ONTARIO CRITICAL CARE PLAN 2015-2018

June 2015

Critical Care Services Ontario
For information regarding this Ontario Critical Care Plan, please contact:

Critical Care Services Ontario
Phone: 416-340-4800 x 5577
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CCSO is funded by the Government of Ontario.
June 2015

The Honourable Dr. Eric Hoskins  
Minister of Health and Long-Term Care  
Government of Ontario  
Toronto, Ontario

Dear Dr. Hoskins:
In accordance with the Ministry of Health and Long-Term Care Agreement with the University Health Network for the Critical Care Services Ontario (CCSO) Program, and reflective of CCSO’s commitment to strategically plan, envision, and set priorities for an integrated critical care system, we are pleased to submit the Ontario Critical Care Plan 2015-2018.

Critical Care Services Ontario is considered an international leader in the development of an effective model for an integrated critical care system including a comprehensive data base key to effective performance measurement. The critical care system in Ontario is complex, comprised of intensive care units providing care across paediatric and adult populations, as well as specialized programs heavily reliant on critical care services such as Neurosurgery, Burns and Trauma. There is a total of 2,017 critical care beds (adult and paediatric), in 206 units in 84 hospital corporations across Ontario. Excellent patient care outcomes are achieved through collaboration with physicians, senior nursing leaders and hospitals, LHIN critical care networks and a collective commitment to patient safety and performance management.

Over the last eighteen months we have engaged critical care system stakeholders to set strategic directions that will continue to enhance quality patient care. Key to this are the following five strategic goals:

✓ Strengthening the experience of patients and families,
✓ Leading performance management,
✓ Targeting patient flow and transition improvements,
✓ Translating innovative and quality approaches to critical care delivery, and
✓ Advancing development and utilization of inter-professional critical care teams.

We are confident that these directions will help achieve high reliability for safe critical care for the patients and families in Ontario.

CCSO looks forward to working with the Ministry and critical care system stakeholders on the implementation of this plan through the initiatives established in the annual CCSO operating plan.

Sincerely,

Bernard Lawless  
MD, MHSc, CHE, FRCSC  
Provincial Lead  
Critical Care Services Ontario

Linda Kostrzewa RN, BAS Hons., MHSc  
Director  
Critical Care Services Ontario

c.c.  
Dr. Robert Bell, Deputy Minister, MOHLTC  
Susan Fitzpatrick, Associate Deputy Minister, MOHLTC  
Lynn Guerriero, Assistant Deputy Minister, MOHLTC
A Message from
Dr. Bernard Lawless and Mrs. Linda Kostrzewa

Critical Care Services Ontario (CCSO) has completed an exciting strategic planning process in collaboration with a broad range of stakeholders from across the province, leading to the production of a new Ontario Critical Care Plan. We are pleased to present the Ontario Critical Care Plan 2015-2018, which builds on the successes of the implementation of Ontario’s Critical Care Strategy and establishes new strategic goals and action plans to strengthen Ontario’s Critical Care System over the next three years.

Since the SARS outbreak in 2003, critical care system leaders have collaborated, supported by CCSO, to strengthen Ontario’s Critical Care System through implementation of Ontario’s Critical Care Strategy. Health system partners are committed to delivering the highest quality, sustainable and safe patient care. This commitment is met with the challenges of an aging population, increasing costs – particularly in relation to technologies and pharmaceuticals – and fiscal constraints. This commitment is also challenged by an increasing demand by citizens and government for greater engagement of patients and families, accountability and transparency in relation to health care spending and the achievement of positive patient outcomes.

The Ontario Critical Care Plan 2015-2018 will guide the work of CCSO and critical care system leaders. After extensive consultation and input, this document will serve as the blueprint from which CCSO will continue to lead and work with health system partners at all levels to improve access, quality and system integration for the benefit of patients within Ontario’s Critical Care System. CCSO will continue to provide leadership in working with partners across the health care system to make enhancements and ensure value under these three tenets. Innovation, enhanced engagement of patients and families, fiscal stewardship and performance measurement will all be instrumental to achieving the desired outcomes of this plan.

The Ontario Critical Care Plan is comprised of five strategic goals with associated action plans. These directions reflect the priorities that were identified by stakeholders and are required to strengthen Ontario’s Critical Care System over the next three years. The diagram on page 3 of this plan provides an overview of these directions.

On behalf of CCSO, we extend sincere thanks and gratitude to all those who thoughtfully contributed to the development of this strategic plan. We look forward to collaborating with critical care system leaders to implement the Ontario Critical Care Plan in the years to come. We are confident that implementation of the plan will result in significant and measurable improvements to Ontario’s Critical Care System for the benefit of all Ontarians.

Sincerely,

Bernard Lawless  MD, MHSc, CHE, FRCSC
Provincial Lead
Critical Care Services Ontario

Linda Kostrzewa  RN, BAS Hons., MHSc
Director
Critical Care Services Ontario
STRENGTHEN EXPERIENCE OF PATIENTS AND FAMILIES IN THE CRITICAL CARE SYSTEM

LEAD PERFORMANCE MANAGEMENT IN THE CRITICAL CARE SYSTEM

ONTARIO CRITICAL CARE PLAN 2015-2018

TARGET PATIENT FLOW AND TRANSITION IMPROVEMENTS IN THE CRITICAL CARE SYSTEM

ADVANCE DEVELOPMENT AND UTILIZATION OF INTERPROFESSIONAL CRITICAL CARE TEAMS

TRANSLATE INNOVATIVE AND QUALITY APPROACHES TO CRITICAL CARE DELIVERY IN ONTARIO
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Part 1: Introduction

Ontario’s Critical Care System has undergone transformational change over the course of the last ten years. This transformation began in 2003 following the Severe Acute Respiratory Syndrome (SARS) crisis.

The SARS crisis highlighted capacity challenges, system gaps and inefficient utilization of critical care resources across the province. Several major issues were identified at the time including:

- Insufficient physical capacity and beds to meet increasing demands;
- Challenges with sufficient human resources and human resource planning to ensure optimal capacity utilization;
- No ability to track available critical care resources, measure resource utilization or performance; and
- Limited ability to leverage resources across hospital corporations or regions to manage surges.

SARS also highlighted the need for a seamless continuum of care across emergency departments, operating rooms, intensive care units and hospital wards. The Ontario Critical Care Steering Committee was established to identify improvements in the quality and efficiency of Ontario’s Adult Critical Care System.

In March 2005, the Ontario Critical Care Steering Committee released its final report outlining 33 key recommendations. These recommendations formed the foundation for Ontario’s Critical Care Strategy, a multi-year implementation plan with an initial focus on seven core initiatives. These seven core initiatives (outlined in the graphic below) and all subsequent initiatives under Ontario’s Critical Care Strategy are anchored in three core principles: improving patient access, improving quality of care and enhancing system integration.
The table below details the mandate of each of the seven core initiatives as defined by Ontario’s first Critical Care Strategy.

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<td><strong>1. Critical Care Response Teams</strong></td>
<td>Bring critical care expertise out of the ICU to patients throughout the hospital 24/7 to improve patient outcomes and efficiency of resource utilization.</td>
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<td><strong>2. System-Level Training Initiatives</strong></td>
<td>Expand the skill and capacity of existing critical care health professionals, enhancing pre- and post-ICU care, and supporting surge capacity response plans.</td>
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<td><strong>3. Critical Care Information System</strong></td>
<td>Enable evidence-based decision-making to support system-wide capacity planning and targeted performance improvement initiatives through data collection, analysis and reporting.</td>
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<td><strong>4. Performance Improvement Collaborative</strong></td>
<td>Employ innovative approaches to achieve quality benchmarks defined at the hospital, LHIN and provincial level, and cultivate a culture of ongoing accountability and performance improvement in critical care service delivery.</td>
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<td><strong>5. Ethical Issues of Access</strong></td>
<td>Establish specific, actionable and medically relevant admission, discharge and triage (ADT) policies supporting Ontario’s critical care providers and patients.</td>
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<td><strong>6. Health Human Resource Investments</strong></td>
<td>Establish and support the achievement of provincially recognized standards in critical care nurse training and education programs.</td>
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<td><strong>7. Surge Planning &amp; Capacity Management</strong></td>
<td>Increase the number of critical care beds to address key pressure points, and develop alternatives for medically stable, chronically ventilated patients.</td>
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The Critical Care Secretariat was established by the Ministry of Health and Long-Term Care (MOHLTC) in 2005 to implement Ontario’s inaugural Critical Care Strategy and engage critical care system leaders and partners to accomplish this strategy.

Over the years, it became clear that there was an ongoing need for hospital, Local Health Integration Network (LHIN) and provincial system coordination to ensure that high quality critical care services are available to all Ontarians, and that the system as a whole operates efficiently and effectively. The transition from the Critical Care Secretariat to Critical Care Services Ontario (CCSO) in 2012 reflects this expanded mandate and system leadership. The focus of CCSO is on provincial programs related to and reliant on critical care including neurosurgery, trauma and burns, adult and paediatric critical care, life or limb and repatriation, and chronic ventilation.

Consistent across all program areas is a focus on the patient journey throughout the continuum of care, and not merely issues related to accessing care within critical care units. This may include working with system partners to identify improvements in pre-hospital care, transfer for emergent care, or transfer to post-acute care settings such as rehabilitation. All of these elements impact patient flow and ultimately access to critical care. The leadership of CCSO is provided within the context of LHINs. The MOHLTC provides support to the work of CCSO through the University Health Network (UHN).
The mission of CCSO is to identify critical care system needs and collaborate with health care partners to improve access, quality, and integration for patients. To achieve this, CCSO collaborates with clinicians, hospital administrators, LHINs, the MOHLTC and other health sector partners in front-line stakeholder engagement, the development of evidence-based policy and the implementation of provincial programs to promote system-level accessibility. The CCSO guiding principles have expanded to include value, in addition to improving access, improving quality, and enhancing system integration. CCSO’s key functions are:

- To strategically plan, vision and set priorities for an integrated critical care system for Ontario;
- To strengthen system accountability through performance management and data transparency;
- To integrate best practices across the critical care system;
- To advance policy and program development, implementation, and evaluation initiatives.

The diagram below outlines the current areas of focus for CCSO.
1.1 – Key Strengths of CCSO

System Leadership
CCSO brings together clinical and administrative representatives from health care organizations across the province to improve Ontario’s Critical Care System. This governance model is a key strength of CCSO, enabling a high level of engagement among critical care system partners and shared accountability for the development of initiatives.

CCSO leads a number of provincial advisory committees including the Critical Care LHIN Leaders, Provincial Neurosurgery Ontario (PNO), the Ontario Trauma Advisory Committee (OTAC), and the Paediatric Critical Care Advisory Committee (PCCAC). Information about these groups can be found in Part 3: Ontario Critical Care Plan of this plan. CCSO also maintains a high level of engagement with each of the 14 LHINs through committee representation, CCSO-led LHIN Town Hall Meetings and other initiatives. A recent example of a successful collaboration between CCSO, LHINs and the MOHLTC is the development and province-wide implementation of the Life or Limb Policy in January 2014.

CCSO is guided by a Stakeholder Coordinating Committee. This committee meets quarterly and acts as a forum for shaping and embracing CCSO’s vision for promoting alignment across initiatives and sharing approaches to developing an improved system of integrated critical care services in Ontario.

Performance Management
The availability of accurate data is fundamental to achieving a high performing and sustainable critical care system. The implementation of the Critical Care Information System (CCIS), Ontario’s most comprehensive database with respect to critical care resources and patient acuity, marked the first step in critical care data collection and resource measurement. The CCIS contains information on bed availability, critical care service utilization and patient outcomes and is a valuable resource for measuring critical care unit level and system level performance. Through ongoing collaboration with stakeholders, CCSO continues to explore opportunities to align with other jurisdictions and is responsive to requests for additional metrics. The addition of the Influenza-Like Illness and Antimicrobial Stewardship indicators to CCIS are two examples of this responsiveness. The availability of this data supports hospitals, LHINs, and the MOHLTC in making decisions and creating policies that ensure accountability and transparency in how scarce resources are being managed, while also maximizing the value of investments in critical care.

Performance management has been embedded within the governance structure of the critical care system for each key program area supported by CCSO. PNO, OTAC and the PCCAC have selected key indicators and targets to measure performance within their respective specialties.

Critical care system leaders identify other enablers that have contributed to successful implementation of Ontario’s Critical Care Strategy. These include: engagement of clinical and administrative leaders, development and implementation of policy, development and implementation of guidelines/protocols, and the distribution of educational tools and knowledge transfer approaches. The table below provides an overview of key CCSO-led initiatives.
| Performance Management | • Critical Care LHIN Scorecard (2015)  
| | • Trauma Performance Improvement Indicator Report and User Guide (2015)  
| | • Neurosurgery Adult Performance and Accountability Indicator Reports (2014)  
| | • Neurosurgery Paediatric Performance and Accountability Indicator Reports (2014)  
| | • Critical Care Unit Scorecard (2012)  
| | • Implementation of the Critical Care Information System (CCIS) (2008)  
| | • Provincial Coaching Team Visits (2006/2007)  
| Educational Products | • Critical Care Access and Consent Toolkit (2014)  
| | • Long-Term Mechanical Ventilation Toolkit for Adult Acute Care Providers (2013)  
| | • Ventilator Associated Pneumonia and Central Line Infection Toolkit (2012)  
| | • Critical Care Unit Balanced Scorecard Toolkit (2012)  
| Resources | • Feature on Epilepsy System Improvement work in the Ontario Medical Association Review (2015)  
| | • Provincial Guidelines for the Management of Epilepsy in Adults and Children (2015)  
| | • Provincial Epilepsy Monitoring Unit Guidelines for Ontario (2014)  
| | • Ruptured and Unruptured Intracranial Aneurysms in Ontario – A Report by the Coil Embolization Implementation Task Force (2014)  
| | • Guidelines for Basic Adult Neurological Observation (2014)  
| | • Trauma Centre Consultation Guidelines (2014)  
| | • Burns Centre Consultation Guidelines (2014)  
| | • Provincial Life or Limb Policy (2014)  
| | • Provincial Repatriation Guide (2014)  
| | • Provincial Life or Limb Policy Poster for Hospitals (2014)  
| | • Life or Limb Policy Implementation Updates (Quarterly, 2014)  
| | • Provincial Acute Neurosurgical and Spine Consultation Guidelines (2013)  
| | • Surge Capacity Management Plan (2008)  
| | • Standards for Critical Care Nursing in Ontario (2006, revised 2012)  
| Training Initiatives | • Critical Care Response Team (CCRT) E-Learning Program (2013)  
| | • Neurosurgical Nurse Educator Initiatives (2012 and ongoing)  
| | • Neurosurgical Physician Assistant Initiatives (2012 and ongoing)  
| | • Training opportunities for community physicians – Acute Care Event Simulation Courses (2007)  
| | • Training program for Critical Care Response Teams (2007)  
| | • Funding for additional training opportunities in post graduate critical care fellowship training programs (2006)  
| | • Critical Care Nursing Training Initiatives (2006 and ongoing)  
| Stakeholder Engagement | • Engagement of critical care system leaders on standing provincial committees: Critical Care LHIN Leaders, Provincial Neurosurgery Ontario, Ontario Trauma Advisory Committee, Paediatric Critical Care Advisory Committee, Critical Care Nursing Committee  
| | • Numerous sub-committees, working groups and advisory panels to support work in each of the program areas  
| | • Implementation of Critical Care Networks in each of the fourteen LHINs  
| | • Collaboration with stakeholders on issues related to organ transplantation in the province (this work was transitioned to Trillium Gift of Life Network)  
| Knowledge Translation Events | • CCSO/OHA Annual Critical Care Conference  
| | • Annual CCSO-led LHIN Town Hall Meetings  
| | • Collaboration with Canadian Critical Care Knowledge Translation Network – aC’KTion Net (2014)  
| | • Innovating CCRT Forum (2011)  

**Critical Care Services Ontario • June 2015**
LIFE OR LIMB POLICY
EFFECTIVE JANUARY 13, 2014

Life or Limb Policy applies when a patient presents with a life or limb threatening condition.

All consultations for Life or Limb cases should be coordinated through CritiCall Ontario:
1-800-668-4357

 Exceptions exist where established processes are already in place, e.g., Ontario Stroke Network, Primary Percutaneous Coronary Intervention STEMI Program.

Referring Physician:
- Request an internal consultation to confirm that the patient requires a higher level of care than the hospital is able to provide.
- Contact CritiCall Ontario to facilitate timely communication between referring physician and most appropriate consulting physician/service.
- Clearly communicate to the CritiCall Ontario call agent that the patient is a life or limb case and cannot be safely cared for at the hospital.

Consulting Physician:
- Respond to pages from CritiCall Ontario regarding a provisional life or limb case within 10 minutes.
- Provide medical consultation even if a bed or resources are not immediately available as the patient’s life or limb threatened condition is priority.
- Accept patients with life or limb threatening conditions that cannot be served by the hospital at which the patient is located, provided the clinical expertise is available.

LONG-TERM MECHANICAL VENTILATION
Toolkit for Adult Acute Care Providers
Critical Care Services Ontario | November 2013

TRAUma CENTRE Consultation GUIDELINES

These guidelines are meant to facilitate consultations and/or transfers with a trauma centre and should be applied using clinical judgement. Final decision to transfer remains at the discretion of the referring and receiving physicians.

The decision to transfer should be made within 1 hour.

All consultations with a TTL should be coordinated through CritiCall: 1-800-668-4357

ALL TRAUMA PATIENTS

For all paediatric and elective cases, contact CritiCall for the appropriate Trauma Centre.

Any patient with a major traumatic injury (severe multisystem; life–or-limb threatening single system) requiring trauma consultation or who requires more care than can be provided at the referring centre. Assessment of the ED physician. Not all patients with single system injuries will need to be transferred to a Level Trauma hospital. For additional details see the Long-Term Mechanical Ventilation Toolkit.

Anatomical Criteria (one or more of the following):
- Suspected (or known) spinal cord injury with paraplegia or quadriplegia
- Unstable fracture limited to the neck, spine, torso, or pelvis (e.g. crush or severe arthritis)
- Severe head injury (e.g., intracranial hemorrhage, skull fracture, severe diffuse axonal injury)
- Penetrating thoracic injuries with hemodynamic instability or significant hemothorax
- Major bowel or vascular injury
- Trauma with burn or inhalation injury

Physiological Criteria:
- GCS ≤ 8
- Significant alteration of consciousness due to trauma
- Hypotension (due to trauma) that is unresponsive or only transiently responsive to fluids
- Hypothermia

High risk considerations which may warrant transfer to a Level Trauma Centre at a lower threshold. These considerations include:
- Age > 55;
- Anticoagulation;
- Immunosuppression;
- Pregnancy; or
- Other significant medical problems.

A CT Scan may not always be required for the decision to transfer or will delay definitive management.

For any considerations, consult with on-call trauma team leader through CritiCall.

Refer to ABA (American Burn Association) Burn Centre Referral Criteria.

Please refer to the Neurosurgery Cranial and Spinal Consultation Criteria for isolated Cranial and Spinal Neurosurgical cases found on site.
1.2 – The Critical Care System Today

Since the SARS outbreak in 2003, critical care system leaders have collaborated, supported by CCSO, to systematically strengthen Ontario’s Critical Care System through implementation of Ontario’s Critical Care Strategy.

Health system partners are committed to delivering the highest quality, sustainable, and safe patient care. This commitment is met with the challenges of an aging population, increasing costs – particularly in relation to technologies and pharmaceuticals – and fiscal constraints. This commitment is also challenged by an increasing demand by citizens and government for greater engagement of patients and families, accountability and transparency in relation to health care spending, and the achievement of positive patient outcomes.

Ontarians expect and deserve a high performing critical care system. Critical care system leaders describe a fundamental shift in culture that has occurred as part of the system transformation to improve access, quality and system integration. This in turn ensures that patients are receiving the ‘right care’ at the ‘right time’ in the ‘right place’ by the ‘right providers.’

Deliberate focus and attention has been targeted to strengthening Ontario’s Critical Care System in the areas of:
1.3 – Composition of Ontario’s Critical Care System

The diagrams below provide an overview of the composition of Ontario’s Adult and Paediatric Critical Care System.

Ontario’s Critical Care System – Adult Bed Map (as of March 31, 2015)

Ontario’s Critical Care System – Paediatric Bed Map (as of March 31, 2015)
A Level 2 critical care unit is capable of providing service to meet the needs of patients who require more detailed observation or intervention such as support for a single failed organ system, short-term non-invasive or invasive ventilation or post-operative care. These units provide a level of care that falls between the general ward and a Level 3 critical care unit.

A Level 3 critical care unit is capable of providing the highest level of service to meet the needs of patients requiring support for multiple organ systems, which may involve invasive ventilatory support.

**Critical Care LHIN Leadership**

Critical Care LHIN Leaders provide local and regional system leadership for critical care services within each of the 14 LHINs through organized LHIN-based Critical Care Networks. The Critical Care LHIN Leaders are clinical experts mandated to:

- Plan and coordinate system-level and LHIN-level critical care service delivery;
- Monitor and measure performance to improve critical care services;
- Plan for critical care surge capacity;
- Forecast demand, allocate resources and set priorities with respect to services;
- Foster best practices and implementation of CCSO initiatives; and
- Represent the LHIN at the provincial level with respect to operational and planning issues in critical care.

The Critical Care LHIN Leaders work with local hospital and provincial partners to accomplish this mandate. They have direct accountability and report to their LHIN Chief Executive Officers (CEO).

