Manitoba Blood Shortages Plan

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Acknowledgements

1. The National Health Service in the United Kingdom
2. Nova Scotia Provincial Blood Coordinating Program
3. Ontario Regional Blood Coordinating Network
4. British Columbia Provincial Blood Coordinating Office
5. National Advisory Committee on Blood and Blood Products

Abbreviations

AABB	American Association of Blood Banks
CBS	Canadian Blood Services
DOH	Days on Hand
MEBMC	Manitoba Emergency Blood Management Committee
NAC	National Advisory Committee on Blood and Blood Products
NEBMC	National Emergency Blood Management Committee
ORBCON	Ontario Regional Blood Coordinating Office Network
P/T EBMC	Provincial /Territorial Emergency Blood Management Committee
P/T BLC	Provincial/Territorial Blood Liaison Committee
PLT	Platelet
RBC	Red Blood Cell
RHA/TPC	Regional Health Authority/Transfusion Practices Committee
WOH	Weeks on hand referring to average weekly issues from CBS

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Introduction

A National Plan for the Management of Shortages of Labile Blood Products was published by the National Blood Advisory Committee (NAC) in 2010 with revisions made October 2015, for more information see: National Advisory Committee on Blood and Blood Products. To ensure a consistent approach was taken across the country, many provinces developed plans around that time. NAC was also asked to develop an Emergency Framework for Rationing of Blood for Massively Bleeding Patients during a Red Phase of a Blood Shortage.

Blood shortages may be caused by many reasons, some of which include: weather, terrorism, pandemics, testing problems, supply chain interruptions and labour disputes.

See Table 1 for examples of causes of blood shortages.

The National Plan for the Management of Shortages of Labile Blood Components outlines the management of blood products for the provinces where blood supply comes from the Canadian Blood Services (CBS). Four phases of inventory availability were developed by the National Plan:

Green Phase: implies that normal blood inventory levels exist and supply generally meets demand. This phase includes abroad range of inventory levels ranging from ideal to temporary shortages that occur periodically and can be managed by existing CBS and hospital/RHA actions.

Green Advisory: Exists when blood inventories are reduced and notification to the hospitals is required to monitor usage. This may occur for a single component or blood group.

Amber Phase (serious): exists when blood inventory levels are insufficient to continue with routine transfusion practice and hospitals/Regional Health Authorities (RHAs) will be required to implement specific measures to reduce blood usage.

Red Phase (critical): exists when blood inventory levels are insufficient to ensure patients with non-elective indications or needs for transfusions will receive the required transfusion.

Recovery Phase: exists when blood inventories have begun to increase and are expected to be at a level that would enable hospitals to move from Red to Amber and subsequently to the Green phase or from Amber to Green.

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A shortage can be determined by NAC or Canadian Blood Services. The NEBMC is convened and is co-chaired by the Chair of the NAC and the VP Medical of Canadian Blood Services. This committee is comprised of the Provincial & Territorial Blood Representatives, and the NAC Members.

The NEBMC determines the level of inventory or shortage (Green, Green Advisory, Amber, Red, Recovery). The Manitoba NAC representative will then convene the core Manitoba Emergency Blood Management Committee (MEBMC).

Once the level of shortage is determined the full MEBMC will be convened.

The MBEMC will initiate the Manitoba Blood Shortages Plan. Canadian Blood Services' Winnipeg production/distribution sites will fax initial notification of a blood shortage to hospitals.

Key Stakeholders would be notified by the MEBMC. At the same time, Canadian Blood Services nationally will re-distribute blood as appropriate and, as always, is responsible for the recruitment of blood donors.

In Manitoba, Shared Health will be responsible for communicating to physicians and patients the expected impacts to patient care. The Regional Health Authorities, through their Transfusion Practices Committees, will implement their contingency plans.

All decisions to reduce inventory, cancel surgery and triaging of requests will be made by each RHA Triage Committee and must be documented. If an allocation decision cannot be made, it will be referred to a Provincial Triage Team.

A gradual Recovery Phase should be implemented when leaving the Red Phase to prevent re-creating a shortage event. Shortage events should be reviewed to determine gaps and improve the plan for the future. Some standards for blood bank accreditation, such as AABB, require that the plan be tested annually. If the plan has been implemented, a test run is not required.

Background

In times of blood product shortages, a contingency plan must be in place to ensure that essential blood products are available for patients on an equal basis across the province and the country, not dependent on geographic location. This plan will help hospitals develop the necessary communication and management strategies to respond to these situations and will facilitate the

overall reduction of blood product use to ensure an available supply for the most urgent cases. The goal is to ensure secure access to safe blood products for patients who are most in need of them in times of critically low inventory levels.

Although the original focus for contingency planning activity around blood shortages was related to the global threat of a pandemic flu outbreak, it is currently recognized that other situations could also result in a blood inventory shortage. Table 1 provides a sampling of these potential situations. Consequently, the need to be prepared for blood shortages is critical.

Table 1 Potential Causes of Blood Shortages

Event	Potential for surge demand	Potential for Decreased Supply
Natural disasters: e.g. hurricane (tropical cyclone) severe windstorm(tornado), winter storm, wildfire, earthquake, tsunami, flood	√	√
Man-made hazards: e.g. industrial accident (fire, building collapse, hazardous material spill), chemical event, biological event, radiological event, nuclear event, explosive event.	√	√
Pandemic outbreak		√
Wide power outage		√
Workplace violence	√	√
Mass casualty/multiple trauma	√	
Inventory stockpiling	√	√
Manufacturing or testing delays		√
Product contamination/recall		√
Labour disruption		√
Transportation disruption		√
Seasonal influence: e.g. increase in trauma; decrease in donations	√	√

Purpose and Scope

The primary purpose of developing a blood management plan is to help ensure urgent needs for blood can be met even during a critical inventory shortage. While occasional inventory shortfalls may be managed through increased donor recruitment and movement of inventory across regions, more severe or longer-term imbalances in donor supply and recipient demand will require strategies to reduce the demand, at least temporarily to allow time for a correction to occur. A large part of blood management (even in normal circumstances) is "transfusion avoidance, transfusion safety, transfusion competency, conservation techniques and education as well as anemia and pre-operative optimization".

Another important component of blood management of inventory shortage in a country with a national blood supplier is that all regions of the country must act together to collaborate during the shortage to ensure patients in one region do not suffer as a result of another region not following national guidelines or direction. It is critical that all provinces and territories in Canada develop plans adhering to the National Plan and, in turn, encourage hospitals in their jurisdiction to develop their internal plans according to the guidance of their respective provincial plans.

The National Plan for Management of Shortages of Labile Blood Products, including the NAC Allocation Framework, and the Manitoba Blood Shortages Plan, were developed to provide a consistent approach for Canadian and Manitoba organizations when developing their facility specific plans for blood management during a critical inventory shortage. Through development of hospital plans based on national guidelines and the allocation framework, a standardized approach to managing blood shortages will result and ensure more consistent and equitable blood management throughout the province and country. In addition, familiarity with the guidelines will facilitate communication of national guidance provided during a blood shortage and aid in monitoring compliance to recommendations made. The NAC has also prepared a document on Red Cell Allocation, so that the principles are consistent between provinces. The document is found on the NAC website. http://www.nacblood.ca/resources/shortages-plan/index.html

Although the National Guidelines have been developed with blood components in mind (red blood cells, platelets, plasma), a similar approach may be taken to address shortages of plasma protein products (i.e. IVIG, albumin).

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Key Participants and Stakeholders

The Manitoba Plan key participants are considered to be those actively involved in the blood system including hospitals, RHAs, Manitoba Health, Seniors and Active Living, and the NAC.

