A Year in Review: A Community Hospital's Journey Adopting the MHP Toolkit

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Disclosures

No conflicts of interest

Objectives

Through attending this presentation participants will be able to:

- Assemble a multidisciplinary working group able to develop and implement their MHP
- Leverage the ORBCON toolkit recommendations to fit their hospital's blood component inventory and existing resources
- Run multidisciplinary MHP debriefs and evaluate quality metrics to make ongoing improvements in team dynamics and patient care

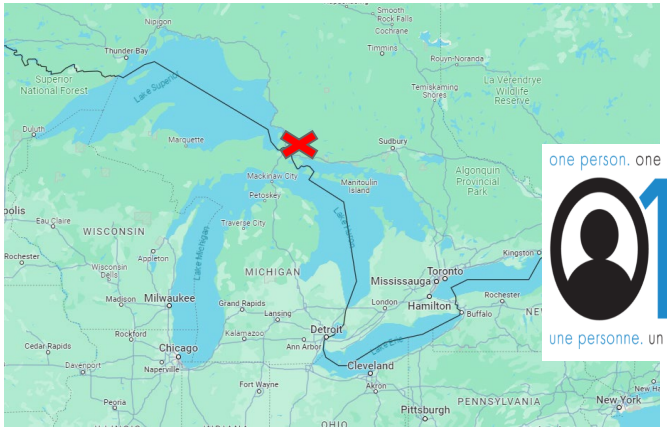
Sault Area Hospital
Sault Ste. Marie, Ontario

Sault Ste. Marie population: 72,051 (2023)
Algoma District population: Approximately 115, 000

Distance from Toronto: 698 km

Distance from Sudbury: 308 km

- Trauma, Vascular Surgery, Neurosurgery



Sault Area Hospital:

- 293 beds
- Emergency Department 120-140 visits/day
- Intensive Care Unit (ICU): Closed unit with 18 beds
- Obstetric Unit with about 700 deliveries per year
- Pediatric unit with NICU
- 6 OR suites with ortho, general surgery, plastic surgery, GI

Meditech Site:

- SAH is one of 3 founding hospitals for the Meditech ONE (One person, One record, One system) Initiative, a north east region-wide project.
- Now 23 sites across the province
- Electronic documentation for physician and nurses
- Electronic orders

Blood Bank Services at SAH

- Full service Transfusion Services department with automated and manual testing
- Using Blood Wisely Hospital since 2021
- Blood Products in stock:
  - 12 units O SD Plasma
  - 5 units A SD Plasma
  - 12 units AB Frozen plasma
  - ~85 units pRBCs
  - ~2 pooled platelets
- Approximately 7,000 type and screens performed per year
- ~25 Code Omegas were triggered in 2023
  - **24 “Code Transfusions” triggered from Jan 2024-Dec 2024**

Poll Question 1:

How confident are you in the effectiveness of your hospital's current massive hemorrhage protocol in improving patient outcomes during a critical hemorrhagic event?

Options:

1. Very confident – I believe it significantly improves patient outcomes.
2. Somewhat confident – It seems effective, but there's room for improvement.
3. Neutral – I'm unsure of its overall impact.
4. Somewhat concerned – There are issues I think need to be addressed.
5. Very concerned – I think the protocol needs major improvements.

How confident are you in the effectiveness of your hospital's current massive hemorrhage protocol in improving patient outcomes during a critical hemorrhagic event?

Very confident – I believe it significantly improves patient outcomes. 0%

Somewhat confident – It seems effective, but there's room for improvement. 0%

Neutral – I'm unsure of its overall impact. 0%

Somewhat concerned – There are issues I think need to be addressed. 0%

Very concerned – I think the protocol needs major improvements. 0%

Highlights from SAH Implementation

Assemble your team

The need for a multidisciplinary working group was identified at our Transfusion Committee in the fall of 2021

Physician Champions:

- Dr Laura Stone, MD, Emergency Medicine and Chair of Transfusion Committee
- Dr Zaid Khot, MD, ICU & General Surgery
- Dr Jacob Pendergrast, MD, Associate Medical Director Blood Transfusion Service, UHN

Clinical Nurse Educators:

- Amanda Lepera, RN, Clinical Educator Emergency
- Jaclyn Armenti, RN, Clinical Educator Women & Children's Program
- Manda Willette, RN, Clinical Educator Critical Care

Collaborative Practice Specialist: Amanda Mathur, PharmD

Senior Medical Lab Technologist: Barb Silveri, Sr Technologist Transfusion Services

Clinical Informatics Specialists:

- Isabelle Wheten, MLT, Regional Clinical Informatics Specialist
- Justine Malo, Clinical Informatics Specialist

Anaesthesia Assistant: Alison Richard, RRT

Updated : Expanded Project Team (Today)

Along our journey we discovered the scope/stakeholders expanded as new gaps and opportunities arose

Additional Clinical Nurse Educators for ongoing MHP training:

- Becky Zappacosta, ICU Nurse Educator
- Adrianna Dugas, Float Pool Nurse Educator

Additional Physician support:

- Dr Hemi Gupta, OBGYN
- Dr Jonathan Dellavedova, Pediatrician
- Dr. Phil Dopp, Anaesthesia

Portering Services Leader:

- Annette Finateri, Manager

Switchboard Services Leader:

- Alayna Hanchuk, Manager

Communications Team

- Rose Calibani and Brandy Sharp-Young

Transfusion Safety Officer:

- Paula Carroll, UHN MLT

Customize the Toolkit for your hospital's needs

Identified gaps between what we had in place and where we wanted to be based on the ORBCON toolkit

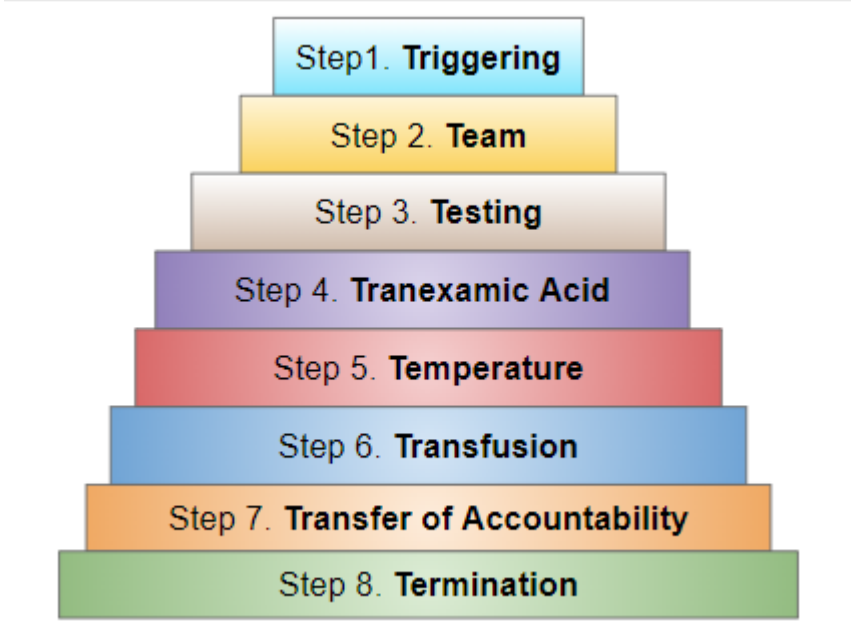
7T Framework in Toolkit was invaluable

Became 8T Framework:

- Transfer of Accountability added

Policy and Protocols structured around these 8Ts (as was education)