**Surge Management**

Increases or surges in the demand for critical care services, whether through expected fluctuations or unpredictable events such as pandemics, could pose additional pressures on available capacity and impact the ability to deliver day-to-day necessary health care services. To meet this potential demand, the Provincial Surge Capacity Management Plan was implemented in March 2009. This plan offers health care providers a framework of principles and elements necessary to manage surges in demand for critical care resources in a timely and patient-focused manner, without compromising patient safety, emergency department wait times or surgical wait times. These surge plans are implemented at the critical care unit level (minor surge) or LHIN level (moderate surge), depending on the degree of patient care demand. CCSO works with the LHINs and CritiCall Ontario during a surge event to ensure patients have access to critical care and sub-specialty services. This ensures that intra-system support occurs seamlessly during periods of increased demand.

In 2009, the MOHLTC surveyed hospitals across Ontario to establish a comprehensive inventory of ventilators and found that there was a need for a provincial level stockpile of ventilators to support any potential significant and sudden demand for critical care and mechanical ventilation. In collaboration with the MOHLTC Emergency Health Services Branch, CCSO planned and implemented a procurement and distribution strategy to ensure that the province would be fully prepared in the case of a demand surge. The ventilator stockpile is distributed across 16 hospitals. Access to the stockpile is coordinated by CritiCall Ontario and is monitored by CCSO. Protocols, policy recommendations and adjustments are made as required.
**CritiCall Ontario**

CritiCall Ontario plays a central role in the critical care system. CritiCall Ontario offers a 24-hour-a-day emergency critical care coordination service for physicians across Ontario. This service facilitates medical advice, consultation and patient referrals for emergent, urgent and critically ill or injured patients. In addition, CritiCall Ontario supports CCSO by collecting and analyzing data from the CCIS, as well as their own database of information.

### 1.4 – About this Ontario Critical Care Plan

This plan builds upon the successes realized within Ontario’s Critical Care System during the past decade and will guide the work of CCSO and critical care system leaders over the next three years. While much has been achieved to strengthen Ontario’s Critical Care System, there continues to be areas for ongoing improvement and a means to address potential challenges within the health care environment.

After extensive consultation and input, this document will serve as the blueprint from which CCSO will continue to lead and work with health system partners at all levels to improve access, quality and system integration for the benefit of patients within Ontario’s Critical Care System. CCSO will continue to provide leadership in working with partners across the health care system to make enhancements and ensure value under these three tenets. Innovation, enhanced engagement of patients and families, fiscal stewardship and performance measurement will all be instrumental to achieving the desired outcomes of this plan.
Five Strategic Goals

This plan is comprised of five strategic goals with associated objectives.

Strategic Goal #1: Strengthen experience of patients and families in the critical care system
- Apply best practices to enhance patient and family experience
- Increase patient and family engagement in critical care system planning and performance management
- Measure and monitor patient and family satisfaction

Strategic Goal #2: Lead performance management in the critical care system
- Improve data quality in the Critical Care Information System
- Continue to measure performance in key program areas and leverage data for change
- Benchmark internationally with other critical care systems
- Lead system change and work with MOHLTC on advancing provincial policy related to critical care

Strategic Goal #3: Target patient flow and transition improvements in the critical care system
- Support a seamless continuum from acute to post-acute care
- Conduct system-wide capacity planning
- Promote the right level of care closest to home
- Foster repatriation strategies

Strategic Goal #4: Translate innovative and quality approaches to critical care delivery in Ontario
- Utilize patient outcomes research to inform improved critical care
- Develop knowledge translation products to support implementation of best practices

Strategic Goal #5: Advance development and utilization of interprofessional critical care teams
- Identify integrated care models and promote achieving full scope of practice
- Develop leadership skills in collaboration and partnerships

The CCSO Strategy Map on page 19 illustrates the goals and objectives of this plan.
The action plans for each of the strategic goals can be found in Part 3: Ontario Critical Care Plan.
Methodology for Development of the Ontario Critical Care Plan
Part 2: Methodology for Development of the Ontario Critical Care Plan

CCSO developed a new Ontario Critical Care Plan in collaboration with critical care system partners. The plan is based on a number of inputs including a literature review, stakeholder consultations, and capacity, utilization and forecasting analysis. The priorities of the MOHLTC, provincial health care organizations, and the LHINs were reviewed in order to ensure strategic alignment.

Literature Review

CCSO conducted a literature review to support the strategic planning process, the development of the capacity, utilization and forecasting analysis, and to supplement the stakeholder consultations. The literature review was guided by an interest in identifying the characteristics of high performing critical care and health care systems that could be applicable to Ontario’s Critical Care System and the development of this plan. More than 80 publications were reviewed. Some of the publications were specific to critical care, while others pertained to different health care environments. Evidence obtained from the literature review was used to inform the development of this plan.

Please see Part 6: Bibliography for a full list of resources included in the literature review.

Stakeholder Consultations

CCSO conducted stakeholder consultations to identify the needs of Ontario’s Critical Care System. Between July and September 2014, focus group sessions were held with representatives from each of the 14 LHINs, CCSO key program areas (Paediatric Critical Care, Neurosurgery, Trauma and Burns, and the Critical Care Nursing Committee), and other critical care system partners including CritiCall Ontario, Emergency Medical Services (EMS)/Ornge and clinical ethicists. More than 170 individuals provided valuable input regarding the current state of Ontario’s Critical Care System, including successes, challenges and opportunities for improvement.

Eight emerging themes were identified during the initial consultation and presented for additional feedback at a series of CCSO-led LHIN Town Hall Meetings in September and October 2014. More than 400 stakeholders attended the LHIN Town Hall Meetings and provided feedback that validated and enhanced understanding of key issues. CCSO then conducted a thorough analysis of each theme, focusing on strengths, weaknesses, opportunities and threats. From this exercise, the five overarching strategic goals that form the basis of this plan were identified. Priority initiatives to support these goals and that could be implemented within a three-year time frame in response to the needs of Ontario's Critical Care System were also identified.

Between December 2014 and February 2015, CCSO facilitated an additional consultation phase to obtain information from each of the LHINs regarding local plans and priorities for the next three years. As part of this process, Critical Care LHIN Leaders and LHIN office representatives completed and submitted a Critical Care Profile and Priorities Template. CCSO will retain a summary of the identified key areas of focus for each LHIN and these profiles will serve to support the development of future opportunities for strategic engagement and alignment.
During the same period, CCSO met with representatives from Provincial Neurosurgery Ontario, the Ontario Trauma Advisory Committee, and the Paediatric Critical Care Advisory Committee to obtain further insight into their priorities for the next three years. The respective program leaders completed a similar Profile and Priorities Template. These program profiles will serve as a checkpoint to monitor progress on system improvements across these provincial advisory committees.

**Capacity, Utilization and Forecasting Analysis**

Part 4: Capacity, Utilization and Forecasting Analysis contains an overview of the methodology related to the capacity, utilization and forecasting analysis.

**External Review and Approval Process**

Between March and May 2015, a draft of the emerging Ontario Critical Care Plan was sent to a broad group of stakeholders for further external review prior to final revisions. The final plan was brought forward to the CCSO Coordinating Committee for review and endorsement and then submitted to the MOHLTC for final endorsement.

Part 7: Appendix A contains a full list of stakeholders consulted throughout the strategic planning process.
Ontario Critical Care Plan
Part 3: Ontario Critical Care Plan

3.1 – Five Strategic Goals

The following section focuses on each of the five strategic goals and the initiatives that will support the achievement of these goals over the course of the next three years.

**Strategic Goal #1: Strengthen Experience of Patients and Families in the Critical Care System**

CCSO is committed to collaborating with system partners to strengthen the experience of patients who receive care in Ontario’s Critical Care System, as well as the experience of the families who are supporting their loved ones during this difficult time. Patients should receive the highest quality of care and, along with their families, have a positive experience throughout the time they spend in the hospital.

As part of Strategic Goal #1, CCSO will be concentrating on three main areas: patient and family experience, engagement and satisfaction. During the external consultation phase, stakeholders clearly identified that patients are receiving the ‘right care’ at the ‘right time’ in the ‘right place’ by the ‘right providers,’ but that the experience of patients and families should be strengthened. It was evident that some hospitals have patient and family representation on their advisory committees, while others have not yet moved in this direction. Stakeholders expressed significant interest in adopting a standardized resource or tool that would support the measurement of patient and family satisfaction in critical care units. While tools are already in place in some units, a standardized approach would be a positive step towards developing consistency across all Ontario critical care units in terms of data collection and comparison of indicators that are important to patients and their families.

CCSO has identified several opportunities for system-wide improvements. One area of focus is creating provincial resources that can be utilized hospital-wide in order to share best practices with the field. An example of such an initiative is the development of a standardized orientation package that can be provided to patients and families at the time of admission to an intensive care unit. This information guide could clarify what patients and families can expect and help ease the transition process. According to The Beryl Institute, patient experience can be defined as, “The sum of all interactions, shaped by an organization’s
culture, that influence patient perceptions across the continuum of care.” As such, patient (and family) experience encompasses more than the actual care experience.

Another area of focus is increasing patient and family engagement. Since patients and families bring a unique perspective, their contribution at the system level is an asset and could ultimately improve future patient and family experiences in Ontario’s Critical Care System. According to the Canadian Foundation for Healthcare Improvement, “Co-designing improvements with patients and families leads to new insights and better results than providers and leaders working on their own.” Thus, patient and family engagement is a gateway to innovation. With this in mind, CCSO has identified several opportunities for improvements, including exploring best practice models for involving patients and families in critical care system planning and performance management. The identified best practice models could be applied broadly.

The third area of focus is measuring patient satisfaction. CCSO will conduct a literature review to identify best practices for measuring patient satisfaction within a critical care environment. Subsequently, a critical care patient satisfaction tool, with input from providers, can be developed and utilized across the province. According to the National Health Service (NHS) Institute for Innovation and Improvement in the United Kingdom, “The data that is collected from patients can help [organizations] to make better decisions about how to improve services.” As such, measuring and monitoring patient satisfaction adds a new dimension to unit and system leadership in critical care.

CCSO has established the following action plans for implementation over the next three years to strengthen the experience of patients and families in Ontario’s Critical Care System.

### Action Plans to Achieve Strategic Goal #1

- Identify best practices in the literature and current practices in the critical care system related to patient and family experience.
- Conduct focus groups and advisory panels to identify what matters most to patients and families within the critical care environment.
- Develop educational tools related to patient and family engagement within the critical care environment.
- Develop, implement and evaluate a critical care patient and family satisfaction tool. Develop targets and report on results to the field.

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Strategic Goal #2: Lead Performance Management in the Critical Care System

CCSO is committed to leading performance management in Ontario’s Critical Care System. A key objective is to strive for a high reliability system across Ontario’s critical care service providers. At all levels of the system, data can be used to drive change. The availability of reliable and accurate information is fundamental to achieving a high performing and sustainable critical care system.

While significant enhancements and developments have occurred in relation to benchmarking processes and the availability of reliable and accurate data, there is a need to further assess the quality, quantity, availability and timeliness of the data. To that end, CCSO has developed a three-year Information Management Strategy to meet the ongoing information needs of CCSO and Ontario’s Critical Care System. This strategy was developed following an assessment of the information that is required to meet the current and future needs of critical care system partners. The analysis included the identification of areas of improvement in accessing and managing information across data sources. The strategy will guide the structures and processes that will address the needs and priorities of CCSO and its system partners.

### Critical Care Scorecard

**Adult Critical Care Units**

The Critical Care Strategy aims to improve quality and access, and work better as a system.

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>OBJECTIVE</th>
<th>PERFORMANCE MEASURE</th>
<th>Baseline</th>
<th>Most Recent</th>
<th>Target</th>
<th>Status</th>
<th>Trend</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUALITY</td>
<td>Deliver Safe Care</td>
<td>CRT Rate</td>
<td></td>
<td></td>
<td>CRT</td>
<td></td>
<td></td>
<td>CCS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ICU Rate</td>
<td></td>
<td></td>
<td>ICU</td>
<td></td>
<td></td>
<td>CCS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Incidence Rate - Unplanned Extubation</td>
<td></td>
<td></td>
<td>ICU</td>
<td></td>
<td></td>
<td>Hospital data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hand Hygiene Compliance (before patient contact)</td>
<td></td>
<td></td>
<td>CCIS</td>
<td></td>
<td></td>
<td>Hospital data</td>
</tr>
<tr>
<td></td>
<td>Deliver Effective Care</td>
<td>ADU Rate</td>
<td></td>
<td></td>
<td>ADU</td>
<td></td>
<td></td>
<td>CCS</td>
</tr>
<tr>
<td></td>
<td>Enhance Staff Competency</td>
<td>% Nurses with Critical Care Training</td>
<td></td>
<td></td>
<td>% Nurses</td>
<td></td>
<td></td>
<td>Hospital data</td>
</tr>
<tr>
<td>ACCESS</td>
<td>Provide Timely Care</td>
<td>Admission to Bed (90 minutes)</td>
<td></td>
<td></td>
<td>Admission to Bed (90 minutes)</td>
<td></td>
<td></td>
<td>Hospital data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% of Beds not Available</td>
<td></td>
<td></td>
<td>% of Beds not Available</td>
<td></td>
<td></td>
<td>CCS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Night-time Discharge Rate</td>
<td></td>
<td></td>
<td>Night-time Discharge Rate</td>
<td></td>
<td></td>
<td>CCS</td>
</tr>
<tr>
<td>SYSTEM</td>
<td>Optimize Patient Flow</td>
<td>ICU Average Length of Stay (Days)</td>
<td></td>
<td></td>
<td>ICU Average Length of Stay (Days)</td>
<td></td>
<td></td>
<td>CCS</td>
</tr>
<tr>
<td>INTEGRATION</td>
<td></td>
<td>Avoidable Days Rate</td>
<td></td>
<td></td>
<td>Avoidable Days Rate</td>
<td></td>
<td></td>
<td>CCS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% of Chronically Ventilated Patients (&gt; 21days)</td>
<td></td>
<td></td>
<td>% of Chronically Ventilated Patients (&gt; 21days)</td>
<td></td>
<td></td>
<td>Hospital data</td>
</tr>
</tbody>
</table>

**Quality:** A high quality health care system is one that is “accessible, appropriate, effective, efficient, integrated, patient-centred, population health focused and safe” (ECFRAA, 2010). All Ontarians should receive the high quality healthcare they need based on the best available scientific information, when they need it. People should not be harmed by an accident or mistakes when they receive care and the system should have appropriately qualified providers and adequate facilities to look after people’s health needs (Quality Improvement Guide, 2012).

**Access:** The right care at the right time in the right setting by the right healthcare provider (Quality Improvement Guide, 2012). Ontarians should be able to get timely and appropriate healthcare services in order to achieve the best possible health outcomes. People should receive the same quality of care regardless of who they are and where they live (Quality Improvement Guide, 2012).

**System Integration:** The province’s health system needs to focus on supporting seamless transitions between health care providers (inter-disciplinary and cross-functional) throughout a patient’s continuum of care. All parts of the healthcare system should be organized, connected and work collaboratively with other healthcare partners to develop a fully integrated system that can provide high quality care (Quality Improvement Guide, 2012). The use of modern information technology is a key enabler to providing quality health care. Organizations within the health system need to embrace and harness the power of information and technology to improve patient care.
The initiatives CCSO will be undertaking are informed by the stakeholder feedback received during external consultations. For example, the Critical Care Unit Scorecard and the Critical Care Information System (CCIS) reports are two data sources that are regularly accessed to understand performance. Stakeholders seek to understand performance relative to their own organizations and with comparator units across the province. The Critical Care Peer Group delineation is viewed as an improvement in understanding performance relative to comparator units/organizations. This understanding provides the opportunity for sharing of best practices to further strengthen the provision of critical care within the province.

Similarly, a recent evaluation of CCIS, shared with stakeholders during the CCSO-led LHIN Town Hall Meetings in September/October 2014, identified opportunities and areas for improvement in the system and the collection of data. This evaluation of CCIS will serve as the foundation for ongoing collaboration with the CCIS Advisory Committee to inform enhancements to CCIS and related reports.

Performance management has been embedded as a primary focus for each of the key program areas supported by CCSO. Provincial Neurosurgery Ontario, the Ontario Trauma Advisory Committee and the Paediatric Critical Care Advisory Committee have selected indicators and targets to measure performance within their respective specialties. These indicators and targets have been identified through consensus based on best evidence. To further support these key program areas, reports are now being provided by CCSO in partnership with CritiCall Ontario. This is a key enabler to understanding successes and gaps within the system and affirms the commitment to quality improvement initiatives for enhanced performance and positive patient outcomes.

CCSO will continue the development of a province-wide system for critical care performance measurement and quality improvement. This includes fostering innovative approaches to achieve quality benchmarks and a continued culture of accountability and performance improvement in critical care services within Ontario.

CCSO has established the following action plans for implementation over the next three years to lead performance management in Ontario’s Critical Care System.

**Action Plans to Achieve Strategic Goal #2**

- Identify best practices for public reporting of critical care performance data. Incorporate a cross-jurisdictional comparison into the provincial critical care scorecard.
- Continue to evaluate the existing critical care scorecards and implement enhancements as required.
- Identify additional metrics to move towards a truly balanced scorecard and reports, including patient and family satisfaction.
- Establish targets for all metrics in all critical care scorecards and reports.
- Lead system change and work with the Ministry of Health and Long-Term Care on advancing provincial policy related to critical care.
Strategic Goal #3: Target Patient Flow and Transition Improvements in the Critical Care System

1. Strengthen experience of patients and families in the critical care system
2. Lead performance management in the critical care system
3. Target patient flow and transition improvements in the critical care system
4. Translate innovative and quality approaches to critical care delivery in Ontario
5. Advance development and utilization of interprofessional critical care teams

CCSO is committed to collaborating with our partners to target patient flow and transition improvements in Ontario’s Critical Care System. It is important that patients who rely on critical care services continue to receive the ‘right care’ at the ‘right time’ in the ‘right place’ by the ‘right providers.’

During external consultations, stakeholders described challenges with respect to balancing competing priorities for beds and the “constant juggling” that occurs on a regular basis between operating rooms (ORs), critical care units, emergency departments (EDs), inpatient beds and scheduled care. Of particular concern is the number of patients in a critical care bed awaiting transfer to a different level of care. In Ontario, it is reported that inpatient acute care beds can have an occupancy rate of patients identified as requiring an Alternate Level of Care (ALC) from 6.2% to a high of 27%. ALC rates vary by LHIN and are impacted by local issues.4 However, the pressures related to ALC bed occupancy impact the ability to transfer patients out of critical care units. According to the Institute for Healthcare Improvement (IHI), “the emergency department, intensive care unit, and operating rooms and their related pre- and post-care areas tend to be areas of bottlenecks because they are non-interchangeable resources. Reducing delays and unclogging bottlenecks depends on assessing and improving flow between and among these departments, and throughout the entire system, rather than in isolated departments.”5

Stakeholders affirmed the importance of CCSO-led initiatives such as the Life or Limb Policy, Repatriation, Surge Management Protocols, Critical Care Response Teams (CCRTs), and the consultation guidelines for trauma and neurosurgical patients. These strategies have positively impacted the critical care system and it is clear that no single strategy will ensure the appropriate movement of patients through the health care system. Collectively these strategies demonstrate the creation of partnerships and collaborations in addressing unit, hospital and/or system level challenges that impede effectiveness, access and system integration.

A number of issues were identified that impact access to critical care resources and the flow of patients. While there is great concern about patients occupying critical care beds awaiting transfer to a different level

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of care, ALC is a patient flow issue across several points in the continuum of care. Discussions focused on how to improve the system and where further attention should be directed including:

- Patient repatriation to the most appropriate setting “closest to home”;
- Timely access to inpatient acute care beds and to appropriate rehabilitation programs when the need for critical care has ended; and
- Support for patients and families transitioning out of the critical care environment.

There was strong agreement among stakeholders that the Life or Limb Policy has strengthened Ontario’s Critical Care System to ensure efficient and effective patient transport for the most critically ill patients. There is also agreement that the repatriation component of the policy is a good first step in supporting health care providers to facilitate the repatriation of patients to the most appropriate setting “closest to home.”

The repatriation of patients is a vital component to ensuring the availability of critical care resources when they are required. Opportunities for ongoing focus and improvement in repatriation include the following: 1) timely access to the most appropriate transportation methods and the appropriate personnel to accompany patients. This is compounded by an unpredictability of when these resources will need to be accessed, and 2) prioritization of the repatriation of patients in relation to competing demands for inpatient beds by patients awaiting transfer out of EDs, ORs, and critical care units. There is an appetite by stakeholders for the development of a provincial strategy for the transport of non-critically ill patients at all points along the patient transport continuum, such as repatriation and inter-facility transport. Critical care system partners can contribute to the strategies that will positively address this situation.
Critical care system stakeholders identified the period of transfer out of the ICU as a particularly stressful time for both patients and families. Many studies have been undertaken to better understand the psychological and physical impact experienced by family members of critical care patients. Anxiety, depression, and stress or symptoms of acute stress disorder (ASD), posttraumatic stress disorder (PTSD), and posttraumatic stress reaction (PTSR) have all been reported. The time of transfer out of the ICU, while considered a positive indication that the patient’s health status is improving, can be extremely stressful for patients and families. The literature is replete with documentation from interviews with patients and families about transfer out of the ICU to the hospital ward. These interviews include feelings of sudden abandonment, vulnerability and helplessness, lack of importance, and ambivalence about the entirety of the ICU experience. Stakeholders within Ontario’s Critical Care System identified similar themes and characteristics amongst their own patients and families and indicated they focus a significant component of their practice on supporting the psychosocial needs of patients and families.

Critical Care Response Teams are an enhancement to the system and an excellent strategy to support patients and families at the time of transition out of the ICU. These teams conduct post-ICU discharge follow-up visits. This process increases the families’ confidence that the patient will continue to be monitored by the critical care staff as appropriate.