The key participants and stakeholders in Manitoba for the management of emergency blood shortages include:

1. Canadian Blood Services Diagnostic Services
2. Shared Health
3. Regional Health Authorities (Transfusion Practices Committees or Hospital Emergency Blood Management Committee)

Overview of Plan Structure

During blood shortages, difficult decisions will need to be made in appropriate allocation and rationing of blood components. The Manitoba plan is based on the following ethical principles:

1. All patients in Manitoba will have equal access to the available blood on the basis of need. No RHA or hospital will stockpile blood for their patients when the need is greater elsewhere.

2. Collaborative approaches that may transcend the needs of a single patient, health care professional or institution may need to be implemented. This could represent a shift in decision making from a focus on individual patients to consideration of the "greater good".

3. A fair and transparent priority-setting process is essential. The MB EBMC and decision makers provincially and nationally need to know the inventory available in each jurisdiction whether stocked at a blood supplier or in a hospital.

4. All affected hospitals are accountable for taking a consistent and transparent approach to blood utilization during a shortage.

   The rationale behind these principles and the ethical framework used to create the is provided in detail in the National Plan.

In keeping with other plans to manage blood shortages, the National Plan and the Manitoba Plan considers four phases of inventory availability, defined below. Roles and responsibilities for the participants (CBS, P/T Ministries, and hospitals/RHA) are described in this section in general terms.

Phases of Inventory Levels

Nationally, the phases of inventory availability levels are:

Green Phase

The Green Phase exists when blood component inventory levels are normal. This phase can range from ideal to periodic temporary shortage. A Green Phase is defined by Canadian Blood Services as:

- 100% optimal inventory or greater than three days (72 hours) of average red blood cell issues
- >1 WOH* for transfusable plasma (type O, A, and B); >2 WOH* transfusable plasma (Type AB)
- > 80-100% of the daily national requirement for platelets
    - **Green Phase Advisory** implies that CBS inventory levels are low with respect to a particular blood product and requires all hospital inventories to determine the likelihood of crossing into an amber or red phase.
    - Inventory levels are slightly reduced, but sufficient for routine practice.

Amber Phase

The Amber Phase exists when blood component inventory levels are insufficient to continue with routine practice. This may apply to a single blood group or component. An Amber Phase is defined by Canadian Blood Services as:

- Two to three days (48-72 hours) of average daily red blood cell issues
- 25-79% of daily national requirement for platelets with recovery anticipated within 12 hours
- Three to seven days of frozen plasma (group O, A, B), and six to fourteen days of group AB plasma and cryoprecipitate

Red Phase

The Red Phase exists when blood component inventory levels are insufficient to meet the needs of patients with non-elective indications. Canadian Blood Services will declare a Red Phase when nationally there is:

- Less than two days (48 hours) of average daily red cell issue
- Less than 25% of the national requirements for platelets
- Less than three days on hand of Group O, A, B frozen plasma or less than six days on hand of Group AB plasma and cryoprecipitate

Recovery Phase

The Recovery Phase implies that blood inventory levels are beginning to be maintained and plans for a gradual restoration of normal transfusion levels will be put in place.

*WOH- Refers to 'weeks on hand' defined as the average weekly issues of red cells, components, from CBS.

Figure 1: CBS Inventory Levels Corresponding to the Contingency Plan Phases.

Phase	Exists when…	Defined by CBS when…	Platelets	Plasma/ Cryoprecipitate
GREEN	Blood component inventory levels are normal.	• 100% optimal inventory • > 3 days (72 hrs.) average red blood cell issues	• 80-100% of daily national	> 7 DOH Group O, A, B frozen plasma; > 14 DOH Group AB plasma >14 DOH cryoprecipitate
AMBER	Blood component inventory levels are insufficient to continue with routine practice.	• 2 – 3 days (48-72 hrs) of average red blood cell issues	• 25-79% of daily national requirements for platelets with recovery anticipated within 12 hours	• 3-7 DOH Group O, A, B frozen plasma; • 6-14 DOH Group AB plasma • 6-14 DOH cryoprecipitate
RED	Blood component inventory levels are insufficient to meet the needs of patients with non-elective indications.	• < 2 days (48 hrs) of average red blood cell issues	• < 25% of the national requirements for platelets. No recovery expected with in 12 hours.	• < 3 DOH Group O, A, B frozen plasma • <6 DOH Group AB plasma • <6 DOH cryoprecipitate
RECOVERY	Blood component inventory levels are beginning to be maintained. Plans for gradual restoration of normal transfusion levels will be put in place.			

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In Manitoba, the inventory levels associated with each phase are found in Table 2

Initiation of Blood Shortage Management Process

1. The CBS VP Medical Affairs & Innovation & The NAC as co-chairs will convene a teleconference of the National Emergency Blood Management Committee (NEBMC).
2. The National Emergency Blood Management Committee will determine the level of blood shortage- i.e. green, amber or red.
3. One of the Co- chairs (the Manitoba NAC representative or the CBS Medical Officer) or their designate will convene a teleconference of the MEBMC
4. The MEBMC communicates the phase of blood shortage and requests Stakeholders to implement their Blood Shortage Plans
5. All the Stakeholders, including The RHA's, CBS and Shared Health will implement their Blood Shortage Plans.
6. RHA's will activate their Triage Teams, if required, and document their decisions.
7. Blood Shortage Plans will be followed until the Recovery Phase is established. Intra-agency communication continues until the emergency resolves.

Regional Health Authorities/Transfusion Practices Committees

Regional Health Authorities are responsible for developing Hospital Emergency Blood Management Plans. The Regional Health Authorities, through their Transfusion Practices Committees, may decide to delegate this function and form separate Hospital Emergency Blood Management Committees to develop the Emergency Blood Management Plans. These plans should coordinate with the existing hospital emergency plans, i.e.: code orange, code brown, etc.

In the event of a major blood shortage, the Regional Health Authorities/Transfusion Practices Committees will be required to reduce blood usage to the degree required for the amount of blood available. This would require communication to the various Clinical Programs of Surgery, Internal Medicine, Anaesthesia, Emergency, Critical Care, Family Medicine, Obstetrics and Pediatrics.

The Regional Health Authorities/Transfusion Practices Committees' Emergency Blood Management Committee may be comprised of:

- Transfusion Practices Committee Chairs
- Chief Medical Officers
- VP's Nursing
- Hospital CEO's
- Others - as deemed appropriate by Transfusion Practices Committee Chairs

Each Regional Health Authority/Transfusion Practices Committee should:

1. Define specific hospital inventory levels of blood components for Green, Amber and Red phases (days on hand).

2. Develop a list of contact information for blood shortages.

3. Develop a communication plan for blood shortages.

4. Have a defined Action Plan for each phase (Green, Amber, Red, Recovery).

5. Have a plan for blood conservation and alternatives. Blood conservation strategies should include any or all of the following: erythropoiesis-stimulating agents, thrombo mimetics, intravenous/oral iron, antifibrinolytics, intraoperative cell salvage,

interventional radiologic procedures, autologous blood donation for elective surgical procedures, rapid access to endoscopy, and non-invasive surgeries.

6. Define how to monitor strict adherence to Transfusion Guidelines.

7. Develop a Triage Team.

8. Develop Triage guidelines using the Synopsis for Triage Team* as attached from the NAC guidelines

9. Develop notification plan for patients/family.

10. Develop a training and competency plan for staff.

**The NAC has developed the Emergency Framework – Synopsis for Triage Team. This was developed with input from specialists across Canada so that fair and equitable practices for blood allocation would be followed across Canada. This was based on the ethical framework for Accountability and Reasonableness. It is expected that hospitals use the synopsis for Triage Teams and document their decisions.*

Triage Teams:

- Should be appointed by the Regional Health Authority (or hospital for large urban sites) in conjunction with the Hospital's Transfusion Practice Committee.
- Requires the physicians on the Triage Team to be experienced in dealing with critically ill patients.
- Requires, if possible, the physicians on the Triage team to be freed of direct patient care at the time of shortage.
- Requires sufficient physicians for 24hour coverage as appropriate for the number of transfusions at the site.

