

CLINICAL GUIDELINES

Trauma ‘Code Crimson’ Pathway

Streamlining access to definitive intervention
for patients with life-threatening haemorrhage

NSW Institute of Trauma and Injury Management



Collaboration. Innovation. Better Healthcare.

The Agency for Clinical Innovation (ACI) works with clinicians, consumers and managers to design and promote better healthcare for NSW. It does this by:

- *service redesign and evaluation* – applying redesign methodology to assist healthcare providers and consumers to review and improve the quality, effectiveness and efficiency of services
- *specialist advice on healthcare innovation* – advising on the development, evaluation and adoption of healthcare innovations from optimal use through to disinvestment
- *initiatives including guidelines and models of care* – developing a range of evidence-based healthcare improvement initiatives to benefit the NSW health system
- *implementation support* – working with ACI Networks, consumers and healthcare providers to assist delivery of healthcare innovations into practice across metropolitan and rural NSW
- *knowledge sharing* – partnering with healthcare providers to support collaboration, learning capability and knowledge sharing on healthcare innovation and improvement
- *continuous capability building* – working with healthcare providers to build capability in redesign, project management and change management through the Centre for Healthcare Redesign

ACI Clinical Networks, Taskforces and Institutes provide a unique forum for people to collaborate across clinical specialties and regional and service boundaries to develop successful healthcare innovations.

A priority for the ACI is identifying unwarranted variation in clinical practice and working in partnership with healthcare providers to develop mechanisms to improve clinical practice and patient care.

www.aci.health.nsw.gov.au

AGENCY FOR CLINICAL INNOVATION

Level 4, Sage Building
67 Albert Avenue
Chatswood NSW 2067

PO Box 699 Chatswood NSW 2057
T +61 2 9464 4666 | F +61 2 9464 4728
E info@aci.nsw.gov.au | www.aci.health.nsw.gov.au

SHPN (ACI) 170038, ISBN 978-1-76000-595-5.

Produced by: NSW Institute of Trauma and Injury Management

Further copies of this publication can be obtained from the Agency for Clinical Innovation website at www.aci.health.nsw.gov.au

Disclaimer: Content within this publication was accurate at the time of publication. This work is copyright. It may be reproduced in whole or part for study or training purposes subject to the inclusion of an acknowledgment of the source. It may not be reproduced for commercial usage or sale. Reproduction for purposes other than those indicated above requires written permission from the Agency for Clinical Innovation.

Version: 1 **Trim:** ACI/D16/5778

© **Agency for Clinical Innovation 2017**

Acknowledgements

NSW Institute of Trauma and Injury Management

Ms Kelly Dee, Clinical Review Officer
Dr Michael Dinh, Clinical Director
Mr Benjamin Hall, Project Officer
Ms Christine Lassen, Manager
Mr Elvis Maio, Data Manager
Dr Pooria Sarrami, Research Officer
Mr Hardeep Singh, A/Data Manager
Mr Glenn Sisson, Project Officer

Institute of Trauma and Injury Management, Clinical Review Committee

Ms Louise Alderson, Paramedic Trauma Advisor, NSW Ambulance Service
Ms Kay Best, Paediatric Trauma CNC, The Children's Hospital at Westmead
Dr Scott D'Amours - Co-Chair, Trauma Director, Liverpool Hospital
Dr Ailene Fitzgerald, Trauma Director, The Canberra Hospital, ACT
Dr Toby Fogg, Medical Director, CareFlight
Dr Tony Grabbs, Trauma Director, St Vincent's Hospital
Dr Karel Habig, Medical Director, HEMS, NSW Ambulance Service
Dr Jeremy Hsu - Chair, Trauma Director, Westmead Hospital
Dr Sean Kelly, Clinical Director, Intensive Care and Coordination Monitoring Unit
Ms Kate King, Trauma CNC, John Hunter Hospital
Dr Timothy Lyons, Clinical Director, Forensic Medicine, Hunter New England Health Service
Ms Maryanne Sewell, Trauma CNC, Northern NSW Local Health District

Other Acknowledgements

Thanks to Dr Oran Rigby, Ms Kellie Wilson, and Dr Tony Joseph for their previous input into this document.