Other transition points identified through the stakeholder consultations (including acute care to rehabilitation, paediatric to adult care, and hospital to home) were also cited as contributors to stress and anxiety experienced by patients and their families.

One subset of the ALC cohort are those patients awaiting access to both inpatient and outpatient rehabilitation services. Neurosurgical and trauma patients are two key populations within this ALC cohort.

Over the past few years there has been an increased focus on establishing an inclusive trauma system in Ontario that can improve functional outcomes following serious traumatic injury. The trauma literature suggests that timely access to rehabilitation services reduces length of stay, hospital costs, and improves patient outcomes in areas such as cognition and functional independence. An essential component of the trauma system is access to rehabilitation services.

Additional inpatient and outpatient rehabilitation services are required to keep pace with patient needs so that neuro cognitive and physical functions can be maximized through active rehabilitation. Improvement in the early identification of patients for rehabilitation and access to rehabilitation services will improve patient flow and avoid unnecessary readmissions or a longer length of stay.

Across the province there is a clear opportunity for standardizing an approach to support patients and families at the various transition points along their journey. This can be accomplished by sharing best practices and implementing strategies proven to be effective and which inform further innovation.

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It is essential that critical care system leaders continue to develop partnerships, look for new ways to work together and identify alignment opportunities to sustain the gains that have already been achieved. The values and principles within Ontario’s Critical Care System have fostered a strong spirit of collaborations and partnerships at both the local and system levels to support the flow and transitions of patients to the appropriate level of care.

CCSO has established the following action plans for implementation over the next three years to target patient flow and transition improvements in Ontario’s Critical Care System.

**Action Plans to Achieve Strategic Goal #3**

- Develop and implement a performance management framework and quality improvement plan for repatriation in collaboration with CritiCall Ontario and health system providers.
- Develop collaboratives and partnerships with other provincial initiatives related to repatriation, alternate level of care in critical care and inter-facility transfers to ensure care coordination, integration and sustainability.
- Develop a framework and improve access to rehabilitation or post-acute care for critical care patients.
- Continue the collaboration between CCSO, CritiCall Ontario and transport providers to improve data integration and patient flow.
Strategic Goal #4: Translate Innovative and Quality Approaches to Critical Care Delivery in Ontario

CCSO is committed to collaborating with system partners to translate innovative and quality approaches to critical care delivery in Ontario. It is important that clinical best practices are identified, disseminated and integrated across Ontario’s Critical Care System so that patients receive the safest and highest quality of care.

CCSO’s provincial mandate and experience in bringing system providers together creates opportunities to promote quality and innovation in patient care. Collaborations with groups including the Canadian Critical Care Knowledge Translation Network – aC3KTion Net – helps identify evidence-based best practices for critical care and mechanisms to improve implementation of these practices at the bedside. Annually, CCSO collaborates with the Ontario Hospital Association (OHA) to deliver educational conferences for care providers. CCSO will continue to work with care providers to develop educational resources and knowledge translation tools, based on clinical best practices, such as the 2013 Long-Term Mechanical Ventilation Toolkit for Adult Acute Care Providers and the 2014 Guidelines for Basic Adult Neurological Observation. Knowledge translation will continue in all CCSO program areas and provincial advisory committees (Paediatric Critical Care Advisory Committee, Provincial Neurosurgery Ontario, Ontario Trauma Advisory Committee, and the Critical Care Nursing Committee).

According to the Canadian Institutes of Health Research, “knowledge translation (KT) is defined as a dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system.” Knowledge translation is not only the sharing of actionable information, but also the implementation. CCSO will strengthen our focus on knowledge translation strategies to promote quality, innovation and system change.

In keeping with this, the strategic planning consultation process identified some patient populations with unique considerations in their care management, such as the long-term mechanically ventilated patient population. It was also identified that some system-level planning may be needed for coordinating access to critical care technologies such as extracorporeal membrane oxygenation (ECMO). In addition, while there is some awareness of the long-term physical and psychological outcomes patients may experience after receiving

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critical care, there is a need to bring greater attention to these issues. Care providers are interested in learning more about post-intensive care unit outcomes for patients and seek to improve rehabilitation outcomes.

CCSO will lead a variety of new initiatives aimed at improving quality and innovation in patient care. CCSO will review current demand and capacity for ECMO and supporting services in the province to identify strategies to address potential system gaps. Issues surrounding intensive care unit survivorship will be reviewed, recognizing that patients may experience a range of short and long-term adverse outcomes after they undergo critical care. There is an expanding body of literature documenting these outcomes and implications for clinical practice. Herridge et al. emphasize that, “A potential gain in short-term survival must be weighed against the likelihood of a potentially difficult and protracted ICU course and long-term expectations for survival and quality of life.”

CCSO has established the following action plans for implementation over the next three years to translate innovative and quality approaches to critical care delivery in Ontario.

**Action Plans to Achieve Strategic Goal #4**

- Review the critical care outcomes literature to identify care practices that promote the best possible patient outcomes in hospital and following discharge.
- Collaborate with system experts to identify priorities for improvement in critical care patient outcomes in Ontario hospitals.
- Identify opportunities for knowledge translation that will lead to improvements in care for critically ill patients.
- Identify existing models of care or programs that improve the care of the long-term mechanically ventilated patients. Develop knowledge translation strategies.
- Review current demand and capacity for specialized technologies to support critically ill patients.
- Continue to make improvements in the areas of neurosurgery, trauma and burns, and paediatric critical care in Ontario. Provincial program profiles and associated action plans for Provincial Neurosurgery Ontario, the Ontario Trauma Advisory Committee and the Paediatric Critical Care Advisory Committee can be found in sections 3.3, 3.4 and 3.5 respectively of this plan.

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Strategic Goal #5: Advance Development and Utilization of Interprofessional Critical Care Teams

CCSO is committed to collaborating with system partners to advance development and utilization of interprofessional critical care teams. Interprofessional teams are integral in the care model for delivery of critical care. A renewed focus on all aspects of the care team is required, including professional collaboration, practices and human resources planning for the efficient provision of critical care services. The Critical Care Networks established in each LHIN will help to develop these ideals.

CCSO will be undertaking initiatives consistent with the feedback received from stakeholders during the external consultation phase. While there is variation in the staffing complement and staff mix across hospitals, interprofessional critical care teams are supporting patients and families. System capacity investments, such as Critical Care Response Teams and the Nurse Training Fund, are valued by the field. Targeted strategies such as funded positions, including Neuro-Nurse Educators and Clinical Nurse Specialists-Outreach, have also been cited as assets.
The health care literature supports interprofessional teams as enablers for successful models of care delivery. Several publications describe the role of interprofessional teams in advancing unit and system performance, particularly in terms of patient safety and care outcomes. In the World Health Organization (WHO) Framework for Action on Interprofessional Education and Collaborative Practice, the authors note that “Collaborative practice strengthens health systems and improves health outcomes.”10 In a recent study that focused specifically on critical care, a group of researchers affirmed that “An interprofessional approach is recognized as an essential feature of effective health care delivery and may be especially important in the intensive care unit (ICU) due to the complex clinical needs of critically ill patients.”11

CCSO has identified several opportunities for action to advance development and utilization of interprofessional critical care teams. One area of focus is developing a critical care workforce profile for health care professionals outside of the physician and nursing roles. This will serve as a system inventory and enhance understanding of the composition of the workforce, enabling a holistic analysis of current and future gaps in health human resources capacity. Another area of focus is creating supporting materials for interprofessional critical care team members, building on the success of previous CCSO-led initiatives such as the Standards for Critical Care Nursing in Ontario. These efforts will support interprofessional critical care teams across the province and promote consistency in care. Finally, CCSO will continue to lead the development of interprofessional Critical Care Networks at the LHIN level to support performance management and priority setting.

CCSO has established the following action plans for implementation over the next three years to advance development and utilization of interprofessional critical care teams.

### Action Plans to Achieve Strategic Goal #5

- Develop, implement and evaluate strategies to maximize LHIN-based critical care networks to promote interprofessional collaboration and health service provider system effectiveness.
- Expand critical care workforce profile for health care professionals outside of the physician and nursing roles such as respiratory therapists, physiotherapists, dietitians and pharmacists.
- Identify educational tools, communication strategies and models of care delivery that help to strengthen collaborative interprofessional models and partnerships.

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3.2 – Summary of LHIN Critical Care Profiles and Three-Year Priorities

In November 2014, CCSO contacted each of the LHINs regarding local plans and priorities for the next three years. A Critical Care Profile and Priorities Template was developed and then completed by Critical Care LHIN Leaders and LHIN office representatives on behalf of each LHIN. Information on the following topics was provided:

a) The critical care network structure within their LHINs;
b) The integration of critical care units across their LHINs;
c) Human resource challenges in moving to or sustaining intensivist-led units;
d) Human resource planning priorities;
e) Emerging trends within critical care and strategies to address these trends;
f) Capital projects underway or planned within the next three years; and
g) The critical care priorities within their LHINs over the next three years.

Please refer to Part 7: Appendix C to review the template outline.

Governance

All LHINs have a formal structure in place to monitor their regional critical care system and support the implementation of Ontario’s Critical Care Strategy. This structure is in the form of a committee or council, with membership comprised of clinical and administrative representatives from both academic and community centres that provide critical care services, as well as staff from the local LHIN office. Some LHINs have representation from CritiCall Ontario. There are also ad hoc individuals who attend these meetings to present on specific local issues. Most committees meet three to four times annually, face to face and/or through video/teleconferencing. The primary purpose of these committees is to strengthen the critical care system within each LHIN through joint planning, service delivery, performance measurement and management, knowledge transfer and implementation of clinical best practices. The committees also provide a forum to promote inter-hospital cooperation, ensure efficiency in resource utilization and a mechanism for problem solving. There are annual work plans/priorities established and accomplished through network activity. These work plans/priorities are aligned with the provincial critical care priorities and also with other local LHIN priorities.

In addition to the LHIN committees, the Critical Care LHIN Leaders have mechanisms in place to meet with individual hospital representatives. These meetings focus on specific performance measurement results such as the Critical Care Unit Scorecard and Critical Care Information System (CCIS) reports. The Critical Care LHIN Leader works in collaboration with hospitals to report and communicate variances from targets (both positive and negative), potential reasons for these variances and together develop strategies to sustain the gains or resolve the issue.

Many of the Critical Care LHIN Leaders meet with their respective LHIN CEOs on a monthly or quarterly basis. The purpose of these meetings is to review performance metrics and discuss issues related to quality
of care and service integration. Strong relationships have been established between the Critical Care LHIN Leaders and LHIN office staff that support the work of the LHIN.

**Critical Care Unit Integration**

The LHINs are committed to patients receiving the ‘right care’ at the ‘right time’ in the ‘right place’ by the ‘right providers.’

All LHINs report that their critical care units/partners actively support the transfer of Life or Limb threatened patients in accordance with the provincial Life or Limb Policy guidelines. Patients are also transferred in a timely manner to ensure access to regional specialty services (such as cardiac, stroke and neurosurgery) or for reasons related to capacity pressures. Many of the LHINs have formal repatriation agreements/processes in place between centres to ensure that patients are receiving care in the ‘most appropriate facility, which is closest to home’, once the need for specialty services has concluded. A number of LHINs have implemented Extramural Critical Care Response Teams or Virtual ICUs to connect smaller, community centres with intensivists, and other members of the health care team, in larger centres. There is regular movement of patients between Level 2 and Level 3 critical care units and the LHINs have a variety of innovative ways to achieve these transitions based on local conditions. A ‘Hub and Spoke’ model is in place in some hospitals whereby Level 3 critical care units support Level 2 critical care units by providing direct clinical advice. This promotes sharing of protocols and policies and may prevent the need for transfer to another centre in some circumstances.

There is a strong commitment and willingness to ensure the maximization of human resources and capital equipment between sites and centres, however there is variance across the LHINs related to the movement of these resources. The merging of hospitals into multi-site corporations/entities has enabled an environment of collaboration and ongoing communication. The implementation of the Provincial Ventilator Stockpile is a key strategy to reduce the movement of capital assets between critical care units and hospital sites. Other capital assets were not addressed in the responses.

The sharing of human resources at the bedside varies depending on local union/collective agreements. There are reports of staff movement across units within the same hospital site but generally not across hospital sites within the same organization.

The responses indicate a high level of engagement of health professionals across the LHINs. Annual conferences targeted at specific disciplines or interdisciplinary teams are occurring in the vast majority of LHINs.

**Health Human Resources – Challenges and Priorities**

The model of care within Level 2 and 3 ICUs in Ontario, where local factors support it, is the intensivist-led model utilizing a high performing interprofessional critical care team.

Many ICUs within the province are intensivist-led while others are working towards this goal. A number of hospitals have a ‘hybrid’ model with the intensivist providing coverage during the day and an alternate physician providing coverage at night. Barriers to becoming intensivist-led are related to issues such as critical mass (for instance, a unit with less than 8-10 beds), the ability to provide 24/7 intensivist coverage,
physician remuneration models and the ability to attract intensivists to units that are in community hospitals and/or rural areas of the province. There is recognition that there needs to be a deliberate approach to ‘matching’ intensivists with their base specialty.

A number of LHINs reported concerns regarding registered nurse staffing as a result of pending retirements and/or limited full-time vacancies. The latter is of particular concern within smaller hospitals in the province due to the movement of nurses, once trained, to larger hospitals where they can secure full-time employment. The provincial Nurse Training Fund is a critical success factor in stabilizing the nursing workforce.

The availability of a dedicated critical care team of allied health professionals is varied across the province. Many hospitals report sharing of staff within sites and on-call availability at night to support critical care unit staffing. There is limited movement of any staff between hospital sites largely due to local union collective agreements. Some LHINs report issues with surge capacity within smaller units. Specifically, when there is a need to implement surge plans, there are inadequate numbers of critical care trained staff to support the plans. Leadership training is required to ensure there is succession planning for current critical care system leaders that are planning to retire. Additionally, ongoing training and professional development for nurses and allied health professionals is declining due to continued fiscal constraints. It is widely recognized that this type of funding needs to be supported to ensure high performing critical care teams are available.

A number of strategies were identified as important to stabilizing and supporting the critical care trained workforce including:

- ‘Best practice’ approaches to staff recruitment and retention;
- Focused attention at the unit level to ensure engagement of front-line staff in initiatives such as quality improvement, unit functioning activities and leadership development;
- System-level orientation and training for nurses and allied health care personnel;
- Further exploration and development of the utilization of advanced practice roles such as nursing, respiratory therapy and physiotherapy;
- Strengthened collaboration with colleges and universities to increase the number of ICU student placements and critical care training programs opportunities; and
- Further exploration and development of the model of ‘cross-hospital coverage’ for critical care trained physicians to support the 24/7 intensivist-led ICU model, facilitate standardization of clinical practices, and ensure coverage.

**Emerging Trends and Planned Strategies**

The aging population and increasing patient acuity are identified by all LHINs as major contributors to the current and future need for and utilization of critical care resources. They also identified an important trend of cultural diversity and the impact this might have on how care is delivered. Further they add this is compounded by increasing treatment options and patient and family expectations.

The majority of LHINs identified the long-term mechanically ventilated patient population as a group that requires focused attention and innovative approaches to care. These patients are often cared for in
the ICU, after the acute phase of critical care has ended. There is a need to collaborate with rehabilitation and community agencies to support the care of these patients in their own home or in supportive housing environments. There is early work in a number of LHINs that are implementing these strategies.

The implementation of Extramural Critical Care Response Teams in select LHINs is a mechanism to ensure appropriate patient transfer to specialty services and support patient care in the ‘hospital closest to home.’ A number of LHINs identified the desire to implement similar models of care.

The Virtual Critical Care (VCC) Program is an expanded concept to the model of consultation and care for critically ill patients providing interprofessional team support on a day-to-day basis. This strategy has been implemented in the North East LHIN and after evaluation, fitness for application across other LHINs will be determined.

Timely patient repatriation was identified as a key enabler to support patient-centered care, patient flow and the appropriate utilization of critical care resources. Further exploration of mechanisms to enhance non-urgent patient transport, both in terms of transport mechanisms and the appropriate personnel to accompany patients is required.

Specific clinical best practices and protocols were identified as priorities for action and implementation. These included antimicrobial stewardship programs, delirium prevention, early mobilization strategies, development of order sets, emerging trends in the treatment of Acute Respiratory Distress Syndrome (ARDS), and point of care technologies.

All LHINs report the need for continued vigilance in response to pandemics, as well as the development and refinement of infection and control management strategies. Central to this is the continued review and ‘rehearsal’ of the surge plans already in place.
Three-Year LHIN -Specific Priorities for Critical Care

The table below is not exhaustive and has been developed based on specific identification of LHIN priorities by Critical Care LHIN Leaders and LHIN constituents. There are many other important critical care initiatives occurring within LHINs to address their individual local issues.

<table>
<thead>
<tr>
<th>LHINs</th>
<th>Priorities 2015-2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>All LHINs</td>
<td>Continue to participate in performance management initiatives to drive decisions to improve quality and maintain best practices – repatriation, Life or Limb Policy, scorecards, CCIS reports, iCORE</td>
</tr>
<tr>
<td>LHINs 1, 2, 4, 5, 6, 7, 8, 9</td>
<td>Long-term ventilated patients – develop and refine hospital and community based strategies to enhance the management of this patient population</td>
</tr>
<tr>
<td>LHINs 2, 3, 5, 6, 7, 8, 9, 13</td>
<td>Repatriation – continue to develop, refine and enhance the strategies to support timely and efficient patient repatriation within and across LHINs</td>
</tr>
<tr>
<td>LHINs 2, 9, 11, 12, 13, 14</td>
<td>Leverage technology to support patient care and LHIN-wide educational initiatives, e.g. telemedicine, Virtual Critical Care, teletrauma, EMR, extramural CCRTs</td>
</tr>
<tr>
<td>LHINs 3, 4, 5, 11, 12, 14</td>
<td>Standardize selected protocols and develop clinical best practices at the LHIN and provincial level e.g. sedation scales, daily spontaneous breathing trials, early mobilization, gentle persuasive approaches, early warning systems, organ donation</td>
</tr>
<tr>
<td>LHINs 1, 4, 6, 11</td>
<td>Prepare for disaster or pandemic events through surge management planning and mock surge exercises at the unit and LHIN levels</td>
</tr>
<tr>
<td>LHINs 1, 2, 3, 8</td>
<td>Facilitate LHIN-wide educational events – interdisciplinary and/or profession specific</td>
</tr>
<tr>
<td>LHINs 4, 5, 9, 13</td>
<td>Critical Care Transport – continue to develop, refine and enhance strategies to support timely and efficient transport of critically ill patients</td>
</tr>
<tr>
<td>LHINs 4, 6, 11</td>
<td>Develop and refine strategies to enhance the patient experience, support patient and family engagement, and measure patient satisfaction</td>
</tr>
<tr>
<td>LHINs 1, 3, 4</td>
<td>Review Level 2 ICU capacity and function</td>
</tr>
<tr>
<td>LHINs 3, 11</td>
<td>Implement intensivist-led ICUs</td>
</tr>
<tr>
<td>LHINs 2, 3, 11</td>
<td>Manage patients requiring ECMO – identify appropriate supports to create an integrated system of care for this patient population</td>
</tr>
<tr>
<td>LHINs 2, 4, 9</td>
<td>Access and Flow – continue to develop, refine and enhance strategies to support efficient, timely and effective access to, and flow through, Ontario’s Critical Care System</td>
</tr>
<tr>
<td>LHINs 8, 9, 12</td>
<td>Conduct health human resource planning to meet current and emerging challenges, e.g. interprofessional care, staffing models, attrition, retirement, medical manpower</td>
</tr>
<tr>
<td>LHINs 1, 5, 6</td>
<td>Complete capital build projects to increase critical care capacity</td>
</tr>
<tr>
<td>LHINs 4, 9</td>
<td>Critical Care Response Teams – continue to implement new teams and enhance existing teams</td>
</tr>
<tr>
<td>LHINs 5, 9</td>
<td>Pursue clinical best practice for end-of-life care</td>
</tr>
<tr>
<td>LHIN 2</td>
<td>Manage patients with a diagnosis of status epilepticus – identify appropriate supports to create an integrated system of care for this patient population</td>
</tr>
<tr>
<td>LHIN 7</td>
<td>Extra-Corporeal Life Support Initiative</td>
</tr>
<tr>
<td>LHIN 9</td>
<td>Develop LHIN centers of excellence for rescue respiratory therapies, e.g. HFO, hemolung</td>
</tr>
<tr>
<td>LHIN 7</td>
<td>Review and increase as appropriate Level 3 capacity</td>
</tr>
</tbody>
</table>
3.3 – Provincial Neurosurgery Ontario: Profile and Action Plans

Background

Over the last decade, access to urgent and emergent neurosurgical care has experienced mounting pressures such as the increasing cost of medical technologies, increasing complexity of patients, increased demand for non-emergent neurosurgical procedures, the availability of health human resources to manage demand, complexity of transferring critically ill patients and accountabilities of programs providing this level of care. This resulted in patients requiring urgent or emergent neurosurgical consultations and interventions sometimes being transferred out of province or out of country. These pressures highlighted challenges and opportunities for improvement within Ontario’s health care system.

In 2007, the Neurosurgical Expert Panel, chaired by Dr. James Rutka, presented the Ministry of Health and Long-Term Care (MOHLTC) with a report highlighting pressures in the neurosurgical system and made recommendations to improve the delivery of neurosurgical services throughout the province. While some progress was made after the release of the Expert Panel Report, Ontario’s neurosurgical system continued to grapple with challenges within the province, causing patients to experience significant delays in accessing life-saving neurosurgical service, ultimately resulting in poor patient outcomes.