Modified each T as necessary for SAH



MHP Adult
Quick Reference

Translating evidence into excellent patient care at the bedside

- Toolkit Checklist

ADULT PATIENTS, DEFINITIVE CARE AT HOSPITAL

To be repeated on each page

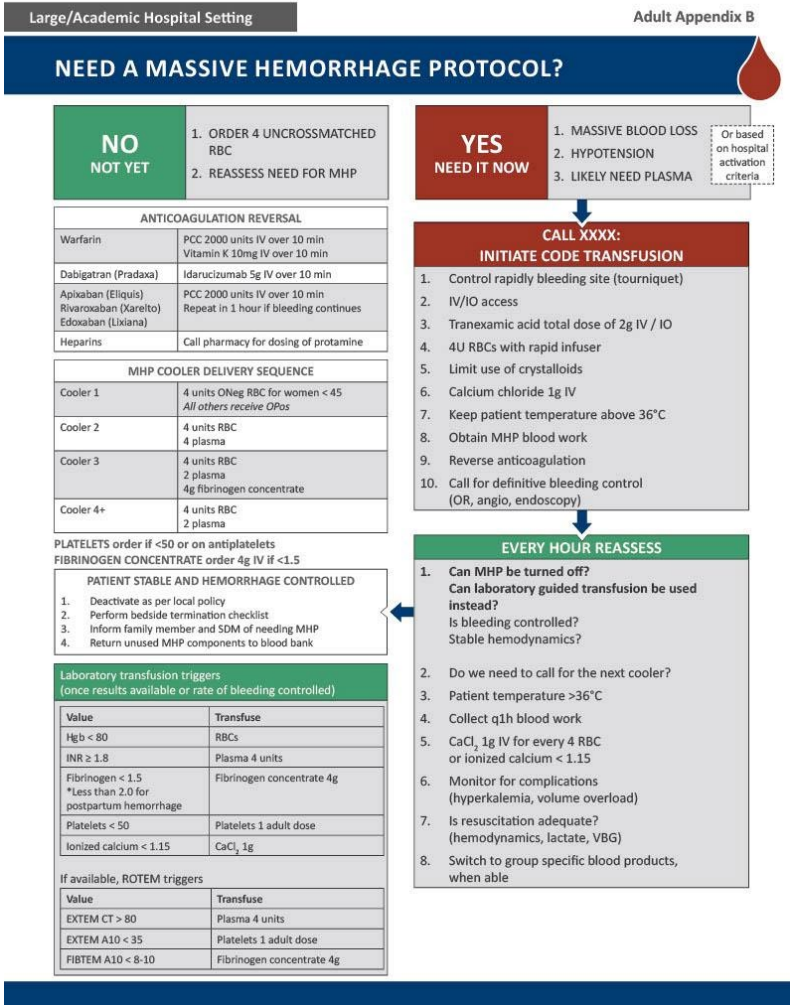
MASSIVE HEMORRHAGE PROTOCOL (MHP) CHECKLIST

TIME	ACTION	INITIALS
ACTIVATION & PACK 1 (date _ _ / _ _ _ / _ _ time _ _ /_ _)		
	MHP Lead RN: _____	
	Call to hospital locating (ext. - - - -) to activate **CODE TRANSFUSION**	
	Provide patient number, name, sex, age, location, and information regarding patient use of antiplatelet or anticoagulants to blood bank at ext. - - - - Antiplatelets ☐ Yes; Anticoagulant ☐ Yes, drug name:_____	
	☐ Ensure identification band is affixed to patient	
	☐ Obtain group and screen sample	
	☐ Obtain baseline blood work	
	Tranexamic acid: Administer 2 gram iv bolus in 100 mL over 20 minutes. *Hold if: more than 3 hours from injury/onset of hemorrhage or given pre-hospital or pre-activation or patient has a gastrointestinal hemorrhage*	
	Hypothermia prevention: ☐ Measure and document patient temperature ☐ Obtain blood warmer for all infusions ☐ If patient temperature less than 36°C start active warming	
	Definitive hemorrhage control: Notify if required: ☐ Operating Room ☐ Interventional Radiology ☐ Gastroenterology	
	Obtain 1st MHP pack (if not obtained before activation): Pack arrival time (_ _/_ _) ☐☐☐☐ 4 units Red Cells (RBCs) *Use Rh-negative blood only for females under 45 years* *Avoid additional boluses or infusions of crystalloid except on physician order*	
	☐ **Platelets:** If platelet count below 50 x10^9/L or patient on an antiplatelet drug, transfuse 1 pool of platelets	
	☐ **Fibrinogen:** if fibrinogen less than 1.5 g/L, 4 grams of fibrinogen concentrate over 5 min by iv push	
	☐ **Calcium:** 1g Calcium Chloride or 3g Calcium Gluconate iv push after pack 1	
	Anticoagulant reversal: ☐ If Warfarin: PCC 2000 IU iv over 10 minutes AND ☐ Vitamin K 10 mg iv ☐ If Xa inhibitors (e.g., apixaban, rivaroxaban): PCC 2000 IU iv over 10 minutes ☐ If Dabigatran: Idarucizumab 5 grams iv over 10 minutes ☐ If Heparins: consult Pharmacy for protamine dosing	
PACK 2 (time _ _ /_ _)		
	☐ Obtain hour one blood work	
	☐ Review last set of blood work to ensure at target: Hemoglobin greater than 80 g/L, INR less than 1.8, fibrinogen greater than 1.5 g/L, platelets greater than 50x10^9/L	
	☐ Measure and document patient temperature ☐ If patient temperature less than 36°C start active warming	
	Obtain 2nd MHP pack (if needed): Transfusions based on laboratory measures where feasible	

MHP Adult
Quick Reference

Translating evidence into excellent patient care at the bedside

- Toolkit Algorithm



Large/Academic Hospital Setting

Adult Appendix B

NEED A MASSIVE HEMORRHAGE PROTOCOL?

NO NOT YET

1. ORDER 4 UNCROSSMATCHED RBC
2. REASSESS NEED FOR MHP

YES NEED IT NOW

1. MASSIVE BLOOD LOSS
2. HYPOTENSION
3. LIKELY NEED PLASMA

Or based on hospital activation criteria

ANTICOAGULATION REVERSAL	
Warfarin	PCC 2000 units IV over 10 min Vitamin K 10mg IV over 10 min
Dabigatran (Pradaxa)	Idarucizumab 5g IV over 10 min
Apixaban (Eliquis) Rivaroxaban (Xarelto) Edoxaban (Lixiana)	PCC 2000 units IV over 10 min Repeat in 1 hour if bleeding continues
Heparins	Call pharmacy for dosing of protamine

MHP COOLER DELIVERY SEQUENCE	
Cooler 1	4 units ONeg RBC for women < 45 *All others receive OPos*
Cooler 2	4 units RBC 4 plasma
Cooler 3	4 units RBC 2 plasma 4g fibrinogen concentrate
Cooler 4+	4 units RBC 2 plasma

PLATELETS order if <50 or on antiplatelets
FIBRINOGEN CONCENTRATE order 4g IV if <1.5

PATIENT STABLE AND HEMORRHAGE CONTROLLED

1. Deactivate as per local policy
2. Perform bedside termination checklist
3. Inform family member and SDM of needing MHP
4. Return unused MHP components to blood bank

Laboratory transfusion triggers
(once results available or rate of bleeding controlled)

Value	Transfuse
Hgb < 80	RBCs
INR ≥ 1.8	Plasma 4 units
Fibrinogen < 1.5 *Less than 2.0 for postpartum hemorrhage	Fibrinogen concentrate 4g
Platelets < 50	Platelets 1 adult dose
Ionized calcium < 1.15	$CaCl_2$ 1g

If available, ROTEM triggers

Value	Transfuse
EXTEM CT > 80	Plasma 4 units
EXTEM A10 < 35	Platelets 1 adult dose
FIBTEM A10 < 8-10	Fibrinogen concentrate 4g

CALL XXXX:
INITIATE CODE TRANSFUSION

1. Control rapidly bleeding site (tourniquet)
2. IV/IO access
3. Tranexamic acid total dose of 2g IV / IO
4. 4U RBCs with rapid infuser
5. Limit use of crystalloids
6. Calcium chloride 1g IV
7. Keep patient temperature above 36°C
8. Obtain MHP blood work
9. Reverse anticoagulation
10. Call for definitive bleeding control (OR, angio, endoscopy)

