

WE HELP KIDS AND FAMILIES
BE THEIR HEALTHIEST



TRANSPORT TEAM



&

PRE-TRANSPORT STABILIZATION



CHEO Neonatal Transport Outreach Website

<https://outreach.cheo.on.ca/neonatal-transport-team>



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Neonatal Transport

The Transport Team is a dedicated specialized neonatal service that brings the expertise of the Children's Hospital of Eastern Ontario (CHEO) directly to the community referral centers. The program provides 24/7 service to community hospitals in Eastern Ontario, Western Quebec and sections of Northern Ontario. The two-person team works collaboratively with the supervising Neonatologist to provide stabilization and safe emergency transport of high-risk neonates to an appropriate level of care hospital. We transport approximately 400 neonatal patients every year.



Mission:

Our primary goal is to improve outcomes for critically ill neonatal patients requiring transport for specialized services. Our passion and core values guide our team in providing the highest quality of care utilizing a patient and family centered approach.

For Neonatal Acute Consult, Transfer & Transport Support

Call CritiCall Ontario 1-800-668-HELP (4357)

Neonatal Stabilization

During the transition from fetus to neonate some babies require active intervention and resuscitation. Neonatal resuscitation and follow up care provided by knowledgeable and skilled health care professionals is critical to a healthy outcome for these babies.

Early intervention and prevention of complications are the basic principles in neonatal resuscitation and stabilization.

Observation following resuscitation may be necessary for some infants while other infants may require immediate management and transfer depending on their needs and the resources available at the delivery hospital.



Infants must be resuscitated and stabilized **prior** to transport. The transport team will be dispatched as soon as possible after an infant is born *and* identified as requiring transport.

Upon arrival, the neonatal transport team will assess the infant and determine further management as required.



Call CritiCall Ontario 1-800-668-HELP (4357) For Neonatal Acute Consult, Transfer & Transport Support

Here's how it works:

Call CritiCall Ontario at **1-800-668-4357 (HELP)**

Provide your name, hospital name and location, phone number and CPSO number

CritiCall Ontario will collect the following patient details:

- Patient name
- Age
- Gestational Age
- Weight (if available)
- Provisional diagnosis
- “Life or Limb” status¹

CritiCall Ontario will contact the designated pediatric hospital for your region to arrange a consultation with a neonatologist

If the patient requires transport, the consulting neonatologist will work with their neonatal/pediatric transport team to coordinate transport

Life or limb means the neonate needs access to care within 4 hours and for neonates aligns with the Canadian Neonatal Transport Network classification, EMERGENT:

Referral sites are having difficulty with resuscitation or stabilization; OR
Infant born or to be born in a facility where resources (equipment/ expertise) are unavailable / inadequate to meet resuscitation or stabilization needs

EXAMPLES:

Ongoing cardiorespiratory arrest, shock, neurological unresponsiveness, inadequate ventilation or oxygenation, Bilious vomiting or
Request for attendance at delivery for \leq 28 week infant in non-tertiary centre

When to call?

Depending on your facility's level of care and resources:

Conditions which *require* referral and transport to a NICU

- Prematurity < 34 weeks +/- Birth weight < 2kg
- Respiratory distress
- Possible seizure activity or neurological examination concerns
- Congenital anomalies requiring specialized diagnostics or treatment
- Gastrointestinal problems
- Genitourinary disorders
- Cardiac anomalies
- Surgical conditions
- Sepsis or generalized pallor
- Bleeding disorders
- Severe hemolysis and jaundiced
- Severe birth trauma
- Suspected metabolic disorder