In 2010, the Office of the Chief Coroner of Ontario released a report with recommendations further supporting the establishment of an integrated system approach in providing access to critically ill patients requiring urgent and emergent neurosurgical services. Critical Care Services Ontario (CCSO) was asked by the MOHLTC to review the reports making recommendations for improving access to neurosurgical services and in collaboration with health care providers, develop integrated solutions to achieve improvements. In 2011, a stakeholder group was formed, and building upon the work of the Expert Panel, CCSO submitted a Final Report proposing 25 comprehensive action items to improve neurosurgical care in Ontario. The work was aligned with improving access, quality of care and system integration, and focused on:

- Organizing services on a regional and provincial basis;
- Creating service level expectations and solid provincial on-call rosters;
- Actively engaging in performance management and measurement; and
- Increasing capacity for urgent/emergent and scheduled neurosurgical services.

The goal was a responsive and integrated comprehensive provincial neurosurgical system, ensuring Ontarians access to neurosurgical services when and where they require it most.
**PNO Mandate and Governance**

Provincial Neurosurgery Ontario (PNO) was established by CCSO to advise and support a comprehensive adult and paediatric neurosurgical system across Ontario hospitals and LHINs. Building on previous models for system improvement developed by CCSO and following the principles of access, quality and system integration, a strategic planning framework for neurosurgery in Ontario (as shown below) was developed.

The priority initiatives informed the establishment of working groups, namely Performance Management, System Capabilities, and Health Human Resources. In addition, special focused projects including the Coil Embolization Implementation (CEI) Task Force and Neuro Educator and Outreach Network (NEON) were also formed.

After successful implementation of an integrated system of neurosurgical care in Ontario, CCSO was asked by the MOHLTC to coordinate services related to care for epilepsy patients in Ontario. The Epilepsy Implementation Task Force (EITF) was formed in 2013, reporting as a sub-committee of PNO. Based on recommendations contained in the Ontario Health Technology Assessment Committee Expert Panel on a Provincial Strategy for Epilepsy Care in Ontario, the EITF has as its Terms of Reference to develop and implement a provincial integrated strategy for epilepsy care in Ontario. The EITF works in collaboration with PNO to support equitable and timely access to epilepsy diagnosis and treatment, including epilepsy surgery, to ensure patients have access to the best possible outcomes available.
Current State

The adult population of Ontario increased from 10.3M to 10.9M, or by 6% between 2009 and 2013. In contrast, the volume of adult neurosurgery cases (cranial and spinal) increased by 15%, with Ontario's 11 adult neurosurgical centres experiencing case volume increases between 6% and 54%.12 (Please note that due to the very low paediatric neurosurgical volumes these are included within Part 4.4: Paediatric Capacity Utilization and Forecasting Analysis.

<table>
<thead>
<tr>
<th>Hospital (LHIN#)</th>
<th>2009</th>
<th>2013</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windsor Regional Hospital (01)</td>
<td>1,036</td>
<td>1,100</td>
<td>6%</td>
</tr>
<tr>
<td>London Health Sciences (02)</td>
<td>1,382</td>
<td>1,614</td>
<td>17%</td>
</tr>
<tr>
<td>Hamilton Health Sciences Corporation (04)</td>
<td>1,645</td>
<td>1,889</td>
<td>15%</td>
</tr>
<tr>
<td>Trillium Health Partners (06)</td>
<td>1,437</td>
<td>1,484</td>
<td>3%</td>
</tr>
<tr>
<td>St. Michael’s Hospital (07)</td>
<td>1,977</td>
<td>2,270</td>
<td>15%</td>
</tr>
<tr>
<td>Sunnybrook Health Sciences Centre (07)</td>
<td>1,351</td>
<td>1,556</td>
<td>15%</td>
</tr>
<tr>
<td>University Health Network (07)</td>
<td>2,162</td>
<td>2,576</td>
<td>19%</td>
</tr>
<tr>
<td>Kingston General Hospital (10)</td>
<td>463</td>
<td>715</td>
<td>54%</td>
</tr>
<tr>
<td>The Ottawa Hospital (11)</td>
<td>1,985</td>
<td>2,070</td>
<td>4%</td>
</tr>
<tr>
<td>Health Sciences North (13)</td>
<td>749</td>
<td>894</td>
<td>19%</td>
</tr>
<tr>
<td>Thunder Bay Regional Health Sciences Centre (14)</td>
<td>312</td>
<td>439</td>
<td>41%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,499</strong></td>
<td><strong>16,607</strong></td>
<td><strong>15%</strong></td>
</tr>
</tbody>
</table>

System improvements have reduced out-of-country transfers from 202 in 2009/2010 to zero in 2013/2014 and 2014/2015. The framework applied by CCSO, the participation of clinicians, lead program administrators and evidence informed investments by the MOHLTC has fostered stronger accountability, responsiveness and system integration. These improvements have included:

- Establishing formal accountabilities, responsibilities and service level expectations for all neurosurgical centres;
- Development of guidelines for consultation and patient transfer between non-surgical and surgical sites coordinated through CritiCall Ontario;
- Development of partnerships and system contribution commitments;
- Collaborative performance measurement and management; and
- Additional health human resources and roles for neurosurgical teams.

12 CIHI Discharge Abstract Database (DAD), the National Ambulatory Care Reporting System (NACRS) 2009-2013, and the Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO
In addition, CCSO established the Coil Embolization Implementation (CEI) Task Force in 2014. The objectives of the CEI Task Force were to create a set of clinical care considerations, outcome measures, reporting requirements, and recommendations to ensure the province is equipped to appropriately meet current and future patient demand. The CEI Task Force found that the province is well equipped to meet this demand and there is no gap in care for the management of ruptured and unruptured intracranial aneurysms in Ontario.

Work is currently underway to develop a Quality Based Procedure for Neck and Low Back Pain, including spinal surgery (non-malignant), with expected completion by Summer 2015.

While the system continues to improve, there is still more work to be done. In the near-term, CCSO in collaboration with PNO, will complete the recommended action items by optimizing neurosurgical care pathways, creating additional neurosurgical and system capacity and enhancing system performance.

Future State

Taking into account the significant accomplishments realized thus far, leaders of the neurosurgical system have identified areas of focus for the next three years that will help inform and support Ontario’s Critical Care Strategy. These priorities will build upon system integration and improvement initiatives, as well as recent investments in additional capacity for scheduled, urgent and emergent procedures in adult and paediatric neurosurgical centres and rehabilitation hospitals. As demand for neurosurgical services continues to grow with an increasing and aging population, the system will continue to require further support and investments to create additional capacity. The leadership of the neurosurgical system will be key to leading improvement initiatives while keeping in step with best practice standards, ensuring access, quality and system integration.
Key Priority #1: Enhance System Performance
Since 2012, the Performance Management Working Group of PNO has been developing a Provincial Neurosurgery Scorecard and Hospital-Level Dashboard Report for both adult and paediatric neurosurgical care across the province. These reports measure 19 indicators for adults and 12 indicators for paediatrics in the domains of access, quality, responsiveness and accountability, with a focus on acute care indicators. Earlier this year, five indicators for adult inpatient rehabilitation for neurosurgery patients were also added.

For each of the past four quarters, there has been a release of the Neurosurgery Scorecard and Dashboard reports. With trending of these indicators over time, next steps will include analysis to identify areas of system improvement. CCSO will work to identify evidence-based performance targets. Where no clear targets or benchmarks exist, CCSO will work in collaboration with system partners to set targets that will drive system-level performance improvement, and to optimize key neurosurgical care pathways.

Currently, optimization of key neurosurgical care pathways is occurring for treatment options such as epilepsy surgery, coil embolization and complex spine surgery. Sub-groups have been established to undertake planning work that will help to identify patient volumes and wait times, and map how patients move through the system, obtain diagnosis, referral, treatment, rehabilitation (if necessary), and recovery. To support the care pathways, practice guidelines will be created and their knowledge translated to support broad adoption. Most importantly, partnerships that support new pathways – that stretch beyond the neurosurgical community to encompass neurosciences more broadly – will help to inform and develop pathways and enrich the patient and family experience.

Key Priority #2: “Getting to Zero”: Focus on Patient Safety and Neurosurgical Best Practices
In the spirit of continuous improvement and building on system performance work that has already occurred within neurosurgical services, there is opportunity over the next three years to ensure that Ontario delivers leading practice cranial and spinal surgical services supported by an accountable and integrated system. Next steps towards advancing safety in neurosurgical services include developing leading practice standards for neurosurgical procedures delivered in Ontario. The neurosurgical system has already begun work on adopting best practice standards through the development of a guideline series for the management of epilepsy care. As with all continuous improvement strategies, an unwavering commitment to overall quality (which encompasses optimizing patient flow) requires an equal commitment to measurement. To support evaluation of establishing practice standards, measurement in the future will need to occur at all levels – from system and individual hospital performance to individual procedure. This level of granularity enables leaders of the neurosurgical system to understand where the neurosurgical system’s expertise is held, and to identify gaps in sub-specialties that need to be addressed.

Key Priority #3: Leverage Innovation to Improve Patient Outcomes
With medical technologies evolving at a rapid pace, previously novel approaches to neurosurgical procedures, such as minimally invasive surgery, are becoming commonplace approaches to treatment in Ontario’s neurosurgical programs. In addition, as technology evolves, treatments such as neuromodulation
are being explored to treat a broader range of conditions such as drug-resistant depression. On the horizon, Proton Therapy, now used in only a few centres in North America, has great potential to be both a safe and effective therapy for the treatment of brain tumours. Over the next three years, new treatments will become more prevalent and practiced, and will require careful evaluation and planning (in conjunction with the Ontario Health Technology Advisory Committee and the MOHLTC) to ensure patients continue to have access to the best quality care, with the best outcomes, while the system provides the best value.

While not strictly the mandate of the critical care system, it is important to note that as the province’s neurosurgical programs undergo evolution to accommodate increasing volumes, there will be an opportunity for hospitals to design and build the physical space to incorporate new approaches to treatment. Capital investments required to construct appropriate physical space to support new treatment methods may vary as the physical space needs change.

**Key Priority #4: Knowledge Translation**

As mentioned earlier in this plan, knowledge translation is a key focus for CCSO. Much of what has been accomplished thus far by CCSO in partnership with leaders in delivering neurosurgical care has been groundbreaking work on a provincial scale and has garnered interest in other national and international jurisdictions. There is an opportunity to share the frameworks and methodologies of how to make health system improvements on a large scale. It is important that ongoing work be supported by best available evidence. Initiatives implemented under the umbrella of CCSO programs will be measured and evaluated both to ensure policies and programs are achieving their intended benefit and for telling the story of system improvement.
3.4 – Ontario Trauma Advisory Committee: Profile and Action Plans

Background

Major trauma is described as serious and often with multiple injuries where there is a strong possibility of death or disability in the absence of highly specialized and timely lifesaving interventions. Trauma is the leading cause of morbidity amongst Canadians between the ages of 1 and 40 years, and it accounts for loss of more potential years of life than any other illness. Inj Injury places an enormous burden on the health care system and has significant impact on both pre-hospital and hospital patient flow.

Over the past few years, there has been an increased focus in establishing an inclusive trauma system in Ontario that can improve functional outcomes following a serious traumatic injury. While high quality patient care is the primary focus of a trauma system, the system must also consider improving injury and burns prevention strategies, rehabilitative care programs, as well as education and research activities.

In the early 1990’s, the MOHLTC designated eleven Ontario hospitals as Lead Trauma Hospitals (LTHs) in order to provide coordinated trauma services across the province. These hospitals, listed below, are located across Ontario and serve to provide leadership and coordinated specialized care to moderately and severely injured patients.

<table>
<thead>
<tr>
<th>#</th>
<th>Lead Trauma Hospital</th>
<th>Location</th>
<th>Adult/ Paediatric</th>
<th>LHIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Children’s Hospital of Eastern Ontario</td>
<td>Ottawa</td>
<td>Paediatric</td>
<td>Champlain</td>
</tr>
<tr>
<td>2</td>
<td>Hamilton Health Sciences</td>
<td>Hamilton</td>
<td>Adult &amp; Paediatric</td>
<td>HNHB</td>
</tr>
<tr>
<td>3</td>
<td>Health Sciences North</td>
<td>Sudbury</td>
<td>Adult</td>
<td>North East</td>
</tr>
<tr>
<td>4</td>
<td>The Hospital for Sick Children</td>
<td>Toronto</td>
<td>Paediatric</td>
<td>Toronto Central</td>
</tr>
<tr>
<td>5</td>
<td>Hotel-Dieu Grace Hospital</td>
<td>Windsor</td>
<td>Adult</td>
<td>Erie St. Clair</td>
</tr>
<tr>
<td>6</td>
<td>Kingston General Hospital</td>
<td>Kingston</td>
<td>Adult</td>
<td>South East</td>
</tr>
<tr>
<td>7</td>
<td>London Health Sciences Centre</td>
<td>London</td>
<td>Adult &amp; Paediatric</td>
<td>South West</td>
</tr>
<tr>
<td>8</td>
<td>The Ottawa Hospital</td>
<td>Ottawa</td>
<td>Adult</td>
<td>Champlain</td>
</tr>
<tr>
<td>9</td>
<td>St. Michael’s Hospital</td>
<td>Toronto</td>
<td>Adult</td>
<td>Toronto Central</td>
</tr>
<tr>
<td>10</td>
<td>Sunnybrook Health Sciences Centre</td>
<td>Toronto</td>
<td>Adult</td>
<td>Toronto Central</td>
</tr>
<tr>
<td>11</td>
<td>Thunder Bay Regional Health Sciences Centre</td>
<td>Thunder Bay</td>
<td>Adult</td>
<td>North West</td>
</tr>
</tbody>
</table>

14 An inclusive trauma system of care is an organized, coordinated effort in a defined geographic area that delivers the full range of care to all injured patients and is integrated with the local public health system. It is distinct from an exclusive system, which limits designation to only a small number of trauma centres designated to provide care to the most severely injured patients. An inclusive system ensures a much larger scope of acute care hospitals participate in the trauma system to the extent their resources allow.
In addition, the MOHLTC designated three major burn centres in the province, listed below. Sunnybrook Health Sciences Centre and Hamilton Health Sciences provide major burn care for the adult population in the province.

<table>
<thead>
<tr>
<th>#</th>
<th>Major Burn Centre</th>
<th>Location</th>
<th>Adult/ Paediatric</th>
<th>LHIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Hospital for Sick Children</td>
<td>Toronto</td>
<td>Paediatric</td>
<td>Toronto Central</td>
</tr>
<tr>
<td>2</td>
<td>Hamilton Health Sciences</td>
<td>Hamilton</td>
<td>Adult</td>
<td>HNHB</td>
</tr>
<tr>
<td>3</td>
<td>Sunnybrook Health Sciences Centre</td>
<td>Toronto</td>
<td>Adult</td>
<td>Toronto Central</td>
</tr>
</tbody>
</table>

The Provincial Trauma Network was a group of medical director representatives from each of the Lead Trauma Hospitals that met regularly to informally address system-level issues in trauma care. In 2012, with a need to formalize this activity and align a framework for organizing an inclusive trauma system for Ontario, CCSO led the transition into the Ontario Trauma Advisory Committee (OTAC). This brought together both clinical and program administrative representation to address needs at the local, regional and provincial levels.

**OTAC Mandate and Governance**

The purpose of the OTAC is to act as an advisory body to the MOHLTC through CCSO. The Committee’s mission is to guide a world class trauma system, focusing on improved outcomes related to injury. OTAC works collaboratively and transparently to ensure:

- A quality-based trauma system that decreases the incidence and severity of trauma;
- Optimal, equitable, accessible, patient-centered care for Ontarians sustaining injuries;
- Implementation of quality and performance improvement activities;
- Designated facilities are supported in working with system partners to meet the needs of injured patients; and
- Appropriate rehabilitation and support services.

OTAC membership is comprised of representatives from Lead Trauma Hospitals, community hospitals, emergency transport services (EMS and Ornge), and other stakeholders participating in the delivery of care for injured patients. OTAC consists of four sub-committees and two advisory panels. The OTAC governance structure is outlined in the diagram below.
Current State

As a key program area supported by CCSO, OTAC has been successful in accomplishing strategic objectives towards establishing an inclusive trauma system in Ontario. Similar to other CCSO provincial program areas, OTAC’s areas of focus include: improving access to timely and appropriate care for all injured patients in Ontario; ensuring access to high quality of care, benchmarking and standardization; and system integration and capacity building amongst health care providers throughout the patient care continuum. To this end, current areas of focus identified within OTAC are Performance Management and System Capacity.

In order to achieve the best possible health outcomes for trauma patients it is essential to deliver the ‘right care’ at the ‘right time’ in the ‘right setting’ by the ‘right healthcare’ provider. In 2014, CCSO, in collaboration with OTAC, developed and launched the Trauma Consultation Guidelines that aim to facilitate consultations between emergency department physicians and Trauma Team Leaders to identify patients who may require transfer or consultation. In addition, CCSO in partnership with the OTAC Burns Sub-Committee developed the Burns Centre Consultation Guidelines, a resource to facilitate consultations and/or transfers of patients to burn centres via CritiCall Ontario. The Burns Centre Consultation Guidelines were also developed to provide criteria for consideration when assessing a patient’s need for transfer to a burns centre or Lead Trauma Hospital. These guidelines are used as tools to improve patient flow and expedite the process for patient referrals and transfer to the most appropriate level of care.
In order to inform strategies for the improvement of trauma service delivery and provide recommendations regarding best practices using provincial targets and benchmarks, CCSO in collaboration with the OTAC Performance Improvement Sub-Committee has developed a Performance Improvement Indicator Report. The first report was launched in January 2015, and focused on analysis of trauma metrics over time to identify performance trends and inform system and local level quality improvement initiatives. Furthermore, the Burns Sub-Committee is working towards the development of a Burns Indicator Report as part of a provincial burn strategy to support the goal of a coordinated burn care system. The Burns Indicator Report will be used to evaluate metrics over time and identify performance measures for all major burn centres.

An inclusive trauma system leverages the capacity and capability among all providers that may be involved in the care of an injured patient. To facilitate better system integration, CCSO in collaboration with OTAC has implemented Regional Trauma Networks (RTNs) in two pilot sites, The Ottawa Hospital and Hamilton Health Sciences. These networks use a hub and spoke model with the Lead Trauma Hospitals working in partnership with their referring hospitals and transport providers to improve patient access to an appropriate level of care. The aim of the RTN is to assist in improving communication, standardizing referral and repatriation practices and improving trauma service delivery throughout the province.

An inclusive trauma system in Ontario is only possible when all parts of the trauma care system are organized, connected and work collaboratively with other healthcare partners to develop a fully integrated system. OTAC recognizes rehabilitative care as a pivotal component of the patient journey; and as a result, in 2014/15, an Advisory Panel on Rehabilitative Trauma Care was established to identify models to improve access to rehabilitative services for trauma patients.
Strategic Priorities – Looking Ahead

In 2014/15, CCSO conducted trauma and burns system consultations with representatives from the Lead Trauma Hospitals, burn centres, community hospitals, emergency transport services and other key stakeholders, in order to identify strategic priorities for Ontario’s trauma care system over the next three years.

An inclusive system guarantees that all injured patients will receive optimal care and this can include the involvement of all acute care facilities along a continuum of care.

The following components support an inclusive trauma system that improves the delivery of care to injured patients in Ontario from pre-hospital care to post-rehabilitative care.

System Integration along the Patient Care Continuum

Pre-Hospital Care

Pre-hospital care consists of injury prevention as well as the process of initial triage and transport of the injured patient to the appropriate level of care.

According to the literature, injury has a profound effect on individuals, families, hospitals, and society at large because it causes tremendous medical, psychosocial, and financial burdens. Therefore the need for a comprehensive injury prevention strategy is clear. Including injury prevention in the OTAC mandate ensures trauma and burns practitioners are using current best practices, knowledge and expertise to prevent injuries from occurring.

Key Priority #1: To create a comprehensive trauma and burns prevention strategy, standardized across the Lead Trauma Hospitals and which engages community organizations, schools and public health through education initiatives to support injury prevention in trauma and burns.

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When an injury has occurred, immediate intervention for the trauma patient consists of timely access to emergency medical services and rapid transport to an appropriate level of care. Emergency care providers should be able to match patients with the assistance from trauma triage guidelines and medical supervision to the correct medical facility equipped with the right resources to best meet the patient's needs.\(^{16}\)

To improve patient outcomes, it is essential to conduct a systematic review of data captured along the patient care continuum with respect to inter-facility consultation and transfer. It is also important to develop options for improved linkage of information across providers to support system planning.

**Key Priority #2:** To link databases across transport systems, CritiCall Ontario, Lead Trauma Hospitals and referring hospitals to improve efficiencies and facilitate performance monitoring and improvements.

**Hospital Care**

Strategic priorities within the hospital care component include building system capacity and capabilities, a focus in health human resources management, performance improvement, research and innovation, and trauma level designation. Systematic thinking ensures clear patient flow practices to facilitate system coordination and create service-level expectations for all Lead Trauma Hospitals and referring hospitals. This will facilitate repatriation pre-planning to ensure that Lead Trauma Hospitals and referring hospitals are able to appropriately manage their capacity.

A recent study found that care at a designated trauma centre is associated with a 19% reduction in injury-related mortality and the quality of life is better for those who survive trauma injury.\(^{17}\) It is pertinent that LTHs continue with regional trauma development with a focus on understanding capacity and capabilities of centres in their catchment area so they can be designated at a level appropriate to their resources and thus fully participate in the regional system. Using the guidelines from the Trauma Association of Canada, now Accreditation Canada, criteria are matched to levels of service already provided by each hospital. This is a key component of Accreditation Canada’s Program of Distinction to support the accreditation of trauma systems and may include identifying level 3 centres.