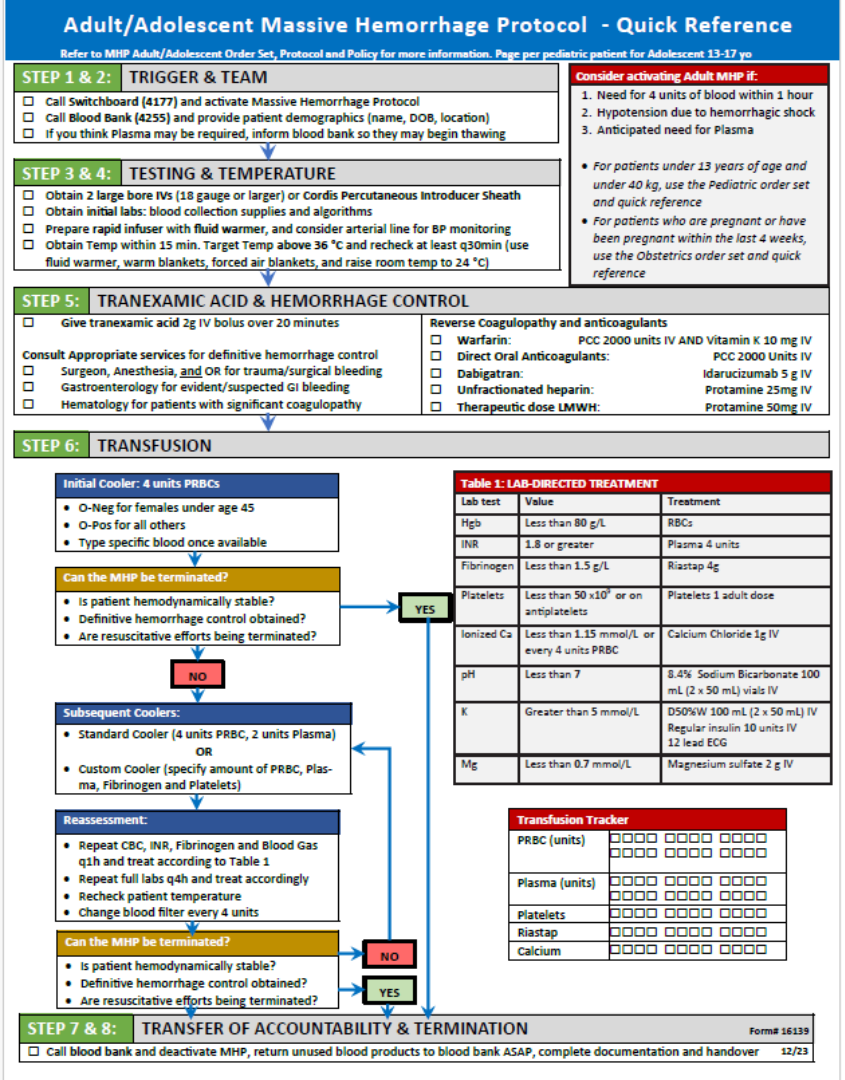
EVERY HOUR REASSESS

1. **Can MHP be turned off?**
   Can laboratory guided transfusion be used instead?
   Is bleeding controlled?
   Stable hemodynamics?
2. Do we need to call for the next cooler?
3. Patient temperature >36°C
4. Collect q1h blood work
5. $CaCl_2$ 1g IV for every 4 RBC or ionized calcium < 1.15
6. Monitor for complications (hyperkalemia, volume overload)
7. Is resuscitation adequate? (hemodynamics, lactate, VBG)
8. Switch to group specific blood products, when able

MHP Adult
Quick Reference

Translating evidence into excellent patient care at the bedside

- Created by Dr. Zaid Khot
- Official SAH document meaning it is housed on the hospital's shared drive
- Enlarged, laminated copies posted in ED, OR, OB and ICU



Adult/Adolescent Massive Hemorrhage Protocol - Quick Reference

Refer to MHP Adult/Adolescent Order Set, Protocol and Policy for more information. Page per pediatric patient for Adolescent 13-17 yo

STEP 1 & 2: TRIGGER & TEAM

- ☐ Call **Switchboard (4177)** and activate Massive Hemorrhage Protocol
- ☐ Call **Blood Bank (4255)** and provide patient demographics (name, DOB, location)
- ☐ If you think Plasma may be required, inform blood bank so they may begin thawing

Consider activating Adult MHP if:

1. Need for 4 units of blood within 1 hour
2. Hypotension due to hemorrhagic shock
3. Anticipated need for Plasma

- *For patients under 13 years of age and under 40 kg, use the Pediatric order set and quick reference*
- *For patients who are pregnant or have been pregnant within the last 4 weeks, use the Obstetrics order set and quick reference*

STEP 3 & 4: TESTING & TEMPERATURE

- ☐ Obtain **2 large bore IVs** (18 gauge or larger) or **Cordis Percutaneous Introducer Sheath**
- ☐ Obtain **initial labs**: blood collection supplies and algorithms
- ☐ Prepare **rapid infuser** with **fluid warmer**, and consider arterial line for BP monitoring
- ☐ Obtain Temp within 15 min. Target Temp **above 36 °C** and recheck at least q30min (use fluid warmer, warm blankets, forced air blankets, and raise room temp to 24 °C)

STEP 5: TRANEXAMIC ACID & HEMORRHAGE CONTROL

- ☐ **Give tranexamic acid** 2g IV bolus over 20 minutes

Consult Appropriate services for definitive hemorrhage control

- ☐ Surgeon, Anesthesia, and OR for trauma/surgical bleeding
- ☐ Gastroenterology for evident/suspected GI bleeding
- ☐ Hematology for patients with significant coagulopathy

Reverse Coagulopathy and anticoagulants

- ☐ **Warfarin**: PCC 2000 units IV AND Vitamin K 10 mg IV
- ☐ **Direct Oral Anticoagulants**: PCC 2000 Units IV
- ☐ **Dabigatran**: Idarucizumab 5 g IV
- ☐ **Unfractionated heparin**: Protamine 25mg IV
- ☐ **Therapeutic dose LMWH**: Protamine 50mg IV

STEP 6: TRANSFUSION

Initial Cooler: 4 units PRBCs

- O-Neg for females under age 45
- O-Pos for all others
- Type specific blood once available

Can the MHP be terminated?

- Is patient hemodynamically stable?
- Definitive hemorrhage control obtained?
- Are resuscitative efforts being terminated?

YES / NO

Subsequent Coolers:

- Standard Cooler (4 units PRBC, 2 units Plasma)
  OR
- Custom Cooler (specify amount of PRBC, Plasma, Fibrinogen and Platelets)

Reassessment:

- Repeat CBC, INR, Fibrinogen and Blood Gas q1h and treat according to Table 1
- Repeat full labs q4h and treat accordingly
- Recheck patient temperature
- Change blood filter every 4 units

Can the MHP be terminated?

- Is patient hemodynamically stable?
- Definitive hemorrhage control obtained?
- Are resuscitative efforts being terminated?