Abbreviations

ACI	Agency for Clinical Innovation
AMRS	Aeromedical and Medical Retrieval Services
CRC	Clinical Review Committee
CT	Computed Tomography
ED	Emergency Department
E-FAST	Extended Focussed Assessment with Sonography for Trauma
ETA	Estimated Time of Arrival
ETT	Endotracheal Tube
HEMS	Helicopter Emergency Medical Services
IIMS	Incident Information Management System
IMIST	Identification, Mechanism, Injury, Signs, Treatment and trends
IRS	Interventional Radiology Suite
ITIM	Institute of Trauma and Injury Management
KPI	Key Performance Indicator
MTP	Massive Transfusion Protocol
OT	Operating Theatre
RBC	Red Blood Cells
RCA	Root Cause Analysis

1. Introduction

Background

Small subsets of severely injured trauma patients require time-critical surgical or interventional radiological procedures to arrest life-threatening non-compressible haemorrhage following blunt or penetrating trauma. Designated trauma centres around NSW have a range of policies, procedures and guidelines and appropriate facilities for the management of patients with exsanguinating haemorrhage. It has been observed through the Institute of Trauma and Injury Management (ITIM) Clinical Review Committee (CRC) that inconsistent application of these policies, procedures and guidelines (especially after-hours) may contribute to delays to definitive surgical or interventional radiological procedures. A range of Incident Information Management System (IIMS) case reports, Root Cause Analyses (RCAs) and sentinel event investigations have identified that intra-hospital delays to definitive intervention continue to occur and directly impact survival in the small subset of patients with uncontrolled non-compressible haemorrhage.

Emergency department (ED) diversion is a technique used in trauma management around the world to streamline access to definitive intervention. Contemporary military trauma systems as well as the Helicopter Emergency Medical Services (HEMS) in Europe and the United Kingdom all practice ED diversion where the patient would benefit from immediate transfer to the Operating Theatre (OT) or Interventional Radiology Suite (IRS), such as in cases of life-threatening haemorrhage and isolated severe brain injury.

In NSW, the physician-based Aeromedical and Medical Retrieval Services (AMRS) have the capability to perform a large range of procedures on-scene, en-route and in referring hospitals, which are traditionally performed by ED based trauma teams in the resuscitation of trauma patients including:

- Pre-hospital emergency anaesthesia and tracheal intubation
- Surgical thoracostomy (simple or tube)
- Pelvic and long bone fracture splinting
- Application of tourniquets
- Maxillo-facial haemorrhage control
- Administration of red blood cells
- Advanced surgical procedures such as clamshell thoracotomy, resuscitative hysterotomy, lateral canthotomy and surgical airways
- Extended Focussed Assessment with Sonography for Trauma (E-FAST) examination to detect pneumothoraces, or significant free intra-peritoneal, pericardial or intra-thoracic haemorrhage.

Patients who remain persistently haemodynamically unstable due to on-going haemorrhage despite such interventions are very unlikely to benefit from prolonged time spent in ED resuscitation areas. A process for expediting transfer to definitive intervention in the Operating Theatre or Interventional Radiology Suite may be lifesaving in such cases.

Definition

'Code Crimson' is a term that has commonly been used by hospital-based teams managing patients with life-threatening haemorrhage that is refractory to resuscitation. The purpose of a 'Code Crimson' is to streamline this patient's access to definitive intervention, including an operating theatre or interventional radiology suite.

Aim

This guideline seeks to enhance the current management of a patient with life-threatening traumatic haemorrhage by recommending that pre-hospital medical retrieval teams initiate a 'Code Crimson' activation, thereby further reducing the time to definitive intervention in these patients.