**Key Priority #3:** Lead Trauma Hospitals in collaboration with their referring hospitals, determine trauma level designations and associated capacity and capabilities based on Trauma Association of Canada guidelines and CritiCall Ontario’s hospital service level inventory.

Assessing trauma system performance and providing tools to monitor and improve is an important step in attaining an inclusive trauma care system. Additionally, the ability to measure system effectiveness, accessibility, cost, and quality of trauma services is essential.\(^{18}\) OTAC has initiated this process with the

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development of the Performance Improvement Indicator Report. It is important to continue to monitor performance, revise the report as appropriate and ensure system and local level quality improvement initiatives remain relevant.

**Key Priority #4:** To develop a trauma system performance management strategy that ensures accountability of all providers involved in the various stages of patient care and to identify a standardized set of performance metrics for all hospitals within the trauma system.

An inclusive trauma system cannot function without the appropriate high-performing interdisciplinary trauma and burn care teams and it is essential to create a process to engage clinicians, rehabilitation specialists, administrators and health care partners across the province.

**Key Priority #5:** To establish Health Human Resources strategies to assist in the recruitment and retention of interprofessional trauma and burn care teams. Develop plans to engage and standardize interprofessional care team structures across the province.

**Rehabilitative Care**

There is evidence that early rehabilitation for injured patients is associated with better outcomes such as: shorter lengths of stay, higher cognitive levels at discharge, better Functional Independence Measure (FIM) scores, and a greater likelihood of discharge to home.\(^1^9\) Published literature supports the notion that early transfer of trauma patients to rehabilitation reduces overall length of stay in hospitals, as well as reducing hospital costs.\(^2^0\) Integration of rehabilitative and post-rehabilitative care is an important step for creating an inclusive trauma system. A positive re-integration into the community is vital for improved patient outcomes. An inclusive system should also ensure continuity of patient care through Community Care Access Centres (CCACs) and outpatient rehabilitation clinics to reduce hospital re-admissions.

**Key Priority #6:** To establish a rehabilitative care framework for trauma and burns patients that includes processes, standards and best practices for facilitating timely access to rehabilitation care including early identification of patients requiring intervention by a rehabilitation specialist.

**Key Priority #7:** To develop a trauma rehabilitative care strategy and framework, applicable across program areas, that fosters strategic partnerships with post discharge service providers such as CCAC and outpatient hospital based rehabilitation programs in order to reduce hospital re-admission and help facilitate effective re-integration of trauma and burns patients into the community.

**Emergency Preparedness**

A mass casualty incident is defined as an event generating large numbers of patients that disrupts the normal course of emergency and health care services. Such dramatic events could often overwhelm the

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health care system. Mass causalities include both natural and man-made events.\textsuperscript{21} In preparation for such events, the inclusive trauma care system works towards the development of an integrated plan to assist in identifying clinical and patient flow best practices to ensure timely access to quality care.

**Key Priority #8:** Building on the provincial surge capacity planning initiative, develop strategies to ensure that the trauma and burns system is integrated with, and complementary to, a risk management and mass casualty plan.

**Patient Engagement**

One of the foundations of building an inclusive trauma system is providing patient-centered care. Patients must be provided the opportunity to inform service delivery planning and evaluation. This needs to go beyond patient consultation to active participation and engagement in decision-making processes and care delivery improvements.\textsuperscript{22}

**Key Priority #9:** Ensure patient engagement through facilitating opportunities for patients to inform service improvement, policy and research.

**Strategic Priorities – Implementation**

It is vital that an inclusive trauma system consider overarching strategies to assist in the implementation and sustainability of key priorities identified. A governance model that is comprehensive and transparent should be considered to clearly outline accountabilities for all Lead Trauma Hospitals and referring hospitals with agreed upon best practices and principles. In 2015/16, the Regional Trauma Network program will be expanded in the province. CCSO will conduct an evaluation of the Regional Trauma Networks to identify gaps and improvement opportunities to enable the spread of this initiative provincially. This will help support the implementation of key priorities and identify unique regional gaps and opportunities to ensure appropriate triage of patients and timely referral to Lead Trauma Hospitals and burn centres when appropriate.

3.5 – Paediatric Critical Care Advisory Committee: Profile and Action Plans

Background

In January 2007, the Ministry of Health and Long-Term Care established the Paediatric Critical Care Subcommittee of the Critical Care Expert Advisory Panel to review paediatric critical care services in Ontario and identify how paediatric services and issues can be integrated into the Ontario Critical Care Strategy.

The Subcommittee completed an inaugural review of existing reports and data on paediatric critical care in Ontario and conducted two surveys assessing system status, while also assessing the Critical Care Strategy components from a paediatric perspective. The Paediatric Critical Care Subcommittee’s Final Report (2007) contained 16 recommendations covering an integrated system of paediatric critical care services, organizational standards of practice, improving critical care performance, sufficient and appropriate resources to meet needs, supporting technologies and success factors. Many of the recommendations were enacted as a natural evolution of, and in alignment with, the Critical Care Strategy and overseen by the Paediatric Critical Care Network (PCCN), which, since its inception in 2002, was comprised of representation from the Paediatric Academic Health Sciences Centres (PAHSC) in Ontario. Playing an important role in coordinating and integrating paediatric critical care services in Ontario, members focused on delivering high-quality, evidence-based, family-centered care in a maximally efficient and accountable manner. CCSO undertook to ensure that all aspects of Ontario’s Critical Care Strategy also included application of initiatives to the paediatric critical care patient population.
In April 2012, to ensure consistent alignment with other program areas under CCSO, CCSO restructured the PCCN to become the Paediatric Critical Care Advisory Committee (PCCAC). Membership included both clinical and administrative leadership from the five core paediatric critical care programs in Ontario. Five working groups were established to allow for an in-depth review of paediatric system-level impacts. Reporting to and supporting the PCCAC, each working group provided research, analysis and overall expertise in order to achieve stated deliverables. These groups included the following:

1. Governance and Accountabilities
2. Health Human Resources
3. Performance Management
4. System Capacity and Capabilities
5. System Level Outreach

Each working group finalized a set of recommendations that focused upon areas in need of system-level improvements and were presented within the PCCAC’s Final Report in 2013. Three overarching areas of focus emerged:

**Goal #1**: Assess current-state system preparedness for future demand  
**Goal #2**: Improve unit-level efficiencies and quality for collective provincial-level impact  
**Goal #3**: Enhance opportunities for education and outreach

These areas of focus provide ongoing scope and system-level planning alignment for the PCCAC.
Alignment

The priorities as outlined within this section for provincial paediatric critical care planning and system improvement are aligned with the five Ontario Critical Care Plan Strategic Goals found earlier in this plan and also reflect the provincial initiatives of the PCCAC.

PCCAC Mandate and Governance

Paediatric critical care is one of the core programs under CCSO. The PCCAC reports to CCSO on the implementation and evaluation of strategies that support the paediatric critical care system in Ontario. It is actively engaged in identifying potential areas for improvement for access to, and delivery of, quality care. The scope of work is across the continuum of care to ensure that regardless of geography, paediatric patients across Ontario have access to specialty critical care. Key to achieving this objective is the development and implementation of a performance management framework to support a culture of accountability and system management.

PCCAC members are comprised of representatives from the five Paediatric Academic Health Sciences Centres (PAHSC) across Ontario, representing Senior Executive and/or Medical Director- level roles from:

- The Hospital for Sick Children
- Children's Hospital of Eastern Ontario
- Children's Hospital of Western Ontario, London Health Sciences Centre
- McMaster Children's Hospital, Hamilton Health Sciences
- Kingston General Hospital

And one representative each, from the following:

- CritiCall Ontario
- Ornge
- The Provincial Council for Maternal and Child Health (PCMCH)
- The Ministry of Health and Long Term Care – a non-voting member

Following completion of the PCCAC Final Report in 2013, two ongoing sub-committees were constituted to support the immediate areas of focus for the PCCAC:

- Performance Management Working Group
- System Capacity and Capabilities Working Group

The overarching working group objectives remain to further analyze current state occupancy levels/capacity/future demand, identify system opportunities, finalize metrics for a paediatric scorecard, as well as address initiatives for system-level improvement.
Current State

Paediatric critical care is key to the provision of quality health care for infants, children and youth in Ontario. Care services from these critical care units—which may be considered at a tertiary, or, in some cases, quaternary level—are facilitated by teams of paediatric medical professionals with access to specialized equipment and innovative technologies. Common avenues through which patients access critical care include emergency departments or hospital wards within a tertiary or community hospital. After a patient has received critical care, he or she may be transported to a number of destinations upon discharge from acute care including rehabilitation services, a children’s treatment centre, a hospice, or home.

It should also be noted that paediatric patients can access critical care at some non-paediatric critical care units. Should additional support be necessary, an extramural component of the Paediatric Critical Care Response Teams (PCCRT) is available 24/7 to physicians in Ontario. Any physician caring for a critically ill paediatric patient can access support from an on-call paediatric intensivist through this service, which is facilitated by CritiCall Ontario.

Currently, there are five Paediatric Academic Health Sciences Centres in Ontario that provide tertiary paediatric critical care services, although some large and small community hospitals also provide critical care for adolescents in their adult critical care units. There are a total of 85 paediatric critical care beds across the province. This total is comprised of 65 Level 3 beds and 20 Level 2 beds. In 2013, there were 2.7 million children less than 18 years of age in Ontario.23 Despite a 2% decrease in this paediatric population from 2009-2013, there is a projected increase of 11% by 2026, for a total close to 3 million children.24

Although increasing paediatric critical care capacity is one solution, there is a need to address continuing issues for the paediatric patient such as access to quality paediatric critical care services, safe and high quality care from trained specialists and the provision of services in an effective and efficient manner.

Future State

Strategic Approach

Emphasis should be given to the paediatric program priorities as outlined, to strengthen the Ontario Critical Care Plan Strategic Goals in a way that will have the most impact to improve paediatric critical care patient experiences and outcomes in the province. Additionally, it is important to acknowledge and support the thorough work already underway, whilst helping to meet future challenges.

In July 2014, the PCCAC provided their input on strengths, weaknesses, opportunities and threats for the current state of paediatric critical care in Ontario. A final consultation was held with PCCAC Co-Chairs in January 2015 to solidify the key priorities for the next three years.

23 Population Projections Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted Oct 2014
24 Population Projections Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted Oct 2014
Key Priorities

This final consultation focused on the system-level provincial view of future paediatric critical care, governance structures, paediatric system partners, system-level accountabilities, centre commitments and the overarching role of the PCCAC. The following areas were identified as the most relevant emerging trends, system needs and priorities within the Ontario paediatric critical care system for the next three years:

**Key Priority #1:** Analyze the performance and behavior of the paediatric critical care system, to understand the impact of interconnectedness on system capacity and utilization.

**Key Priority #2:** Assess the impact of medical complexities and technology-dependent patients in relation to resource requirements and capacity needs within the paediatric critical care system.

**Key Priority #3:** Explore opportunities to share best practices across paediatric hospitals to promote quality and safety in the provision of critical care to paediatric patients and families.

**Key Priority #4:** Assess areas for improvement related to paediatric transport within Ontario in collaboration with health system providers across the continuum of care.

**Key Priority #5:** Evaluate current strategies for transitioning older adolescents with complex conditions to adult sub-specialty care programs and identify potential areas for improvement.
Capacity, Utilization and Forecasting Analysis
Part 4: Capacity, Utilization and Forecasting Analysis

4.1 – Capacity, Utilization and Forecasting Analysis: Adult Critical Care Services

This section pertains to the adult population only. For the current state analysis and ICU bed forecast for the paediatric population (<18 years), refer to Part 4.4: Capacity, Utilization and Forecasting Analysis: Paediatric Critical Care Services.

Data Sources

The number of ICU admissions and the number of critical care beds in the province were obtained from the Critical Care Information System (CCIS), calendar years (CY) 2009-2013.

Additional information on ICU patients (including patient LHIN of residence, major clinical category) was obtained from the Discharge Abstract Database, Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014.

Population estimates and projections were used for the calculation of ICU rates per 1,000 and ICU volume projections. Population estimates and projections account for births, deaths, and migration patterns. Population estimates were obtained for CY 2009-2013 from the Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014. Population projections were obtained for CY 2014-2026 from the Population Projections Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014.

Exclusions: paediatric population (<18 years)

Calculations

- ICU admission rate per 1,000 = volume of ICU admissions / (population x 1,000).
- Occupancy rates = total ICU patient days in a year / (365 x number of beds in inventory).
- Total ICU patient days = the sum of days the critical care unit has been occupied for all patients for the period.
- ICU beds = (ICU admission rate x average ICU length of stay x population projection) / (365 x occupancy rate assumption).
- For ICU admission rate and average ICU length of stay (LOS), 2013 occupancy levels were assumed; the occupancy rate assumption was 85%.

To account for the provincial nature of some programs resulting in several LHINs providing ICU care to patients from across the province, the bed requirements were calculated at the LHIN level (i.e. using LHIN-specific admission rates, average LOS, etc.), and then aggregated at the provincial level. As a result, ICU admission rates captured total ICU admissions (irrespective of LHIN of residence) in proportion to the population of a specific LHIN.
Limitations

Forecasting is done with a mathematical formula, using best historical data available and with best estimates of population projections. There are a number of factors that may change the projection over time. Also, strategies implemented at a local hospital level or a system wide level can mitigate demand for projected bed or case volumes. These factors should be taken into account when interpreting projections for future needs to meet future demands.

Analysis

Figure 1: Ontario Population (2009-2013, Adult)

From 2009 to 2013, the adult (≥18 years) population of Ontario increased from 10.3M to 10.9M, or by 6%.

<table>
<thead>
<tr>
<th>Year</th>
<th>Ontario Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>10,336,282</td>
</tr>
<tr>
<td>2010</td>
<td>10,502,286</td>
</tr>
<tr>
<td>2011</td>
<td>10,654,727</td>
</tr>
<tr>
<td>2012</td>
<td>10,804,513</td>
</tr>
<tr>
<td>2013</td>
<td>10,941,099</td>
</tr>
</tbody>
</table>

Data Source: Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014

Over the same time period, Level 3 ICU admissions increased from 80,753 to 83,110, or by 3%. In contrast, as shown in Figure 2, the volume of ICU Level 2 admissions increased by 17% (from 49,757 to 58,432). This may be due to capturing CCIS data from a greater number of Level 2 units over this time period.

Figure 2: ICU Admissions and Critical Care Beds by ICU Level (2009-2013, Adult)

Data Source: Critical Care Information System (CCIS)
Consistent with this pattern, the provincial ICU admission rates per 1,000 for this period were stable at 7.4 for ICU Level 3 and slightly increased from 5.0 to 5.4 for ICU Level 2 (Table 1). The average ICU length of stay remained stable at approximately 5 days for ICU Level 3 and 3 days for ICU Level 2.

Table 1: Provincial ICU Admission Rates, Average LOS and Beds per 100,000 (Adult)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>ICU L3</th>
<th>ICU L2</th>
<th>ICU L3</th>
<th>ICU L2</th>
<th>ICU L3</th>
<th>ICU L2</th>
<th>ICU L3</th>
<th>ICU L2</th>
<th>Vented (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>7.4</td>
<td>5.0</td>
<td>4.9</td>
<td>3.0</td>
<td>12</td>
<td>6</td>
<td>11</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>7.3</td>
<td>5.2</td>
<td>4.9</td>
<td>2.8</td>
<td>12</td>
<td>5</td>
<td>11</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>7.3</td>
<td>5.3</td>
<td>5.1</td>
<td>2.9</td>
<td>12</td>
<td>5</td>
<td>11</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>7.4</td>
<td>5.4</td>
<td>4.9</td>
<td>2.9</td>
<td>12</td>
<td>6</td>
<td>10</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>7.4</td>
<td>5.4</td>
<td>4.8</td>
<td>3.0</td>
<td>12</td>
<td>6</td>
<td>10</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Data Sources: Critical Care Information System (ICU admissions), Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014

A comparison of ICU beds in Ontario, expressed as the number of beds per 100,000 population, with other developed countries (Figure 3) reveals three main findings. First, there is a vast variability in the number of adult ICU beds per 100,000 across the countries. Second, Canada ranks 6th out of 14, making it a country with a higher supply of ICU beds, compared to others. Third, Ontario’s ICU bed supply is higher than overall Canadian levels.

Figure 3: Adult ICU Beds per 100,000 in USA and Europe

Sources:

While this comparison provides some interesting insights, caution should be exercised in interpreting this data, due to the various ways in which countries classify ICU beds. For example, according to Murthy and Wunsch (2012), the ICU bed definition reflects staffing intensity in the United States, but patient type and
Further variations are also possible within these two definitions. When the ICU bed is defined in terms of staffing intensity, the actual level of staffing provided may not be the same across countries using this definition. Similarly, criteria with respect to the severity of patient condition required for admission to an ICU may vary from one country to another. As a result, the absence of a universal definition makes international comparisons or conclusions on “appropriate ICU bed levels” very difficult.

Another source of variation across studies reporting ICU bed numbers could be due to specific exclusion criteria. For example, Rhodes et al. (2012) excluded coronary, stroke and renal units, in addition to paediatric and neonatal units. It was not clear if (apart from paediatric units) similar exclusion criteria were applied in other publications. Consequently, the number of beds reported for the same country varies from one study to another. Gooch and Khan (2014) report 25 ICU beds per 100,000 in the United States, compared to 20 reported by Murthy and Wunsch (2012). Rhodes et al. (2012) reported 29.2 for Germany, 11.6 for France, and 3.8 for the United Kingdom (UK), whereas Murthy and Wunsch (2012) reported 24.6, 9.3, and 3.5 respectively for the same countries.

Finally, the difficulty in applying international comparisons to gauge the adequacy of the bed supply in any given country is further exacerbated by the fact that organizational models of care delivery are different across countries; therefore, what may appear to be an under-supply of beds in one setting may be sufficient in another.

The current demand for adult critical care services in Ontario is evident in the trend of increasing ICU occupancy rates across a number of LHINs. As shown in Table 2, Level 3 average occupancy rates were at or exceeding 85% for seven of fourteen LHINs. Level 2 occupancy rates were at or exceeding 85% for three of fourteen LHINs. Taking into account the populations of these regions, this means that 75% of the Ontario population resides in LHINs with ICU occupancy rates at/or exceeding 85% for at least one of the ICU levels.

Table 2: ICU Occupancy Rates by LHIN 2009-2013

<table>
<thead>
<tr>
<th>LHIN</th>
<th>Level 3</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(01) ERIE ST. CLAIR</td>
<td>2009</td>
<td>2010</td>
</tr>
<tr>
<td>(02) SOUTH WEST</td>
<td>2011</td>
<td>2012</td>
</tr>
<tr>
<td>(03) WATERLOO WELLINGTON</td>
<td>2013</td>
<td>2009</td>
</tr>
<tr>
<td>(06) HAMILTON (MHNB)</td>
<td>2010</td>
<td>2011</td>
</tr>
<tr>
<td>(05) CENTRAL WEST</td>
<td>2012</td>
<td>2013</td>
</tr>
<tr>
<td>(06) MISSISSAUGA HAITON</td>
<td>2014</td>
<td>2015</td>
</tr>
<tr>
<td>(07) TORONTO CENTRAL</td>
<td>2016</td>
<td>2017</td>
</tr>
<tr>
<td>(08) CENTRAL</td>
<td>2018</td>
<td>2019</td>
</tr>
<tr>
<td>(09) CENTRAL EAST</td>
<td>2020</td>
<td>2021</td>
</tr>
<tr>
<td>(10) SOUTH WEST</td>
<td>2022</td>
<td>2023</td>
</tr>
<tr>
<td>(11) CHAMPLAIN</td>
<td>2024</td>
<td>2025</td>
</tr>
<tr>
<td>(12) NORTH SALEMUSKOKA</td>
<td>2026</td>
<td>2027</td>
</tr>
<tr>
<td>(13) NORTH-EAST</td>
<td>2028</td>
<td>2029</td>
</tr>
<tr>
<td>(14) NORTH-WEST</td>
<td>2030</td>
<td>2031</td>
</tr>
</tbody>
</table>

Data Source: Critical Care Information System


Given projected increases in population growth, particularly a higher rate of growth in older age groups, the potential need for critical care resources in future years will also increase. As shown in Figure 4, from 2013 to 2026, the Ontario population is projected to increase from 10.9M to 12.7M, or by 16% (Population Projections Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014).

**Figure 4: Provincial Adult Population Projections (2013-2026)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Population (1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>10,941,099</td>
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<tr>
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<td>12,403,407</td>
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<td>2025</td>
<td>12,540,774</td>
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<tr>
<td>2026</td>
<td>12,681,218</td>
</tr>
</tbody>
</table>

Data Source: Population Projections Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014

More importantly from an ICU utilization perspective, the proportion of the 65+ age group will increase from the current level of 19% to 26% in 2026, with the most prominent increase in the 65-79 age category (Figure 5).