NO / YES

Table 1: LAB-DIRECTED TREATMENT

Lab test	Value	Treatment
Hgb	Less than 80 g/L	RBCs
INR	1.8 or greater	Plasma 4 units
Fibrinogen	Less than 1.5 g/L	Riastap 4g
Platelets	Less than 50 x10^9 or on antiplatelets	Platelets 1 adult dose
Ionized Ca	Less than 1.15 mmol/L or every 4 units PRBC	Calcium Chloride 1g IV
pH	Less than 7	8.4% Sodium Bicarbonate 100 mL (2 x 50 mL) vials IV
K	Greater than 5 mmol/L	D50%W 100 mL (2 x 50 mL) IV Regular insulin 10 units IV 12 lead ECG
Mg	Less than 0.7 mmol/L	Magnesium sulfate 2 g IV

Transfusion Tracker

PRBC (units)	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Plasma (units)	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Platelets	☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Riastap	☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Calcium	☐☐☐☐ ☐☐☐☐ ☐☐☐☐

STEP 7 & 8: TRANSFER OF ACCOUNTABILITY & TERMINATION

Form# 16139

- ☐ Call blood bank and deactivate MHP, return unused blood products to blood bank ASAP, complete documentation and handover

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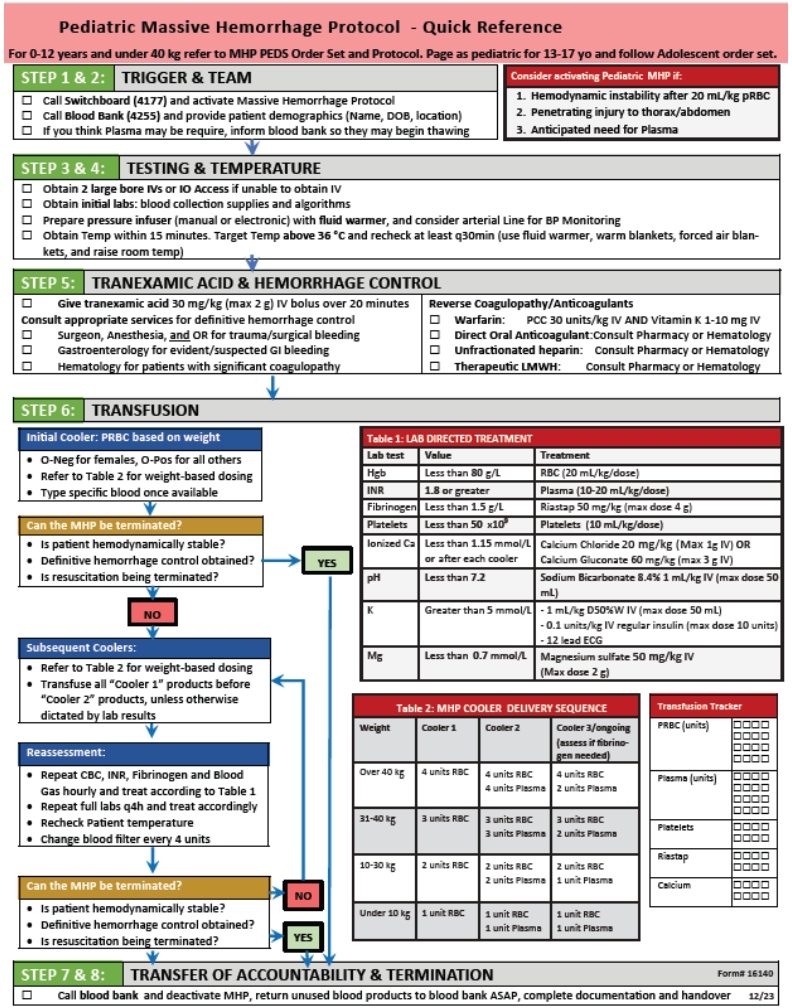
Pediatric MHP Quick Reference

Translating evidence into excellent patient care at the bedside



Pediatric Massive Hemorrhage Protocol - Quick Reference

For 0-12 years and under 40 kg refer to MHP PEDS Order Set and Protocol. Page as pediatric for 13-17 yo and follow Adolescent order set.

STEP 1 & 2: TRIGGER & TEAM

- ☐ Call **Switchboard (4177)** and activate Massive Hemorrhage Protocol
- ☐ Call **Blood Bank (4255)** and provide patient demographics (Name, DOB, location)
- ☐ If you think Plasma may be require, inform blood bank so they may begin thawing

Consider activating Pediatric MHP if:

1. **Hemodynamic instability after 20 mL/kg pRBC**
2. **Penetrating injury to thorax/abdomen**
3. **Anticipated need for Plasma**

STEP 3 & 4: TESTING & TEMPERATURE

- ☐ Obtain **2 large bore IVs** or **IO Access** if unable to obtain IV
- ☐ Obtain **initial labs**: blood collection supplies and algorithms
- ☐ Prepare **pressure infuser** (manual or electronic) with **fluid warmer**, and consider arterial Line for BP Monitoring
- ☐ Obtain **Temp** within 15 minutes. Target Temp **above 36 °C** and recheck at least q30min (use fluid warmer, warm blankets, forced air blankets, and raise room temp)

STEP 5: TRANEXAMIC ACID & HEMORRHAGE CONTROL

- ☐ **Give tranexamic acid** 30 mg/kg (max 2 g) IV bolus over 20 minutes

Consult appropriate services for definitive hemorrhage control

- ☐ Surgeon, Anesthesia, and OR for trauma/surgical bleeding
- ☐ Gastroenterology for evident/suspected GI bleeding
- ☐ Hematology for patients with significant coagulopathy

Reverse Coagulopathy/Anticoagulants

- ☐ **Warfarin**: PCC 30 units/kg IV AND Vitamin K 1-10 mg IV
- ☐ **Direct Oral Anticoagulant**:Consult Pharmacy or Hematology
- ☐ **Unfractionated heparin**: Consult Pharmacy or Hematology
- ☐ **Therapeutic LMWH**: Consult Pharmacy or Hematology

STEP 6: TRANSFUSION

Initial Cooler: PRBC based on weight

- O-Neg for females, O-Pos for all others
- Refer to Table 2 for weight-based dosing
- Type specific blood once available

Can the MHP be terminated?

- Is patient hemodynamically stable?
- Definitive hemorrhage control obtained?
- Is resuscitation being terminated?

YES / NO

Subsequent Coolers:

- Refer to Table 2 for weight-based dosing
- Transfuse all "Cooler 1" products before "Cooler 2" products, unless otherwise dictated by lab results

Reassessment:

- Repeat CBC, INR, Fibrinogen and Blood Gas hourly and treat according to Table 1
- Repeat full labs q4h and treat accordingly
- Recheck Patient temperature
- Change blood filter every 4 units

Can the MHP be terminated?

- Is patient hemodynamically stable?
- Definitive hemorrhage control obtained?
- Is resuscitation being terminated?

NO / YES

Table 1: LAB DIRECTED TREATMENT

Lab test	Value	Treatment
Hgb	Less than 80 g/L	RBC (20 mL/kg/dose)
INR	1.8 or greater	Plasma (10-20 mL/kg/dose)
Fibrinogen	Less than 1.5 g/L	Riastap 50 mg/kg (max dose 4 g)
Platelets	Less than 50 $x10^9$	Platelets (10 mL/kg/dose)
Ionized Ca	Less than 1.15 mmol/L or after each cooler	Calcium Chloride 20 mg/kg (Max 1g IV) OR Calcium Gluconate 60 mg/kg (max 3 g IV)
pH	Less than 7.2	Sodium Bicarbonate 8.4% 1 mL/kg IV (max dose 50 mL)
K	Greater than 5 mmol/L	- 1 mL/kg D50%W IV (max dose 50 mL) - 0.1 units/kg IV regular insulin (max dose 10 units) - 12 lead ECG
Mg	Less than 0.7 mmol/L	Magnesium sulfate 50 mg/kg IV (Max dose 2 g)

Table 2: MHP COOLER DELIVERY SEQUENCE

Weight	Cooler 1	Cooler 2	Cooler 3/ongoing (assess if fibrinogen needed)
Over 40 kg	4 units RBC	4 units RBC 4 units Plasma	4 units RBC 2 units Plasma
31-40 kg	3 units RBC	3 units RBC 3 units Plasma	3 units RBC 2 units Plasma
10-30 kg	2 units RBC	2 units RBC 2 units Plasma	2 units RBC 1 unit Plasma
Under 10 kg	1 unit RBC	1 unit RBC 1 unit Plasma	1 unit RBC 1 unit Plasma

Transfusion Tracker

PRBC (units)	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Plasma (units)	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Platelets	☐☐☐☐ ☐☐☐☐
Riastap	☐☐☐☐ ☐☐☐☐
Calcium	☐☐☐☐ ☐☐☐☐

STEP 7 & 8: TRANSFER OF ACCOUNTABILITY & TERMINATION

Form# 16140

- ☐ Call **blood bank** and deactivate MHP, return unused blood products to blood bank ASAP, complete documentation and handover

