



Trauma programme project plan: Critical haemorrhage

June 2020

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This ‘final’ version was approved by the core expert reference group on 24 June 2020 and published by the Health Quality & Safety Commission August 2020; however, it is a working document and therefore subject to change – updated versions will be published as appropriate

Overall project timeline: October 2019 to December 2020

Project team: Dr Kerry Gunn, David Drower, Gabrielle Nicholson, Paul McBride, Sandy Ngov, Siobhan Isles and Ian Civil

Sponsor: Health Quality & Safety Commission (under contract for the Accident Compensation Corporation)

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Project aim

This project seeks to reduce mortality and complications in critically haemorrhaging trauma patients.

The overall project aim is to eliminate avoidable deaths from haemorrhage and multiple organ failure in trauma patients by 2025.

The aspirational goal is to achieve zero in-hospital deaths from haemorrhage following trauma.

The project team will work in partnership with the sector and experts to develop national best practice guidance, which will include an associated 'massive transfusion protocol' (MTP) and 'critical bleeding bundle of care', which can be tailored for hospital size and context. The implementation of these will support early recognition and appropriate action for critical haemorrhage across ambulance services, emergency departments (EDs), perioperative teams and intensive care units (ICUs).

Problem statement

The annual global incidence of critical haemorrhage following major trauma is understood to be approximately 4 percent in patients with coagulopathy and an Injury Severity Score (ISS) > 15. One study from England and Wales demonstrated an incidence of critical haemorrhage across all patients with an ISS > 15 of between 5 percent and 14 percent annually, based on blood transfusion requirement.¹

The last decade or so has witnessed advances in trauma resuscitation and surgery. Most survivable trauma haemorrhage deaths are now seen as avoidable through the development of sophisticated identification and treatment processes from the point of injury to surgical treatment.

Between 2008 and 2017 London's major trauma system reduced mortality in patients activating the major haemorrhage protocol from 45 percent to 27 percent (a 40 percent reduction), at least partially because of improved haemorrhage management, which included activating the major haemorrhage protocol and giving at least one unit of blood.²

While this is promising, it is difficult currently to compare with Aotearoa New Zealand, as activation of a major haemorrhage protocol and blood product usage are not recorded in the New Zealand Major Trauma Registry and because prehospital mortality attributable to traumatic haemorrhage is not easily obtainable. A key component in the project work will be establishing links between databases so we can understand mortality in a similar cohort of patients.

Aotearoa New Zealand's major trauma caseload as recorded in the New Zealand Major Trauma Registry was 2,355 cases across the 2018/19 financial year, with 198 deaths (8.4 percent). Of these, 25 deaths were from haemorrhage (1.1 percent of caseload; 12.6 percent of deaths). An additional 16 deaths (0.7 percent of caseload; 8.0 percent of deaths) were from multi-organ failure, some of which may be the consequence of haemorrhage. In addition, a cohort of patients experienced multiple-organ dysfunction or failure without dying. These latter patients usually require prolonged critical care and consume substantial resources.³

¹ Stanworth SJ, et al. 2016. Mortality from trauma haemorrhage and opportunities for improvement in transfusion practice. *British Journal of Surgery* 103(4). DOI: 10.1002/bjs.10052

² Cole E, et al. 2019. A decade of damage control resuscitation: new transfusion practice, new survivors, new directions. *Annals of Surgery* E-pub ahead of print. DOI: 10.1097/sla.0000000000003657.

³ Cole E, et al. 2019. Multiple organ dysfunction after trauma. *British Journal of Surgery* 107(4): 402–12. DOI: 10.1002/bjs.11361.

Project rationale

- Trauma is the leading cause of death for New Zealanders aged 1–39 years.⁴
- In the first 12 hours after injury, blood loss is the leading cause of death, even after reaching hospital.⁵
- International research shows critically bleeding patients treated with a bundle of care that addresses bleeding and coagulopathy are more likely to survive.
- The critical bleeding bundle of care could prevent up to 100 deaths in Aotearoa New Zealand over five years.
- We also expect the bundle of care to reduce complications such as multiple-organ failure in haemorrhage survivors, reducing hospital stay length, potentially with financial savings due to better hospital resource use and lower blood product consumption.

Project objectives

The objectives for this project build on the work already done in the sector and include the following:

- The national best practice guidance and associated critical bleeding bundle of care cover all crucial aspects of critical haemorrhage management, including but not limited to:
 - early recognition and control of bleeding (including prehospital recognition and control and advance warning to the receiving hospital)
 - prehospital intervention (eg, whole blood where this is possible)
 - rapid transfer (from ED) and intervention
 - appropriate process-level (eg, code crimson or similar activation), system-level and education elements that must be in place for best practice.
- All hospitals implement the national best practice guidance in a way that fits with their size and context.
- All hospitals implement an agreed, nationally consistent best practice MTP, with some variation for hospital size and context.
- All hospitals implement a nationally agreed critical bleeding bundle of care that integrates with each hospital's acute trauma response system.
- All hospitals implement system and resource improvements that result in patients getting what they need at the time they need it and avoid inappropriate or wasteful use of limited resources.
- Gaps in education and skills are understood and addressed.
- Equipment (eg, viscoelastic monitoring) and blood products are fit for purpose, with a focus on simplifying and improving access.
- Hospitals work closely with the New Zealand Blood Service to achieve all the above.

