HIS.	B1	Continue piloting new technology solutions at existing sites.	C1	Re-evaluate the mobility plan and strengthen cyber security.	D1	Refine the redevelopment project vision and develop a brand for SNH.
A2	Conduct wireless/wired network updates and a 5G assessment.	B2	Assess the impacts of the changing health system on NH's hospital design and partner ecosystem.	C2	Define the comprehensive requirements to optimize patient & staff experience.	D2	Re-evaluate business & clinical workflows for SNH.
A3	Development of an integration platform and specifications.	B3	Explore opportunities related to tourism in the Niagara region.	C3	Establish an enterprise data governance to support digital transformation across NH.	D3	Create a transition/migration plan for SNH.
A4	Adopt a cloud first strategy including future data centre needs assessment.			C4	Re-evaluate the current ICT operating model to ensure applicability for SNH in 2026.		
A5	Complete an inventory of current state information systems and capabilities.			C5	Create an ICAT retrofit plan for existing programs and services across existing NH sites based on the new SNH.		
A6	Establish an enterprise change management program.						

Strategic roadmap

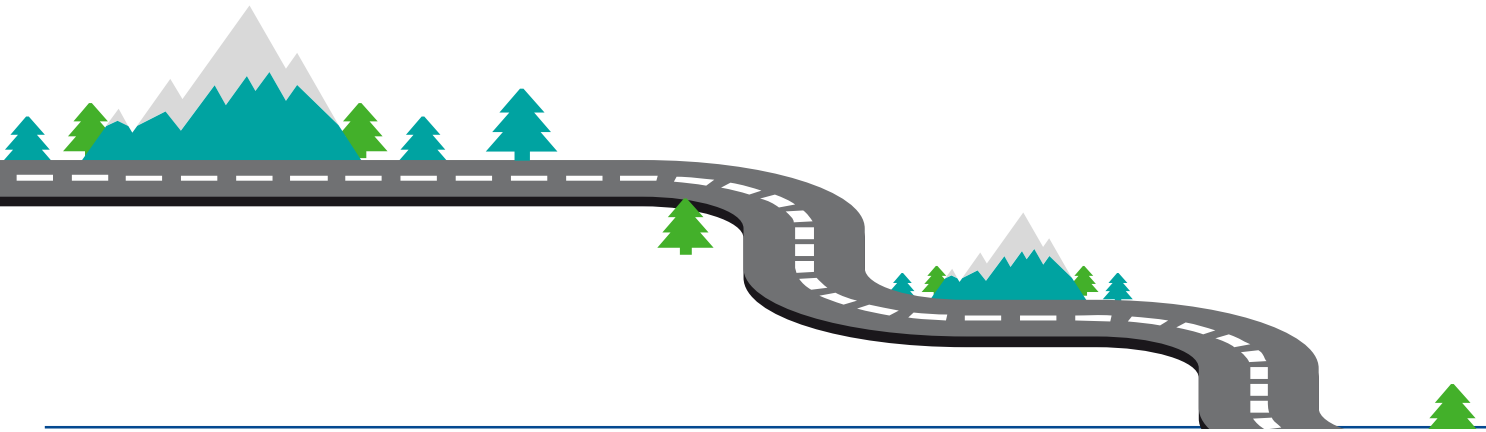
Each of the ICAT strategic initiatives have been mapped on to a roadmap that identifies the recommended sequencing and duration associated with each initiative. Please refer to the next page for the visualization of the roadmap.

Roadmap context

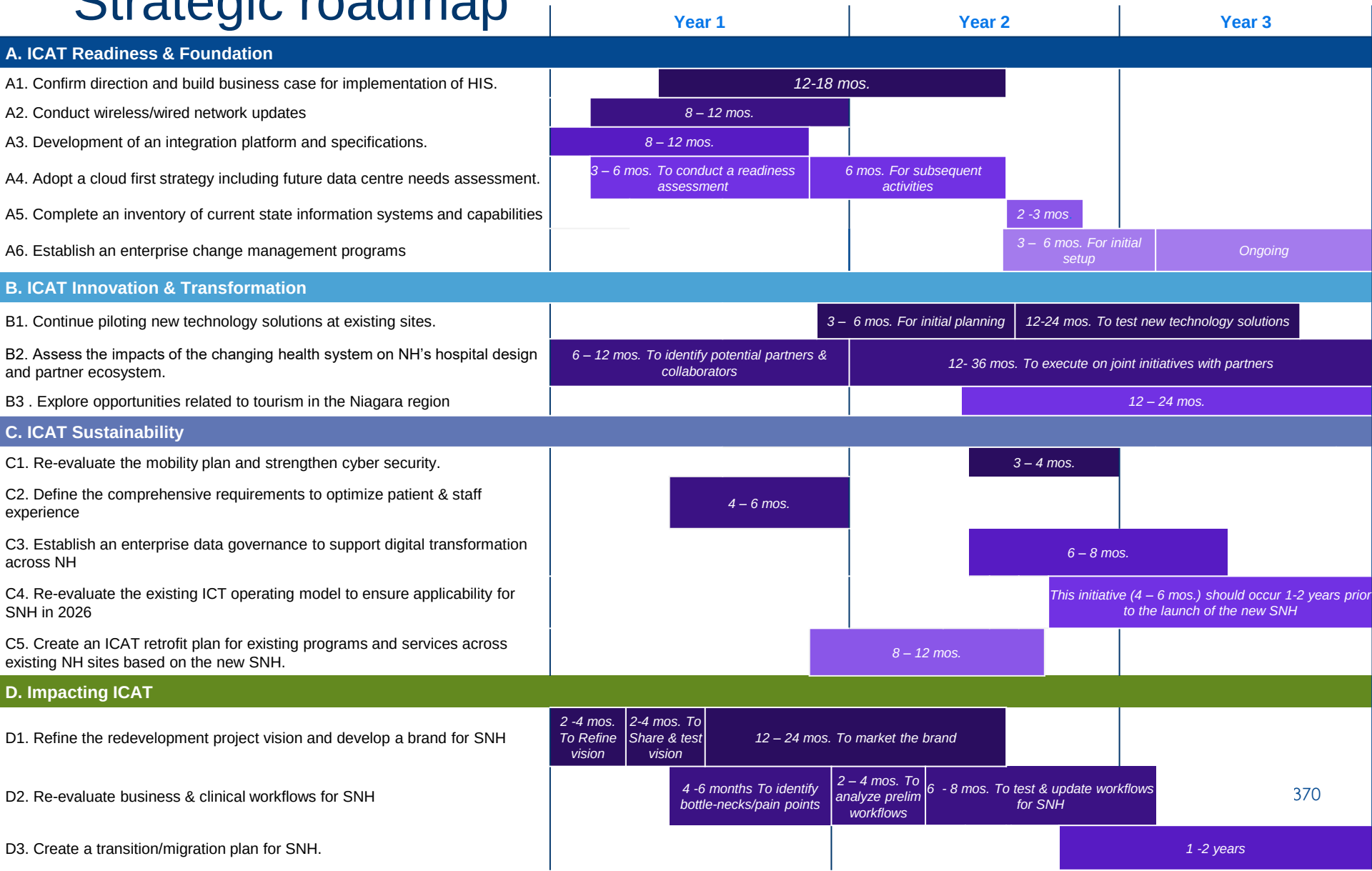
Given the pace of changes in technology and challenges with anticipating environmental changes in the long term the strategic initiatives have been defined for a 3 year time-frame.

Some initiatives may span beyond this 3 year time-frame. For these initiatives, the roadmap will help to set the foundation for further progress on the initiatives beyond the 3 year duration.

The ICAT strategic initiatives should be re-visited on an annual basis to determine their validity and relevance with consideration for the internal and external environment of NH and other changes that may impact the SNH redevelopment project.



Strategic roadmap



A1. Confirm direction and build business case for implementation of HIS.

STRATEGIC INITIATIVE DESCRIPTION

- NH should ensure the implementation of a new HIS is completed at least 1 year prior to the launch of SNH. The implementation of a modern HIS will help to enable many of the ICAT solutions proposed for the SNH and represents the foundation for capturing patient related information electronically. By completing the implementation of the new HIS in advance of the launch of SNH, this will provide NH with time to perform optimization to both the system and relevant workflows.

KEY ACTIVITIES

- ❑ **Initiate HIS pre-planning activities**: NH has already identified a set of critical 120 day objectives and a Stage 1 Preparation and Readiness phase of work related to pre-planning the HIS implementation. Additional scope to consider in the pre-planning is completing an inventory of the current state clinical workflows.
- ❑ **Explore funding options**: In collaboration with MOH and IO, determine whether is an opportunity to fund a portion of the HIS implementation through the redevelopment project. Build out the TCO for the implementation as part of the business case.
- ❑ **Engage the current HIS vendor in the process**: Determine the appropriate method for engaging the existing HIS vendor and understand whether there are any options available to have the existing vendor provide support with updating the existing HIS to the level which NH is seeking to achieve in preparation for SNH.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Minimizing the impact of change fatigue**: The sooner the HIS implementation takes place, the more likely NH can reduce the amount of change fatigue that staff may experience in the future. Given the significant change that the HIS implementation and redevelopment may bring, NH should be mindful of spreading the activities from both transformations.
- ✓ **Informing ICAT investments and decisions in later stages of redevelopment**: Changes made to the existing HIS may influence ICAT choices as the redevelopment gets underway through the engagement of the Project Co. and ICAT consultant(s).The sooner the HIS implementation is completed, the more likely decisions related to ICAT can be made based on design decisions in the HIS.