12/23

Obstetric MHP Quick Reference

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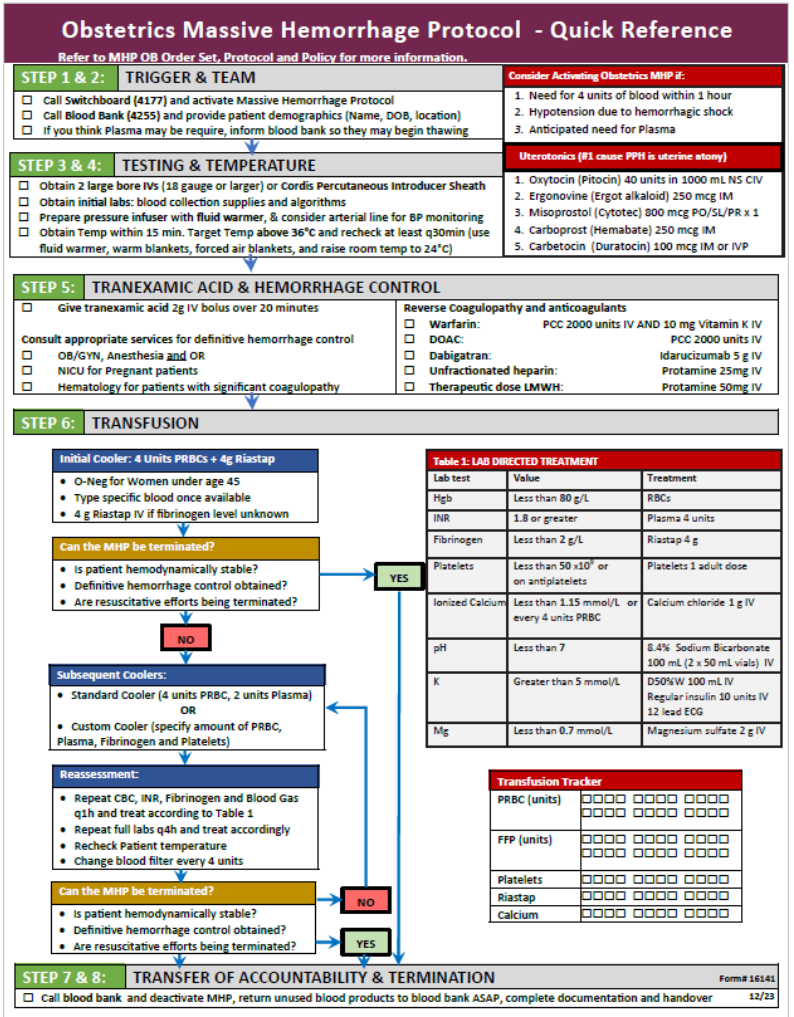

Obstetrics Massive Hemorrhage Protocol - Quick Reference

Refer to MHP OB Order Set, Protocol and Policy for more information.

STEP 1 & 2: TRIGGER & TEAM

- ☐ Call **Switchboard (4177)** and activate Massive Hemorrhage Protocol
- ☐ Call **Blood Bank (4255)** and provide patient demographics (Name, DOB, location)
- ☐ If you think Plasma may be require, inform blood bank so they may begin thawing

Consider Activating Obstetrics MHP if:

1. Need for 4 units of blood within 1 hour
2. Hypotension due to hemorrhagic shock
3. Anticipated need for Plasma

STEP 3 & 4: TESTING & TEMPERATURE

- ☐ Obtain **2 large bore IVs** (18 gauge or larger) or **Cordis Percutaneous Introducer Sheath**
- ☐ Obtain **initial labs:** blood collection supplies and algorithms
- ☐ Prepare pressure infuser with **fluid warmer**, & consider arterial line for BP monitoring
- ☐ Obtain Temp within 15 min. Target Temp **above 36°C** and recheck at least q30min (use fluid warmer, warm blankets, forced air blankets, and raise room temp to 24°C)

Uterotonics (#1 cause PPH is uterine atony)

1. Oxytocin (Pitocin) 40 units in 1000 mL NS CIV
2. Ergonovine (Ergot alkaloid) 250 mcg IM
3. Misoprostol (Cytotec) 800 mcg PO/SL/PR x 1
4. Carboprost (Hemabate) 250 mcg IM
5. Carbetocin (Duratocin) 100 mcg IM or IVP

STEP 5: TRANEXAMIC ACID & HEMORRHAGE CONTROL

- ☐ **Give tranexamic acid** 2g IV bolus over 20 minutes

Consult appropriate services for definitive hemorrhage control

- ☐ OB/GYN, Anesthesia and OR
- ☐ NICU for Pregnant patients
- ☐ Hematology for patients with significant coagulopathy

Reverse Coagulopathy and anticoagulants

- ☐ **Warfarin:** PCC 2000 units IV AND 10 mg Vitamin K IV
- ☐ **DOAC:** PCC 2000 units IV
- ☐ **Dabigatran:** Idarucizumab 5 g IV
- ☐ **Unfractionated heparin:** Protamine 25mg IV
- ☐ **Therapeutic dose LMWH:** Protamine 50mg IV

STEP 6: TRANSFUSION

Initial Cooler: 4 Units PRBCs + 4g Riastap

- O-Neg for Women under age 45
- Type specific blood once available
- 4 g Riastap IV if fibrinogen level unknown

Can the MHP be terminated?

- Is patient hemodynamically stable?
- Definitive hemorrhage control obtained?
- Are resuscitative efforts being terminated?

→ YES

NO

Subsequent Coolers:

- Standard Cooler (4 units PRBC, 2 units Plasma)
  OR
- Custom Cooler (specify amount of PRBC, Plasma, Fibrinogen and Platelets)

Reassessment:

- Repeat CBC, INR, Fibrinogen and Blood Gas q1h and treat according to Table 1
- Repeat full labs q4h and treat accordingly
- Recheck Patient temperature
- Change blood filter every 4 units

Can the MHP be terminated?

- Is patient hemodynamically stable?
- Definitive hemorrhage control obtained?
- Are resuscitative efforts being terminated?

→ NO

→ YES

Table 1: LAB DIRECTED TREATMENT

Lab test	Value	Treatment
Hgb	Less than 80 g/L	RBCs
INR	1.8 or greater	Plasma 4 units
Fibrinogen	Less than 2 g/L	Riastap 4 g
Platelets	Less than 50 x10^9 or on antiplatelets	Platelets 1 adult dose
Ionized Calcium	Less than 1.15 mmol/L or every 4 units PRBC	Calcium chloride 1 g IV
pH	Less than 7	8.4% Sodium Bicarbonate 100 mL (2 x 50 mL vials) IV
K	Greater than 5 mmol/L	D50%W 100 mL IV Regular insulin 10 units IV 12 lead ECG
Mg	Less than 0.7 mmol/L	Magnesium sulfate 2 g IV

Transfusion Tracker

PRBC (units)	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐
FFP (units)	☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Platelets	☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Riastap	☐☐☐☐ ☐☐☐☐ ☐☐☐☐
Calcium	☐☐☐☐ ☐☐☐☐ ☐☐☐☐

STEP 7 & 8: TRANSFER OF ACCOUNTABILITY & TERMINATION

Form# 16141

☐ Call **blood bank** and deactivate MHP, return unused blood products to blood bank ASAP, complete documentation and handover

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Poll Question

Does your hospital currently have an up-to-date electronic MHP order set?

Options:

1. Yes, and it functions well.
2. Yes, but it is not very user friendly or well liked.
3. No, but it is currently in progress.
4. No, but I wish we had one.
5. No, and I don’t want one!

Does your hospital currently have an up-to-date electronic MHP order set?

Yes, and it functions well. 0%

Yes, but it is not very user friendly or well liked. 0%

No, but it is currently in progress. 0%

No, but I wish we had one. 0%

No, and I don’t want one! 0%

Electronic order sets built in Meditech to reflect Adult, Pediatric and OB MHP protocols

Required dedicated IT team, took almost two years!