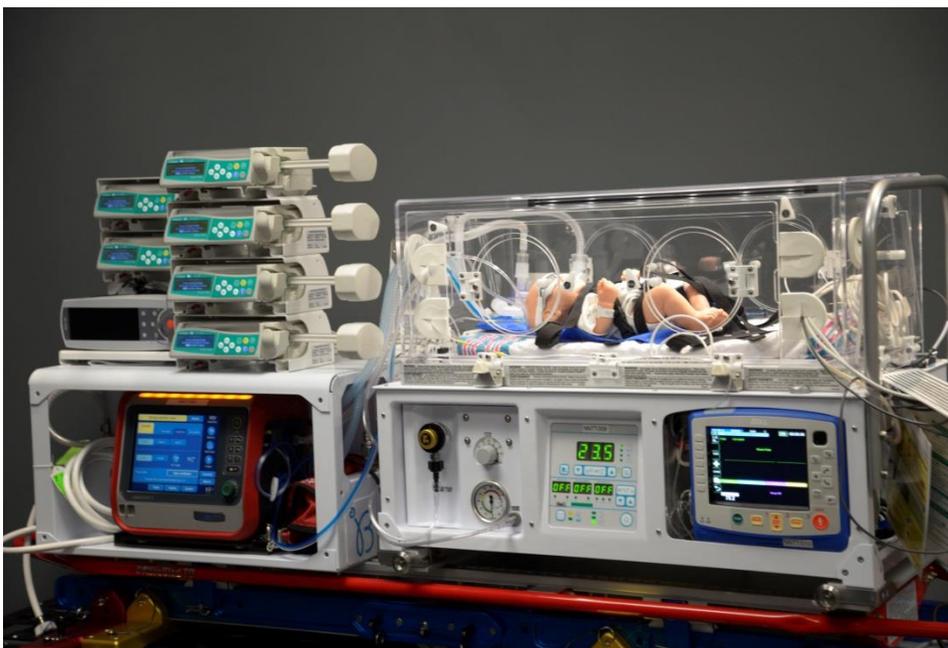
Conditions which *may* require referral

- Apgar score of < 7 at 5 minutes
- Difficult labour and/or delivery
- Abnormal transition period
- Suspected sepsis
- Meconium present at birth and infant is non-vigorous
- Infant of a substance using mother
- Infant of a diabetic mother
- Maternal illness and/or fever
- Abnormal transition period
- Rupture of membranes > 24 hours prior to delivery
- Congenital anomalies
- Near term infants (35-37 weeks gestation)
- Low birth weight infants (between 2000-2500 grams)
- Cardiac murmur

Information required when you call

- Caller identification
- Patient information
- Current clinical status **with** current set of vitals
- Maternal health and antenatal history
- Delivery history, including intrapartum details
- Resuscitation and postnatal course
- Current IV fluids and medications
- Laboratory and imaging results (if available)
- Patient OHIP and physician #'s requested

Please see Appendix 1 –
Neonatal Transport Interdisciplinary telephone Log for further detail



Post Resuscitation Stabilization

Monitoring And Assessment Prior To Transport

- ✓ *Observe continuously & do not leave infant unattended*
- ✓ *Any infant who is unwell or showing signs of compromise should NOT be given oral feeds*
- ✓ *IV access should be established*

Vital Signs

- **Respiratory Rate:**
Normal 40-60 per minute
- **Heart Rate:**
Normal 110 – 160 bpm
- **Temperature:**
Maintain 36.5 – 37.2 0 C (unless otherwise directed)
- **Blood Pressure:**
Aim to correlate MBP with GA (Term MBP 38-42)



Measures of adequate perfusion include good capillary refill, color, palpable brachial and femoral pulses and adequate urinary output

- **Pulse Oximetry**
Aim for Preductal levels (Right hand) 88-95% (unless otherwise directed)

Consultation **must** be sought specifically for Preterm and Cardiac infants to identify appropriate ranges

Record Q15-30 mins (min) depending on the infant's condition

Thermoregulation

Maintain 36.5 – 37.2 0 C (unless otherwise directed)

A normal body temperature is the environmental temperature in which an infant uses the least energy (neutral thermal zone). It depends on the infant's weight, gestation, and postnatal age.