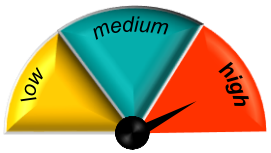
ESTIMATED DURATION

- 12-18 months for the pre-planning and readiness work

DEPENDENCIES

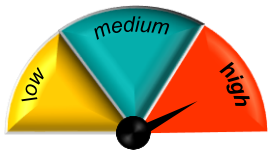
- Approval from NH Board of Directors and Senior Team.

ESTIMATED LEVEL OF COMPLEXITY



- *High*: An HIS implementation is complex and the pre-planning activities will also be complex in nature due to the large scope of clinical and administrative services involved. Availability of resources will also be challenging given other priorities.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS



High level of effort is estimated. Several internal FTEs will be needed to support the pre-planning activities. Approx. 2-5 internal FTEs (Project Managers and Analysts) from ICT will be needed.

Return to Strategic Roadmap

A2. Conduct wireless/wired network updates and a 5G assessment.

STRATEGIC INITIATIVE DESCRIPTION

- NH should conduct the necessary updates to both the wired,/wireless and telecommunications infrastructure at SCS and other existing sites to ensure they are able to support the same capabilities as the future SNH. This scope of this work should include the DAS infrastructure. Broadband internet connectivity will become an essential requirement for the SNH and will be critical to enabling many of the ICAT solutions in scope for SNH. The throughput and bandwidth capabilities should be standardized across all sites.

KEY ACTIVITIES

- ❑ **Conduct an analysis of requirements at existing sites**: An inventory should be created to document current and future requirements and use cases relating to the existing network infrastructure.
- ❑ **Identify gaps in wired/wireless connectivity at existing sites**: Work closely with staff across sites to better understand areas at the existing sites that have poor connectivity. These should be captured and prioritized for improvement as part of the updates.
- ❑ **Work with ISPs to understand their 5G roadmap for the Niagara region and perform an assessment of the infrastructure**: NH should engage with the provider(s) in the region to understand the 5 year roadmap for broadband internet infrastructure and 5G. This will be important to capture and incorporate into ICAT planning for SNH.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Ensuring broadband connections are available at SCS and other existing sites**: Completing the necessary updates to wired/wireless infrastructure at existing sites will ensure broadband connectivity is enabled for sites today and establish a foundation to build upon as redevelopment on SNH continues into the next stage.
- ✓ **Future proofing the ability for existing sites to support ICAT solutions**: Updating the network infrastructure will ensure that any capabilities or ICAT solutions retrofitted to existing sites may be properly utilized under the assumption that a broadband connection will likely be required for many of the ICAT solutions implemented SNH.

ESTIMATED DURATION

- 8-12 months

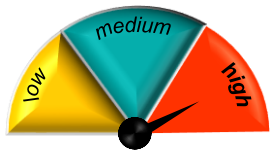
DEPENDENCIES

- Approval for capital funding to conduct infrastructure upgrades.

ESTIMATED LEVEL OF COMPLEXITY

- *Medium:* Identifying the current state infrastructure and gaps in connectivity will require an exhaustive analysis of the existing NH sites. Certain sites may have challenging physical layouts and materials that may add to the complexity of assessing connectivity capabilities.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS



- *High* level of effort is estimated for this initiative.
- 0.50 – 0.75 FTE internal Technical Analyst, 0.10-0.25 FTE internal Technical Manager.

Return to Strategic Roadmap

A3. Develop an integration platform and specifications.

STRATEGIC INITIATIVE DESCRIPTION

- NH should upgrade the integration engine in its existing state as it is unlikely to meet future needs as new workflows and integrations with non HL7 and non traditional systems are considered for SNH. There will be increased functionality needed from the integration engine in order to handle integration with building systems, FHIR, APIs and microservices. There will likely be an increase in the scope of devices and systems that the integration engine will be supporting as it is expected that more information will be exchanged between systems and devices when the SNH redevelopment is completed.

KEY ACTIVITIES

- ❑ **Identify the requirements for a new integration platform**: NH should leverage any existing planning around developing specifications for a new enterprise service bus and ensure future requirements are considered. For example, point to point integration will likely not be sufficient, multipoint integration is the direction of the future.
- ❑ **Conduct a market scan for available solutions**: Identify the functionality and services available from the current marketplace of integration engine vendors and providers and perform a gap analysis to understand the maturity of existing solutions and the breadth of capabilities available on the marketplace.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Ease the burden of data sharing and enable new workflows**: A more robust integration engine will help to enable the scale in which data is integrated and exchanged between a multitude of systems that are expected in the future including: the HIS, other clinical systems, building systems and medical device systems.
- ✓ **Greater ability to maintain the integration engine for the long term**: A modern integration engine will have a greater lifespan particularly as the demands for system and data integration will be greater with the completion of the SNH redevelopment.

ESTIMATED DURATION

- 8-12 months to develop the specifications and requirements for a new integration platform.

DEPENDENCIES

- Approval for capital funding to conduct infrastructure upgrades.

ESTIMATED LEVEL OF COMPLEXITY

- *Medium:* Upgrade the existing integration engine will require thoughtful analysis on the future state requirements based on the ICAT priorities identified thus far in the redevelopment process.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this imitative. IT may vary during different stages of the process.
- 0.50 – 0.75 FTE internal Technical Analyst, 0.25 FTE internal Technical Manager or Director.

Return to Strategic Roadmap

A4. Adopt a cloud first strategy including future data centre needs assessment.

STRATEGIC INITIATIVE DESCRIPTION

- NH should take a cloud first approach to the SNH redevelopment and apply this approach to the rest of the infrastructure at existing sites. A cloud first approach means the majority of technologies considered for the future SNH and infrastructure for the rest of NH will need to be cloud enabled. The industry is shifting in a significant way towards cloud infrastructure solutions and NH will need to ensure its approach to cloud infrastructure is aligned to industry best practices in order to deliver on future ICAT solutions.

KEY ACTIVITIES

- ❑ **Conduct a cloud readiness assessment**: The scope of this assessment will include a review of existing data and technology assets at NH and will help to inform an action plan for adopting cloud services in the future.
- ❑ **Identify opportunities to leverage cloud solutions in the current infrastructure**: There may be opportunities to leverage cloud solutions within the current infrastructure at NH. A small deployment of cloud could provide a sample of the expected workflows and processes needed to support a cloud environment.
- ❑ **Align on an approach for cloud at SNH**: In the subsequent stages of the redevelopment, NH should become aligned on their approach for the data centre at SNH that is tailored to business needs, whether it be on-premise cloud, off-premise cloud or a mix of both.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Potential for improved performance**: Cloud technology typically providers greater reliability and resiliency. Storage and server environments can be consolidated to reduce complexity which may help with maintenance in the long term.
- ✓ **Potential for decreased technology costs**: Cloud technology may reduce the infrastructure operational costs associated with storage. There are also opportunities to potentially achieve savings with managed services of cloud infrastructure.
- ✓ **Faster implementation of technology**: Cloud technology can enable automation of certain operations and improve the ability to quickly scale storage and server capacity.

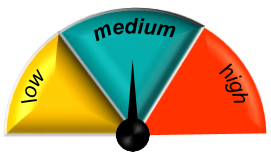
ESTIMATED DURATION

- 3-6 months to conduct a cloud readiness assessment.
- 6 months for subsequent activities.

DEPENDENCIES

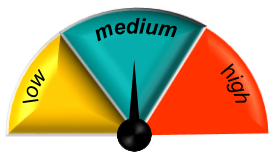
- Alignment among the leadership team on a cloud first approach and approval to adopt the approach.

ESTIMATED LEVEL OF COMPLEXITY



- *Medium:* There may be some complexity associated with determining how current infrastructure can transition to a cloud based environment.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS



- *Medium* level of effort is estimated for this initiative.
- 0.25-0.75 FTE internal Technical Analyst, 0.10 FTE internal Technical Manager.

Return to Strategic Roadmap

A5. Complete an inventory of current state information systems and capabilities.

STRATEGIC INITIATIVE DESCRIPTION

- NH should prioritize the development of a robust current state inventory of information systems and their capabilities. The scope of the information systems should include clinical and administrative. This inventory will help to inform which of the current information systems will be sunset or remain operational as part of the implementation of a new HIS. There may be new functionality introduced in the new HIS that overlaps with functionality available in another information system.

KEY ACTIVITIES

- ❑ **Identify the relevant information system attributes to capture**: Suggested attributes to capture in the current state inventory include: business owner, annual licensing fee/maintenance cost, number of FTEs supporting and providing ongoing support, a description of the functionality, strength of relationship with vendor and the # of users.
- ❑ **Meet with information system owners to understand current business needs that are fulfilled through current information systems**: As part of gathering information to complete the system inventory, it is recommended to better understand whether current information systems are providing the functionality and value that the business requires.
- ❑ **Share outputs of the inventory with ICT staff and relevant business owners/SMEs**: The information system inventory should be shared more broadly with NH to provide an overview of the current information system landscape.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **The ability to make well-informed decisions on which information systems to retain or sunset**: The information system inventory will help NH determine which applications have a business case to be retained and identify which systems should be sunset with the implementation of a new HIS.
- ✓ **Outputs from the inventory may add value to the HIS discovery process with vendors**: Information consolidated into the inventory could help to inform questions and requirements during the discovery phase with the vendor(s) involved with the HIS implementation. NH would have the ability to quickly communicate with the vendor(s) the high level functionality and business problems that each operational information system is currently providing.