Contact Isabelle Wheten at wheteni@sah.on.ca for more information!

Go- Live

December 12th, 2023

- Order sets and protocols available in the EMR live environment
- Updated policy posted
- Hospital- wide communication provided in multiple formats: newsletters, email, posters, huddles

Poll Question

Does your current MHP debrief process improve future responses, team dynamics and patient care?

Options:

1. Yes, they provide valuable insights for improvement.
2. Sometimes, but a more structured process could be beneficial.
3. No, debriefings are rarely conducted or are not helpful.

Does your current MHP debrief process improve future responses, team dynamics and patient care?

Yes, they provide valuable insights for improvement.

0%

Sometimes, but a more structured process could be beneficial.

0%

No, debriefings are rarely conducted or are not helpful.

0%

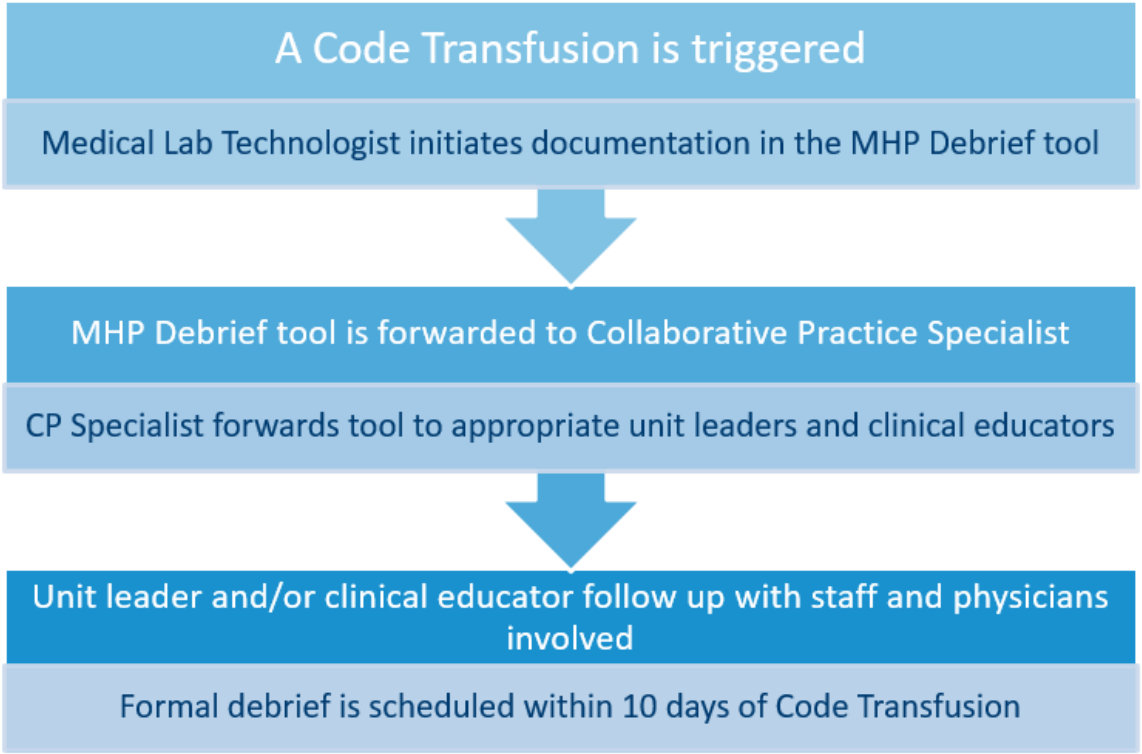
Debrief Time!

- Streamlined our process over time:
  - Created formal debrief process
  - Created SAH debrief form everyone could edit
  - Initially met for every debrief, now only if required

	Quality metric	Local Reporting	Provincial Reporting
Q1	The proportion of patients receiving tranexamic acid within 1 hour of protocol activation.	X	X
Q2	The proportion of patients in whom RBC transfusion is initiated within 15 minutes of protocol activation.	X	X
Q3	The proportion of patients (of patients requiring transfer for definitive care) with initiation of call for transfer within 60 minutes of protocol activation.	X	
Q4	The proportion of patients achieving a temperature >35°C at termination of the protocol.	X	
Q5	The proportion of patients with hemoglobin levels maintained between 60-110 g/L during protocol activation, excluding certain pediatric populations (e.g., neonates) that may require higher hemoglobin values.	X	
Q6	The proportion of patients transitioned to group specific RBCs and plasma within 90 minutes of arrival/onset of hemorrhage.	X	X
Q7	The proportion of patients with appropriate activation (>6 RBC units in first 24 hours; >40 ml/kg/24 hours of RBCs in pediatric patients) or before this level in patients dying due to hemorrhage within 24 hours.	X	
Q8	The proportion of patients without any blood component wastage (including plasma that is thawed and not used within the 5 day limit on another patient).	X	

https://transfusionontario.org/en/category/massive-hemorrhage-protocol/

Code Transfusion Debrief Process at SAH



Customizing Our Debrief Form

Started with Toolkit quality metrics

Additional fields were added to SAH debrief tool:

- Debrief date and attendance
- Overview of Code Transfusion
- Team members involved
- Good news and recognition
- Issues identified
- Takeaways/learning opportunities

Additional metrics added: details matter!

- pRBC issued within 10 min of protocol activation
- Porter documentation: Time call was received, arrival in lab, left lab, arrival at code transfusion with first cooler
- Calcium at target
- Electronic order set used
- Patient survived at termination

We are now working with analytics to try to make ongoing data collection easier!

A Year in Review
What's happening at SAH?

24 MHPs in calendar year (Jan 2024-Dec 2024) *vs.* **25** in year prior

Survival at termination **17/24 (71%),** one patient passed away 30 days later

5 patients ultimately transferred out after OR at SAH

5 stab wounds, **2** GSW, **5** MVCs, **6** related to medical complications or surgical procedures/complications, **3** GIB, **1** spontaneous splenic hemorrhage, **1** OB hemorrhage, **1** ruptured AAA, **0** Pediatric MHPs

Electronic Order Set was used in **17/24 (71%)** MHPs

Completed debriefs after **100%** MHP with stakeholders (including staff and physicians involved when needed)

Successes and Opportunities for Improvement

Our data

ORBCON Quality Metrics	Results for 2024	Intervention
1) TXA within 1 hr of activation	**20/24 (83%)**	Send out TXA reminder with bedside reference tool
2) pRBC transfusion initiated within 15min	**20/24 (83%)**	-identified and corrected some portering challenges (better wheelchairs for blood, elevator keys, clarified process for picking up blood and announcing delivery in resuscitation room)
pRBCs issued from blood bank within 10min activation ***additional metric at SAH	**24/24 (100%)**	

Successes and Opportunities for Improvement
Our data

ORBCON Quality Metrics	Results for 2024	Intervention
3) Call for transfer within 60min	N/A	Initial hemorrhage control at SAH
4) Temp <35C at termination	**3/24 (12.5%)**	Will highlight on bedside reference, send out communication/education with reminder
5) Hb outside of 60-110g/L during activation	**5/24 (21%)** -2 Hb <60g/L -3 Hb >110 g/L	Address overactivation
6) Failure to transition to type specific pRBCs within 90min of activation	**3/24 (12.5%)** -2 pts B+, we stock very little type B	
Uncorrected hypocalcemia ***additional metric at SAH	**3/24 (12.5%)**	Will highlight on bedside reference, send out communication/education with reminder

ORBCON Quality Metrics	Results for 2024	Intervention
7) Inappropriate activation (≤6 units within 24hrs in patient who survived)	**6/24 (25%)**	Ongoing education (critical administrative threshold, once at 3, think ABC)!
8) Blood products wasted due to activation	**5/24 (21%)** All Plasma	Increased communication between blood bank and resuscitation team

ORBCoN
Ontario Regional Blood Coordinating Network

Massive Hemorrhage Protocol Quality Metrics Portal: Blood Component Wastage at 11 Hospital Sites