This clinical guideline therefore aims to standardise the:

- pre-hospital identification of a trauma 'Code Crimson'.
- activation of a trauma 'Code Crimson' pathway by pre-hospital medical retrieval teams and the subsequent notification to a receiving trauma centre.
- procedures instituted by trauma centres following activation of a trauma 'Code Crimson' pathway.

Scope

This guideline is intended for use by Aeromedical and Medical Retrieval Services and ED clinicians in Major Adult and Paediatric Trauma Services managing patients with life-threatening traumatic haemorrhage refractory to pre-hospital resuscitation. Whilst it is acknowledged that some hospitals are not in a position to fulfil the requirements of this document, its use in Regional Trauma Services is encouraged and supported.

This guideline provides recommendations on the pre-hospital activation of a trauma 'Code Crimson' pathway and subsequent procedures instituted in the ED following activation. It is recognised that the recommendations may not suit all patients in all clinical settings and should not replace clinical judgement. This guideline relies on individual clinicians to decipher the needs of individual patients.

2. Trauma 'Code Crimson' Pathway

The trauma 'Code Crimson' pathway:

1. identifies exsanguinating trauma patients in the pre-hospital environment who would benefit from rapid transfer to definitive interventional care area of a trauma centre, when there is likely to be minimal benefit from time spent in ED resuscitation areas.
2. outlines the process for pre-hospital medical retrieval teams (physician with paramedic) to activate 'Code Crimson' pathways in trauma centres, in order to facilitate early transfer to definitive interventional care.
3. outlines the required actions by the receiving trauma centre when the 'Code Crimson' pathway is activated by the pre-hospital medical team (physician with paramedic).

Objective

For trauma patients who are bleeding despite pre-hospital resuscitation by medical teams (physician with paramedic), and requiring time-critical life-saving intervention, to be rapidly transferred to definitive intervention.

Criteria for Activation

Persistent haemodynamic instability despite standard trauma care (see below), assessed as being secondary to ongoing haemorrhage in blunt or penetrating trauma, which is unresponsive to intravenous fluids and or blood transfusion.

Clinical examples of potential injuries meeting the above criteria:

Blunt trauma	Penetrating trauma
<ul style="list-style-type: none">• Abdominal trauma with grossly positive E-FAST• Uncontrolled maxillo-facial haemorrhage• Gross pelvic disruption• Massive haemothorax• Traumatic amputation	<ul style="list-style-type: none">• Penetrating trauma to chest/abdomen• Junctional penetrating trauma• Pericardial tamponade on E-FAST• Penetrating neck wounds with hard signs of vascular injury

Standard trauma care

Clinical issues to address irrespective of pre-hospital activation of trauma 'Code Crimson':

1. **Airway:** Patent and protected – patient alert or endotracheal tube insitu (confirmed with continuous waveform capnography)
2. **Breathing:** Significant pneumothorax excluded with pre-hospital ultrasound or definitive thoracic decompression performed (surgical thoracostomy)
3. **Circulation:** Pelvic binder in place, long bone fractures appropriately splinted and external haemorrhage treated (where feasible)

Aeromedical and Medical Retrieval Service activation procedure

The following points outline the recommended procedure for the pre-hospital activation of the Trauma 'Code Crimson' Pathway by the medical retrieval team:

- Trauma notification ("Bat phone") call to be made as soon practicable from the medical retrieval team to the receiving ED identifying "pre-hospital activation of trauma 'Code Crimson'"
- Notification to be given in the Identification, Mechanism, Injury, Signs, Treatment and trends (IMIST) format including an expected time of arrival (ETA)
- If the source of the haemorrhage is clear (for example, positive E-FAST, massive haemothorax external haemorrhage) this information should be passed on as part of the initial IMIST
- Provide the receiving hospital with an updated ETA closer to arrival where indicated

Early pre-hospital activation is essential to allow the trauma centre to assemble the trauma team and any other required specialty staff in OT or IRS and to activate a massive transfusion protocol (MTP).