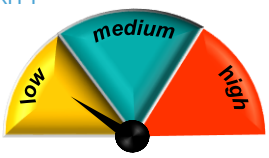
ESTIMATED DURATION

- 2-3 months

DEPENDENCIES

- None

ESTIMATED LEVEL OF COMPLEXITY



- *Low:* Gathering this information from business owners may take time to compile but the process should not be complex to complete.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this initiative.
- 0.25-0.50 FTE internal Analyst, 0.10-0.25 FTE internal Project Manager.

Return to Strategic Roadmap

A6. Establish an enterprise change management program.

STRATEGIC INITIATIVE DESCRIPTION

- NH should develop an enterprise change management program dedicated to supporting the organization through the major transformation activities the organization will be undertaking in the near future including the HIS implementation and SNH redevelopment. A dedicated change management program can help to provide guidance to staff and patients through coaching and education to support them through the change they will see in their day to day workflows and processes.

KEY ACTIVITIES

- ❑ **Begin with identifying existing resources who can support a change management program**: Identify whether there are individuals who have experience or change management capabilities who could contribute to the design of an enterprise change management program and support the program. If gaps in skills and capabilities exist, consider recruiting externally to fill.
- ❑ **Identify priority areas to focus on change efforts**: Work with clinical leadership to identify the areas of NH that require immediate change management support based on existing challenges.
- ❑ **Invite patients and caregivers to participate in the program**: Patients, family members and caregivers should be given the opportunity to participate in supporting the change management program and offer their perspective on relevant change topic areas.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **A dedicated resource for staff and patients will ease the transformation**: Establishing an enterprise change management program will demonstrate NH's commitment to supporting staff through their change needs. This should help with easing any anxiety towards the major transformation projects on the horizon for the organization.
- ✓ **Consolidation of change management best practices across NH**: A centralized change management centre of excellence would bring together best practices and skills across the organization. Combining skillsets and experiences from across different teams will help to strengthen the overall effectiveness of the change management program.

ESTIMATED DURATION

- 3-6 months for the initial setup of the program.
- Once in place, the program will be ongoing throughout major transformation activities.

DEPENDENCIES

- Approval from NH Senior Team.

ESTIMATED LEVEL OF COMPLEXITY

- *Medium:* Creating an enterprise change management program will require leadership buy-in and support. Clarity on the initial set of goals and objectives for the program will need to be identified.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this initiative.
- 0.50-1.00 FTE internal Analyst, 0.25-0.50 FTE internal Project Manager.

Return to Strategic Roadmap

B1. Continue piloting new technology solutions at existing sites.

STRATEGIC INITIATIVE DESCRIPTION

- NH should consider the expansion of the current program in place at NH to for testing new ICAT solutions and understanding their impact on workflows and processes. NH is a multi-site organization which offers flexibility for identifying areas within the organization in which ICAT solutions may be tested and observed at a smaller scale before scaling to a broader rollout.
- Expansion of this program can help NH with understanding the impact of ICAT solutions on workflows/processes and validating their expected benefits.

KEY ACTIVITIES

- ❑ **Prioritize which ICAT solutions to test**: As the in-scope ICAT solutions are determined, NH should prioritize which of the solutions to pilot and an approximate timeline to identify the sequence of when solutions will be piloted.
- ❑ **Leverage the SCS simulation lab where possible**: There are opportunities to leverage the existing simulation lab at the SCS. This space should be utilized in preparation for the new SNH.
- ❑ **Create a standardized approach for observing and action on outcomes from pilots**: NH should standardize the types of attributes to observe in pilots. This may include time monitoring, impact to patient interactions and number of information hand-offs between staff. In addition, a process should be identified to determine how outcomes from pilots will be acted on and addressed prior to SNH.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **A clear understanding of the benefits and issues stemming from new ICAT solutions**: This will help to inform tweaks that may be needed prior to rolling out the ICAT solution on a larger scale.
- ✓ **An opportunity to engage staff and patients in the redevelopment process**: Piloting new ICAT solutions would enable staff and patients to participate in the redevelopment process and provide them with an opportunity to contribute and influence the implementation approach of ICAT solutions. This may help with achieving buy-in and uptake of new processes and workflows that may be introduced as part of the ICAT solution.

ESTIMATED DURATION

- 3-6 months to complete the initial planning.
- 12-24 months to undergo testing for new solutions.

DEPENDENCIES

- None

ESTIMATED LEVEL OF COMPLEXITY

- *Medium:* Identifying the ICAT solutions to pilot and obtaining support and approval to move forward with these programs may be difficult given resource and time constraints.

ESTIMATED RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this initiative.
- 0.25 FTE internal Project Manager, 0.50 FTE internal Analyst for the initial 3-6 months of planning.

Return to Strategic Roadmap

B2. Assess the impacts of the changing health system on NH's hospital design and partner ecosystem.

STRATEGIC INITIATIVE DESCRIPTION

- NH should identify how changes related to OHTs may impact the way care will be delivered by NH as a hospital but also with their community providers. For example, there may be innovative partnerships with local grocery stores (to provide dietary plans as part of patient discharges) and pharmacies (to provide education prior to a hospital visit).
- This may influence ICAT investment choices in the redevelopment process.

KEY ACTIVITIES

- ❑ **Identify collaborators who are willing to innovate**: Based on work done to date around the Government of Canada's Smart Cities Challenge, and NH's membership on the Niagara CIO Consortium, initiate discussions with the organizations who have expressed an interest and willingness to think outside of the box.
- ❑ **Leverage the SNH redevelopment project as a pitch to obtain interest from potential partners**: Use the branding and vision for SNH as a platform to create buzz around the potential of creating a more connected care experience for Niagara residents.
- ❑ **Understand the implications of such partnerships on ICAT design**: Depending on the nature of partnerships defined, this may ICAT design choices at SNH.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Provide patients with a more seamless and enhanced care experience**: Patients will benefit from even greater integration of community providers that extend beyond the initial scope defined for the Niagara OHT. These end-to-end services between NH and community partners will have a significant impact on the well-being of the community.
- ✓ **Enable NH's ability to create an integrated health delivery system**: Partnerships with organizations who are not traditionally considered health providers will help to achieve a truly integrated health delivery system that will transform the care journeys for the Niagara community.

ESTIMATED DURATION

- 6-12 months to initially identify potential partners and collaborators.
- 12-36 months to execute on joint initiatives with partners.

DEPENDENCIES

- None

ESTIMATED LEVEL OF COMPLEXITY

- *Medium:* Rallying and coordinating other partners on a joint initiative may be difficult due to the alignment needed among leaders at the participating organization(s) and the need for legal collaboration agreements between organizations.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this initiative.
- 0.25-0.50 FTE internal Project Manager, 0.10 FTE internal Sr. Manager or Director for the initial planning.

Return to Strategic Roadmap

B3. Explore opportunities related to tourism in the Niagara region.

STRATEGIC INITIATIVE DESCRIPTION

- NH should investigate strategic opportunities to capitalize on the tourism industry in Niagara. There may be opportunities related to creating an education centre of excellence or learning facility for tourists to visit and learn about health. The SNH redevelopment could be leveraged to support or strengthen any strategic opportunities that arise from this exercise.

KEY ACTIVITIES

- ❑ **Articulate potential offerings that would cater to the tourism industry**: Identify 3-5 ideas that could resonate. Other suggestions include: a) creating a centre of excellence in artificial intelligence, b) providing education to citizens to enable population health management, c) providing virtual and physical tours of the hospital and d) creating a "ride" through the human body.
- ❑ **Create a business case to identify the strategic approach, outcomes and cost analysis**: Once a potential offering has been agreed upon, a thorough business case should be developed to explore the strategic goals and objectives, the expected outcomes and a robust cost benefit analysis to show the return on investment.
- ❑ **Socialize the opportunity with external funders and support**: As part of developing the business case and socializing potential offerings, NH should engage the NH Foundation, the Mayor of Niagara and other stakeholders in the tourism industry to gauge interest and support for supporting this endeavor.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Development of a new model to engage citizens and tourists of Niagara in health education and/or population health management**: If successful, a new opportunity related to tourism would revolutionize the role of a healthcare institution and set NH apart from their peers in the province and country. This pursuit would demonstrate innovation that capitalizes on the unique demographics of the community.
- ✓ **Creation of new partnerships between NH and the Niagara community**: This initiative would build upon current efforts around establishing a OHT. Creating partnerships with the tourism industry would only extend NH's connectivity into the community and demonstrate their commitment to delivering an integrated health system to Niagara.

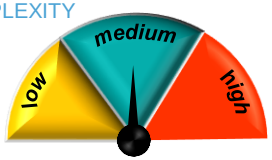
ESTIMATED DURATION

- 12-24 months

DEPENDENCIES

- Approval from the NH Board of Directors and NH Senior Team.

ESTIMATED LEVEL OF COMPLEXITY



- *Medium:* It may be difficult to obtain buy-in and support for pursuing opportunities related to tourism given its less common for healthcare organizations to be active in this industry.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this initiative.
- 0.25 – 0.50 FTE internal Project Manager.