Cold stress will result in hypoglycemia, hypoxemia, and acidosis by increased oxygen consumption and abnormal glucose utilization.

Heat is lost by:

- **Evaporation** - Minimize by drying the baby and removing wet linen
- **Radiation** - Minimize by ensuring warm room and away from cold windows
- **Convection** - Minimize with draft-free environment
- **Conduction** - Minimize by warming linen in contact with the baby

Control environment by using an Incubator or a Radiant warmer

- Suggested starting temperatures for incubator:

<1000 gms: 35-36° C

1000-1500 gms: 34-35° C

1500-2000 gms: 33-34° C

>2000 gms: 32-33°C

Regulate by air-mode, or by servo-control using a skin probe (babymode). Suggested setting for skin probe is 36.5°C

Radiant heat is delivered to infant and regulated by servo-control using a skin probe. Suggested starting temperature is 36.5 °C.

When using a servo-control mode do not cover the baby. If a skin probe is not used, do not leave the baby unattended as there is a danger of overheating.

Continue to take the axillary temperature every 30 minutes

Oxygenation and Circulation

Signs of respiratory distress:

- Ineffective respirations including; Gaspings, periodic breathing, or apnea
- Tachypnea (RR > 70 / min), chest wall retractions (intercostal, sternal)
- Grunting +/- or nasal flaring

Respiratory distress it is often difficult to differentiate from infectious etiology . For this reason, blood cultures and IV antibiotic therapy is often essential until infection is ruled out.

Ventilation

Respiratory failure = increasing oxygen demands and respiratory distress

Immediate steps should be taken to provide the required oxygen +/- or ventilation support for infants with evidence of respiratory failure ***in consultation with the tertiary care facility.***

- CPAP, PPV (consider Neopuff/T-Piece Devices) (See appendix)
- Intubation/Mechanical ventilation

Cardiac output = Stroke Volume x Heart Rate

Infants with unstable conditions are usually kept NPO and an IV infusion started If a peripheral vein cannot be accessed, consider catheterisation of umbilical vein

Infants requiring intravenous infusions for transport include;

- | | |
|--|------------------------|
| • very low birth weight infants (VLBW) | • respiratory distress |
| • gastro-intestinal anomalies | • dehydration |
| • hypoglycaemia (PO not possible) | • suspected sepsis |
| • cardiac anomalies, Shock | • seizures |

Fluid administration guidelines with D10W for infants first 24 hrs of life

- 60 - 80 cc/kg/24 hours minimum

In certain circumstances ***after consultation with a neonatologist***, a lower or higher volume might be requested.

Perinatal Asphyxia (HIE & Hypothermia)

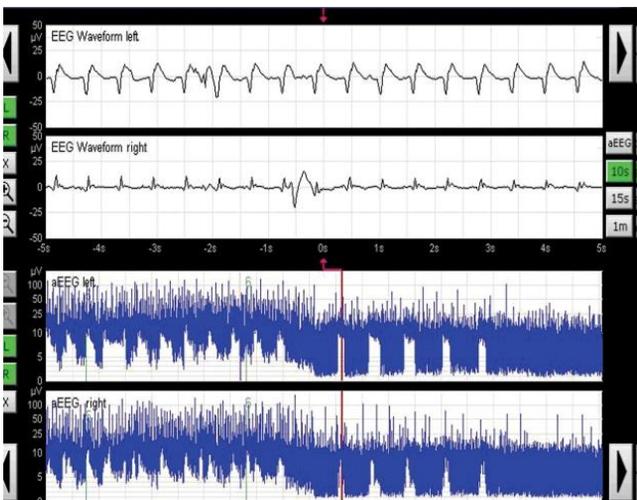
Hypoxic-ischemic encephalopathy (birth asphyxia) is a subset of neonatal encephalopathy (NE). It is unclear how often birth asphyxia is responsible for neonatal encephalopathy.