Trauma centre procedure following activation

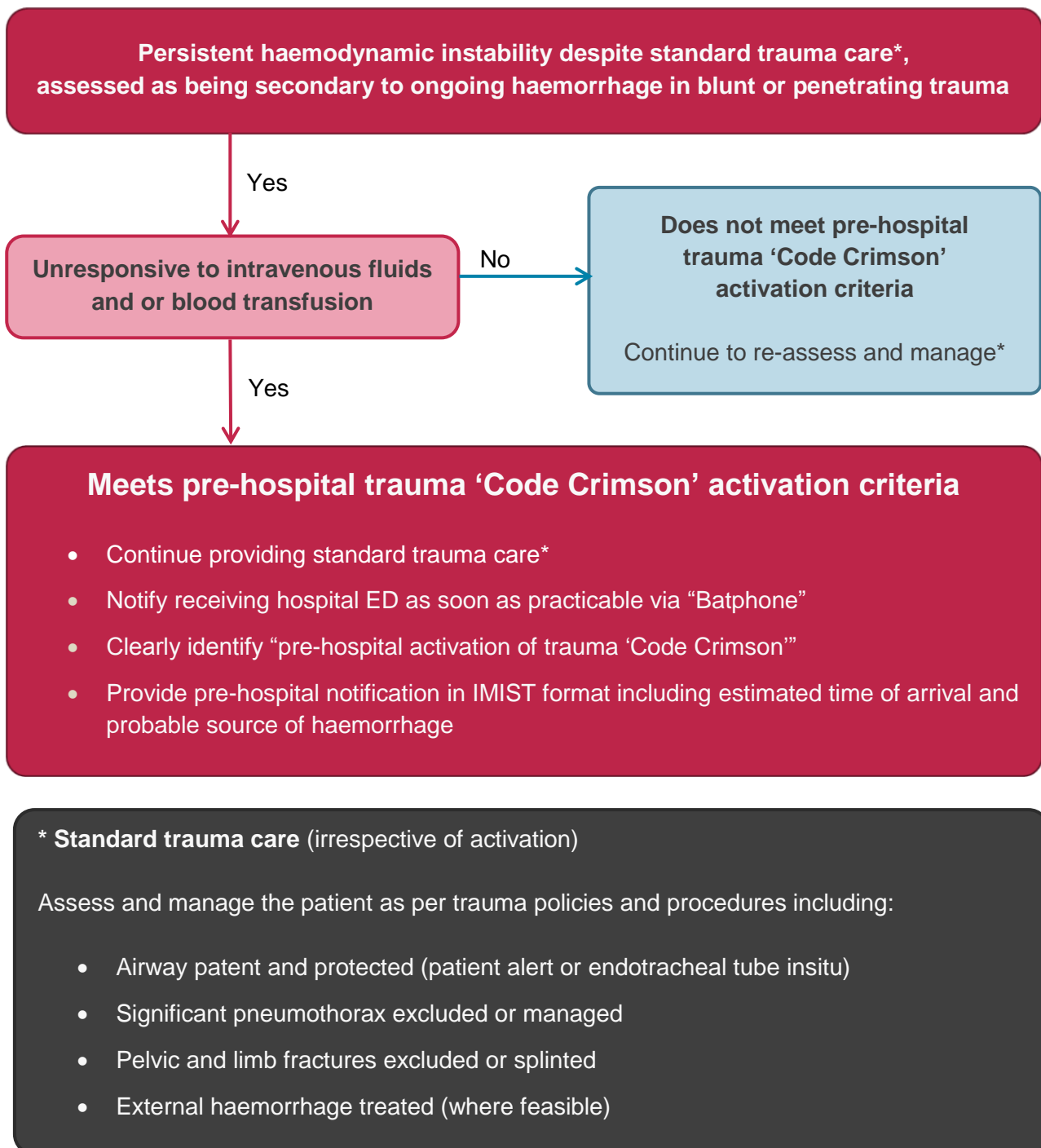
The following points outline the recommended procedures for a trauma centre once they have received a pre-hospital activation of the Trauma 'Code Crimson' Pathway from a medical retrieval team.