Return to Strategic Roadmap

C1. Re-evaluate the mobility plan and strengthen cyber security.

STRATEGIC INITIATIVE DESCRIPTION

- As mobile technology adoption continues to grow, NH should consider reevaluating their mobility plan on a reoccurring basis (e.g. every 2-3 years) to meet staff and patient expectations for leveraging mobile technology as part of the care delivery experience. In addition, NH should take steps to further strengthen their cyber security capabilities to ensure they are protected from potential cyber threats.

KEY ACTIVITIES

- ❑ **Review existing mobility plan and identify gaps:** Ensure that the existing mobility plan is aligned with the hospital's innovative vision and workflows. If not, conduct stakeholder interviews to discuss concerns and potential adjustments.
- ❑ **Develop a mobility plan for patients:** A mobility plan for patients and their families of all age groups would clearly define the process to connect with NH to manage their healthcare experiences.
- ❑ **Investigate opportunities to partner with telecommunication providers:** Investigate whether there is an opportunity to partner with telecommunication providers to potentially offer special contracts on mobile devices and service plans for NH patients and staff.
- ❑ **Strengthen cyber security capabilities with a partner**: NH should find an appropriate vendor partner capable of providing the organization with support against cyber threats.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Keep SNH relevant and applicable in the rapidly changing landscape of mobile devices:** Refraining from updating a enterprise mobility plan, may lead to "fragmented" implementations of new mobile devices. Fragmented implementations may deter staff experiences, as staff may be required to carry multiple devices to access relevant systems and/or applications to deliver care.
- ✓ **Ensure the mobility plan is age-friendly**: By re-evaluating the mobility plan on a consistent basis, the needs of all age-groups will be accommodated based on the evolving demographics of the Niagara region.

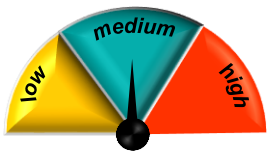
ESTIMATED DURATION

- 3-4 months

DEPENDENCIES

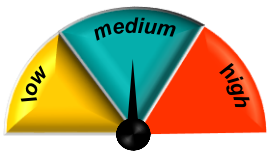
- Agreement and approval from NH Senior leadership

ESTIMATED LEVEL OF COMPLEXITY



- *Medium:* Reviewing and identifying gaps in the existing mobility plan may be time consuming but fairly straightforward. However, obtaining agreement and approval from key stakeholders on newly proposed policies could be challenging.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS



- *Medium* level of effort is estimated for this initiative.
- 0.25 FTE internal Project Manager, 0.25-0.50 FTE internal ICAT Analyst

Return to Strategic Roadmap

C2. Define the comprehensive requirements to optimize patient & staff experience.

STRATEGIC INITIATIVE DESCRIPTION

- NH should define the priority areas of the patient and staff experience that will be focused on in preparation for the SNH redevelopment recognizing that not all experiences may be achievable. NH should consider creating focus groups to identify priority requirements for optimizing patient and staff experiences. These experiences may include various elements that could impact how services are delivered at SNH and other existing sites, including parking, wayfinding, self-service check-in, virtual visits, patient portals, etc.

KEY ACTIVITIES

- ❑ **Leverage the patient engagement network to create a patient focus group:** Provide patients and caregivers with the opportunity to co-design by contributing their insight on ideal experiences.
- ❑ **Create staff focus groups across all NH sites from various departments:** Provide front-line staff with the opportunity to co-design by contributing their insight on ideal experiences for staff and patients.
- ❑ **Prioritize ICAT solutions that are feasible and most impactful to patient & staff experiences:** As there may be many possible ICAT solutions that could impact experiences, solutions that are easy to implement and have a large potential to improve experiences should be prioritized.
- ❑ **Implement ICAT solutions as part of SNH redevelopment:** Based on the priority ICAT solutions, implement and pilot solutions as part of the redevelopment process.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Clear understanding of both patient and staff expectations**: Understanding both patient and staff expectations may help NH to clearly identify priority areas in the redevelopment project for the new SNH. The expectations should be openly communicated as part of the redevelopment process to ensure there is broad understanding on the priority areas of patient and staff experience that will be improved.
- ✓ **Build trust with patients and staff, while setting a reputation for the new SNH:** Including patients and staff in the redevelopment process for the new SNH may build trust with NH and could alleviate any sensitivities to the changes occurring in the Niagara region.

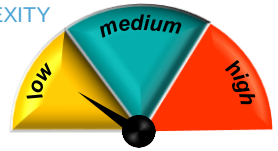
ESTIMATED DURATION

- 4-6 months for the defining the initial requirements.

DEPENDENCIES

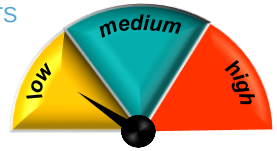
- Patient and staff participation and approval from NH Senior leadership

ESTIMATED LEVEL OF COMPLEXITY



- *Low:* Patient and staff participation is critical for achieving this initiative. Luckily, both are usually keen to provide insight on how to improve care and/or workplace environments.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS



- *Low* level of effort is estimated for this initiative.
- 0.50 – 0.75 FTE internal Analyst

Return to Strategic Roadmap

C3. Establish an enterprise data governance model to support digital transformation across NH.

STRATEGIC INITIATIVE DESCRIPTION

- NH should consider creating an enterprise data governance structure to help manage data collection and utilization in the organization. An enterprise data governance structure could also clearly define data management ownership. This enterprise data governance structure will become a critical component as NH continues to plan for a more "connected" and "seamless" future, where data will become a primary asset to the organization.

KEY ACTIVITIES

- ❑ **Create a committee to support the development of a strategic data governance structure:** Identify key stakeholders required to be members of a data governance committee. This committee would support developing the strategic oversight on data management and utilization. The mandate of the committee should evolve overtime to align with organizational changes and needs.
- ❑ **Develop relevant policies:** Create data governance and data management policies to clearly outline how data will be managed in the organization to make sure data integrity, protection, and accessibility is maintained.
- ❑ **Implement the data governance structure into the organization:** Communicate any newly proposed policies across the organization, including relevant governance committees and NH staff.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Improved access to information:** Establishing an enterprise data governance structure may provide a more clear and comprehensive understanding of what data is stored and where it is stored. Improved access to information may also allow for better decision making, such that hospital staff would have quick access to accurate data.
- ✓ **Improved data quality:** An enterprise data governance structure may support the consistency and standardization of data.
- ✓ **Improved regulatory compliance:** An enterprise data governance structure may help to enforce rules and regulations for data management and utilization.

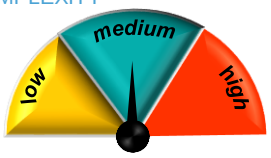
ESTIMATED DURATION

- 6-8 months to establish the terms of reference, structure of the governance model and define the initial priority areas for the governance group.

DEPENDENCIES

- Approval and support from the NH Board and Senior leadership.
- Current state of data and information management and flow across all sites in the Niagara region.

ESTIMATED LEVEL OF COMPLEXITY



- *Medium:* Considering data governance is a relatively new concept for hospitals in Ontario, individuals may be unfamiliar with the process and could require additional support and time to successfully proceed.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this initiative.
- 0.25 FTE internal Project Manager, 0.25-0.50 FTE internal Analysts

Return to Strategic Roadmap

C4. Re-evaluate the existing ICT operating model to ensure applicability for SNH in 2026.

STRATEGIC INITIATIVE DESCRIPTION

- NH should consider re-evaluating their existing ICT operating model to ensure that its structure, capabilities and approach/culture to providing support are appropriately aligned to the future state model of care delivery at SNH and broadly at NH. ICT will be required to continuously provide support to enable the delivery of future clinical workflows enabled by ICAT solutions at SNH. Specific areas of the operating model that could be examined as part of the re-evaluation include: capabilities, processes, and governance.

KEY ACTIVITIES

- ❑ **Review and identify gaps in the current ICT operating model:**
  - ❑ Ensure that the future ICT operating model includes support for external partners.
  - ❑ Ensure that the future ICT operating model is designed based on agile principles to create flexibility and to be able to quickly act on continuous changes in technology across all NH sites.
- ❑ **Adopt an approach to updating the ICT operating model that is based on best practices**: At the time at which the operating model evaluation takes place, NH should investigate best practices for digital and IT operating models given the landscape of how technology platforms and solutions are supported and delivered.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Ensure the right capabilities and skills are considered when recruiting to the ICT team**: The new SNH is approximately 7 years away but NH should begin to define the types of skills and capabilities that existing staff will need to develop and for new staff to be evaluated against during the hiring process.
- ✓ **Ensure ICAT solutions are supported in a sufficient manner to enable all stakeholders involved delivering and receiving care**: An updated operating model will ensure ICAT solutions selected for SNH will be supported to enable the future vision of care delivery through ICT's capabilities, processes and governance structures.

ESTIMATED DURATION

- 4-6 months to perform the re-evaluation. This initiative would occur later in the redevelopment process approximately 1-2 years away from the launch of SNH.

DEPENDENCIES

- Near final ICAT design including selection of ICAT solutions and supporting vendors.

ESTIMATED LEVEL OF COMPLEXITY

- *Medium*: Designing and updating the operating model for ICT will require expertise and an understanding of best practices and trends in digital and IT operating models 1-2 years before the new SNH launches.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this initiative.
- 0.50 FTE internal Project Manager, 0.75-1.00 FTE internal Analyst,
- 1.00 FTE external resources.