In a population-based study of neonatal encephalopathy

- 4% cases had evidence of intrapartum hypoxia in the absence of antepartum risk factors
- 25% had both antepartum risk factors, intrapartum signs & symptoms of hypoxia

Hypothermia treatment for 72 hours improves survival and neurodevelopment in newborns with moderate to severe HIE.

Early identification and referral of these patients is essential for optimizing outcomes as cooling should be initiated *within 6 hours of birth*



Whole Body Hypothermia

Inclusion Criteria:

Infants >35 weeks gestation who are <9 hours of age and meet the following criteria ([A1 or A2] AND B):

A1. Cord pH ≤ 7.0 or base deficit ≥ 16

OR

A2. Cord pH 7.01-7.15 or base deficit -10 to -15.9 or no cord gas or gas within 1h, along with:

- History of acute perinatal event (cord prolapse, placental abruption...) **AND**
- One of : Apgar score ≤ 5 at 10 minutes OR At least 10 min of PPV

B. Evidence of moderate to severe encephalopathy defined as clinical seizures OR presence of at least one sign in 3 or more of the 6 categories below

Note: *Clinical discretion may be used for inclusion in borderline cases*

Category	Moderate Encephalopathy	Severe Encephalopathy
1. Level of Consciousness	Lethargic	Stupor / Coma
2. Spontaneous Activity	Decreased Activity	No activity
3. Posture	Distal flexion, full extension	Decerebrate (arms extended & internally rotated, legs extended with feet in forced planter flexion)
4. Tone	Hypotonic (focal, general)	Flaccid
5. Primitive Reflexes – Suck – Moro	Weak Incomplete	Absent Absent
6. Autonomic System – Pupils – Heart Rate – Respirations	Constricted Bradycardia Periodic breathing	Skewed deviation/dilated/non-reactive to light Variable Apnea

Hypothermia Protocol

Exclusion Criteria:

Any one of the following:

- Presence of known chromosomal anomaly
- Presence of major congenital anomalies
- Severe intrauterine growth restriction (weight <1800g)
- Evidence of head trauma or possible intracranial hemorrhage
- Inability to insert a rectal probe (congenital ano-rectal anomaly)
- Infants in severe condition (i.e. refractory hypotension, refractory acidosis, comatose with absent brain-stem reflexes etc.)



Such cases require significant further discussion with parents by attending neonatologist

Target Temperature: rectal temperature between **33°C and 34°C** (within 1-3 hours of initiating hypothermia protocol)

Passive Cooling: The process of providing whole body hypothermia by removing all external heat sources and exposing the greatest body surface area to air.

Active Cooling: The process of providing whole body hypothermia by applying a cooling source (cold packs or cooling blanket) onto the baby.

If the neonatologist recommends the commencement of passive cooling, measurement and documentation of the infant's temperature (preferably rectal) is required every 15 minutes.

Baseline blood work required prior to the initiation of hypothermia includes:

- CBC, blood gas, glucose, lactate, Coagulation, AST, ALT, Electrolytes, Ca, Mg

Hypoglycemia

Glucose screening is indicated within 30 minutes of life in newborns who are at risk, unwell/symptomatic, or unable to feed.

Continue to assess blood glucose according to advice given

The infant with risk factors who is able to feed and is asymptomatic should have a glucose screen 2 hours **AFTER** a feed *as per the CPS guideline*

- <http://www.cps.ca/documents/blood-glucose-en.pdf>

Risk factors for hypoglycemia include:

- Prematurity, low birthweight infants , intrauterine growth restriction
- Infants Large for Gestational Age (LGA)
- Infant of a diabetic mother (IDM)
- Infants of mothers treated with propranolol, oral hypoglycemic agents
- Infants unable to maintain a normal temperature

Signs of hypoglycemia can be variable and include:

Jitteriness, tremors, hypothermia, lethargy, limpness, hypotonic, apathy, intermittent apnea or tachypnea, sudden pallor, episodes of cyanosis, weak suck or poor feeding, vomiting, high pitched or weak cry, eye-rolling, seizures, cardiac arrest.