- ED confirms "pre-hospital activation of trauma 'Code Crimson'"
- Document IMIST notification from the medical retrieval team
- Activate Trauma Team (for example: "Trauma Attend")
 - Surgical Consultant or Fellow on for Trauma notified by phone; respond immediately
 - Relevant subspecialty Surgical Consultant or Fellow notified
 - Radiographer notified and present in resuscitation room
- Confirm OT / IRS room and staff availability - mobilise additional teams if not available
- Inform Blood Bank of 'Code Crimson' – activate Massive Transfusion Protocol (MTP):
 - Blood products to be available immediately in resuscitation room and or helipad
 - Blood Bank to prepare additional blood products e.g. uncrossmatched plasma, cryoprecipitate
 - Fluid warmer and or rapid infuser primed with blood in ED

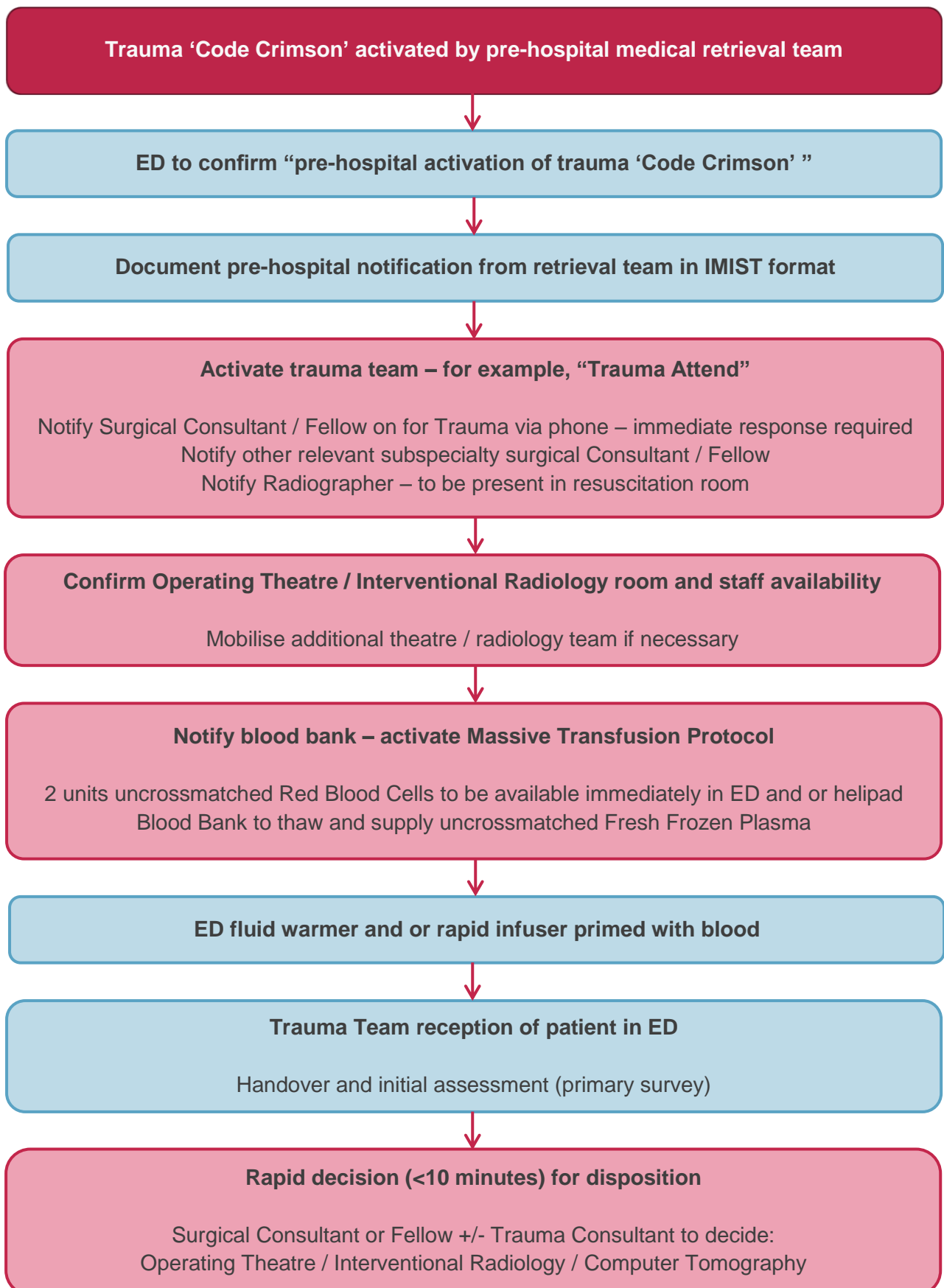
Trauma Team reception in ED – critical decision point