Documentation of Triage (Reference Appendix 4 for Documentation Tools and Clinical Scoring)

Patient decision and tracking forms must be completed & distributed to:

- Patient's medical record
- Regional Health Authority/Transfusion Practices Committee Emergency Management Committee
- The Triage Team for continuity

After a blood shortage (or exercise), the Regional Heath Authorities/ Transfusion Practices Committee should review the event, define any gaps and make a report to the MEBMC.

The MEBMC is in turn required to summarize all the regional reports and provide a summary to the National Emergency Blood Management Committee.

Tertiary Triage (Red Phase)

Tertiary Triage would most likely be necessary in a Red Phase.

Communications During A Blood Shortage

Effective and timely communication is critical in attempts to mitigate a blood shortage, while in a shortage situation and afterwards during recovery efforts. The principal organizations involved in managing a blood shortage are the NAC on Blood and Blood Products, Canadian Blood Services, Shared Health and Regional Health Authorities (RHAs)/hospitals. Each organization is independent, and has its own communications infrastructure, procedures and complexities. However, a common course of action is required by these partners, however different they may be, to promote alignment, consistency and collaboration during a crisis or potential crisis. Shortages can be identified by either Canadian Blood Services or any hospital faced with a demand for blood greater than the supply.

Step One: When a shortage is identified, Canadian Blood Services will contact the chair of the NAC. This first meeting will be within 24 hours to determine the phase of the shortage. The final phase is determined by the co-chairs of the NEBMC, based on inventory levels.

The Manitoba NAC representative and the Provincial Territorial (P/T) Representatives are members of the National Emergency Blood Management Committee. In the absence of both of Manitoba's NAC members and the P/T Blood Representative, the Transfusion Medicine Physician on-call for Canadian Blood Services will proceed with enacting Manitoba's Blood Shortages Committee.

The Manitoba Emergency Blood Management Committee (MEBMC) is co-chaired by the NAC Representative and the appointed clinical provincial lead.

- Provincial/Territorial Representative
- Technical Director, Transfusion Medicine, Shared Health
- Manager, Blood Management Services
- Diagnostics Services Laboratory Manager, Canadian Blood Services
- Site Production Manager, Canadian Blood Services
- Chairs of Transfusion Practice Committees

Step Two: The MEMBC will discuss the shortage and the phase, then notify the Chief Medical Officer of Shared Health, the Chair of the Chief Medical Officers of the Regional Health Authorities, the Manitoba Health, Seniors and Active Living contact person and the members of the MBEMC.

The role of the MEMBC is to provide notification of the shortage levels, ensure that the recommendations of the NEBMC are appropriately communicated to and have ongoing review of the shortage to Provincial stakeholders. MEBMC is a conduit for communications/feedback between the NEBMC and the RHA/hospitals Emergency blood management committees.

Canadian Blood Services has developed a communication plan in which Canadian Blood Services notifies Hospital Blood Banks of any change to inventory phase by fax.

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Actions by Stakeholders During Phases *(in alphabetical order)*

Canadian Blood Services – National Office

GREEN PHASE

- Participate with NAC in the development of the Emergency Blood Shortage Plan for the management of shortages of labile blood components.
- Develop the communication plan to be used in the event of a national Blood Shortage.
- Co-Chair the National Emergency Blood Committee with the chair of the NAC
- Conduct an Annual Exercise of the National Emergency Plan
- Receive notification from NAC or internally of a possible blood shortage

AMBER PHASE

- Implement the National Communication Plan
- Continue to fill orders as inventory permits
- If blood reduction strategies are not implemented, CBS will reduce order fill rates as deemed necessary
- Communicate with Hospital Blood Banks through fax and email
- In conjunction with the NEBMC, determine if the shortage phase has changed, i.e. amber to green, amber to red.

RED PHASE

- Communicate the implementation of Red Phase
- Cut inventory depending on severity & length of the anticipated shortage (10-50%)
- Continue to coordinate the need for increased blood donations
- Coordinate on-going communication with Hospital Senior Administrators
- In conjunction with the NEBMC, determine phase change, i.e. red to amber, red to recovery phase

RECOVERY PHASE

- Continue communication through the National Emergency Blood Management Committee.
- Maintain standard communication with key messages at all levels/stages of the recovery. Key messages will be developed by the National Emergency Blood Shortage Committee.
- Coordinate gradual re-stocking to normal blood inventory levels.
- Communicate to Hospital Senior Management when the shortage is over.
- Review and evaluate the plan to identify gaps and deficiencies.
- Amend the plan as required.

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Canadian Blood Services – Winnipeg Office

GREEN PHASE

- Participate in the Manitoba Emergency Blood Management Committee.
- Assist in developing the Manitoba Blood Shortages Plan.
- Participate on the Canadian Blood Services Local Emergency Response Team (LERT).
- Develop contingency plans.
- Train staff to follow guidance in the plan.
- Participate in mock Blood Shortage exercises.
- Review and evaluate the plan bi-annually.
- Transfusion Medicine Physician on-call for Canadian Blood Service will be the lead in the absence of the Medical Officer.

AMBER PHASE

- Communicate (fax) to all hospitals decision to move into Amber Phase.
- Coordinate communications for increasing blood donations.
- Continue to fill orders to RHA's/hospitals as long as the inventory permits. If blood reduction strategies are not enacted, Canadian Blood Services will reduce order/fill rates to hospitals.

RED PHASE

- Continue to fill orders to RHA's/hospitals as long as the inventory permits. If blood reduction strategies are not enacted, Canadian Blood Services will reduce order/fill rates to hospitals.

RECOVERY PHASE

- Maintain contact with the MB EBMC and the NEBMC.
- Communicate by fax change to Recovery Phase to Manitoba Stakeholders.
- Adjust inventory fill rates of affected components slowly to levels consistent with those previously determined as appropriate for recovery.
- Review and evaluate the plan for gaps and deficiencies.

- Revise Blood Shortage Plan as required.

Shared Health

GREEN PHASE

- Participate on the MB EBMC
- Assess normal blood inventory utilization.
- Develop a Blood Shortages plan.
- Assist Transfusion Practice Committees (TPCs) in developing their plan.
- Facilitate TPCs monitoring of transfusions.
- Coordinate Plan with RHA/TPC/Hospital Emergency Plans.
- Train staff to follow guidance in the plan.
- Participate and review in a mock Blood Shortage.

AMBER PHASE

- Assess current blood inventory.
- Reporting is automatic in Traceline® Sites and must be done manually in non-Traceline® site.
- Implement Blood Shortage Plan.
- Decrease blood inventory levels to 2-3 days of average red blood cell issues.
- Participate in MEBMC Teleconferences.

RED PHASE

- Implement Red Phase Plan with Triage Document from NAC.
- Assess current blood inventory.
- Decrease blood inventory levels to 2 days or less of average red blood cell issues.
- Continue to participate in MEBMC.

RECOVERY PHASE

- Maintains contact with MEBMC.
- Implement Recovery Plan in conjunction with TPC's to stage a gradual return to normal operating capacity.

- Review and evaluate the plan for gaps or deficiencies.
- Report any gaps or deficiencies to the MEBMC.

Manitoba Emergency Blood Shortages Committee

GREEN PHASE

- Develop the Manitoba Blood Shortages Plan.
- Develop Terms of Reference for the Committee.
- Ensure linkage of the Manitoba Plan with the National Blood Shortages Plan.
- Coordinate liaison with Stakeholders.