**Figure 5: Population Projections by Age**

The implications of these projected increases on future utilization of ICU resources stem from the age and gender specific rates of ICU admission. As shown below, the ICU admission rates per 1,000 are the highest among men 80+ years of age, followed by men 65-79 years of age for both Level 3 and Level 2 ICUs. This pattern was consistent over five years, although the Level 3 rates for both men and women over 65 slightly decreased from 2009 to 2013.
Figure 6: Provincial ICU Admission Rates per 1,000 by Demographic Group

<table>
<thead>
<tr>
<th>LHIN Year</th>
<th>Sex</th>
<th>Age Group</th>
<th># People</th>
<th>ICU 3 Adm</th>
<th>ICU 2 Adm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>F</td>
<td>18-39</td>
<td>119,461</td>
<td>189</td>
<td>109</td>
</tr>
<tr>
<td>2012</td>
<td>M</td>
<td>65-79</td>
<td>123,036</td>
<td>183</td>
<td>108</td>
</tr>
<tr>
<td>2011</td>
<td>M</td>
<td>80+</td>
<td>128,554</td>
<td>572</td>
<td>375</td>
</tr>
<tr>
<td>2010</td>
<td>F</td>
<td>65-79</td>
<td>9,783</td>
<td>379</td>
<td>301</td>
</tr>
<tr>
<td>2009</td>
<td>F</td>
<td>40-64</td>
<td>122,111</td>
<td>156</td>
<td>110</td>
</tr>
<tr>
<td>2009</td>
<td>F</td>
<td>18-39</td>
<td>126,256</td>
<td>535</td>
<td>360</td>
</tr>
<tr>
<td>2008</td>
<td>F</td>
<td>18-39</td>
<td>17,828</td>
<td>558</td>
<td>766</td>
</tr>
<tr>
<td>2007</td>
<td>M</td>
<td>40-64</td>
<td>53,636</td>
<td>1,334</td>
<td>1,707</td>
</tr>
<tr>
<td>2006</td>
<td>M</td>
<td>65-79</td>
<td>140,199</td>
<td>312</td>
<td>381</td>
</tr>
<tr>
<td>2005</td>
<td>F</td>
<td>65-79</td>
<td>51,313</td>
<td>1,332</td>
<td>1,677</td>
</tr>
<tr>
<td>2004</td>
<td>F</td>
<td>40-64</td>
<td>27,894</td>
<td>542</td>
<td>853</td>
</tr>
<tr>
<td>2003</td>
<td>M</td>
<td>65-79</td>
<td>136,525</td>
<td>253</td>
<td>270</td>
</tr>
<tr>
<td>2003</td>
<td>M</td>
<td>18-39</td>
<td>166,438</td>
<td>1,441</td>
<td>1,836</td>
</tr>
</tbody>
</table>

Data Sources: Critical Care Information System (ICU admissions), Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014

Based on the Canadian Institute for Health Information (CIHI) classification of inpatient episodes into Major Clinical Categories (MCC), the vast majority of ICU admissions were accounted for by diseases related to the circulatory system, followed by the respiratory, nervous, trauma and digestive systems. Most of the MCCs showed steady and substantial increases in volumes from 2009-2013.
Figure 7: ICU Patient Volume Admissions by Major Clinical Category (2009-2013)

<table>
<thead>
<tr>
<th>MAJOR CLINICAL CATEGORY</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>(05) CIRCULATORY SYSTEM</td>
<td>49,646</td>
<td>50,478</td>
<td>48,882</td>
<td>48,746</td>
<td>50,262</td>
<td>1%</td>
</tr>
<tr>
<td>(04) RESPIRATORY SYSTEM</td>
<td>11,638</td>
<td>11,688</td>
<td>12,605</td>
<td>13,659</td>
<td>14,690</td>
<td>26%</td>
</tr>
<tr>
<td>(01) NERVOUS SYSTEM</td>
<td>8,594</td>
<td>9,053</td>
<td>9,138</td>
<td>9,623</td>
<td>10,478</td>
<td>22%</td>
</tr>
<tr>
<td>(19) SIGNIFICANT TRAUMA, INJURY, POISONING, AND TOXIC EFFECTS OF DRUGS</td>
<td>8,370</td>
<td>8,493</td>
<td>8,724</td>
<td>9,250</td>
<td>9,913</td>
<td>18%</td>
</tr>
<tr>
<td>(06) DIGESTIVE SYSTEM</td>
<td>9,440</td>
<td>9,656</td>
<td>9,638</td>
<td>10,011</td>
<td>9,865</td>
<td>5%</td>
</tr>
<tr>
<td>(16) MULTISYSTEM OR UNSPECIFIED SITE INFECTIONS</td>
<td>3,319</td>
<td>3,769</td>
<td>3,916</td>
<td>4,476</td>
<td>4,768</td>
<td>44%</td>
</tr>
<tr>
<td>(10) ENDOCRINE, NUTRITION AND METABOLISM</td>
<td>2,860</td>
<td>3,092</td>
<td>3,430</td>
<td>3,849</td>
<td>4,069</td>
<td>42%</td>
</tr>
<tr>
<td>(11) KIDNEY, URINARY TRACT AND MALE REPRODUCTIVE SYSTEM</td>
<td>3,419</td>
<td>3,558</td>
<td>3,574</td>
<td>3,786</td>
<td>4,046</td>
<td>18%</td>
</tr>
<tr>
<td>(08) MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE</td>
<td>2,592</td>
<td>2,879</td>
<td>2,924</td>
<td>3,076</td>
<td>3,397</td>
<td>31%</td>
</tr>
<tr>
<td>(07) HEPATOBILIARY SYSTEM AND PANCREAS</td>
<td>2,525</td>
<td>2,807</td>
<td>2,898</td>
<td>3,205</td>
<td>3,342</td>
<td>32%</td>
</tr>
<tr>
<td>(20) OTHER REASONS FOR HOSPITALIZATION</td>
<td>1,774</td>
<td>2,162</td>
<td>2,066</td>
<td>2,123</td>
<td>2,170</td>
<td>22%</td>
</tr>
<tr>
<td>(03) EAR, NOSE, MOUTH AND THROAT</td>
<td>1,597</td>
<td>1,397</td>
<td>1,499</td>
<td>1,685</td>
<td>1,914</td>
<td>20%</td>
</tr>
<tr>
<td>(15) BLOOD AND LYMPHATIC SYSTEM</td>
<td>1,268</td>
<td>1,266</td>
<td>1,362</td>
<td>1,356</td>
<td>1,558</td>
<td>23%</td>
</tr>
<tr>
<td>(09) SKIN, SUBCUTANEOUS TISSUE AND BREAST</td>
<td>806</td>
<td>852</td>
<td>941</td>
<td>1,040</td>
<td>1,112</td>
<td>38%</td>
</tr>
<tr>
<td>(17) MENTAL DISEASES AND DISORDERS</td>
<td>770</td>
<td>847</td>
<td>947</td>
<td>1,083</td>
<td>1,069</td>
<td>39%</td>
</tr>
<tr>
<td>(13) PREGNANCY AND CHILDBIRTH</td>
<td>517</td>
<td>498</td>
<td>498</td>
<td>522</td>
<td>613</td>
<td>19%</td>
</tr>
<tr>
<td>(12) FEMALE REPRODUCTIVE SYSTEM</td>
<td>449</td>
<td>453</td>
<td>454</td>
<td>484</td>
<td>510</td>
<td>14%</td>
</tr>
<tr>
<td>(18) BURNS</td>
<td>206</td>
<td>246</td>
<td>248</td>
<td>271</td>
<td>262</td>
<td>27%</td>
</tr>
<tr>
<td>(02) EYE</td>
<td>34</td>
<td>30</td>
<td>33</td>
<td>32</td>
<td>33</td>
<td>-3%</td>
</tr>
<tr>
<td>(09) MISCELLANEOUS CMG AND UNGROUPABLE DATA</td>
<td>16</td>
<td>11</td>
<td>12</td>
<td>18</td>
<td>17</td>
<td>6%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>109,840</td>
<td>112,255</td>
<td>113,793</td>
<td>118,245</td>
<td>124,088</td>
<td>13%</td>
</tr>
</tbody>
</table>

Data Source: Discharge Abstract Database (Ontario Ministry of Health and Long Term Care, InteelliHEALTH ONTARIO, extracted October 2014)
Note: Due to differences in the capture of ICU admission information in DAD and CCIS, the volumes of ICU admissions will differ.

Based on 2009-2013 trends, major growth patterns appear to be in diseases related to the respiratory and nervous systems, followed by trauma and injuries. At the same time, dedicated programs located in specific LHINs support several of these disease categories. There is a substantial degree of ICU patient migration across LHINs to access these specialized services.

For example, due to multiple specialty programs located in the Toronto Central LHIN (e.g., cancer, burns, transplant, neurosurgery, cardiac, vascular and trauma), only 40% of ICU patients receiving care in this LHIN are local residents, and 60% are residents of other LHINs, such as the Central, Central East, and Central West LHINs.

Many ICU patients who reside in the Central, Central West, Mississauga Halton, Central East, and North Simcoe LHINs receive care outside of their LHIN of residence. For example, only 50% of ICU patients who are residents of the Central LHIN receive care within their LHIN.

Figure 8 summarizes the current and potential future demands on ICU resource utilization across the fourteen LHINs. The first source of pressure results from currently high and/or increasing occupancy rates in a number of LHINs. Another source of pressure stems from patterns of in- and out-migration for ICU care across LHINs. These patterns should be considered along with LHIN-specific demographic trends. For example, the population of the Toronto Central LHIN is expected to grow at a slower rate, compared to the provincial level (16%); furthermore, this LHIN is expected to have a lower proportion of 65+ age groups by 2026, compared to the provincial level. However, should the current referral patterns continue, pressures on ICU utilization in the Toronto Central LHIN will stem from higher than provincial population growth in other LHINs, such as the Central West, Mississauga, Central, and Central East LHINs.
Similarly, in addition to the aging local population in the South West LHIN, future pressures on ICU utilization will also come from the aging of the population in the Erie St. Clair LHIN, since 20% of ICU patients residing in this LHIN receive care in the South West LHIN.

**Figure 8: Current and Future Sources of Pressure on ICU Utilization**

<table>
<thead>
<tr>
<th>LHIN</th>
<th>Current Pressures (2013)</th>
<th>Future Pressures (2026)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Occupancy Rates</td>
<td>% ICU Patients</td>
</tr>
<tr>
<td>(01) ESC</td>
<td>78% (13), 69% (12)</td>
<td>&gt;1%</td>
</tr>
<tr>
<td>(02) South West</td>
<td>80% (13), 68% (12)</td>
<td>19% (12% from ESC)</td>
</tr>
<tr>
<td>(03) Waterloo</td>
<td>76% (13), 80% (12)</td>
<td>12% (8% from SW)</td>
</tr>
<tr>
<td>(04) HNHB</td>
<td>93% (13), 90% (12)</td>
<td>8%</td>
</tr>
<tr>
<td>(05) Central West</td>
<td>85% (13), 77% (12)</td>
<td>16% (5% from Central)</td>
</tr>
<tr>
<td>(06) Mississauga</td>
<td>88% (13), 69% (12)</td>
<td>25% (13% from CW)</td>
</tr>
<tr>
<td>(07) Toronto Central</td>
<td>84% (13), 86% (12)</td>
<td>78% (L3), 72% (L2)</td>
</tr>
<tr>
<td>(08) Central</td>
<td>96% (13), 77% (12)</td>
<td>32% (14% from NSM)</td>
</tr>
<tr>
<td>(09) Central East</td>
<td>89% (13), 68% (12)</td>
<td>11% (4% from Central)</td>
</tr>
<tr>
<td>(10) South East</td>
<td>80% (13), 78% (12)</td>
<td>8%</td>
</tr>
<tr>
<td>(11) Champlain</td>
<td>86% (13), 83% (12)</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>(12) North Simcoe</td>
<td>76% (13), 54% (12)</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>(13) North East</td>
<td>74% (13), 67% (12)</td>
<td>&lt;4%</td>
</tr>
<tr>
<td>(14) North West</td>
<td>77% (13), 53% (12)</td>
<td>&lt;4%</td>
</tr>
</tbody>
</table>

**ICU Bed Forecast**

A review of the literature suggests that the approach to forecasting bed capacity applied in this plan is used widely in practice and continues to serve as a starting point for the development of more sophisticated approaches. Hill et al (2009) used it to forecast the required number of mechanically ventilated beds in Ontario from 2006-2026. Apart from the difference in occupancy rate assumptions, the most marked difference between the two methodologies is that the current approach uses LHIN-based stratification whereas Hill and her colleagues used demographic group stratification. Given much higher admission rates and length of stay in the older age groups, as well as the aging of the population, their results suggested that from 2006 to 2026, the system would require between 602 and 812 new ventilated beds, depending on the bed occupancy assumption (90% and 80%, respectively).

Other researchers criticize the formulaic approach for various reasons, such as instability of results due to the nature of length of stay distribution (Farmer and Emami, 1990), or underestimation of the required bed pool due to the failure to take into account wait lists (Jones, 2003). For example, Jones (2003) argued that the same approach and inputs as used in the current analysis led to considerable underestimation of the required number of beds in the United Kingdom because it did not take into account the length of the queue and the time spent waiting in the queue.

The solutions to improve the modeling of bed forecasting include queuing theory (Jones, 2003), time series (Farmer and Emami, 1990), Poisson and simulation modeling (Kumar and Mo, 2010), Autoregressive

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Inductive Moving Average (ARIMA), and stochastic simulation (based on the literature review in Kumar and Mo, 2010).\textsuperscript{31}

It is possible that some of these approaches may result in better and/or more stable estimates of the required bed capacity in the future. However, for the purpose of strategic planning, the methodology used in this forecasting analysis was selected for several reasons. First, it remains a widely used methodology as it is easily understood across stakeholder groups and easy to validate. Second, a consensus in the literature is yet to be developed regarding the best alternative and incremental benefits of its use, compared to the others, or even considering the loss of parsimony offered by a simple mathematical formula. For instance, it is not known how material the impact of using a very sophisticated modeling technique would be, compared to modifications in inputs, such as stratification of admission rates and length of stay by age and gender.

Finally, all of the current approaches are based on the same inputs, and essentially aim to offer better predictive modeling of inputs, rather than creating a different model based on changes in utilization due to the development of new health care technologies, and/or changes in disease-specific incidence rates.

\textbf{Results}

\textbf{Level 3 ICU.} In the absence of investments in alternative mitigation strategies, similar to the ones described below, a modeling forecast based on the method described above would result in a requirement of over 60 additional Level 3 ICU beds to maintain sufficient capacity in the system for 2015/16. According to the current modelling, an additional 12 beds per year is required to maintain sufficient capacity in the system until 2021, and 13 beds per year thereafter up to 2026 (Figure 9).

\textbf{Level 2 ICU.} In the absence of investments in alternative mitigation strategies, and based solely on the modeling forecast, Ontario would require approximately 12 additional Level 2 ICU beds to maintain

sufficient capacity in the system in 2015/16, with an additional 4 beds per year until 2021, and 5 beds per year thereafter up to 2026 (Figure 9).

It is, however, important to understand that the forecast methodology is based on an “all else being equal” assumption. This means it assumes that no other changes are introduced into the system. In reality, this is not the case. Due to the continuous development of new technologies and effective drugs and treatments, the demand for ICU resources in the near future may not be similar to what it has been historically. For these reasons, the forecast should be updated periodically and always be regarded in the context of other inputs into informed decision making, rather than a prescription that must be precisely followed.

**Mitigation Strategies**

Overall, the analysis would suggest that Ontario requires an additional 189 Level 3 and 61 Level 2 Adult ICU beds by 2026. As described earlier, there are a number of strategies that can impact or mitigate the demand for forecasted critical care resources. Some of the strategies implemented by CCSO include:

1. **Critical Care Response Teams (CCRTs)**
   31 CCRTs (27 adult and 4 paediatric) are currently supported by the MOHLTC to provide critical care to patients located anywhere in the hospital (outside of the ICU) on a 24/7 basis.

2. **Nurse Training Fund**
   The intent of this funding (which commenced in 2007) was to support the training of critical care nurses to a consistent standard. Over the last seven fiscal years, this program has helped to support the training of 3,106 critical care nurses.

3. **Critical Care Nursing Positions for the Neurosurgical Patient Population**
   In 2011, funding from the MOHLTC allowed for the development of Neurosurgery Nurse Educator, Clinical Nurse Specialist, and Advanced Practice Practitioner roles as part of the Neurosurgery Outreach Program. The goal of the program was to improve the quality of care for neurosurgical patients receiving care in community hospitals and to facilitate repatriation strategies.

4. **Critical Care LHIN Leaders**
   Fourteen Critical Care LHIN Leader positions were funded to support the delivery of critical care services in the province. These leaders are clinical experts who work collaboratively with hospitals, LHIN CEOs, CCSO, CritiCall Ontario and the MOHLTC. Their mandate is planning and coordination of system-level and LHIN-level delivery of critical care services.

5. **Surge Capacity Management Plan**
   The purpose of surge capacity planning was to provide hospitals and providers with the tools needed to better handle dramatic increases in the demand for critical care services.

Through regular performance improvement and monitoring of the system, CCSO works with system level care providers, health system leaders, the LHINs and the MOHLTC to understand system level pressures and to determine where targeted investments can be made to ensure access to quality care for patients.
4.2 – Capacity, Utilization and Forecasting Analysis: Neurosurgery (Adult Population)

Data Sources
The data in this section was obtained from several sources. Neurosurgery (spinal and cranial) volumes were estimated using the CIHI Discharge Abstract Database (DAD), the National Ambulatory Care Reporting System (NACRS) 2009-2013, and the Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO. Post-acute neurosurgery rehabilitation volumes were obtained using the CIHI National Rehabilitation Reporting System (NRS) Data Set, and the Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO.

Population estimates and projections were used for the calculation of neurosurgery and post-acute neurosurgery rehabilitation rates and volume projections. Population estimates and projections account for births, deaths and migration patterns. Population estimates were obtained for calendar years (CY) 2009-2013 from the Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014. Population projections were obtained for CY 2014-2026 from the Population Projections Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014.

Exclusions
Neurosurgery cases were identified using the most responsible provider (MRP) as neurosurgeon. It should be noted that this methodology excludes spinal surgery activity performed by orthopaedic surgeons. Work is underway to address this limitation in the overall neurosurgical data methodology, but no final approach has been confirmed. Ambulatory cases were restricted to day surgery case type.

Paediatric units and paediatric cases (age <18) were excluded from this analysis.

Calculations
Patterns of activity by neurosurgical centre were established based on the patient’s LHIN of residence identified using the postal code recorded in DAD, NACRS, and NRS.

Neurosurgery/rehab rate per 1,000 = (neurosurgery volumes within demographic group/population within the same demographic group) x 1,000. The rates were calculated for the following age categories: 18-39, 40-64, 65-79, 80+, and further analyzed by gender.

For volume projections, the 2013 rates per 1,000 (age and gender specific) were applied to respective age and gender-specific population estimates projected by the Ministry of Finance to arrive at the estimated volumes of neurosurgery cases for each demographic group by year. These volumes were then added to obtain provincial level projections.
Limitations
Forecasting is done with a mathematical formula, using best historical data available and with best estimates of population projections. There are a number of factors that may change the projection over time. Also, strategies implemented at a local hospital level or a system wide level can mitigate demand or projected bed or case volumes. These factors should be taken into account when interpreting projections for future needs to meet future demands.

Provincial Patterns for Inpatient and Day Surgery Neurosurgical Activity
From 2009 to 2013, provincial hospital neurosurgical admissions increased by 15% (from 14,504 to 16,612), with every neurosurgical centre experiencing growth. Urgent admissions had a higher rate of increase, compared to elective activity (21% and 9%, respectively). See Table 1.

At the facility level (see Figures 1 and 2), the highest increases in elective cases were at Thunder Bay Regional Health Sciences Centre and Kingston General Hospital (KGH) (52% and 76%, respectively), and the highest increases in urgent cases were at Sunnybrook (54%), Kingston General Hospital (KGH) (39%), Hamilton Health Sciences (HHS) (36%) and University Health Network (UHN) (28%):

Table 1: Percent Change in Neurosurgical Admissions by Centre

<table>
<thead>
<tr>
<th>Neuro Centre</th>
<th>% Change 2009-13</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elective</td>
<td>Urgent</td>
</tr>
<tr>
<td>Hamilton Health Sciences</td>
<td>-6%</td>
<td>36%</td>
</tr>
<tr>
<td>Health Sciences North</td>
<td>21%</td>
<td>16%</td>
</tr>
<tr>
<td>Kingston General Hospital</td>
<td>76%</td>
<td>39%</td>
</tr>
<tr>
<td>London Health Sciences Centre</td>
<td>27%</td>
<td>6%</td>
</tr>
<tr>
<td>St. Michael's Hospital</td>
<td>13%</td>
<td>17%</td>
</tr>
<tr>
<td>Sunnybrook Health Sciences Centre</td>
<td>-8%</td>
<td>54%</td>
</tr>
<tr>
<td>The Ottawa Hospital</td>
<td>0%</td>
<td>9%</td>
</tr>
<tr>
<td>Thunder Bay Regional Health Sciences Centre</td>
<td>52%</td>
<td>26%</td>
</tr>
<tr>
<td>Trillium Health Partners</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>University Health Network</td>
<td>13%</td>
<td>28%</td>
</tr>
<tr>
<td>Windsor Regional Hospital</td>
<td>-1%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9%</strong></td>
<td><strong>21%</strong></td>
</tr>
</tbody>
</table>
As of 2013, the Toronto Central LHIN, with 3 hospitals providing adult neurosurgical services, had almost 40% of all provincial hospital neurosurgical admissions, providing care to residents of the Central, Central East, and North Simcoe Muskoka LHINs, as well as many patients residing in the Central West and Mississauga Halton LHINs.