Management of hypoglycemia in the at risk infant:

- Blood Glucose < 2.6 mmol/L in the **symptomatic baby** should be treated
- If glucose < 2.0 - Bolus of D10W 2 mls/kg IV
- Thereafter, administration of a 10% Dextrose solution at 60mls/kg/day
- Recheck blood glucose every 30 minutes until blood glucose is ≥ 2.6 .

*** Repeated boluses of D10W may result in a rebound hypoglycaemia**

Assess for Infection

Clinical signs of sepsis include: respiratory distress, abnormal skin perfusion, temperature instability, feeding intolerance, abnormal heart rate, low blood pressure and abnormal neurological status.

If sepsis is suspected based on clinical signs or maternal history, obtain blood for culture if possible and CBC with differential.

Intravenous antibiotic administration should not be delayed if unable to obtain a blood culture - as directed by neonatologist

Antibiotic dosages:

Ampicillin 50 mg/kg every 12 hours, IV over 5 minutes

AND

Gentamicin / Tobramycin : slow IV infusion over 30 minutes.

Gentamicin dosing guidelines:

Term > 37 weeks - 0-7 days – 3- 3.5 mg /kg/ dose Q18H

Preterm (<36 weeks GA)

- 0-14 days: Traditional Dosing
 - ≤28 weeks GA: 3 mg/kg/dose Q24H
 - 29-36 weeks GA: 3.5 mg/kg/dose Q24H
- >14 days: Traditional Dosing
 - ≤28 weeks corrected GA: 3-3.5 mg/kg/dose Q18H
 - > 29 weeks corrected GA: 3-3.5 mg/kg/dose Q12H

**** For frequency adjustment due to renal dysfunction, consult clinical pharmacist**

The Premature Infant

Guiding principles & Key concepts

- The first hours of life of the preterm infant (<32 weeks or < 1500g) and the care received during this time have a **direct** impact on the long term outcomes of the infant
- Thermoregulation, fluid and glucose management, respiratory support and oxygen exposure impact survival and morbidities such as IVH, BPD, ROP and neurodevelopmental outcomes
- The initial management of the extremely preterm infant **must** be efficient, coordinated and 'optimally undertaken by a highly skilled team' with enhanced communication throughout
- Developmentally supportive care should be intrinsic to all phases of newborn care, including stabilization
- Newborns experience pain that may have potentially detrimental physiological consequences
- Severe cold stress may impede resuscitation & stabilization efforts

Management Goals

- The infant to transition to life as smoothly as possible
- To be in an isolette with a normal body temperature
- Optimal respiratory support
- IV solution with dextrose and protein infusing within **one** hour after birth
- The goal for the proceeding hours is...to leave them as undisturbed as possible!!

Kattwinkel, J. (Ed.). (2011). *Textbook of neonatal resuscitation* (6th ed.). Elk Grove: American Academy of Pediatrics and American Heart Association.



Seizures

Seizures in the newborn may be subtle

- staring, chewing, poor suck and swallow, bicycling, posturing, apneas or overt rhythmic or jerking movements
- Look for possible associated changes in vital signs

A history (e.g. maternal drug use), alertness, muscle tone (hyper or hypotonia), reflexes and breathing should also be evaluated.

Jitteriness (symmetrical rapid movements of limbs) may be confused with seizures. Tremors associated with jitteriness **stop** when the limb is held and are sensitive to stimuli.



Biochemical Status

Monitoring of electrolytes is recommended in infants having seizures or who are greater than 24 hours of age and are unwell or compromised

At a minimum we would recommend checking glucose, sodium, calcium, magnesium and potassium levels.