Ontario MHP

Troy Thompson[1], Daniel Roque[2], Stephanie Cope[1], Jeannie Callum[3], Katerina Pavenski[4] Kimmo Murto[5] Andrew Petrosoniak[4], Dylan Grimm[6], Laurence Delorme[6], Monika Stodulska[6], Artyom Korenevsky[6], Na Li[7], Mark Ly[8]
[1]Ontario Regional Blood Coordinating Network, [2]University Health Network, [3] Kingston Health Sciences, [4]St. Michaels Hospital,[5]Children's Hospital of Eastern Ontario, [6]Queen's University, School of Medicine,
[7]Community Health Sciences, University of Calgary, [8]Centre for Health Informatics, Cumming School of Medicine, University of Calgary

Figure 3. MHP Activation Classification- Appropriate/Inappropriate

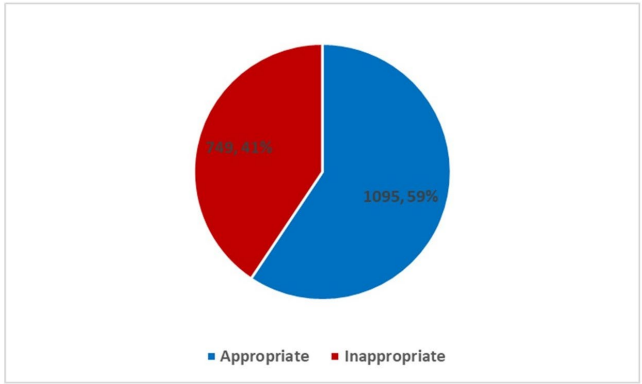


Table 1. Hospital Sites Total Wastage and Percentage of MHP Activations with Wastage

Hospital	Total # of MHP Activations	Total # of Blood Comp/Products Wasted	% of MHP activations with blood component wastage
A	67	18	26.9
B	14	13	71.4
C	217	58	21.7
D	10	3	20.0
E	431	153	31.1
F	43	4	7.0
G	60	26	36.7
H	408	95	22.5
I	16	1	6.2
J	326	147	35.0
K	252	11	4.4

- Retrospective chart review 15 ON hospitals Jan 2019 - July 2022
- 41% activations inappropriate, which accounted for 37% blood component waste
- Overall, there was waste in 29% of activations
- Wastage rates ranged from 4.4%-36.7%

Successes and Opportunities for Improvement
Beyond the data

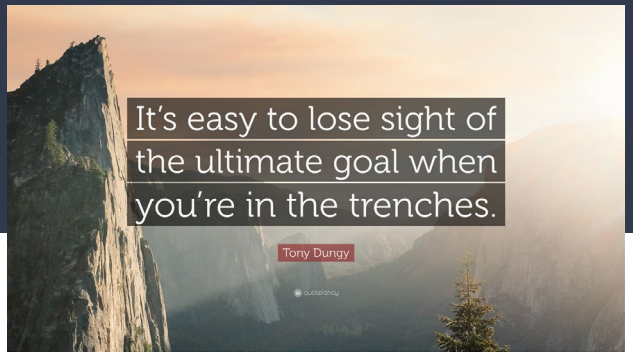
Opportunities for Improvement	Intervention
Clearly identifying team roles Transitioning from code blue or basic resuscitation to code transfusion roles	Labels for different roles included in transfusion kit Team members will be added to bedside reference tool
Code transfusion on medical floor Staff availability/training Equipment availability	Added phlebotomy to automatically respond to code transfusion on medical floor Ordered more Level 1 rapid infusers for ICU/OR Expanded and reinforced education
Staff access to EMR charts in other areas (eg ICU nurses could not access patient charts in the ED)	IT improved access for all users

Successes and Opportunities for Improvement
Beyond the data

Debrief Successes

- Great multidisciplinary discussion
- Improved understanding of the processes and challenges of other specialties/areas of the hospital
- Solidified team approach towards improving patient care
- Improved resuscitation team dynamics extending to other types of resuscitations

Our reflections after 1 year



- A great team is essential to success! Assemble your team with all stakeholders represented
- The ORBCoN toolkit is an incredible resource. Modify as needed to fit your hospital
- Debriefs provide a wealth of information! These will improve multidisciplinary collaboration and highlight key areas for improvement
- Overall, this has been an incredibly rewarding process
    - Great opportunity for interdisciplinary collaboration
    - Although a challenging process, you will improve patient outcomes and team dynamics!

Thank you!
Please reach out!

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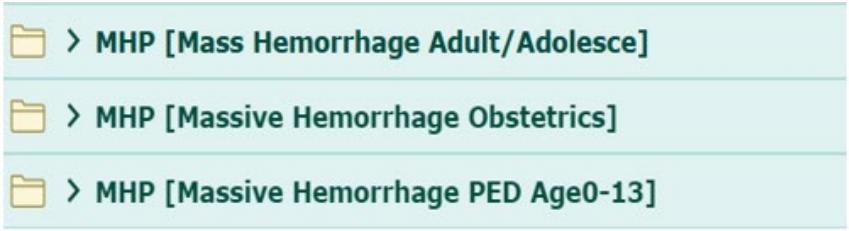
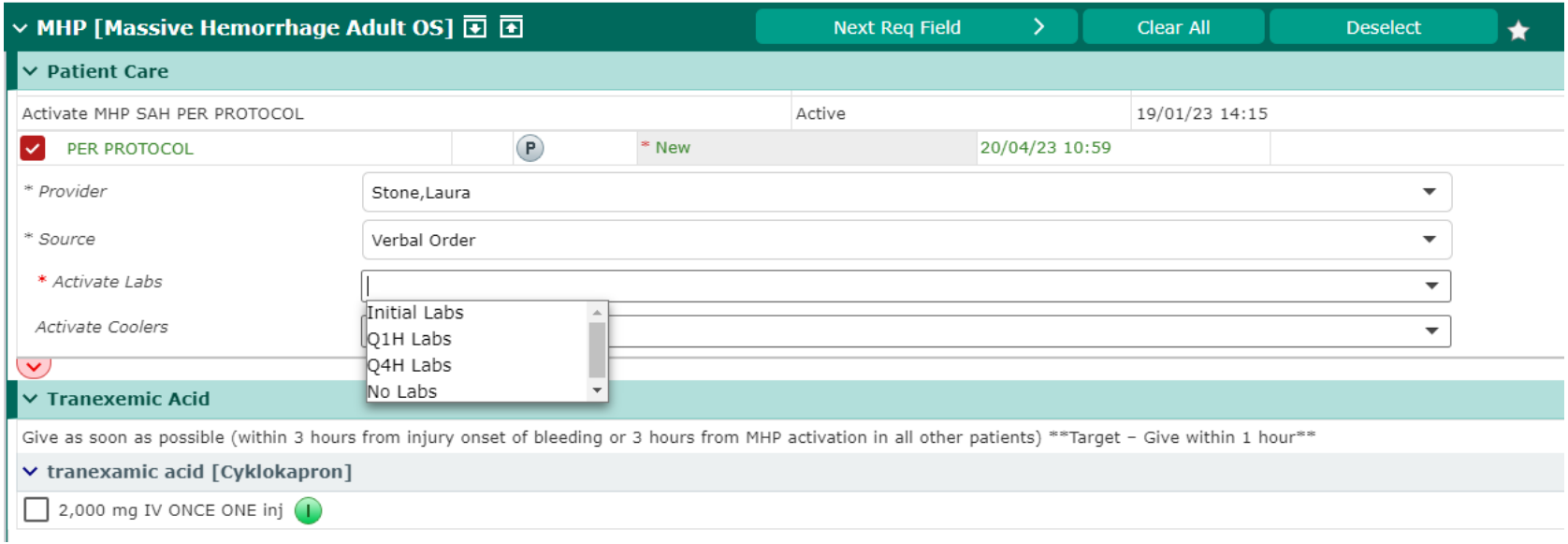
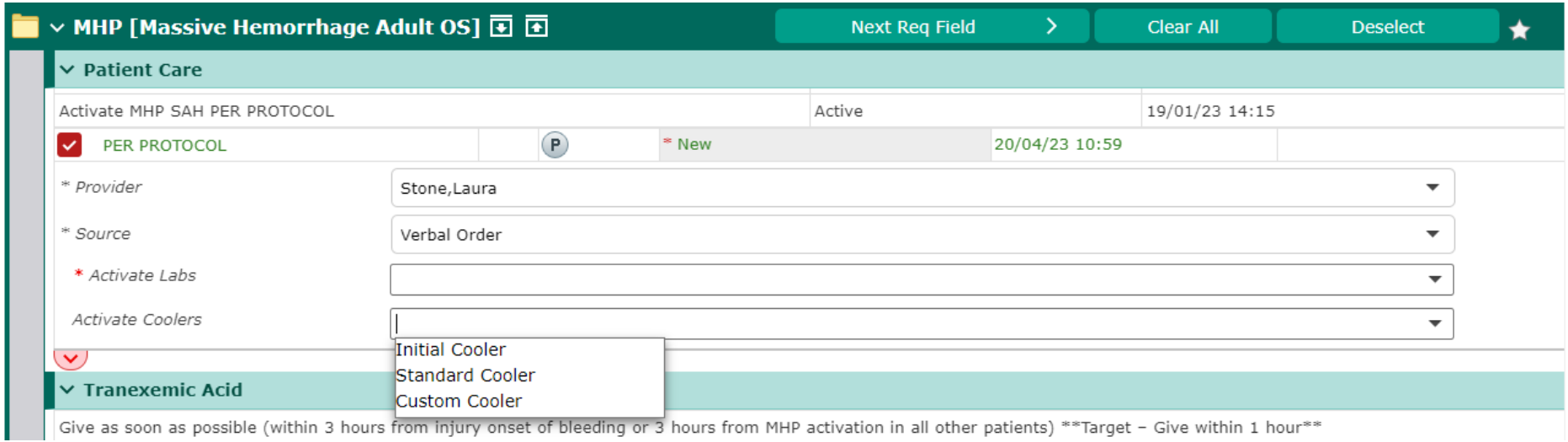