In May 2014, referral patterns were established for urgent neurosurgical cases for those LHINs that do not have specialized neurosurgical programs (source: Revised Provincial Neurosurgical and Spine Roster, PNO Memo to Ontario Hospital Emergency Departments, May 26, 2014). Table 2 shows how these established patterns aligned with the 2013 actual referrals for urgent and elective cases. With the exception of the Central West LHIN, the referral pattern for urgent cases was already in place in 2013. The Central, Central East and North Simcoe Muskoka LHINs referral patterns for both urgent and elective cases were similar.
Table 2: Comparison of 2013 Actual Referral Patterns with Referral Patterns for Urgent Neurosurgical Cases Established by Revised Provincial Neurosurgical and Spine Roster

<table>
<thead>
<tr>
<th>LHIN</th>
<th>2013 Actual Patterns*</th>
<th>Elective</th>
<th>Revised Provincial Neurosurgical and Spine Roster (May 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urgent</td>
<td>Elective</td>
<td>Windsor Regional and LHSC</td>
</tr>
<tr>
<td>Erie St. Clair</td>
<td>Windsor (78%), LHSC (19%), TC LHIN (3%)</td>
<td>Windsor (77%), LHSC (18%), TC LHIN (4%)</td>
<td>Windsor Regional and LHSC</td>
</tr>
<tr>
<td>South West</td>
<td>LHSC (95%), HHSC (2%), TC LHIN (2%)</td>
<td>LHSC (86%), HHSC (3%), TC LHIN (7%), Trillium (4%)</td>
<td>LHSC</td>
</tr>
<tr>
<td>Waterloo Wellington</td>
<td>HHSC (78%), LHSC (12%), TC LHIN (8%)</td>
<td>HHSC (45%), LHSC (19%), TC LHIN (23%), Trillium (12%)</td>
<td>HHSC</td>
</tr>
<tr>
<td>HNHB</td>
<td>HHSC (91%), TC LHIN (4%), LHSC (2%), Trillium (2%)</td>
<td>HHSC (72%), TC LHIN (14%), LHSC (5%), Trillium (8%)</td>
<td>HHSC</td>
</tr>
<tr>
<td>Central West</td>
<td>Trillium (40%), TC LHIN (54%), HHSC (3%)</td>
<td>Trillium (57%), TC LHIN (42%)</td>
<td>Trillium</td>
</tr>
<tr>
<td>Mississauga Halton</td>
<td>Trillium (63%), TC LHIN (31%), HHSC (5%)</td>
<td>Trillium (68%), TC LHIN (28%), HHSC (3%)</td>
<td>Trillium</td>
</tr>
<tr>
<td>Toronto Central</td>
<td>TC LHIN (97%), Trillium (2%)</td>
<td>TC LHIN (92%), Trillium (7%)</td>
<td>TC LHIN centres</td>
</tr>
<tr>
<td>Central</td>
<td>TC LHIN (97%)</td>
<td>TC LHIN (92%)</td>
<td>TC LHIN centres</td>
</tr>
<tr>
<td>Central East</td>
<td>TC LHIN (87%), KGH (11%)</td>
<td>TC LHIN (90%), KGH (7%)</td>
<td>TC LHIN centres and KGH</td>
</tr>
<tr>
<td>South East</td>
<td>KGH (76%), TOH (11%), TC LHIN (12%)</td>
<td>KGH (62%), TOH (13%), TC LHIN (24%)</td>
<td>KGH</td>
</tr>
<tr>
<td>Champlain</td>
<td>TOH (97%)</td>
<td>TOH (92%), TC LHIN (5%)</td>
<td>TOH</td>
</tr>
<tr>
<td>North Simcoe Muskoka</td>
<td>TC LHIN (97%)</td>
<td>TC LHIN (87%), Trillium (9%)</td>
<td>TC LHIN centres</td>
</tr>
<tr>
<td>North East</td>
<td>HSN (72%), TC LHIN (19%), TOH (4%)</td>
<td>HSN (78%), TC LHIN (14%), TOH (2%), LHSC (3%)</td>
<td>HSN</td>
</tr>
<tr>
<td>North West</td>
<td>Thunder Bay (93%), TC LHIN (3%), LHSC (2%), HHSC (2%)</td>
<td>Thunder Bay (93%), TC LHIN (3%)</td>
<td>Thunder Bay</td>
</tr>
</tbody>
</table>

* Interpretation (example of Waterloo Wellington urgent cases): out of all neuro urgent patients residents of WW LHIN, 78% were admitted in HHSC, 12% were admitted in LHSC and 8% to TC LHIN centres
(Data Source: NRS, Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO)
### Future Projections

Hospital admission rates per 1,000 vary greatly by demographic group, with men over 65 years of age experiencing the highest rates (approximately 3.6 neurosurgery admissions per 1,000), followed by women 65-79 years of age (approximately 2.5 per 1,000). In contrast, the rates for the 18-39 age group were in the 0.6-0.7 per 1,000 range.

Assuming 2013 gender and age-specific rates of neurosurgery volumes per 1,000, the volumes of neurosurgery cases are projected to increase from 16,612 to 20,749, or by 4,137 cases, by 2026. This represents a 25% increase over 13 years, or about 7-8% over each five-year period from 2013-2026. The projected growth, therefore, is somewhat lower compared to the 15% growth over the 2009-2013 time period. The facility-specific projections are shown in Figure 3.

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* Toronto neurosurgical centres: University Health Network, Sunnybrook Health Sciences Centre and St. Michael’s Hospital

Data Sources: Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014; Rehab Volumes – NRS, Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO.
Post-acute Neurosurgery Rehabilitation Activity

From 2009-2013, the provincial post-acute neurosurgery rehabilitation volumes increased by 23% (from 2,684 to 3,291).

As of 2013, seven out of fourteen LHINs had hospitals receiving specialized post-acute neurosurgery rehabilitation funding. In five of these LHINs, the average length of stay was substantially higher for patients receiving care in specialized facilities.

The vast majority of post-acute neurosurgery rehabilitation patients remain in their LHIN of residence. There are exceptions to this pattern for the LHINs surrounding the Greater Toronto Area (GTA) where rehabilitation activity follows the surgical pattern at St. Michael's Hospital, Sunnybrook Health Sciences Centre, Trillium Health Partners and the University Health Network.

Assuming no change in gender and age-specific rates of rehabilitation volumes per 1,000 from 2013, the volume of post-acute neurosurgery rehabilitation cases is projected to increase by 1,086 cases (from 3,291 to 4,377, see Figure 4) by 2026. This represents a 33% increase over 13 years. This may be in keeping with a continuation of the historical trend.

Figure 4: Provincial Projections for Post-acute Neurosurgery Rehabilitation Volumes

Data Sources: Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014; Rehab Volumes - NRS, Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO.

From 2013 to 2026, the projected increase in neurosurgery rehabilitation volumes will be driven by the aging population and will be higher for the 65+ age groups.
Figure 5: Post-acute Neurosurgery Rehabilitation Provincial Projections by Demographic Group

Table 3: Percent Change in Post-acute Neurosurgery Rehabilitation Volumes by Demographic Group

<table>
<thead>
<tr>
<th>REHAB VOLUMES</th>
<th>2013</th>
<th>2026</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-39 F</td>
<td>129</td>
<td>139</td>
<td>7%</td>
</tr>
<tr>
<td>18-39 M</td>
<td>272</td>
<td>294</td>
<td>8%</td>
</tr>
<tr>
<td>40-64 F</td>
<td>453</td>
<td>478</td>
<td>6%</td>
</tr>
<tr>
<td>40-64 M</td>
<td>689</td>
<td>719</td>
<td>4%</td>
</tr>
<tr>
<td>65-79 F</td>
<td>493</td>
<td>785</td>
<td>59%</td>
</tr>
<tr>
<td>65-79 M</td>
<td>588</td>
<td>966</td>
<td>64%</td>
</tr>
<tr>
<td>80+ F</td>
<td>359</td>
<td>501</td>
<td>40%</td>
</tr>
<tr>
<td>80+ M</td>
<td>308</td>
<td>495</td>
<td>61%</td>
</tr>
<tr>
<td>Overall</td>
<td>3,291</td>
<td>4,377</td>
<td>33%</td>
</tr>
</tbody>
</table>
4.3 – Capacity, Utilization and Forecasting Analysis: Trauma and Burns (Adult Population)

Data Sources
Trauma admissions were obtained from the Ontario Trauma Registry (OTR), FY 2007-2011. Population estimates and projections were used for the calculation of trauma rates per 10,000 and trauma volume projections. Population estimates and projections account for births, deaths, and migration patterns. Population estimates were obtained for calendar years (CY) 2007-2013 from the Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014. Population projections were obtained for CY 2014-2026 from the Population Projections Summary LHIN (Ontario Ministry of Finance), and the Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014.

Exclusions
The paediatric population (<18 years) and cases with an Injury Severity Score (ISS) <12 were excluded from the analysis.

Calculations
Patterns of trauma admissions by Lead Trauma Hospital (LTH) were established based on the patient’s postal code as recorded in the OTR.

Trauma rate per 10,000 = (trauma volumes within demographic group/population within the same demographic group) x 10,000. The rates were calculated for the following age categories: 18-39, 40-64, 65-79, 80+, and analyzed by gender.

For the trauma projections, the 2011 rates per 10,000 (age and gender-specific) were applied to respective age and gender-specific population estimates to arrive at estimated trauma volumes for each demographic group by year. These volumes were then added to obtain provincial level projections.

Limitations
Forecasting is done with a mathematical formula, using best historical data available and with best estimates of population projections. There are a number of factors that may change the projection over time. Also, strategies implemented at a local hospital level or a system wide level can mitigate demand for projected bed or case volumes. These factors should be taken into account when interpreting projections for future needs to meet future demands.

Provincial Trends
From 2007 to 2011, hospital trauma admissions to Lead Trauma Hospitals increased by 4% (from 4,000 to 4,176). At the same time, as shown in Figure 1, the total number of in-hospital days incurred by these cases increased at a higher rate over the same time period. Thus, the total number of in-hospital days increased
by 6% (from 59,725 to 63,569), the days in special care units (SCU) increased by 10%, and the Alternate Level of Care (ALC) days increased by 37%. The ALC day increase should be interpreted with caution, given possible data quality issues. The average Injury Severity Score (ISS) did not change over this period.

Figure 1: Provincial Trends in Adult Trauma Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volumes</td>
<td>4,000</td>
<td>3,821</td>
<td>3,919</td>
<td>4,036</td>
<td>4,176</td>
<td>4%</td>
</tr>
<tr>
<td>Total LOS (Days)</td>
<td>59,725</td>
<td>57,756</td>
<td>58,149</td>
<td>58,067</td>
<td>63,569</td>
<td>6%</td>
</tr>
<tr>
<td>Total SCU Days</td>
<td>19,990</td>
<td>19,521</td>
<td>21,015</td>
<td>–</td>
<td>22,057</td>
<td>10%</td>
</tr>
<tr>
<td>Total ALC Days</td>
<td>6,188</td>
<td>5,845</td>
<td>7,286</td>
<td>9,607</td>
<td>8,459</td>
<td>37%</td>
</tr>
<tr>
<td>Average ISS</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>0%</td>
</tr>
<tr>
<td>Died in LTH</td>
<td>520</td>
<td>487</td>
<td>508</td>
<td>513</td>
<td>510</td>
<td>-2%</td>
</tr>
<tr>
<td>% Died</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
<td>12%</td>
<td>–</td>
</tr>
</tbody>
</table>

Data Source: Ontario Trauma Registry

Variations by Demographic Group, LHIN and Cause of Injury

Male patients accounted for 70% of trauma admissions, 70% of the total hospital length of stay, and 77% of the SCU length of stay.

Based on the patient's LHIN of residence and 2011 data, there was a substantial variation across LHINs for trauma rates per 10,000, with the Toronto Central and North West LHINs having the highest rates of hospital admissions, compared to the provincial rate (8.4, 6.9, and 3.8, respectively).

As shown in Figure 2, unintentional falls and transport incidents accounted for the vast majority (over 80%) of hospital trauma admissions to the 11 Lead Trauma Hospitals. During the period of 2007-2011, the order between these two causes reversed. This is related to a higher rate of falls (19%), in contrast to a slight decrease in trauma cases due to transport incidents. In 2007, transport incidents were the leading cause of trauma, but by 2011, they were superseded by falls.

Figure 2: Adult Trauma Volumes by Injury Cause

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>1,485</td>
<td>1,560</td>
<td>1,575</td>
<td>1,655</td>
<td>1,770</td>
<td>19%</td>
</tr>
<tr>
<td>Transport Incidents</td>
<td>1,790</td>
<td>1,591</td>
<td>1,611</td>
<td>1,674</td>
<td>1,696</td>
<td>-5%</td>
</tr>
<tr>
<td>Assault</td>
<td>326</td>
<td>305</td>
<td>360</td>
<td>318</td>
<td>344</td>
<td>6%</td>
</tr>
<tr>
<td>Exposure to Mechanical Forces</td>
<td>160</td>
<td>155</td>
<td>164</td>
<td>146</td>
<td>143</td>
<td>-11%</td>
</tr>
<tr>
<td>Self-Inflicted incl. Poisoning</td>
<td>121</td>
<td>85</td>
<td>87</td>
<td>111</td>
<td>100</td>
<td>-17%</td>
</tr>
<tr>
<td>Other</td>
<td>65</td>
<td>64</td>
<td>67</td>
<td>69</td>
<td>70</td>
<td>8%</td>
</tr>
<tr>
<td>Exposure to Smoke, Fire, Flames</td>
<td>53</td>
<td>61</td>
<td>55</td>
<td>63</td>
<td>53</td>
<td>0%</td>
</tr>
</tbody>
</table>

Data Source: Ontario Trauma Registry
Future Projections

Hospital admission rates per 10,000 vary greatly by demographic group, with men over 80+ years of age experiencing the highest rates followed by women 80+ years of age and men 65-79 years of age.

Assuming 2011 gender and age-specific rates, the volume of trauma cases is projected to increase to 5,441 cases by 2026 (Figure 3). This represents a 7-8% increase over each five-year period, compared to 4% during 2007-2011.

Figure 3: Adult Trauma Volume Projections

![Graph showing projected adult trauma volume projections from 2011 to 2026.](image)

Data Sources: Ontario Trauma Registry, Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014

The projected rate may be higher due to the proportion of the aging population, as the 80+ age group has a substantially higher rate of trauma. It is to be noted that injury rates are estimates derived from Lead Trauma Hospital discharges only. Therefore, it is plausible that improvements in triage and transport or redistribution of patients across a more inclusive system might positively or negatively impact these rates respectively.

Figure 4: Adult Trauma Volume Projections by Demographic Group

![Graph showing projected adult trauma volume projections by demographic group from 2011 to 2026.](image)

Data Sources: Ontario Trauma Registry, Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014
4.4 – Capacity, Utilization and Forecasting Analysis: Paediatric Critical Care Services

Data Sources
ICU admissions and the number of critical care beds in the province were obtained from the Critical Care Information System (CCIS), calendar years (CY) 2009-2013.

Additional information on ICU patients (e.g. patient LHIN of residence, major clinical category) was obtained from the Discharge Abstract Database (Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014).

Population estimates and projections were used for the calculation of ICU rates per 1,000 and ICU volume projections. Population estimates were obtained for CY 2009-2013 from the Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014. Population projections were obtained for CY 2014-2026 from the Population Projections Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014.

Exclusions
Neonate (<28 days) data admitted to a neonatal ICU is not captured in CCIS, however this patient population is included in the provincial population estimates and projections.

Calculations
ICU Admission Rate per 1,000 = Volumes of ICU admissions / Population x 1,000.

Occupancy Rates = Total ICU patient days in a year / (365 x Number of Beds in Inventory).

Total ICU patient days = the sum of days the unit has been occupied for all patients for the period.

Projected ICU Beds = (ICU admission Rate x Average ICU Length of Stay x Population projection) / (365 x Occupancy Rate Assumption).

For ICU admission Rate and Average ICU Length of Stay, 2013 average values were used

Occupancy Rate Assumption for forecasting – 85%

Limitations
Forecasting is done with a mathematical formula, using best historical data available and with best estimates of population projections. There are a number of factors that may change the projection over time. Also, strategies implemented at a local hospital level or a system wide level can mitigate demand or projected bed
volumes. These factors should be taken into account when interpreting projections for future bed needs to meet future demands.

**Provincial Patterns 2009-2013**

From 2009 to 2013, the paediatric population in Ontario decreased from 2.73M to 2.69M, or by 1.5%. At the same time, the provincial number of paediatric ICU admissions increased from 4,846 to 5,045, or by 4% (see Figure 1).

**Figure 1: Paediatric Population and ICU Admissions in Ontario: 2009-2013**

Data Sources: Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO; ICU Admissions - Critical Care Information System (CCIS)

The paediatric population in most LHINs did not change or in fact decreased, except for the Mississauga Halton and Central LHINs. The most noticeable decreases were in the Erie St. Clair, North East, North West and South West LHINs (6%).

As of 2013, the Central LHIN had the highest volume of the paediatric population in the province (376, 539 or 14%), followed by the Central East, HNHB, and Mississauga Halton LHINs (Figure 2).
Figure 2: Paediatric Population by LHIN in 2013

Data Sources: Population Estimates Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO

As of 2013, 48% of Level 3 paediatric ICU patients received care in the Toronto Central LHIN, 16% were treated in the South West and HNHB LHINs (each), and 15% in the Champlain LHIN. For Level 2 ICUs, almost half (49%) of patients were treated in the HNHB LHIN, 25% in the South East LHIN, and 10% in the Toronto Central LHIN.

The Toronto Central LHIN provides care to paediatric patients residing across the whole province. 11% of patients treated in the Toronto Central LHIN were residents of the Toronto Central LHIN. 90-99% of the paediatric patients from the Central West, Central East, Central and Mississauga Halton LHINs receive paediatric critical care in the Toronto Central LHIN.

**Provincial Projections for Paediatric Volumes**

The provincial paediatric population is projected to increase 11% by 2026, as shown in Figure 3.

Figure 3: Paediatric Population by LHIN in 2013

Data Sources: Population Estimates and Projections Summaries LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014
If the 2009-2013 ICU admission trends are sustained in the future, the projected volumes of ICU admissions for Level 3 and 2 ICUs will increase to 4,631 and 978, respectively.

**Figure 4: Paediatric Volume Projections by ICU Level**

Data Sources: Population Estimates and Projections Summaries LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted October 2014; Critical Care Information System (ICU admissions).

**Anticipated Sources of Pressure**

As a result of technological and pharmaceutical advances, the survival rates for paediatric critical illnesses are expected to increase. This could lead to an increased number of children with medically complex conditions. If the 2009-2013 trends are sustained in the future (Figure 5), pressures due to higher volumes of children with medically complex conditions should be anticipated in the following areas:

1. Diseases of the nervous, respiratory, digestive, endocrine systems and multisystemic infections (pressures due to volume increases),
2. Diseases of the musculoskeletal system and connective tissue, and newborns/neonates with perinatal conditions (complexity), and
3. Diseases of the kidney, urinary tract, hepatobiliary system/pancreas, as well as mental diseases and disorders (both volumes and complexity of patients).
Figure 5: 2009-2013 Volume and Case Mix Trend for Paediatric ICU Population

<table>
<thead>
<tr>
<th>Major Clinical Category</th>
<th>Volumes</th>
<th>HIG</th>
<th>LOS %</th>
<th>% Change 2009-2013</th>
<th>Volumes</th>
<th>HIG</th>
<th>LOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIRCULATORY SYSTEM</td>
<td>886</td>
<td>1,003</td>
<td>7.6</td>
<td>8.0</td>
<td>12</td>
<td>14</td>
<td>13%</td>
</tr>
<tr>
<td>NERVOUS SYSTEM</td>
<td>638</td>
<td>840</td>
<td>6.4</td>
<td>6.2</td>
<td>15</td>
<td>14</td>
<td>32%</td>
</tr>
<tr>
<td>RESPIRATORY SYSTEM</td>
<td>551</td>
<td>769</td>
<td>5.3</td>
<td>4.5</td>
<td>13</td>
<td>12</td>
<td>40%</td>
</tr>
<tr>
<td>NEONATES WITH PERINATAL CONDITIONS</td>
<td>615</td>
<td>682</td>
<td>10.8</td>
<td>15.1</td>
<td>27</td>
<td>36</td>
<td>11%</td>
</tr>
<tr>
<td>SIGN. TRAUMA, INJURY, POISONING, TOXIC EFFECTS OF DRUGS</td>
<td>353</td>
<td>335</td>
<td>5.0</td>
<td>3.8</td>
<td>13</td>
<td>10</td>
<td>-5%</td>
</tr>
<tr>
<td>MUSCULOSKELETAL SYSTEM AND CONNECTIVE TISSUE</td>
<td>306</td>
<td>307</td>
<td>4.6</td>
<td>5.9</td>
<td>9</td>
<td>13</td>
<td>0%</td>
</tr>
<tr>
<td>EAR, NOSE, MOUTH AND THROAT</td>
<td>278</td>
<td>281</td>
<td>4.2</td>
<td>2.7</td>
<td>11</td>
<td>8</td>
<td>1%</td>
</tr>
<tr>
<td>ENDOCRINE, NUTRITION AND METABOLISM</td>
<td>190</td>
<td>240</td>
<td>3.7</td>
<td>3.1</td>
<td>11</td>
<td>8</td>
<td>26%</td>
</tr>
<tr>
<td>DIGESTIVE SYSTEM</td>
<td>135</td>
<td>198</td>
<td>6.7</td>
<td>6.1</td>
<td>19</td>
<td>18</td>
<td>47%</td>
</tr>
<tr>
<td>BLOOD AND LYMPHATIC SYSTEM</td>
<td>130</td>
<td>138</td>
<td>17.2</td>
<td>9.2</td>
<td>41</td>
<td>24</td>
<td>6%</td>
</tr>
<tr>
<td>MULTISYSTEMIC OR UNSPECIFIED SITE INFECTIONS</td>
<td>82</td>
<td>122</td>
<td>8.0</td>
<td>5.7</td>
<td>25</td>
<td>16</td>
<td>49%</td>
</tr>
<tr>
<td>KIDNEY, URINARY TRACT AND MALE REPRODUCTIVE SYSTEM</td>
<td>89</td>
<td>109</td>
<td>6.2</td>
<td>7.6</td>
<td>17</td>
<td>20</td>
<td>22%</td>
</tr>
<tr>
<td>HEPATOBLIARY SYSTEM AND PANCREAS</td>
<td>53</td>
<td>94</td>
<td>11.9</td>
<td>15.2</td>
<td>23</td>
<td>32</td>
<td>77%</td>
</tr>
<tr>
<td>OTHER REASONS FOR HOSPITALIZATION</td>
<td>45</td>
<td>67</td>
<td>6.8</td>
<td>1.3</td>
<td>27</td>
<td>6</td>
<td>49%</td>
</tr>
</tbody>
</table>
| MENTAL DISEASES AND DISORDERS                              | 13      | 51   | 1.6   | 3.0                | 7        | 14  | 292%
| BURNS                                                      | 9       | 21   | 16.8  | 12.3               | 36       | 15  | 133%
| SKIN, SUBCUTANEOUS TISSUE AND BREAST                       | 8       | 16   | 2.7   | 6.8                | 12       | 15  | 100%
| EYE                                                        | 4       | 7    | 0.8   | 1.4                | 3        | 6   | 75%
| PREGNANCY AND CHILDBIRTH                                  | 1       | 4    | 2.4   | 1.5                | 3        | 6   | 75%
| MISCELLANEOUS OR UNGROUPABLE DATA                          | 1       | 2    | 0.2   | 0.2                | 1        | 1   | 100%
| FEMALE REPRODUCTIVE SYSTEM                                | 4       | 1    | 1.1   | 2.0                | 11       | 6   | 75%
| TOTAL                                                      | 4,391   | 5,287| 6.9   | 6.6                | 16       | 15  | 106%

Data Source: DAD, Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted Oct. 2014

Paediatric Bed Projections

Level 3 ICU. In the absence of investments in alternative mitigation strategies, a modeling forecast based on the method described above would result in a requirement of approximately 7 additional Level 3 beds in 2015/16 in order to meet current demand, and another 1 bed every other year thereafter up to 2026 to maintain sufficient capacity in the system.