Anticonvulsant management for seizures: ***Consultation recommended***

- Lorazepam IV(0.1 mg/kg) (CHEO Concentration 0.4 mg/mL - Dilute 1 mL (4 mg) with 9 mL of 0.9%NaCl for a final concentration of 0.4 mg/mL. Give over 3 - 5 minutes)

See Transport Website for drug calculator

<https://outreach.cheo.on.ca/emergency-drug-calculator/15>

Consultant/tertiary centre can provide further direction if seizure activity continues or repeat dosing required.

Consideration of Special Conditions

Pneumothorax

Breath sounds will be diminished on the side of the pneumothorax. Diagnosis can be made with an x-ray or transillumination.

If the infant has respiratory or cardiovascular compromise, the air may need to be aspirated from the chest +/- formal chest drain insertion.

Please actively consult for advice regarding management.

Diaphragmatic Hernia

A large bore orogastric tube (#10 or #12) with a vented port should be inserted to prevent gastric distension that could impede respiration. Minimise bag and mask ventilation. **If** ventilator assistance is required, endotracheal intubation is recommended rather than bag and mask.

Keep baby NPO. Establish IV of D10W and consider 2nd IV.

Ongoing management in consultation with tertiary care center.

Choanal Atresia

If infant has respiratory distress an oropharyngeal airway or endotracheal tube may be necessary

Pierre-Robin Syndrome (mandibular hypoplasia)

Position infant prone to maintain open airway. Note if cleft palate is present.

Suspected Tracheo-esophageal fistula or Esophageal atresia

Elevate infant's head to prevent aspiration of gastric contents. The upper esophageal pouch should be gently suctioned at frequent intervals. Gently insert a large bore orogastric tube until resistance is met and connect to low intermittent suction. Keep baby NPO. Establish IV of D10W.

Consideration of Special Conditions

Suspected Gastrointestinal obstruction

Infant should be kept NPO. Insert a large bore orogastric tube (#10 or #12) with a vented port to remove gastric contents and prevent abdominal distension.

Establish IV of D10W.

Exposed Abdominal or Neural Contents

Handle exposed organs using sterile technique. Wrap defect in warm, sterile saline dressing and cover with plastic wrap to prevent drying. Position so no pressure is applied to the defect.

Neural defects - Aim for latex free environment if possible

Neonatal Abstinence Syndrome

NAS can occur with exposure to prescription drugs such as narcotics and anti-depressants as well as through exposure to alcohol, nicotine and illegal drugs. Drug withdrawal can appear within hours to several days depending on previous exposure.

Monitor infant for restlessness, hypertonicity/hypotonicity, tremors, poor feeding, vomiting, repetitive sneezing, sweating and stuffy nose. Document age of the infant at the onset of symptoms. Assess for severity of symptoms every two hours until transfer.

See Appendix 2 for Finnegan Scoring Tool.

Provide supportive care (dim lighting, reducing noise and stimulation, swaddling). Consult with Neonatologist regarding pharmacologic intervention.