Return to Strategic Roadmap

C5. Create an ICAT retrofit plan for existing programs and services across existing NH sites based on the new SNH.

STRATEGIC INITIATIVE DESCRIPTION

- NH should consider creating an ICAT retrofit plan for existing programs and services offered across existing NH sites. The plan is intended to identify which ICAT solutions, at the new SNH, could be extended to other sites in the region.

KEY ACTIVITIES

- ❑ **Identify lessons learned from previous multi-site redevelopment projects:** NH should consider scheduling discussions with Halton Healthcare and Mackenzie Health to understand their process to retrofitting new technologies to existing sites.
- ❑ **Prioritize the stakeholders in which ICAT solutions could be extended across all sites and conduct current state analyses at each site to determine the extent of change required to perform the retrofitting:** Understanding the current state workflow, infrastructure and capabilities available at each site will help to identify which stakeholders need to have more of a seamless experiences across NH sites. This exercise will also help identify which ICAT solutions should be prioritized for retrofitting in alignment with the schedule for the SNH launch. Retrofitting certain ICAT solutions may require more effort than others.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Establish a level of ICT standardization and consistency across all sites in the Niagara region:** Extending ICAT solutions throughout all NH sites could help to improve workflow efficiencies and provide better quality and consistent care across all sites.

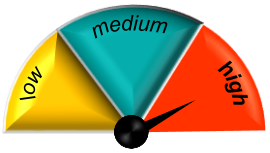
ESTIMATED DURATION

- 8 – 12 months

DEPENDENCIES

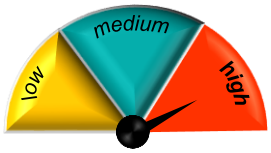
- Completion of the redevelopment stage 3 submission.

ESTIMATED LEVEL OF COMPLEXITY



- *High:* Conducting analysis at each site, to understand the extent to which new technologies could be retrofitted into existing programs and services, is complex and requires thoughtful understanding of ICAT solutions and clinical/administrative workflows.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS



- *High* level of effort is estimated for this initiative.
- 0.25-0.50 FTE internal Project Manager, 0.75-1.00 FTE internal Analyst
- 0.50 - 1.00 FTE external resources

Return to Strategic Roadmap

D1. Refine the redevelopment project vision and develop a brand for SNH.

STRATEGIC INITIATIVE DESCRIPTION

- NH should consider refining the redevelopment project vision and develop a brand for the new SNH. The vision should encompass all relevant elements including, the ICAT, Clinical, and Facility design.

KEY ACTIVITIES

- ❑ **Leverage existing work completed with the facility design vision:** NH will have existing content, including the facility design and ICAT Design Report to help guide the development of the vision and brand.
- ❑ **Identify and understand expectations of the new SNH and determine what differentiates it from other healthcare facilities in the Niagara region:** NH should consider engaging with NH staff and patients to capture user expectations on the performance of the new SNH and develop a brand that is consistent with user insight. NH should also consider identifying what differentiates SNH from existing healthcare facilities to highlight its role and/or position in the community to create an appealing narrative & build interest.
- ❑ **Communicate the vision to the public:** NH should provide patients and family members with an opportunity to co-design or provide input on the project vision. NH should also consider communicating the brand with the community to raise awareness of the changes and provide oversight on the messaging around the new facility.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Create awareness and attract patients:** A strong vision and brand will help to communicate the redevelopment project in a meaningful manner to all relevant stakeholders including: patients, caregivers, and staff. A brand that will help to rally support, build trust and establish confidence in the services envisioned for the new SNH.
- ✓ **Achieve staff engagement by establishing a common goal at the SNH:** A strong vision and brand could help bring staff closer together as they work to achieve a common goal. Many resources and efforts will be devoted towards the SNH redevelopment for the foreseeable future at NH, and it is recommended that staff be engaged throughout the process to ensure staff morale is maintained throughout the change.

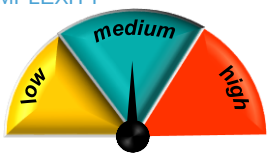
ESTIMATED DURATION

- 2-4 months to refine the preliminary vision.
- 2-4 months to share and test the preliminary vision with NH staff.
- 12-24 months to market the brand

DEPENDENCIES

- NH Senior Team approval to finalize the project vision and brand.

ESTIMATED LEVEL OF COMPLEXITY



- *Medium:* Coordinating meetings with key stakeholders and obtaining agreement on “one” vision and brand could be challenging.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS

- *Medium* level of effort is estimated for this initiative.
- 0.50 FTE internal Project Manager, 0.50-0.75 FTE internal Communications Lead

Return to Strategic Roadmap

D2. Re-evaluate business & clinical workflows for SNH.

STRATEGIC INITIATIVE DESCRIPTION

- NH should consider re-evaluating current business and clinical workflows at existing sites to identify any barriers and inefficiencies. These workflows could be redesigned with full optimization and appropriate sequencing of patient and staff flow between various programs and services between sites. This process will become critical to both the facility design and ICAT design for the new SNH.
- The ICAT design solution for SNH may influence the process for redesigning these workflows, such that some of the ICAT solutions could remove barriers and improve workflow efficiencies and patient and/or staff experiences.

KEY ACTIVITIES

- ❑ **Identify bottle-neck and/or pain point areas at existing NH sites:** Evaluate current workflows that have a significant impact on patient flow and identify opportunities for optimization. It is recommended to prioritize the following: the emergency department, areas providing diagnostic services, and admission & discharge processes.
- ❑ **Conduct a deep analysis on the preliminary workflows for SNH and identify opportunities for automation, where possible:**. Findings from the current state analysis should be considered when assessing proposed high-level workflows for SNH. NH should create detailed versions of these future state workflows for SNH to ensure that all necessary information is available to appropriately inform facility design and ICAT design choices.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Provide patients and staff with more seamless and enhanced experiences:** Patients could benefit from optimized workflows by allowing them to receive more timely and accurate care (e.g. minimizing duplications in the system) through seamless transitions between different programs, services or providers.
- ✓ **Proactively provide change management support**: By understanding current workflows and defining future workflows, NH will have the ability to proactively provide change management support to address the change required to transition from current workflows to future workflows.

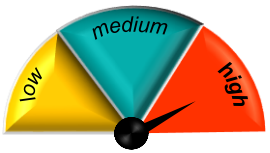
ESTIMATED DURATION

- 4-6 months to identify bottle-necks and/or pain points at existing sites
- 2-4 months to analyze preliminary workflows for SNH
- 6-8 months to test and update workflows for SNH

DEPENDENCIES

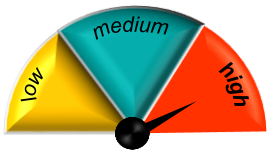
- Any workflow re-design stemming from a HIS implementation may impact the appropriate timing for this initiative.

ESTIMATED LEVEL OF EFFORT



- *High:* Analyzing existing workflows to identify bottle-neck and/or pain point areas may be time consuming and challenging to coordinate with respective staff across all sites.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS



- *High* level of effort is estimated for this initiative.
- 0.25 FTE internal Project Manager, 0.75-1.00 FTE internal Analyst.
- 1.00-2.00 FTE external resources

Return to Strategic Roadmap

D3. Create a transition/migration plan for SNH.

STRATEGIC INITIATIVE DESCRIPTION

- NH should initiate planning efforts to determine the transition schedule and necessary activities to migrate clinical and administrative programs from existing sites to the SNH.

KEY ACTIVITIES

- ❑ **Conduct a deeper dive on lessons learned from other multi-site redevelopment projects**: There may be opportunities to incorporate lessons learned from other recent multi-site redevelopment projects in which programs transitioned/migrated from one site to another. Examples in Ontario include: Humber River Hospital, Halton Healthcare and Mackenzie Health.
- ❑ **Analyze current and projected clinical volumes**: NH should consider updating the project volumes identified in the 2015 Clinical Design report. This will help to inform how resources should be allocated across sites when SNH opens.
- ❑ **Identify the programs that will be most impacted by the launch of the SNH**: NH should develop an evaluation framework to identify which programs will be most impacted. Once programs are prioritized, NH should initiate the planning activities required to transition these programs.

ANTICIPATED OUTCOMES/BENEFITS

- ✓ **Minimize the potential disruption to patient care and ensure a more seamless transition of programs when SNH opens:** A transition/migration plan could help to identify whether additional resources are needed to keep programs running, while the transition is in progress, to ensure that patients are still receiving care.
- ✓ **Providing staff with information about the transition**: Proactive planning will help to inform the necessary steps to transition existing programs and services. This is information that staff will be need to understand and support. Sharing this information is a key step in managing the significant change of opening a new facility.

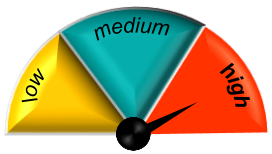
ESTIMATED DURATION

- 1-2 years

DEPENDENCIES

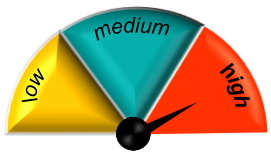
- Completion of the stage 3 submission.
- Approval from NH Senior Team.

ESTIMATED LEVEL OF EFFORT



- *High:* Conducting the initial analysis to understand current clinical volumes, project clinical volumes and using this information to create a transition plan for clinical and administrative programs is complex and involves multiple stakeholders and information sources.