AMBER PHASE

- Communicate with the NEBMC, the CMO of Shared Health and the Chair of the Regional Health Authorities Chief Medical Officers.
- Organize teleconferences with Stakeholders.
- Communicate with Stakeholders.
- In the absence of the NAC member or the CBS Medical Officer the Transfusion Medicine (TM) Physician on-call will chair the MEBMC.
- Communicate with Key Stakeholders.

RED PHASE

- Receive communication from NEBMC regarding Red Phase.
- Continue to communicate with the NEBMC and Regional Health Authorities Senior Management by teleconference.
- Continue to communicate with Stakeholders.

RECOVERY PHASE

- Notify stakeholders of Recovery Phase.
- Review and evaluate the plan to identify gaps and deficiencies.
- Amend the Manitoba Emergency Blood Shortages Plan if required.

Regional Health Authorities/Transfusion Practices Committee (incl. NW Ont.)

GREEN PHASE

- Establish practices to minimize blood wastage.
- Review inventory stocking and outdates.
- Utilize blood conservation strategies and blood alternatives.
- Perform regular audits of blood ordering practices.
- Develop a Massive Transfusion and/or Hemorrhage Protocol.
- Develop a Regional Blood Shortage Plan.
- Integrate the Blood Shortage Plan with existing Regional Health Authorities or Hospital plans.
- Develop Triage Team (RN's, Midwives, Physicians).
- Provide training for the Triage Team.
- Participate annually in trial of the plan.
- Evaluate the Plan for gaps and deficiencies after a shortage or trial of the plan.

AMBER PHASE

- Receive communication from the MEBMC.
- Initiate Blood Shortage Plan and Communications Plan regarding the Blood Shortage.
- Participate in teleconferences hosted by the MEBMC.
- Implement RHA/Hospital Communication plans.
- Reduce demand for the affected blood component by:
    - Deferring/cancelling of surgical and medical procedures impacted by the decreased blood component
    - Activating the triage team
    - Conducting triage as required and document
    - Increasing blood conservation strategies
    - Consulting with Regional Transfusion Medicine Physician or Transfusion Medicine MD on call for issues
- Notify patients and families if transfusions will be cancelled or delayed or if surgery/hospitalization is cancelled or delayed.

RED PHASE

- Receive communication from the MEBMC of a Blood Shortage – Red Phase.
- Participate in Manitoba Blood Shortages Committee teleconferences.
- Activate communication plans – notify physicians and patients to cancel surgery
- Implement/continue with the pre-approval process for transfusion requests.
- Reduce inventory to minimal levels of the affected blood component.
- Defer/Cancel elective surgeries.
- Defer/Cancel admissions.
- Notify patients and families of current or future cancellations.
- Activate the Triage Team.
- Utilize the Emergency Framework for Rationing of Blood for Massively Bleeding Patients during a Red Phase of a Blood Shortage - Synopsis for Triage Team.
- Utilize the Tracking forms (see above link).
- Report blood & blood component inventory to the Manitoba Blood Shortages Committee as requested.
- Re-assess patients daily who were denied blood transfusion.
- Stop transfusions for patients with a low chance of survival (The Emergency Framework, as mentioned above, gives guidance for patients who are massively bleeding.)
- Consider deferring chemotherapy and induction for Bone Marrow Transplants.
- Increase focus on blood conservation, i.e. erythropoietin.
- Consult with the Provincial Triage Team to arbitrate in areas of dispute between physicians/facilities in the allocation of the shortage component.
- Reinforce message not to stockpile blood & blood components.

RECOVERY PHASE

- Maintain contact with the MEBMC.
- Plan a slow return to normal activities so that a gradual return to service occurs and blood component inventories are not adversely affected.
- Slowly re-institute medical/surgical procedures requiring transfusion.
- Review patients who were previously denied transfusion.
- Perform review and evaluate Blood Shortage Plan for gaps and deficiencies.
- Provide feedback on gaps and deficiencies to the Manitoba Blood Shortages Committee.

References

1. National Plan for the Management of Shortages of Labile Blood Components. National Advisory Committee on Blood & Blood Products & Canadian Blood Services; March 2020.
2. Emergency Framework for Rationing of Blood for Massively Bleeding Patients during a Red Phase of a Blood Shortage. Working Group on Emergency Disposition of Blood during a Red Phase Blood Shortage: National Advisory Committee on Blood and Blood Products; April 14, 2012.
3. Red Blood Transfusion: A Clinical Practice Guideline from the AABB; Carson, J; Grossman B; Kleinman MD; et al. Annals of Internal Medicine 2013; 157(1):49-58
4. CAN/CSA-Z902-10 Blood and Blood Components; February 2010 Canadian Standards Association; Mississauga, Ontario.
5. CSTM Standards for Hospital Transfusion Services v.3; February 2011 Canadian Society for Transfusion Medicine; Ottawa, Ontario.
6. Public Hospitals Act R.S.O. 1990, c.P.40 e-Laws–Ontario
7. Provincial Contingency Plan for Blood Component/Blood Product Shortages in Nova Scotia. Nova Scotia Health and Nova Scotia Provincial Blood Coordinating Program. April 2010.
8. Development of an Integrated Blood Shortage Plan for the National Blood Service and Hospitals. NHS and NBS Chief Medical Officer's National Blood Transfusion Committee Dec 2004.
9. An Integrated Plan for the National Blood Service and Hospitals to Address Platelet Shortages. NHS and NBS Chief Medical Officer's National Blood Transfusion Committee. Gateway Reference 6514 06 Sept 2006.
10. British Columbia Blood Contingency Plan. BC Provincial Blood Coordinating Office, Provincial Health Services Authority, BC Transfusion Medicine Advisory Group. UM.CONT.0001ver2.0; December 21, 2009.

Appendix 1: Terms of Reference - Manitoba Emergency Blood Management Committee

Mandate:

- To develop a Manitoba Blood Shortages Plan.
- Integrate elements of National Plan for the Management of Shortages for Manitoba.
- To coordinate the communication from the National Emergency Blood Management Committee to the Provincial Stakeholders during a shortage.
- To establish a process to monitor the adherence to the plan in times of blood shortage.
- To assist Regional Health Authorities/Hospital Transfusion Practice Committee in developing their plans for blood shortage.

Meetings:

- Will be at the call of the Co-Chairs of the MEBMC.
- Should be held at minimum, annually.
- Efforts by all members or delegates to attend.
- All members to receive minutes.
- Quorum is number present.

Multi-Disciplinary Membership:

- NAC Representatives
- Medical Officer, Canadian Blood Services
- Transfusion Medicine Physicians
- CMO Shared Health
- Chair of the RHA CMOs

Appendix 2: Terms of Reference - National Emergency Blood Management Committee

Membership:

The chair of the National Emergency Blood Management Committee is the current chair of the National Advisory Committee for Blood and Blood Products (NAC). The Vice-Chair is the designate in the absence of the chair.

The members include:

- From Canadian Blood Services
  - Chief Supply Chain Officer
  - Director, Product & Hospital Services
  - Director, Operations Support
  - Director, Internal Communications
  - Director, Governmental Relations
  - Director, Media Relations & External Communications
- All National Advisory Committee members
- All Provincial/Territorial Representatives
- Québec Ministry Representatives
- Héma-Québec Representatives
- Health Canada
- Two blood transfusion representatives

Every member of the National Advisory Committee is responsible for naming their delegate.

The term of the appointee is determined by the body that appointed them.

Additional experts may be asked to provide subject matter advice on the area of interest, i.e. infectious disease.