Appendix 2

NAS Finnegan Score Sheet

SYSTEMS	SIGNS AND SYMPTOMS	SCORE	AM						PM						DAILY WT.	
			2	4	6	8	10	12	2	4	6	8	10	12		
CENTRAL NERVOUS SYSTEM DISTURBANCES	High Pitched Cry	2														
	Continuous High Pitched Cry	3														
	Sleeps < 1 Hour After Feeding	3														
	Sleeps < 2 Hours After Feeding	2														
	Hyperactive Moro Reflex	2														
	Markedly Hyperactive Moro Reflex	3														
	Mild Tremors Disturbed	2														
	Moderate Severe Tremors Disturbed	3														
	Mild Tremors Undisturbed	1														
	Moderate Severe Tremors Undisturbed	2														
	Increased Muscle Tone	2														
	Excoriation (specify area): _____	1														
Myoclonic Jerks	3															
Generalized Convulsions	3															
METABOLIC VASOMOTOR/ RESPIRATORY DISTURBANCES	Sweating	1														
	Fever < 101 ^o F (39.3 ^o C)	1														
	Fever > 101 ^o F (39.3 ^o C)	2														
	Frequent Yawning (> 3-4 times/interval)	1														
	Mottling	1														
	Nasal Stuffiness	1														
	Sneezing (> 3-4 times/interval)	1														
	Nasal Flaring	2														
Respiratory Rate > 60/min	1															
Respiration Rate > 60/min with Retractions	2															
GASTROINTESTINAL DISTURBANCES	Excessive Sucking	1														
	Poor Feeding	2														
	Regurgitation	2														
	Projectile Vomiting	3														
	Loose Stools	2														
Watery Stools	3															
SUMMARY	TOTAL SCORE															
	SCORER'S INITIALS															
	STATUS OF THERAPY															

Neopuff/T-Piece Devices

Advantages:

- Control of T_i by varying the duration of time spent occluding the PEEP cap
- Can provide CPAP via a face mask or ETT tube
- Delivers consistent set peak PIP
- Delivers consistent set PEEP

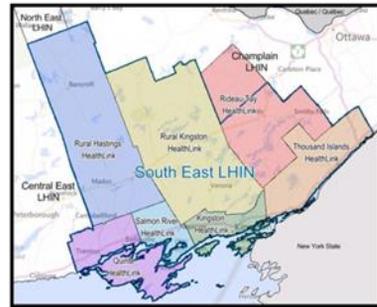
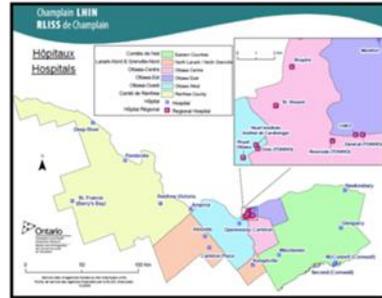
Limitations:

- Requires a gas source to operate
- The set PIP can be reached despite a face mask leak of up to 90%
- T- piece device delivers a set pressure vs. volume



Kattwinkel, J. (Ed.). (2011). *Textbook of neonatal resuscitation* (6th ed.). Elk Grove: American Academy of Pediatrics and American Heart Association.

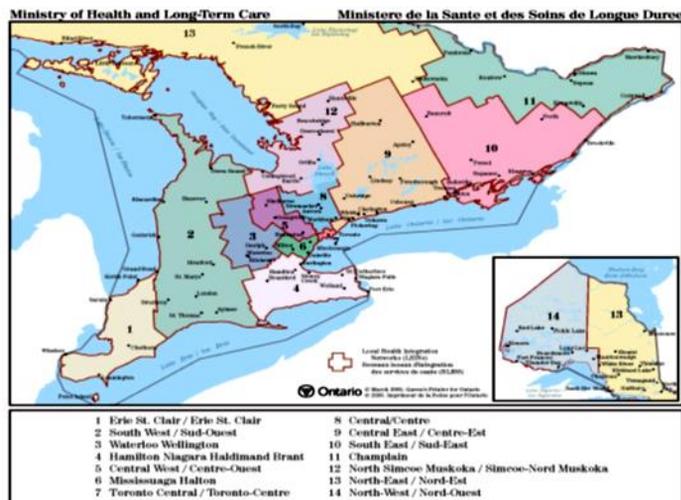
Regions Served



Current mandate is to provide transport coverage and support to:

- LHIN's **10, 11 and more recently 13**
- Massive, largely rural, region spanning almost 440,000 km
- Population of 2,255,000 with annual births of approximately 24,000

Between the 4 teams in Ontario we will cross cover if feasible



Resources

- ACoRN Editorial Board (2012). *Acute care of at-risk newborns: A resource and learning tool for health care professionals*. (2012 Update). Vancouver: Author.
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