ESTIMATED EFFORT & RESOURCE REQUIREMENTS



- *High* level of effort is estimated for this initiative.
- 0.50 FTE internal Project Manager, 0.75-1.00 FTE internal Analyst
- 1.00 - 2.00 FTE external resources.

Return to Strategic Roadmap

Q) Implementation plan, & budget cost estimate

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Implementation plan considerations

Identified below are recommended activities for NH to consider in the subsequent stages of the redevelopment process related to ICAT Design:

	ACTVITIY DESCRIPTION	*EXPECTED OUTCOME(S)*
A	**Site visits to/from other hospitals**: To gain a deeper understanding of how other hospitals have transformed care delivery through redevelopment, NH should conduct site visits or facilitate discussions locally.	✓ An opportunity to directly interact with leaders and representatives from other organizations who have gone through redevelopment to understand lessons learned and key findings
B	**ICAT showcase**: Staff across NH should be given an opportunity to experience some of the ICAT solutions that will be in-scope for SNH. IT is recommended that a showcase take place prior to the formation of Project Co. and another showcase take place after near completion of the new site.	✓ Provide a broader representation of NH staff with the opportunity to understand the role of ICAT solutions and the types of experiences that they will help enable. ✓ Provide NH staff with an opportunity to provide their input to shape and influence future workflows and processes.
C	**Innovation day**: An “innovation day” should be held leading up to the PSOS development stage to validate the prominent ICAT solutions and invite further discussion and understanding of how these solutions will enable care delivery.	✓ Get NH staff excited about the redevelopment planning. ✓ Create transparency into the ICAT planning process so far. ✓ Confirm the ICAT Vision and Principles.

Infrastructure Ontario (IO) considerations

Over the next set of pages, considerations have been described for NH to help manage the partnership between NH and Infrastructure Ontario (IO) moving forward in future phases of the SNH redevelopment project.

The capital planning process in Ontario has been heavily geared towards the use of the Design-Build-Finance (DBF) or Design-Build-Finance-Maintain (DBFM) model in recent years. The NH SCS was delivered as a DBFM in 2009 (completed in late 2012); it is expected that the SNH redevelopment project will be delivered as a DBFM as well.

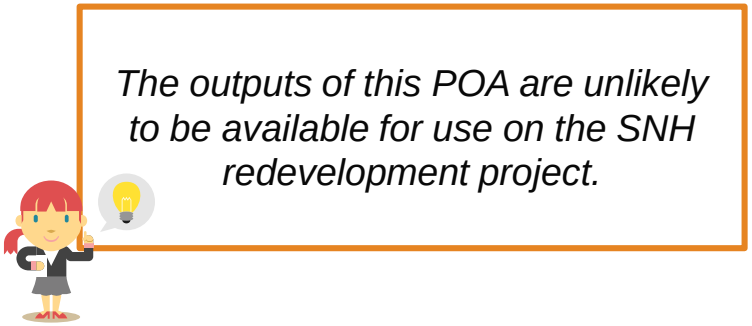
The DBFM model combines the delivery of several major project components, including the Group project components into the scope of the project, including ICAT services and other MIS services, within a single agreement. In general, the DBFM agreement is governed by a series of project specific output specifications that are largely performance based as opposed to prescriptive requirements.

- *The private sector consortium responsible for delivering the services within the agreement (Project Co.) is compensated based on its ability to deliver or exceed the performance standards outlined in the agreement.*
- *The incorporation of technology related specifications in the agreement have made developing and defining the performance specifications related to these items increasingly complex.*

Overview of procurement model selection

Infrastructure Ontario (IO) is currently developing a robust Procurement Options Analysis (POA) framework that it intends to roll out on all major projects in the coming months.

- The POA framework will review the merits of several procurement options and its ability to support the delivery of the project scope and achieve project objectives.
- Some of the procurement options considered in the framework have a more collaborative approach to developing project requirements and specifications (e.g., alliance contracting) – this may not be applicable for all projects.



IO Performance Regime

The schedule of output specifications contained in the Project Agreement will outline the full scope of services required to be performed by Project Co. The output specifications cover functional requirements, program requirements, building systems guidelines, technology systems and facilities management. These specifications are used to guide the design and service levels required for the facility and Project Co. is assessed against its ability to achieve the performance requirements.

Depending on the characteristics of the output specification, different performance indicators or measurements may be identified and used to assess the adequacy of performance by Project Co. If the performance specification is not met, a "failure" is deemed to have occurred, which could have financial implications for Project Co. Types of failures are described below:

Quality Failures

Failure by Project Co. to provide services in accordance with the performance indicators designated as administrative type services.

Example: The site manager provided by Project Co. at the facility is available and contactable 24 hours, 365 days a year for all purposes related to Project Co. services.

Service Failures

Failure to respond to and/or rectify an event within the required timeframe as stipulated in the agreement. Some output specifications will not have associated response or rectification times and therefore the failure is deemed to occur at the point of non-compliance.

Example: Report of hole in wall not responded to or rectified within the required timeframe.

System Failures

Failure to rectify an event impacting the Project Co. managed IMS within the relevant rectification period, where the IMS fails to comply with the functionality conditions set out in the agreement.

Example: Graphic user interface malfunctions, impacting the safety security system in the facility and is not rectified within the relevant rectification period.

Availability Failures

Failure which causes a functional unit or area within the facility to be in a state or condition that does not comply with the intended use or purpose of the functional part and is not rectified within the relevant rectification period.

Example: Door to operating room does not close properly rendering the operating room unavailable for use.

IO Payment Mechanism

As mentioned previously, the payments received by Project Co. can be impacted based on its ability to achieve the performance standards contained in the project agreement. Depending on the type of failure event, monetary deductions can be made to Project Co.'s monthly service payment. The severity and frequency of the event occurring can also impact the amount of the applicable deduction.

The tables below summarize these factors for each failure type:

Quality Failures

Frequency – typically applied on a monthly or annual basis for specific contractual requirements.

Classification of Failure (and approximate $ value)

Minor QF = $55 per failure
Medium QF = $275 per failure
Major QF = $550 per failure

Service Failures

Frequency – typically on a per occurrence basis (if the service failure is related to reporting, then only applied once for that reporting period)

Classification of Failure (and approximate $ value)

Minor SF = $15 per failure
Medium SF = $55 per failure
Major SF = $110 per failure

System Failures

Frequency – typically on a per occurrence basis.

Classification of Failure (and approximate $ value)

Tier 1 Project Co Managed IMS = $TBD
Tier 2 Project Co Managed IMS = $TBD
Tier 3 Project Co Managed IMS = $TBD

Availability Failures

Frequency – typically on a per occurrence basis.

Classification of Failure
Can be classified as Routine, Urgent or Emergency – these classifications dictate the relevant rectification timeframe for each event.

Deductions are calculated based on the relative importance of the functional unit and/or area impacted. These amounts vary by project. The minimum deduction amount is $10 per event per session.

Output Specs Relating to Technology Systems

In recent years, system failures have been included in the project agreement to account for events relating to the technology systems that impacted the overall performance of the facility. These output specifications have focused on a variety of elements including structured cabling and physical spaces, network equipment, telephony, electronic security, AV, nurse calling and overall system integration.

In 2017, Arup performed a review of the output specifications related to technology systems for a sample of hospital projects delivered by IO. The relevant findings of that report are summarized below:

- ***Overly prescriptive documentation:*** *In some instances too much detail was provided, potentially restricting innovation and introducing the risk of enforcing requirements that were proprietary to specific systems, not accurately reflecting the actual integration environment of a particular project.*
- ***Inconsistent documentation:*** *Technology requirements are not often described in relevant sections of the PSOS and are often not coordinated between sections of the agreement or RFP.*
- ***Lack of clarity in scope:*** *The PSOS was structured in a way that caused confusion particularly around what could be considered as in-contract and enforceable based on the use of guidance, requirement and important statements.*
- ***Unclear delineation of roles and responsibilities:*** *A thorough understanding of which party is responsible for providing each technology system, including responsibilities for installing, operating and maintaining, is required.*

Source: Arup. "Infrastructure Ontario Output Specifications Relating to Technology Systems Project Final Report." Jan. 2017

Considerations for ICAT Implementation

As noted in the Arup report, "integrated and interoperable systems are a relatively new inclusion to AFP project scope, therefore the ICAT sections of the Output Specifications have not had the same time to develop and mature as other building systems such as Mechanical and Electrical." As a result, it is critical that NH take the time to carefully review the output specifications and roles and responsibilities associated with technology systems to ensure the documentation clearly identifies NH' vision and objectives with respect to its technology and associated infrastructure.