Appendix 3: Synopsis for Triage Team

Emergency framework for rationing of blood for massively bleeding patients during a red phase of a blood shortage - Synopsis for Triage Team

Excerpted from: (http://www.nacblood.ca/resources/shortages-plan/synopsis-triage-team.pdf)

Purpose and Scope

The National Advisory Committee on Blood and Blood Products *(*NAC—an advisory committee, composed of hospital-based transfusion medicine experts chosen by their respective Provincial Ministries of Health and Canadian Blood Services representatives that report to a joint Canadian Blood Services/Provincial and Territorial Ministries of Health committee) developed the National Plan for the Management of Shortages of Labile Blood Components (The National Shortages Plan). The National Shortages Plan required further expansion for dealing with patients who require massive blood transfusion during a red phase blood shortage. This document has been developed as an adjunct to the National Shortages Plan (available at http://www.nacblood.ca/) to address these massively hemorrhaging patients as they can consume up to 25% of the national blood supply and urgent decisions are needed to ration blood to these patients during a red phase blood shortage.

The document for the rationing of blood for massive hemorrhage (defined as expected blood loss of one blood volume over less than a 24 hour period; 0.5 blood volume in 3 hours; or four or more units of red blood cells in one hour) is a guide for the management of patients in need of massive transfusion (trauma patients, patients undergoing liver/lung/heart transplantation, patients requiring ventricular assist devices or extracorporeal membrane oxygenation, patients with ruptured aortic aneurysms or gastrointestinal bleeding and obstetrical patients) during a red phase blood shortage. A red phase blood shortage is defined as the availability of less than 48 hours of red blood cell units in Canada where it is not foreseeable that a shortage will be averted by increasing the collection of blood or by reducing elective surgical procedures. In other words, the blood inventory levels are insufficient to ensure that patients with non-elective indications for transfusion will receive the required transfusion.

This document has been developed to ensure that blood transfusions are provided to Canadians during a red phase blood shortage in an ethical, fair, and transparent way to ensure

that the greatest numbers of lives are saved and to minimize the suffering and maximize the use of alternatives for those who may not survive due to insufficient availability of blood.

Target Audience

This emergency framework is intended to be used by key blood system participants who are defined to be Canadian Blood Services, hospitals and regional health authorities, the Provincial and Territorial Ministries of Health and the National Emergency Blood Management Committee (NEBMC) as per the National Shortages Plan.

Summary of the Development Process

In 2009, a working group of experts was convened to develop an emergency framework. The working group members were from large tertiary care centers in Canada and had expertise in transfusion medicine, trauma, anesthesiology, gastroenterology heart/lung/liver transplantation, obstetrics, cardiovascular surgery, allied health, medical ethics, law and methodology. The working group also included members of the National Advisory Committee on Blood and Blood Products. The working group did not include patient representatives, although widespread lay consultation was sought during the development process.

A systematic search was conducted of the literature to identify predictors of massive blood loss and mortality to guide the working group members in determining which patients would be the most likely to benefit from blood transfusion.

An extensive literature search was also conducted for ethical frameworks and allocation protocols dealing with the allocation of scarce resources as the allocation of any scarce resource is one of the most challenging ethical issues faced in health care. This emergency framework was developed to ensure a fair, transparent and just distribution of blood when the demand for transfusion will exceed the available resources. This framework may transcend the needs of a single patient, health care professional or institution but represents a focus on the 'greater good'.

The working group through an iterative process developed recommendations that were assigned a level of evidence and grade of recommendation according to the Canadian Task Force http://canadiantaskforce.ca/. In addition to the recommendations, the working group also adapted a previously published Canadian critical care triage protocol developed for pandemic influenza planning. Recommendations for the patients who are massively hemorrhaging do not address comorbidities that may impact on the survival of patients.

National experts including professional societies, the blood provider and lay groups reviewed the final recommendations to provide input on the recommendations. Their agreement to all recommendations and the overall document review was elicited and all comments were subsequently addressed in the final document.

The Triage Team

It is recommended that triage teams be established in advance of a shortage. The role of the triage team is to provide a structure that formally oversees the triage process be it provincial /regional or at the hospital level during a crisis. The triage team should receive comprehensive information on the triage framework in advance of a blood shortage being declared. The triage team must be a multidisciplinary team with adequate background knowledge in terms of patient triage and managing patients under a 'crisis standard of care'.

Membership

The triage team should be comprised of any of the following and be appointed by the regional/hospital transfusion committee or regional/hospital emergency blood management committee (the number of team members should be proportional to the transfusion volume of the institution or region):

1. Clinical Chair of MEBMC. This person should be an experienced physician with familiarity in triaging critically ill patients, broad based knowledge of resources and capabilities of healthcare organizations. Will have final responsibility and authority over clinical decisions. Jayson Stoffman
2. CMO Shared Health or designate. Perry Gray
3. Representatives (2) from the Emergency Room, Trauma, Transplantation, Cardiovascular Surgery, Gastroenterology, and Obstetrics to provide updates on demand, impact and assist in decision making. Could be regional CMO. At least one representative should have clinical expertise relevant to the triage decisions.
4. Psychosocial representation (1). Could be from Social Work, Spiritual Care, or Nursing.

   Triage team should be encouraged to consult with other outside clinicians as required for evidence or expertise relevant to the triage decisions. A current contact list of potential clinical experts will be maintained in the Appendix.

In addition, the triage team leader should have another triage physician available to them for assistance with decision making for difficult cases. The Regional/Hospital Transfusion Committee or Regional/Hospital Emergency Blood Management Committee should appoint members of the triage teams with the number of individuals proportional to the transfusion volume of the institution or region. It will be the responsibility of the triage teams to report back to the transfusion committee or emergency blood management committee all triage decisions made.

The triage teams must be educated on the background information and how to apply the triage tool in advance of a blood shortage. The responsibility for education of physicians and triage teams rests with the Regional Emergency Blood Management Committee in collaboration with the Hospital/Regional/District Health Authority. Specific training at dedicated intervals is difficult to achieve as there is varying frequency with which simulation exercises occur, the level of involvement of various medical services during a simulation and a large turnover of physicians throughout the system. However, through simulation exercises, continuous education, and dissemination of the National Blood Shortages Plan and this emergency framework, physicians would be more inclined to align with the National Blood Shortages Plan to ensure all patients receive quality levels of care during a shortage. Post simulation reporting may provide the best training opportunities in that lessons learned can be addressed at the Medical Advisory Committee level. Training and development modules should occur in collaboration with Canadian Blood Services as they will be instrumental in invoking the National Blood Shortages Plan. A core part of this pre-shortage education should clearly focus the triage team on their role in ensuring the best care for the community of patients that they serve, rather than the needs of individual patients.

Responsibilities

The responsibilities of the triage team are to ensure:

• documentation of the state of emergency (i.e., that an emergency has been activated, that all existing resources are exhausted, the rationale for withholding transfusion, and that all supportive care and blood conservation strategies will be instituted);

• documentation of inclusion/exclusion criteria;

• adherence to decisions and alternate levels of care;

• efficient and regular re-evaluation of patients;

• re-evaluation of triaged patients daily and every 10th red blood cell transfusion;

• physicians receive the required assistance; and,

• the public receive information about the status of the emergency and where to obtain further information.

Implications

The triage team should not be directly involved in the care of the patient. The triage team assigned to allocate blood components needs to be clearly cognizant that their duty is to the population, not just to the individual patient. The triage teams should be blinded to identifying patient information when presented with clinical information in determining if a patient is eligible to receive transfusion as per the triage criteria. It is suggested that the triage team convene in an area not within the immediate vicinity of the patient bedside. Typically given the acute and emergent nature of the presenting cases, it is anticipated that there will be no ability to manage an appeals process in the middle of the mass casualty situation or other disaster. In addition, decisions during a massive hemorrhage must be made within minutes and therefore a formal appeals process is not clinically feasible as such the triage decisions must be final with no appeal process. The triage teams should be offered adequate administrative and psychological support.