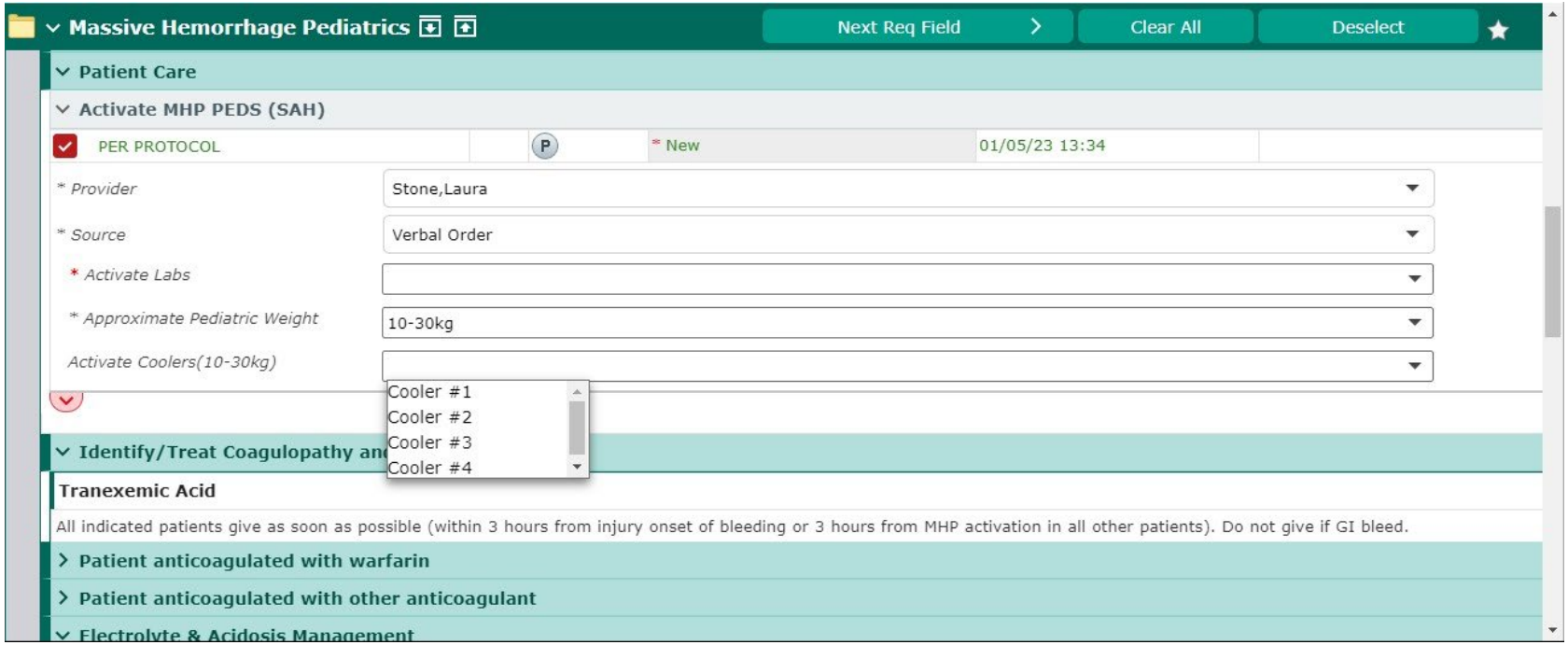
Meditech Order Set



Meditech Order Set



Meditech Order Set



Meditech Order Set

- Tranexemic Acid
  - tranexamic acid [Cyklokapron]
- Patient anticoagulated with warfarin
- Patient anticoag with apixaban, rivaroxaban, edoxa
- Patient anticoagulated with dabigatran (Pradaxa)
- Patient anticoagulated therapeutic heparin infus.
- Patient anticoagulated therapeutic LMWH within 8hr
- Patient anticoag. therapeutic LMWH over 8hr ago
- Critical Electrolyte/Acid Base Correction

Patient anticoagulated with warfarin

phytonadione (vit K1) [Vitamin K1]

☐ 10 mg IV ONCE ONE inj (I)

The 2011 NAC recommendation based the dosing of prothrombin complex concentrate on the INR but stated that if the INR is unknown and major bleeding is present, 2000 IU (80mL) should be administered. Please see attached Protocol.

⊕ Prothrombin Complex Conc

☐ Stat (P)

Patient anticoag with apixaban, rivaroxaban, edoxa

Example Factor Xa inhibitors: apixaban, edoxaban, rivaroxaban

The 2011 NAC recommendation based the dosing of prothrombin complex concentrate on the INR but stated that if the INR is unknown and major bleeding is present, 2000 IU (80mL) should be administered. Please see attached Protocol.

⊕ Prothrombin Complex Conc

☐ Stat (P)

Hypomagnesemia

For magnesium less than 0.7 mmol/L

magnesium sulfate bolus

magnesium sulfate 2 g bolus (2 g/50 mL - premixed bag)

☐ 29.5 mls/hr IV ONCE ONE

Hypocalcemia Prevention & Management

For ionized calcium less than 1.15 mmol/L AND after every 4 units of PRBC

calcium chloride

☐ 1,000 mg IV ONCE ONE syringe

calcium gluconate

☐ 3,000 mg IV ONCE ONE inj

Correction of Acidosis

For pH less than 7. Repeat blood gas q30 minutes and treatment until pH above 7

sodium bicarbonate [Sodium bicarbonate 8.4% syringe (1 mEq/mL)]

☐ 100 meq IV ONCE ONE syringe

Hyperkalemia Management

For potassium greater than 5 mmol/L - Select BOTH orderables below

Part 1 of 2

dextrose 50 % in water [D50W vial (25 g/50 mL)]

☐ 100 ml IV ONCE ONE inj2

Part 2 of 2

insulin regular [Novolin Toronto ; Humulin R]

☐ 10 unit IV ONCE ONE inj.ml

Meditech Order Set