When developing documentation for the RFP or project agreement, NH should consider the following:

- *Ensuring that the output specifications sufficiently describe NH's ICAT vision – to the extent required, be more prescriptive in the description of key concepts and principles.*
- *Identifying clear milestones for testing and commissioning of the ICAT systems, taking into account the type of technology and availability of other systems required for integrated testing.*
- *The extent to which relevant risks have been evaluated related to the potential use of unproven ICAT solutions.*
- *Overall integration of the ICAT systems with existing network systems (e.g., St. Catherine's site).*
- *The amount of time required to develop documentation related to ICAT systems cannot be underestimated. NH should ensure that its expectations and required deliverables are clearly defined in the Project documentation to assist in minimizing any potential disputes or conflicts with Project Co. during the construction or operating phases of the Project.*

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ICAT Budgetary Costing

Approach

1. This document outlines a high level cost estimate for the ICAT components for Niagara Health System - New South Niagara Hospital, based on preliminary information available from Stage 2 and ICAT Visioning. The costs noted in this document are provided at a high level for budgeting purposes only and do not constitute a commitment from any particular vendor. As the functional and technical requirements for the solutions are still being developed, some costing assumptions may change by completion of the project. The information used to develop these estimates comes from NHS, master planning/functional programming documentation and our professional experience.
2. Building square footage and total rooms are based on the baseline option Stage 2 Budget Cost Estimate dated August 28, 2019, prepared by Marshall & Murray.
3. Funding sources indicated (local share, cost share) are based on prior experience on similar projects and do not constitute a guarantee of funding.
4. Operating costs include support, maintenance, annual licensing and equipment breakage/turnover/replacement. Estimates are based on previous knowledge but may vary considerably depending on the system and options selected. Hospital resources have been assumed where possible.
5. ıd quantities:

Costing Assumptions	
Number of patient beds	469
Building square footage	1,200,000

ICAT costs have been organized into the following 6 categories:

1. Redevelopment – ICAT Cost Share: ICAT costs which are typically part of the 90/10 cost share with the Ministry of Health and Long Term Care (MOHLTC).
2. Redevelopment – ICAT Local Share: ICAT costs which are part of the local share plan (not typically cost shared by the MOHLTC).
3. Redevelopment – Non-ICAT Cost Share: costs which are part of the 90/10 cost share with the MOHLTC but are not typically part of ICAT, such as building components, or mechanical and electrical systems.
4. Redevelopment – Equipment: equipment and devices which are typically part of the equipment list, such as computers, mobile phones and electronic displays. Equipment is typically 100% local share.
5. Hospital Projects – projects which have been deferred to after the Redevelopment project, or will be implemented independently of Redevelopment.
6. Operating Costs – an estimate of the approximate annual operating costs, including annual licensing, lifecycle, support & maintenance.

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Cost premium over traditional system

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Appendix

Appendix A: Visioning Session attendees
Appendix B: Summary of Visioning Session outputs
Appendix C: Summary of completed stakeholder engagement interviews

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Appendix A: Visioning session #1 attendees

Visioning Session #1 Fri Sep 6, 2019		
#	First name, Last name	Role
1	Linda Boich	Executive
2	Caroline Bourque-Wiley	Executive
3	Derek McNally	Executive
4	Johan Viljoen	Executive
5	Angela Zangari	Executive
6	Sime Pavlovic	Executive
7	Dr. Satish Chawla	Regional Chief of Pathology
8	Dr. Rafi Setrak	Chief of Emergency Medicine
9	Cathy Sutherland	Board Member
10	Marti Jurmain	Board Member
11	Bunny Alexander	Board Member
12	Ron Mergl	Board Member
13	Ken Kawall	Board Member
14	Cliff Harvey	Redevelopment
15	Ben Embir	Redevelopment
16	Mary Jane Johnstone	Redevelopment
17	Jessica Mottola	ICT
18	Jeff Wilson	ICT

Appendix A: Visioning session #2 attendees

Visioning Session #2 Wed Sep 11, 2019		
#	First name, Last name	Role
1	Jessica Mottola	Project Manager, ICT
2	Amir Gill	Regional Director of Engineering/Facilities and Biomedical
3	Martin Ruaux	Director of Regional Kidney Care Program, Clinical Services, Executive Lead and Chief Nursing Officer SCS
4	Jane Doan	Director of Health Information Management, Patient Registration, Corporate
5	Nancy Fletcher	Director of Clinical Practice
6	Sonia Pagura	Director of Quality, Safety, Risk and Patient Relations
7	Jeff Wilson	Director for Information Communication and Technology
8	Chuck Quigley	Director of ICT- Transformation
9	Mark Rajack	Project Director, Partnerships and Innovation
10	Cliff Harvey	Chief Capital Project Officer
11	Ben Embir	Senior Design Manager, Redevelopment
12	Sue Nenadovic	Regional Director of Materials Management
13	Bobby Alexander	Director of Environmental Services, Parking & Security
14	Teresa Struk	Director of Financial Services and Decision Support
15	Mary Jane Johnson	Project Director, Communications

Appendix B: Summary of Visioning Session outputs

Topic Area #1: Ambulatory care services (1/2)

Questions	Group Session Notes	Additional comments
1. What are the types of a) patient and b) staff experiences that should be created?	- **Less stressful and more efficient experiences** for both patients and staff by streamlining processes (e.g. registration processes, etc.). - More **informative experiences** for both patients and staff by **improving access to educational materials, personal medical information, online platforms for delivery of instructions** for either patient preparation or staff training, and visibility of wait times and patient/staff flow. - More **personalized experiences** for both patients and staff by enabling **self-selected scheduling of patient appointments & staff shifts, enabling notifications and reminders**, **allowing reservations** for accessibility **equipment** & **parking** spots, improving access to **transportation services** e.g. "Uber Health" and wayfinding applications, etc.). - **Positive patient experiences** by avoiding having patients to wait at all.	- It was noted that the **caregiver experience should also be considered**. Caregivers should feel **"included", "aware", and "informed"** about their love one's care journey.
2. What are the most important clinical/admin processes that can be enabled by ICAT solutions?	- **"Smarter" or "faster" registration processes** by enabling **biometric technology** in the Niagara Health Navigator app (e.g. a patient would scan their finger on their phone to "check-in" and a message would be sent to the respective department). - **Automated transcription processes** which could also enable sharing of medical notes with patients. - **Automatic dictation processes** with the use of voice recognition technology. - **Smarter reservation and scheduling systems** that could help recognize patient profiles (e.g. which patients need 30 min vs patients who need 5 minutes to do something) and improve utilization of missed appointments. Push notifications could also be enabled to confirm a patient's arrival, make an appointment, etc. - **Communication and coordination between care providers** (i.e., improve connectivity to other providers in the region. For example, discharge notes sent to GP, prescriptions sent directly to a pharmacy, etc. - **Connecting patients to other services in the Niagara region** (e.g. counselling, coupons, groceries, Uber Health, etc.). - **Smarter systems** that could help **predict patient needs** and **bundle services together** - These smarter systems could improve staff productivity and better utilize hospital resources	- It was noted that **one-way technologies** (e.g. pagers) could be provided to individuals who do not have access to mobile devices - It was noted that **"reverse notifications"** should be considered, where patients would be "telling staff to do things"

Appendix B: Summary of Visioning Session outputs

Topic Area #1: Ambulatory care services (2/2)

Questions	Group Session Notes	Additional comments
3. What do you anticipate as the major challenges to achieving these experiences?	- **Retraining of staff, educating staff and patients of new processes**, **accommodating those who need** extra and/or different kinds of **support** (i.e., change management) - **Privacy concerns** - **Connecting with other services** - **Collective agreements** on these experiences	- It was noted that only 35% of people at SCS use credit cards to pay for parking
4. How do you envision ICAT might support NH's role in the broader community?	- Compatibility for Niagara Health to be **"integrate-able" with community partners** - **Cost prohibitive** for a lot of other community agencies - Enable **a "one health record"** across the region - Support **"cross-border" delivery of care** - **Improve communication** across the region	

Appendix B: Summary of Visioning Session outputs

Topic Area #2 : Inpatient services (1/2)

Questions	Group Session Notes	Additional comments
1. What are the types of a) patient and b) staff experiences that should be created?	- Create **clear medical and surgical pathways** (e.g. pre and post op processes), which may contribute to **more efficient and organized experiences** for both patients and staff - **Provide staff with visibility** of their patients, staff, and equipment flow throughout the hospital - Provide patients with **detailed and "real-time" information** about their care plan so, they are "always in the know" (e.g. scheduled appointments, lab results, when a visitor arrives at the hospital, etc.). - Provide patients with a **continuous connection** to their care team and the "outside world" (e.g. patients could skype their loved one outside of the hospital) - Enable **more efficient admission processes**, including **faster registration** - Improve patient experiences and make patients **feel more "at home"** when staying overnight at the hospital. For example, **smart whiteboards** could be used to minimize "strange" or "unfamiliar" environments - Allow patients to stay at home as much as possible by enabling virtual care	- Consider **building a space for staff to decompress, share ideas/collaborate**, etc.
2. What are the most important clinical/admin processes that can be enabled by ICAT solutions?	- **Faster registration processes** with the use of **biometric technology** (e.g. retinal scanning, fingerprint ID, handprint ID, etc.) - **Faster and more seamless processes** of **sharing and accessing a patient's medical history**. For example, with the use of **smart health cards**. This technology could also **encourage patients to have more control** over their health records and health related journeys - **Enhance learning experiences** among staff, patients, and caregivers	

Appendix B: Summary of Visioning Session outputs

Topic Area #2 : Inpatient services (2/2)