There must be sufficient coverage of the triage team to allow for 24 hour coverage. The triage team decisions need to be reported daily to the Regional/Hospital Emergency Blood Management Committee to ensure 'over triage' and 'under triage' errors are minimized. Consideration needs to be given by the hospital of having a joint intensive care and transfusion triage teams, where possible, to maximize the use of resources. The triage decisions need to be transparently communicated to the patient, the patient's family, the clinical team caring for the patient and recorded clearly in the patient's chart. Patients should be re-assessed at a minimum of daily, every 10th unit of red blood cells, or sooner if their clinical status improves or deteriorates substantially prior to 24 hours.

In the setting of a scarcity of multiple hospital resources, the blood triage tool should be utilized sequentially with the other rationing tools. It is possible that a blood shortage may occur as an isolated event or in the setting of multiple resource scarcity (e.g., ventilators or critical care beds). In the setting of an isolated blood shortage, all other available therapies, including blood

conservation strategies, should be offered to all patients. In addition, ensuring pain and symptom management should be a core part of the triage team's oversight responsibility so that patients and their families do not feel abandoned.

Documentation

Clear and complete documentation will be essential for a complete patient record and for evaluation after the red phase. In the patient chart, the triage team shall document the following: phase of blood shortage, triage decision, reason for exclusion if applicable, date/time of next planned re-evaluation, a copy of the triage documentation tool, and the number to page if the clinical status of the patient substantially improves or deteriorates before the next planned re-assessment. Extensive clinical notes will not be possible, or appropriate, as the triage team will be required to triage multiple patients. Documentation can be delegated to any member of the triage team and need not be done by the triage physician. Documentation on the triage documents should include a triage tracking log of all cases and a triage sheet for each patient. Efforts should be made to be as complete as possible to allow for the best possible review of triage decisions after the resolution of the red phase. At the end of each shift, a copy of the documents should be given to the chair of the Regional/Hospital Emergency Blood Management Committee, or their designate, and the original documents given to the next triage team with appropriate verbal handover. At the completion of the red phase, copies of all triage tools should be forwarded to the Provincial Emergency Blood Management Committee for review and analysis.

The Framework

Patient Population: This framework applies only to patients experiencing massive hemorrhage (defined as expected blood loss of one blood volume over less than 24 hours; 0.5 blood volume in three hours; or four or more units of red blood cells in 1 hour) during a red phase blood shortage.

In general all patients should receive access to all available blood conservation strategies including but not limited to: erythropoiesis-stimulating agents, intravenous iron, oral iron, antifibrinolytics, intraoperative cell salvage, interventional radiologic procedures, rapid access to endoscopy, and non-invasive surgeries.

Figure 1 – Algorithm for the Triage Team

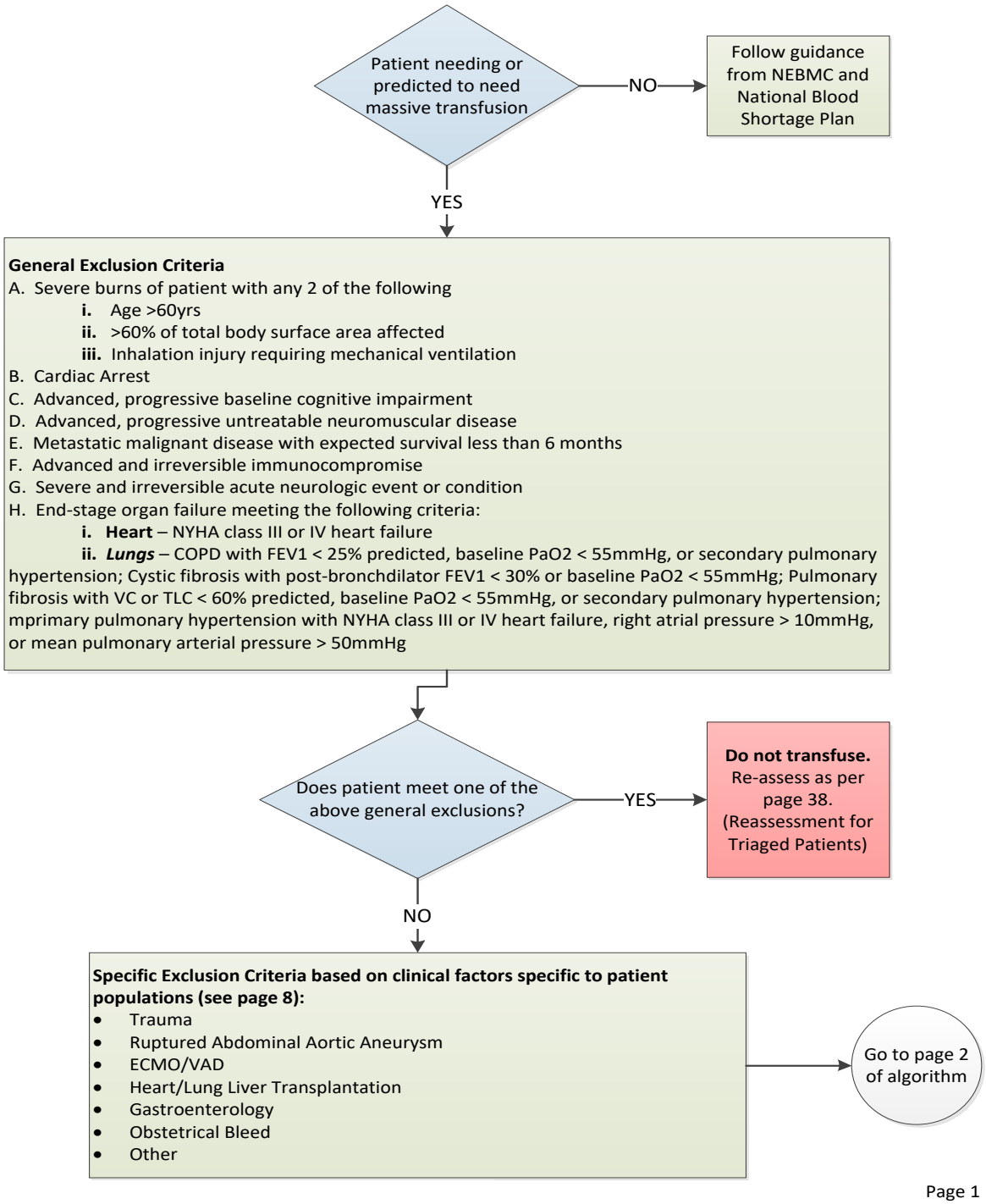
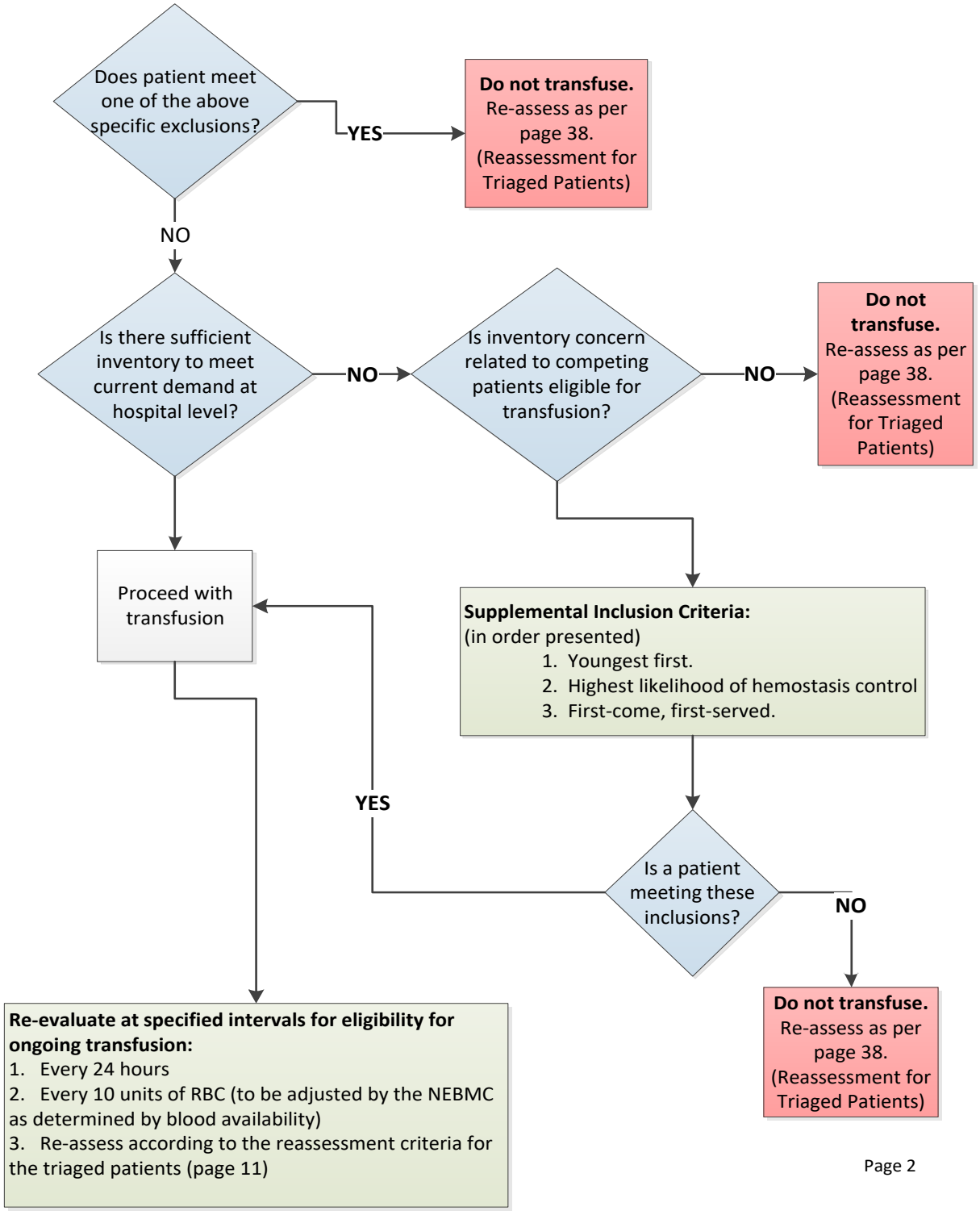