- Handover and initial trauma assessment (primary survey) in ED
- Rapid decision (<10 minutes) made by Surgical Consultant or Fellow +/- Trauma Consultant or Fellow for disposition to Operating Theatre (OT), Interventional Radiology Suite (IRS), Hybrid Angiography Suite or Computed Tomography (CT)

3. Algorithm 1: Pre-hospital Activation of Trauma 'Code Crimson' by the Medical Retrieval Team



4. Algorithm 2: Trauma Centre ED Response to Pre-hospital Activation of Trauma 'Code Crimson'



5. Ongoing evaluation of pathway

All cases involving the Trauma 'Code Crimson' Pathway being activated should be reviewed locally, as per usual processes. It is recommended that the local review covers the patient assessment, interventions performed, and whether the recommended Key Performance Indicators (KPIs) were met.

All cases should be notified to the ITIM Clinical Review Officer for de-identified case review at the ITIM Clinical Review Committee. ITIM will provide six-monthly feedback to all stakeholders to inform the clinical guideline.

Recommended Key Performance Indicators or Outcome Measures

The following KPIs or outcome measures are recommended to be part of individual service's ongoing evaluation of the pathway:

- Trauma 'Code Crimson' Pathway is activated by a medical retrieval team according to the criteria
- The disposition of a patient fitting the criteria for Trauma 'Code Crimson' Pathway activation is determined within 10 minutes of review by the receiving hospital trauma team.
- A patient fitting the criteria for Trauma 'Code Crimson' Pathway activation is transferred to the Operating Theatre and or Interventional Radiology Suite within 30 minutes of review by the receiving hospital trauma team.
- Other trauma process indicators as outlined in the NSW ITIM Trauma Process Indicators webpage: <https://www.aci.health.nsw.gov.au/networks/itim/Data/nsw-trauma-process-indicators>

6. Bibliography

Eastern Association for the Surgery of Trauma (2010) Triage of the Trauma patient.
<https://www.east.org/education/practice-management-guidelines/triage-of-the-trauma-patient>

Grabs, A., M. AN, et al. (2008). "Code Crimson: a life-saving measure to treat exsanguinating emergencies in trauma." ANZ J Surg **78**(7): 523-525.

Reed, M., A. Glover, et al. (2017). "Experience of implementing a National pre-hospital Code Red bleeding protocol in Scotland." Injury **48**(1): 41-46.

Tai, N. and R. Russell (2011). "Right turn resuscitation: frequently asked questions." J R Army Med Corps **157**(3 Suppl 1): S310-314.

Tinkoff, G. and R. O'Connor (2002). "Validation of new trauma triage rules for trauma attending response to the emergency department." J Trauma **52**(6): 1153-1158; discussion 1158-1159.

Weaver, A., C. Hunter-Dunn, et al. (2016). "The effectiveness of Code Red transfusion request policy activated by pre-hospital physicians." Injury **47**(1): 3-6.