Questions	Group Session Notes	Additional comments
3. What do you anticipate as the major challenges to achieving these experiences?	- There may be a **risk of losing personalization of care**, such that **face-to-face interactions** may be limited with the use of technology - As technology automates many processes in hospitals, there may need to be **restructuring or redesigning of current roles and responsibilities** among staff. Some individuals may not be very happy with these changes - It may be challenging to implement new technologies because of **limited funding** - **Usability and adoption of new technologies** among patients and staff - **Accommodation for all types of patients** (e.g. patients who speak a different language, patients with cognitive barriers, etc.) - Identification of indiv**iduals to manage real-time data** - **Physician compensation** does not currently include virtual/remote care (i.e., hospital funding vs physician FFS is not aligned)	- Consider identifying ways to **support and include caregivers(e.g**. notifying caregivers that their love one is in surgery and send updates about their progress in surgery) - Consider identifying ways to **visualize change for patients and staff**, which could help with **stakeholder "buy-in" of new technologies** and processes
4. How do you envision ICAT might support NH's role in the broader community?	- **Connect partners in the community** with each other (e.g. community based referring physicians, schools, libraries, etc.) - Creation of a **secure platform** for a "**healthcare ecosystem**" in Niagara - Support **"seamless" continuity of care a**cross the continuum (e.g. extend care post discharge by enabling virtual home care) - **Improve access to health resources** and imp**rove the ability to share health information** with providers across the continuum	

Appendix B: Summary of Visioning Session outputs

Topic Area #3: Clinical, Diagnostic and Therapeutic services (1/2)

Questions	Group Session Notes	Additional comments
1. What are the types of a) patient and b) staff experiences that should be created?	- **Less stressful experiences** for staff by enabling smart systems that could **help manage and engage patients** (e.g. RTLS). - More **proactive experiences** for staff by enabling smart systems and technologies that could **help analyze how patients are feelings and predict how they will react**. - More **personalized experiences** for patients by **enabling self-selected scheduling** of appointments, **providing patients with options for care** (e.g. wait times for a CT scan may be lower at another facility in the region) - Enable smart technologies that could **optimize asset utilization** (e.g. staff & equipment) to **improve the efficiency of departmental workflows** - Create **"satisfying", "encouraging", "empowering", and "innovative" environments** for patients and staff.	- It was noted that AI/virtual technology could also provide healthcare professionals with an opportunity to be **more "patient-centered"**. For example, radiologists could virtually explain test results to a patient, instead of waiting for a family physician.
2. What are the most important clinical/admin processes that can be enabled by ICAT solutions?	- **Faster registration processes** by **automating repetitive tasks** (e.g. asking a patient the same questions multiple times, like when is your birthday, name, address information, etc.). Patients could tap or swipe a card to register and/or "check-in" to an appointment. An automatic alert could also be sent to the respective team to notify them that about the patient's arrival. - **More accurate and efficient reporting processes for diagnostic imaging exams** with the use of artificial intelligence (AI) programs (i.e., interpretation of images). AI could also be used to enable **teleradiology services** across the Niagara region.	- It was noted that ICAT solutions could also **support centralization of diagnostic & therapeutic services** in the region (i.e., the referring and reporting processes of these services).

Appendix B: Summary of Visioning Session outputs

Topic Area #3: Clinical, Diagnostic and Therapeutic services (2/2)

Questions	Group Session Notes	Additional comments
3. What do you anticipate as the major challenges to achieving these experiences?	- Technology may not be reliable enough, which means "back-up" processes need to be clearly defined before any technology is implemented - Implementing "one" new technology may not accommodate all patients. For example, implementation of self- service kiosks may not be favored by all patients, as some may prefer to speak to a human being. In order to help mitigate these challenges, consider **offering patients with multiple channels**. For example, patients could use self-service kiosks to register, speak to a human being, or use the Niagara Health Navigator app to register. - **Communication and coordination between hospital providers** (e.g. hospital physicians) **and community providers** (e.g. GPs) - **Fear of losing the "personal" and "warm" feeling of the environment at the new SNH**. It was noted that some people prefer to visit the Welland Site as opposed to the SCS because it feels more "warm" and "home-y, whereas the SCS feels more "cold".	- Consider brainstorming ways that could help patients and staff **build more trust with technology.** - Consider including key words like **"personalized care", "compassionate environments", and "person-first" approach for branding of the SNH**.
4. How do you envision ICAT might support NH's role in the broader community?	- **Improve the communication and coordination with community providers and agencies**. - Support the **enablement of virtual care** in the region and **provide patients with options for care** (e.g. bundled care, virtual visits, etc.)	

Appendix B: Summary of Visioning Session outputs

Topic Area #4: Support & Administrative services (1/2)

Questions	Group Session Notes	Additional comments1.
1. What are the types of a) patient and b) staff experiences that should be created?	- Provide staff with **positive experiences** to enjoy coming to work everyday - Provide patients and staff with **less stressful and more efficient experiences** by **automating simple administrative processes** (e.g. minimizing repetitive manual tasks) - Provide patients and staff with **more supportive experiences** by enabling broader "wayfinding" solutions to **support navigation** in and around the hospital - Provide both patients and staff with **safe experiences** - Provide patients with more **patient-centered experiences** by en**abling real-time notifications** that allow patients to "wait" at home in comfort. - Provide staff with **proactive experiences** by enabling **smart systems to understand patients' needs in advance in "real-time"** (e.g. duress badges that monitor biometrics which could send a signal for de-escalation assistance) - Provide patients and staff with **informative experiences** by enabling **real-time information** (e.g. informing patients about traffic delays to adjust travel time to an appointment)	- Consider becoming **"well certified" to create healthy environments** for staff and patients - Consider implementing a **smart "queuing system" in waiting rooms** that could **predict wait times** (e.g. ED)
2. What are the most important clinical/admin processes that can be enabled by ICAT solutions?	- **Predictive forecasting of patient flow** using **'heat maps'**, particularly busy times (e.g. flu season, festival in the city, etc.) - **Automate processes that are reliable** and **enable automatic notifications to respective staff**. For example, automatic notifications to inform staff when a clean patient bed is available, automatic requests for environmental services (e.g. when a department needs more paper towels) and portering services, etc. - **Patient transportation** - **Registration and access to information** - **Recognition of duplication** throughout a patient's care journey (e.g. avoid repeating tests) - **Remote monitoring of patients** with the use of **wearable health devices** - **Staff reminders and alerts** - **Staff/resource optimization** and timing of clinic hours (e.g.	- Consider leveraging other **industry solutions for distribution of patients and/or services**

Appendix B: Summary of Visioning Session outputs

Topic Area #4: Support & Administrative services (2/2)

Questions	Group Session Notes	Additional comments
3. What do you anticipate as the major challenges to achieving these experiences?	- **Integration of data systems** - Finding individuals with the **right skillset to manage data into meaningful information** - Ensuring people who are at the front line of care are **part of the discussions for planning** - Some patients and staff may be **apprehensive of being continuously monitored** (e.g. RTLS) - Ensuring equitable access to technology among patients and caregivers (e.g. not everyone has a mobile device) - **Changing patient and staff behaviors** (i.e., change management) - **Privacy and cyber security challenges** - **Usability** of new technologies and applications (e.g. Hospital apps)	- Consider how to **accommodate individuals who *don't want* to use technology**
4. How do you envision ICAT might support NH's role in the broader community?	- Enable **remote consultations and monitoring** of patients - Improve **access to community services** (e.g. Mental Health, etc.) - Build a **health database** - **Extend services outside of hospital walls** and into the community - **Full integration** with technology available in the community (e.g. long term care facilities, Mental Health services, adult programs, EMS, etc.) - **Advance notifications with community partners** for emergent issues (e.g. long term care facilities → Emergency Department, Mental Health facility → ICU/police services, etc.) - **Better prediction of space, resources** (physical or humans) and **location** in the hospital and in the region (e.g. heat maps) - **Improve health literacy** by providing various types of information and channels to access information	- It was noted that the role of "health and wellness" and the "hospital" may change in the future (e.g. individuals in the community can come to the "hospital" or a **"health campus"** to learn about health - Consider implementing technology that could enable **"tapping" into patient/caregiver experiences** for knowledge, safety, concerns (i.e., for quality improvement)

Appendix C: Summary of completed stakeholder engagement interviews (1/2)

Name	Title
Bobby Alexander	Director, Security, Parking, EVS
Caroline Bourque-Wiley	Director, Communications
Jane Doan	Director, Health Information Management, Patient Registration, Corporate
Ben Embir	Interim Design Director
Zeau Ismail	Director, Interprofessional Practice, Ethics & Research
Nancy Fletcher	Director of Clinical Practice
Amir Gill	Director, Engineering/Facilities Management
Cliff Harvey	Chief Capital Project Officer
Lori MacCullouch	Director Nursing Professional Practice & Elder Care
Sue Nenadovic	Director, Materials Management
Sonia Pagura	Director, Quality, Safety, Risk and Patient Relations
Chuck Quigley	Director, Transformation, ICT

Appendix C: Summary of completed stakeholder engagement interviews (2/2)

Name	Title
Mark Rajack	Director, Partnerships ICT
Jill Randall	Site Director, St. Catherine's
Martin Ruaux	Executive Lead, St. Catherine's Site
Dr. Thomas E. Stewart	Chief Executive Officer
Dr. Johan Viljoen	Interim Chief of Staff, EVP Medical
Jeff Wilson	Director, Operations, ICT
Linda Boich	EVP, Quality, Community Development and Mental Health and Addictions
Dr. Julian Dobranowski	Chief of Radiology
Derek McNally	EVP, Clinical Services and Chief Nursing Executive
Flo Paladino	EVP, People and OD
Angela Zangari	Interim President, EVP of Finance and Operations