Figure 1 –Algorithm for Triage Team


Does patient meet one of the above specific exclusions?
YES
Do not transfuse. Re-assess as per page 38. (Reassessment for Triaged Patients)
NO
Is there sufficient inventory to meet current demand at hospital level?
NO
Is inventory concern related to competing patients eligible for transfusion?
NO
Do not transfuse. Re-assess as per page 38. (Reassessment for Triaged Patients)
Proceed with transfusion
Supplemental Inclusion Criteria:
(in order presented)
1. Youngest first.
2. Highest likelihood of hemostasis control
3. First-come, first-served.
YES
Is a patient meeting these inclusions?
NO
Do not transfuse. Re-assess as per page 38. (Reassessment for Triaged Patients)
Re-evaluate at specified intervals for eligibility for ongoing transfusion:
1. Every 24 hours
2. Every 10 units of RBC (to be adjusted by the NEBMC as determined by blood availability)
3. Re-assess according to the reassessment criteria for the triaged patients (page 11)

Specific Exclusion Criteria for Massively Bleeding Patients:

Trauma

1. During a red phase, do not administer transfusions to children or adults with non-survivable brain injury.
Level of evidence: III
Grade of recommendation: A
Clinical Consideration: CT scanning should be done as soon as possible to confirm the diagnosis of a non-survivable brain injury.

2. During a red phase, do not administer transfusion to children or adults with a Glasgow Coma Scale =3 who have hypotension not attributable to reversible factors and who have fixed and dilated pupils.
Level of evidence: III
Grade of recommendation: A

3. During a red phase, do not transfuse patients after the declaration of brain death for the purpose of deceased organ donation.
Level of evidence: III
Grade of recommendation: A

4. During a red phase, do not administer transfusions to adults or children with penetrating cranial trauma and a Glasgow coma scale =3 that is not attributable to reversible factors.
Level of evidence: III
Grade of recommendation: B

5. During a red phase, do not administer transfusions to adults or children with penetrating cranial trauma, a Glasgow coma scale <8 that is not attributable to reversible factors, hypotension and severe thoracoabdominal trauma.
Level of evidence: III
Grade of recommendation: B

6. During a red phase, do not administer transfusions to adults or children with blunt trauma, and a Glasgow Coma Scale =3 that is not attributable to reversible factors.
Level of evidence: III
Grade of recommendation: B

7. During a red phase, do not administer transfusions to adults or children with blunt trauma who have lost vital signs pre-hospitalization.
Level of evidence: III
Grade of recommendation: A

8. During a red phase, do not administer transfusions to patients with transcranial gunshot injuries.
Level of evidence: III
Grade of recommendation: A

9. During a red phase, do not administer transfusions to patients >65 years with severe brain injury and profound shock and severe thoracic or abdominal trauma.
Level of evidence: III
Grade of recommendation: B

10. During a red phase, do not administer transfusions to patients >75 years with moderate brain injury, a Glasgow Coma scale of <12, who are in profound shock and who have thoracoabdominal injury.
Level of evidence: III
Grade of recommendation: B

Ruptured Abdominal Aortic Aneurysm

1. During a critical blood shortage, do not transfuse patients who have a cardiac arrest preoperatively.
Level of evidence: III
Grade of recommendation: B

2. During a critical blood shortage, do not transfuse patients with a systolic blood pressure less than 70mmHg who are unresponsive to fluid resuscitation and have lost consciousness.
Level of evidence: III
Grade of recommendation: B

3. During a critical blood shortage, do not transfuse patients with RAAA that do not meet criteria for emergent vascular repair.
Level of evidence: III
Grade of recommendation: A

ECMO/VAD

1. During a red phase, do not transfuse patients who require ECMO/VAD and who have multi-organ (> 1 organ) failure.
Level of evidence: III
Grade of recommendation: B

2. During a red phase, inform patients/families that patients receiving ECMO/VAD support who have multi-organ failure may not receive transfusion support if massively bleeding.
Level of evidence: III
Grade of recommendation: B

Heart, Lung, Liver Transplantation

1. Deceased Donor Organ Recovery - During a red phase, deceased donor organ recovery for transplantation should proceed, with the understanding that the deceased donor will not be transfused in the process of deceased donor stabilization.
Level of evidence: III
Grade of recommendation: B

2. Deceased Donor Transplantation - During a red phase, deceased donor solid organ transplants may proceed with informed consent regarding increased risk from restriction of blood transfusion, and with the understanding (among patient and all involved physicians) that blood may not be available for transfusion.
Level of evidence: III
Grade of recommendation: B

3. Living Donor Transplantation – During a red phase, living donor transplantation should be deferred.
Level of evidence: III
Grade of recommendation: B

Gastroenterology

1. During a red phase do not administer transfusions to patients with gastrointestinal bleeding and a Rockall score >8.
Level of evidence: III

Grade of recommendation: B

2. During a red phase do not administer transfusion to patients with liver cirrhosis and gastrointestinal (i.e. variceal) bleeding who have a Child Pugh score more than 10 (MELD score of more than 18) and who are not on the list for transplantation.