Level 2 ICU. Based on the modeling forecast, Ontario would require approximately 1 additional bed in 2015/16 to maintain sufficient capacity in the system, and an additional 1 bed thereafter up to 2026.
Implementation of the Ontario Critical Care Plan and Mechanisms for Review
Part 5: Implementation of the Ontario Critical Care Plan and Mechanisms for Review

Evaluation is an important component of the new Ontario Critical Care Plan for the next three years. The overall goal of the evaluation is twofold. First, to determine how well the implementation of the various components of the Ontario Critical Care Plan is progressing and if any changes to the project activities are required based on the evaluation. The second goal is to assess the impact of the Ontario Critical Care Plan.

CCSO will undertake both process and impact evaluation of the Ontario Critical Care Plan. The annual process evaluation will monitor the facilitators and challenges that may be impacting the progress, or lack of progress in achieving the defined strategic goals, objectives and action plans. The findings from process evaluations will inform the annual CCSO work plans and may point to changes or adjustments in operational activities. After the conclusion of the Ontario Critical Care Plan, an impact evaluation will be conducted to determine the successes and limitations of the plan and to document the lessons learned. The details of the evaluation design and data collection framework will be developed after the launch of the plan.

The CCSO operational plan is developed annually in consultation with the MOHLTC and progress is reviewed on a quarterly basis. The CCSO Coordinating Committee will review progress related to the Ontario Critical Care Plan on an annual basis.

The specific objectives of the evaluation are as follows:

- To determine the number of objectives outlined within the five strategic goals that are translated into the annual CCSO operational plan, and to measure the implementation of CCSO annual operational plans;
- To assess if the process of implementation for each objective is occurring as planned;
- To determine how satisfied the MOHLTC and CCSO Coordinating Committee are with the quarterly and annual progress reviews; and
- To understand the perceptions of the provincial advisory committees (PNO, PCCAC and OTAC) in relation to progress within their respective program areas.

The plan for the annual process review and final impact evaluation is illustrated in the figure below.

**Progress and Performance Review of the Ontario Critical Care Plan 2015-2018**

- **Year 1**: Operational Plans → Annual review
- **Year 2**: Annual review → Progress and performance reviews and stakeholders dialogue → Final (impact) and situational analysis
- **Year 3**: Final (impact) and situational analysis

Data analysis and synthesis from appropriate data sources

Systematic assessment using quantitative and qualitative methods

**Annual review** will focus on the indicators specified in annual operational plans. These are input, process and output indicators. The annual reviews will help inform evaluation on a regular basis.

**Final review** will involve a comprehensive analysis of progress for the three-year period. The final review builds upon the annual reviews, but also includes the results of the prospective evaluation that will be developed after the launch of the plan.
Part 6: Bibliography

The following resources were consulted as part of the CCSO strategic planning process.

Journal Articles


**Publications**

**Books**


**Documents**


Legislation


White Papers


Online Resources


Capacity, Utilization and Forecasting Analysis

Data Sources

Critical Care Information System (CCIS), calendar years 2009-2013

Discharge Abstract Database (DAD), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted Oct 2014

National Ambulatory Care Reporting System (NACRS), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted Oct 2014

National Rehabilitation Reporting System (NRS), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted Oct 2014
Ontario Critical Care Plan 2015-2018


Population Projections Summary LHIN (Ontario Ministry of Finance), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, extracted Oct 2014

Journal Articles


Publications


Appendix A: List of Stakeholders Consulted

This is a complete list of stakeholders consulted as part of the CCSO strategic planning process. More than 600 individuals were consulted during the development of this plan including Chief Executive Officers, clinical and non-clinical administrators, medical leaders and key provincial partners. The consultation phase included focus sessions (teleconference and/or in-person), select one-on-one interviews and LHIN Town Hall Meetings.

CCSO Provincial Program Areas
CCSO consulted with representatives from the following provincial advisory committees:
- CCSO Coordinating Committee
- Critical Care Nursing Committee
- Ontario Trauma Advisory Committee
- Paediatric Critical Care Advisory Committee
- Provincial Neurosurgery Ontario

Critical Care LHIN Leaders
CCSO consulted with all of the Critical Care LHIN Leaders during the strategic planning process.

Critical Care System Partners
CCSO consulted with representatives from the following organizations:
- Ministry of Health and Long Term Care
- CritiCall Ontario
- Emergency Medical Services (EMS)
- Ornge
- Provincial Clinical Ethicists
Local Health Integration Networks

CCSO consulted with representatives from each of the fourteen LHINs in the province.

LHIN 1 – Erie St. Clair
Bluewater Health
Chatham-Kent Fire and Emergency Services
Chatham-Kent Health Alliance
Emergency Medical Services (EMS)
Erie St. Clair LHIN Office
Hotel Dieu Grace Hospital Windsor
Leamington District Memorial Hospital
University of Windsor
Windsor Regional Hospital

LHIN 2 – South West
Alexandra Marine and General Hospital
Emergency Medical Services (EMS)
Grey Bruce Health Services
Hanover and District Hospital
Listowel Wingham Hospitals Alliance
London Health Sciences Centre
Middlesex Hospital Alliance
South Bruce Grey Health Centre
South West LHIN Office
St. Joseph’s Health Care London
St. Thomas Elgin General Hospital
University of Western Ontario

LHIN 3 – Waterloo Wellington
Cambridge Memorial Hospital
Grand River Hospital
Groves Memorial Community Hospital
Guelph General Hospital
North Wellington Health Care
St. Mary’s General Hospital
Waterloo Wellington LHIN Office

LHIN 4 – Hamilton Niagara
Haldimand Brant
Brant Community Healthcare System
Emergency Medical Services (EMS)
Haldimand War Memorial Hospital
Hamilton Niagara Haldimand Brant Community Care Access Centre (CCAC)
Hamilton Niagara Haldimand Brant LHIN Office
Hamilton Health Sciences
Joseph Brant Hospital
McMaster Children’s Hospital
McMaster University
Niagara Health System
Norfolk General Hospital
St. Joseph’s Healthcare Hamilton
West Haldimand General Hospital

LHIN 5 – Central West
Central West LHIN Office
Emergency Medical Services (EMS)
Headwaters Health Care Centre
William Osler Health System

LHIN 6 – Mississauga Halton
Emergency Medical Services (EMS)
Halton Healthcare Services
Mississauga Halton Community Care Access Centre (CCAC)
Mississauga Halton LHIN Office
Trillium Health Partners
### LHIN 7 – Toronto Central
- Emergency Medical Services (EMS)
- Mount Sinai Hospital
- St. Joseph’s Health Care Centre Toronto
- St. Michael’s Hospital
- Sunnybrook Health Sciences Centre
- The Hospital for Sick Children
- Toronto Central LHIN Office
- Toronto East General Hospital
- Trillium Gift of Life Network
- University Health Network
- University of Toronto

### LHIN 8 – Central
- Central LHIN Office
- Emergency Medical Services (EMS)
- Humber River Regional Hospital
- Mackenzie Health
- Markham Stouffville Hospital
- North York General Hospital
- Southlake Regional Health Centre
- Stevenson Memorial Hospital

### LHIN 9 – Central East
- Campbellford Memorial Hospital
- Central East LHIN Office
- Emergency Medical Services (EMS)
- Lakeridge Health
- Northumberland Hills Hospital
- Peterborough Regional Health Centre
- Ross Memorial Hospital
- Rouge Valley Health System
- The Scarborough Hospital

### LHIN 10 – South East
- Brockville General Hospital
- Emergency Medical Services (EMS)
- Kingston General Hospital
- Lennox and Addington County General Hospital
- Perth and Smiths Falls District Hospital
- Queen’s University
- Quinte Health Care
- South East LHIN Office

### LHIN 11 – Champlain
- Carleton Place and District Hospital
- Champlain LHIN Office
- Cornwall Community Hospital
- Emergency Medical Services (EMS)
- Glengarry Memorial Hospital
- Hôpital Montfort
- Kemptville District Hospital
- Pembroke Regional Hospital
- Queensway Carleton Hospital
- Renfrew Victoria Hospital
- Royal Ottawa Health Care Group
- St. Lawrence College
- The Children’s Hospital of Eastern Ontario
- The Ottawa Hospital
- University of Ottawa Heart Institute

### LHIN 12 – North Simcoe Muskoka
- Collingwood General & Marine Hospital
- Emergency Medical Services (EMS)
- Georgian Bay General Hospital
- Muskoka Algonquin Healthcare
- North Simcoe Muskoka LHIN Office
- Orillia Soldiers Memorial Hospital
- Royal Victoria Hospital
LHIN 13 – North East
Blind River District Health Centre
Espanola Regional Hospital and Health Centre
Health Sciences North
Hôpital de Mattawa Hospital
Manitoulin Health Centre
MICs Group of Health Services
North Bay Regional Health Centre
North East LHIN Office
Sault Area Hospital
Temiskaming Hospital
Timmins and District Hospital
West Parry Sound Health Centre

LHIN 14 – North West
Atikokan General Hospital
Dryden Regional Health Centre
Geraldton District Hospital
Lake of the Woods District Hospital
North West LHIN Office
Riverside Health Care
Sioux Lookout Meno Ya Win Health Centre
Thunder Bay Regional Health Sciences Centre
Appendix B: Stakeholder Consultation Questions

For the purpose of the discussion, we are taking into account the continuum of care and the relationships within the system.

Discussion from the perspectives of patient care, education, research, administration/policy and information management:

- **Critical Care System Successes** – What are the strengths of the critical care system that promote access, quality, system integration and improved patient outcomes? What initiatives or strategies are in place that demonstrate these strengths?
- **Critical Care System Challenges and Gaps** – What challenges and gaps do you and your colleagues face in providing or accessing critical care services for patients?
- **Critical Care Patient Challenges** – What challenges do critical care patients and their families face?
- **Opportunities** – What are the potential opportunities to enhance the critical care system, as well as the patient care experience and outcomes?
- **Enablers for Success** – What recommendations would you make to bridge any gaps in the critical care system?

Additional question:

- What literature, in addition to that circulated within the consultation package, would you suggest that we access to inform our planning process?

**Facilitated Consultations – Suggested Topic Areas**

Participants in facilitated consultations were invited to comment on the following topic areas and others of relevance to the system.

1. Anti-microbial stewardship
2. Chronic ventilation
3. Critical care protocols outside the ICU
4. Ethics, including end-of-life care
5. Health human resource planning
6. Knowledge translation
7. Implementation of best practices
8. Infection control
9. Information management
10. New and emerging treatments
11. Patient engagement
12. Patient outcomes – in the ICU and long-term
13. Rehabilitation
14. Safety
15. Technology
16. Transport
Appendix C: LHIN Adult Critical Care Profile and Priorities Template

<table>
<thead>
<tr>
<th>LHIN Name</th>
<th>Critical Care LHIN Leader</th>
<th>LHIN Office Representative</th>
<th>Contact Phone Number</th>
<th>Contact Email</th>
</tr>
</thead>
</table>

Section 1: Current State

1.1 Below is the information for FY 2014/15 related to the Adult Critical Care Capacity within the LHIN (Information obtained from CCIS – Q1 2014/15) (see attached for hospital specific information)

<table>
<thead>
<tr>
<th>Community L2</th>
<th>CCSO Information # Beds/# Vented Beds</th>
<th>LHIN Confirmation # Beds/# Vented Beds</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>Community L3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching L2</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Teaching L3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.2 Please describe the Critical Care governance model in place within the LHIN (the structure in place to address issues/priorities related to the critical care system within the LHIN – committees and membership, critical network structure and processes, and performance management).

1.3 Please describe how the critical care units within the LHIN support one another, e.g. transfer of patients between units, sharing of resources – both human and capital.
1.4 What are the most significant Human Resource needs / challenges in moving towards, or sustaining, closed model units and high performing interdisciplinary care teams within the LHIN? (recognizing that some units may not be able to move to a closed unit, but may also be better supported by a better complement of interdisciplinary care providers)

1.5 Please identify the top 3 – 4 priorities for Human Resources planning within the LHIN over the next 3 years and your planned strategies to address these.

1.6 Please identify any emerging trends / needs / priorities within the critical care system within the LHIN anticipated over the next 3 years. Please describe the most important 4 – 5 and the planned strategies to address these. e.g. changing patient population, new practices/technologies/pharmacology.

1.7 Please describe any Critical Care related construction or capital projects that are underway or planned within the next three years. Will this (these) project(s) increase Critical Care capacity within the LHIN?

Section 2: Three Year Plan
Please describe the priorities for the Critical Care System within the LHIN over the next three years. Response could include special projects the LHIN critical care system is embarking on, issues that address changes to governance structure, LHIN critical care capacity changes, changes related to critical care delivery, health human resource planning, surge planning, initiatives to improve access, quality, system integration, patient engagement strategies.
Appendix D: Program Profile and Priorities Template

Co-Chair Names

Contact Phone Numbers

Contact Emails

CCSO Project Manager

Section 1: Current State

1.1 Please describe the governance model in place within the Ontario paediatric/neurosurgical/trauma and burns system. (the structure in place to address issues/priorities related to the paediatric/neurosurgical/trauma and burns system within the province – committees and membership, structure and processes, and performance management)

1.2 Please describe how the paediatric/neurosurgical/trauma and burns centres within the province support one another, e.g. transfer of patients between centres, sharing of resources – both human and capital.

1.3 What are the most significant Human Resource needs/challenges in achieving high performing interdisciplinary care teams within the Ontario paediatric/neurosurgical/trauma and burns system?
1.4 Please identify the top 3 – 4 priorities for Human Resources planning within the Ontario paediatric/ 
neurosurgical/trauma and burns system over the next 3 years and your planned strategies to address these. 


1.5 Please identify any emerging trends / needs / priorities within the Ontario paediatric/neurosurgical/trauma 
and burns system anticipated over the next 3 years. Please describe the most important 4 – 5 and the planned 
strategies to address these e.g. changing patient population, new practices/technologies/pharmacology. 


1.6 Please describe any construction or capital projects that are underway or planned within the next three 
years that will support the Ontario paediatric/neurosurgical/trauma and burns system. Will this (these) 
project(s) increase paediatric/neurosurgical/trauma and burns capacity within the province? 


Section 2: Three Year Plan

Please describe the priorities for the Ontario paediatric/neurosurgical/trauma and burns system over the 
next three years. Response could include special projects the paediatric/neurosurgical/trauma and burns 
system is embarking on, issues that address changes to governance structure, paediatric/neurosurgical/ 
trauma and burns capacity changes, changes related to paediatric/neurosurgical/trauma and burns care 
delivery, health human resource planning, surge planning, initiatives to improve access, quality, system 
integration, patient and family engagement strategies.
## Appendix E: Abbreviations List

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>aC3KTion Net</td>
<td>A Canadian Critical Care Knowledge Translation Network</td>
</tr>
<tr>
<td>ADT</td>
<td>Admissions, Discharge, and Triage</td>
</tr>
<tr>
<td>ALC</td>
<td>Alternate Level of Care</td>
</tr>
<tr>
<td>ARDS</td>
<td>Acute Respiratory Distress Syndrome</td>
</tr>
<tr>
<td>ARIMA</td>
<td>Autoregressive Inductive Moving Average</td>
</tr>
<tr>
<td>ASD</td>
<td>Acute Stress Disorder</td>
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<td>CCAC</td>
<td>Community Care Access Centre</td>
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<td>CCIS</td>
<td>Critical Care Information System</td>
</tr>
<tr>
<td>CCRT</td>
<td>Critical Care Response Team</td>
</tr>
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<td>CCSO</td>
<td>Critical Care Services Ontario</td>
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<tr>
<td>CEI</td>
<td>Coil Embolization Implementation</td>
</tr>
<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
</tr>
<tr>
<td>CIHI</td>
<td>Canadian Institute for Health Information</td>
</tr>
<tr>
<td>CY</td>
<td>Calendar Year</td>
</tr>
<tr>
<td>DAD</td>
<td>Discharge Abstract Database</td>
</tr>
<tr>
<td>ECMO</td>
<td>Extracorporeal Membrane Oxygenation</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>EITF</td>
<td>Epilepsy Implementation Task Force</td>
</tr>
<tr>
<td>EMR</td>
<td>Electronic Medical Record</td>
</tr>
<tr>
<td>EMS</td>
<td>Emergency Medical Service</td>
</tr>
<tr>
<td>FIM</td>
<td>Functional Independence Measure</td>
</tr>
<tr>
<td>GTA</td>
<td>Greater Toronto Area</td>
</tr>
<tr>
<td>HFO</td>
<td>High Frequency Oscillation</td>
</tr>
<tr>
<td>HHSC</td>
<td>Hamilton Health Sciences Corporation</td>
</tr>
<tr>
<td>HNHB</td>
<td>Hamilton Niagara Haldimand Brant</td>
</tr>
<tr>
<td>HSN</td>
<td>Health Sciences North</td>
</tr>
<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
</tr>
<tr>
<td>IHI</td>
<td>Institute for Healthcare Improvement</td>
</tr>
<tr>
<td>ISS</td>
<td>Injury Severity Score</td>
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<tr>
<td>KGH</td>
<td>Kingston General Hospital</td>
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<tr>
<td>KT</td>
<td>Knowledge Translation</td>
</tr>
<tr>
<td>LHIN</td>
<td>Local Health Integration Network</td>
</tr>
<tr>
<td>LHSC</td>
<td>London Health Sciences Centre</td>
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<tr>
<td>LOS</td>
<td>Length of Stay</td>
</tr>
<tr>
<td>LTH</td>
<td>Lead Trauma Hospital</td>
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<tr>
<td>MCC</td>
<td>Major Clinical Categories</td>
</tr>
<tr>
<td>MOHLTC</td>
<td>Ministry of Health and Long-Term Care</td>
</tr>
<tr>
<td>MRP</td>
<td>Most Responsible Provider</td>
</tr>
<tr>
<td>NACRS</td>
<td>National Ambulatory Care Reporting System</td>
</tr>
<tr>
<td>NEON</td>
<td>Neuro Educator and Outreach Network</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
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<tr>
<td>NHS</td>
<td>National Health Service</td>
</tr>
<tr>
<td>NRS</td>
<td>National Rehabilitation Reporting System</td>
</tr>
<tr>
<td>OHA</td>
<td>Ontario Health Association</td>
</tr>
<tr>
<td>OR</td>
<td>Operating Room</td>
</tr>
<tr>
<td>OTAC</td>
<td>Ontario Trauma Advisory Committee</td>
</tr>
<tr>
<td>OTR</td>
<td>Ontario Trauma Registry</td>
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<tr>
<td>PAHO</td>
<td>Pan American Health Organization</td>
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<tr>
<td>PAHSC</td>
<td>Paediatric Academic Health Science Centre</td>
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<td>PCCAC</td>
<td>Paediatric Critical Care Advisory Committee</td>
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<td>PCCN</td>
<td>Paediatric Critical Care Network</td>
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<tr>
<td>PCCRT</td>
<td>Paediatric Critical Care Response Team</td>
</tr>
<tr>
<td>PCMCH</td>
<td>Provincial Council for Maternal and Child Health</td>
</tr>
<tr>
<td>PNO</td>
<td>Provincial Neurosurgery Ontario</td>
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<tr>
<td>PTSD</td>
<td>Posttraumatic Stress Disorder</td>
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<tr>
<td>PTSR</td>
<td>Posttraumatic Stress Reaction</td>
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<tr>
<td>RTN</td>
<td>Regional Trauma Network</td>
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<tr>
<td>SARS</td>
<td>Severe Acute Respiratory Syndrome</td>
</tr>
<tr>
<td>SCU</td>
<td>Special Care Unit</td>
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<tr>
<td>TC LHIN</td>
<td>Toronto Central Local Health Integration Network</td>
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<td>TOH</td>
<td>The Ottawa Hospital</td>
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<td>UHN</td>
<td>University Health Network</td>
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<td>UK</td>
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<td>United States of America</td>
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<td>VCC</td>
<td>Virtual Critical Care</td>
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<td>World Health Organization</td>
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