Level of evidence: III

Grade of recommendation: B

3. During a red phase, triage patients with gastrointestinal bleeding to centers with endoscopy to minimize the use of blood products.

Level of evidence: III

Grade of recommendation: B

Obstetrics

1. In a red phase, red cell transfusion should not be withheld from the bleeding obstetrical patient.

Level of evidence: II-2-III

Grade of recommendation: B

Other massively bleeding situations not listed above

1. **In a red phase, for patients massively bleeding for reasons not listed above, do not transfuse patients for whom the triage team believes the mortality rate exceeds 80%**

Reassessment for Triaged Patients

1. Patients triaged to no blood components:

   Patients triaged to no transfusion care will be re-assessed at a minimum of every 24 hours. The triage team will review requests from the most responsible physician if an improvement in a patient's status would now qualify them to be triaged to active transfusion management. In addition, the triage team will assure that the patient and their family are given adequate access to psychological support and that adequate symptom management is given to minimize pain and distress.

2. Patients triaged to blood components:

For patients triaged to active transfusion care, they will be re-assessed at a minimum of every 10 units of red blood cells (including pediatrics) or every 24 hours for patients receiving less than 10 units of blood or until cessation of hemorrhage(or more frequently – e.g. every 5 units - if deemed necessary by the NEBMC). At each assessment, the triage team will utilize the following variables to guide their decisions regarding the value of continued transfusions: SOFA score, total blood products used, need for ongoing transfusion support and ability to control bleeding with either surgery or other procedure (e.g. interventional radiology, endoscopy). Patients with a SOFA score >11, continued need for large amounts of blood components, and with no foreseeable ability to control blood loss will be triaged to palliative care.

Documentation for Transfusion Decisions

Transfusion decisions should be documented on a patient tracking tool. An example of a patient tracking tool is available in the appendix of this document.

Competing Patients Triaged to Active Transfusion Care

In the event of two or more patients requiring blood components at the same hospital for whom both qualify for active transfusion management by the triage team, the following principles (in order) are suggested to prioritize transfusion resources:

1. Administer blood to the youngest patients first i.e. pediatric patients first

2. Administer blood to patients who have the highest likelihood of hemostasis control

3. Administer blood according to the first-come, first-served principle.

In the event that two or more patients are competing for blood components at different hospitals and the blood still resides at the local blood center, the same aforementioned principles will be applied jointly by the blood center physician and the triage team leader from the hospitals involved.

Appendix 4: Triage - Documentation Tools and Clinical Scoring

Triage Tracking Log – Emergency Disposition of Blood during Red Phase Blood Shortage

Tracking Number	Medical Record Number	Last Name	First Name	Location	Blood Group
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
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33					
34					
35					
36					
37					
38					

Patient Triage Record' – Emergency Disposition of Blood during Red Phase Blood Shortage

Patient Tracking Number	Hospital	
Reason for Massive hemorrhage	Date of Triage	Time of Triage
Predicted to need >10 units in the next 24 hours ☐ Yes ☐ No (if no refer to standard tracking tool) Has patient received product in the previous 24 h? ☐ Yes ☐ No If yes, list products:	Age Hemoglobin Platelet INR PTT Fibrinogen	Blood Group pH Lactate Temp
Meets any exclusion criteria ☐ Yes ☐ No If yes, which one(s)?	Product Required	Units of ABO compatible product available
Meets any specific exclusion criteria ☐ Yes ☐ No If yes, which one(s)?	Date/Time of Assessment	SOFA score
Decision made to administer blood? ☐ Yes ☐ No	Date/Time	Number of units & products transfused
Patient Outcome at 24 hours	Date/Time	Re-Assessment Decision
Comments by Triage Team	Comments regarding patient and family concerns	
Triage Documentation completed by	Signature	
Triage Officer Name	Signature	
Follow-up:		
Patient Outcome at Discharge	Patient Outcome at 6 Months	

Glasgow Coma Scale

Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale Lancet. 1974 Jul 13;2(7872):81-4.

The chart from the above reference has been modified to reflect a more recent version of the scale:

Eye Opening	Spontaneous	4
	To speech	3
	To pain	2
	None	1
Best verbal response	Orientated	5
	Confused	4
	Inappropriate	3
	Incomprehensible	2
	None	1
Best motor response	Obeying	6
	Localising	5
	Withdraws	4
	Flexing	3
	Extending	2
	None	1

Rockall Score

As described by T A Rockall, R F A Logan, H B Devlin, T C Northfield, and the steering committee and members of the National Audit of Acute Upper Gastrointestinal Haemorrhage. Gut. 1996; 38:316-321.

Rockall Score	**0**	**1**	**2**	**3**
Age	<60 years	60-79 years	>=80 years	
Shock	'No Shock', Systolic BP>=100, Pulse <100	'Tachycardia', Systolic BP>=100, Pulse>=100	'Hypotension', Systolic BP <100	
Comorbidity	No major cormobidity		Cardiac failure, ischaemic heart disease, any major comorbidity	Renal failure, liver failure, disseminated malignancy
Diagnosis	Mallory-Weiss tear, no lesion identified and no SRH	All other diagnoses	Malignancy of upper GI tract	
Major SRH	None of dark spot only		Blood in upper GI tract, adherent clot	

Child Pugh Score

Pugh RN, Murray-Lyon IM, Dawson JL, Pietroni MC, Williams R Transection of the oesophagus for bleeding oesophageal varices. Br J Surg. 1973 Aug;60(8):646-9.

Clinical and Biochemical Measurements	Points Scored for Increasing Abnormality		
	1	2	3
Encephalopathy (grade)	None	1 and 2	3 and 4
Ascites	Absent	Slight	Moderate
Bilirubin (mg per 100 ml)	1 - 2	2 - 3	>3
Albumin (g per 100 ml)	3.5	2.8 – 3.5	<2.8
Prothrombin time (sec. prolonged)	1 – 4	4 – 6	>6
For primary biliary cirrhosis – Bilirubin (mg per 100 ml)	1 – 4	4 – 10	>10

MELD Score

As per Kamath P.S, et al. A model to predict survival in patients with end-stage liver disease. Hepatology. 2001; 33(2): 464-470.

Formula **:** 3.8*loge(bilirubin[mg/dL]) + 11.2*$\log_e$(INR) + 9.6*$\log_e$(creatinine [mg/dL]) + 6.4*(etiology: 0 if cholestatic or alcoholic, 1 otherwise).

An online calculator is available: http://www.mayoclinic.org/meld/mayomodel6.html

SOFA Score

The SOFA score as described by Vincent JL, Moreno R, Takala J, Willatts S, De Mendonca A, Bruining H, et al. The SOFA (sepsis-related organ failure assessment) score to describe organ dysfunction/failure on behalf of the working group on sepsis-related problems of the European society of intensive care medicine. Intensive Care Med. 1996 Jul;22(7):707-10.

Sofia Score	0	1	2	3	4
PaO2/FIO2 Ratio	>400	≤400	≤300	≤200 and mechanically vented	≤100 and Mechanically vented
Platelet Count	>150	≥150	≤100	≤50	≤20
Bilirubin umol/L	<20	20 – 32	33 – 101	102 – 204	>204
Hypotension (ug/kg/min)	None	Map<70	Dopamine ≤5 or dobutamine (any dose)	Dopamine >5 Or epinephrine ≤0.1 or Norepinephrine ≤0.1	Dopamine >15 Or epinephrine >0.1 or Norepinephrine >0.1
Glasgow Coma Scale	15	13 – 14	10 – 12	6 – 9	<6
Creatine or Urine ouput	<110	110 – 170	171 – 299	300 – 440 or urine output <500 mL/day	>440 or urine output <200 mL/day