The 'theory of change' diagram in Appendix 1 presents identified workstreams and outlines the links between system outputs and desired outcomes to achieving the project aim. The diagram may be amended and updated following engagement with the core and wider expert reference groups (ERGs) and wider sector input.

⁴ 1996–2016; data sources: Ministry of Health Historical Mortality report; NZ Injury Query System (NIQS). Injury Prevention Research Unit, Department of Preventive and Social Medicine, University of Otago.

⁵ NZ Major Trauma Registry.

Project approach

This project is a partnership between the National Trauma Network (the Network), the Accident Compensation Corporation (ACC), the Health Quality & Safety Commission (the Commission), the New Zealand Blood Service, the Australian and New Zealand Massive Transfusion Registry (ANZ-MTR), ambulance services and district health boards (DHBs); specifically EDs, perioperative teams and ICUs.

The project will develop, promote and support the implementation of national best practice guidance, the MTP and the critical bleeding bundle of care. It will support both prehospital and initial hospital early identification and effective management of critical haemorrhage in trauma patients. A key approach will be to confirm best practice approaches using ERGs (see Appendices 2 and 3) and sector feedback. The guidance, MTP and critical bleeding bundle of care will then be promoted to all acute trauma receiving hospitals and ambulance services, which will be supported to implement the bundle as appropriate depending on their size and context. Implementation will be supported by small tests of change, eg, plan–do–study–act cycles, and where necessary draw on methods and tools of improvement science.

A clinical lead (Dr Kerry Gunn) has been recruited for 12 months (at 0.2 FTE) to lead the project and direct the project team.

A core ERG consisting of approximately 15 key stakeholders and experts will come together (approximately five times throughout the project, initially in person and then via Zoom) to advise on aspects of the project and the development of the guidance (refer Appendix 2). The core ERG, in conjunction with the project team, will define the quality indicators/metrics that the programme of work will use. A consumer representative will provide input into the core ERG and bring consumer engagement where appropriate as the project unfolds.

A wider ERG, consisting of additional approximately 25 key stakeholders and experts, will be used as a consultation group to confidentially and 'safely' test the work of the project team and the core ERG (refer Appendix 3).

The project team will consult with prehospital services, a selection of trauma receiving acute hospitals and the New Zealand Blood Service to understand their current processes and inform the development of the guidance.

It will visit a select group of hospitals once the guidance and critical bleeding bundle of care have been finalised to promote and support their adoption. Other hospitals will be supported to implement the guidance and bundle via other engagement methods.

The project team will work closely with the New Zealand Blood Service to integrate the critical bleeding bundle of care with existing and future hospital acute blood systems.

Project team

The Commission project team includes:

- Dr Kerry Gunn, project clinical lead, 0.2 FTE
- David Drower, quality improvement advisor, 0.4 FTE
- Gabrielle Nicholson, project manager, 0.3 FTE
- Paul McBride, project data analyst, 0.2 FTE
- Sandy Ngov, project coordinator, 0.2 FTE.

The Network's programme manager, Siobhan Isles, and Network clinical lead, Ian Civil, are also part of the project team.

Key activities, deliverables and timelines

#	Activity	Deliverable	Who	Start	End
1.	Project set-up	<ul style="list-style-type: none"> ▪ Project plan agreed ▪ Costings agreed 	Gabrielle, Sandy, David and Kerry	18 Sept 2019	May 2020
2.	Case for change	<ul style="list-style-type: none"> ▪ Data analysis re current state ▪ Infographic (as communication tool) ▪ Literature review and commentary 	David, Kerry and Paul	13 Jan 2020	July 2020
3.	Communication plan	<ul style="list-style-type: none"> ▪ Stakeholder summary ▪ Engagement summary (who, how, what, when) ▪ Plan for engagements (in person visits, presentations at key meetings/ conferences, etc, Zooms) 	Gabrielle, Sandy, David and Kerry	13 Jan 2020	July 2020
4.	Communication with key stakeholders (ie, implementation of communication plan)	<ul style="list-style-type: none"> ▪ Introductory letter to key stakeholders ▪ Targeted emails ▪ Presentation at key meetings, eg, trauma network meetings ▪ Include information on website and in newsletters 	David, Kerry and Ian	13 Jan 2020	December 2020
5.	Expert reference group	<ul style="list-style-type: none"> ▪ Terms of reference agreed ▪ Members invited ▪ First meeting approx March 2020 ▪ To meet in person once and via Zoom approx four times during the project 	Gabrielle and Kerry	13 Jan 2020	October 2020
6.	Measurement	<ul style="list-style-type: none"> ▪ Develop and implement national measures aimed at measuring: 	David, Kerry, Paul,	Mar 2020	October 2020

		1. Implementation of the new guidance in each DHB (process measures) 2. Mortality due to haemorrhage and associated multiple-organ failure (outcome measure) <ul style="list-style-type: none"> ▪ Agreed data and baseline with ongoing monitoring plan 	and core ERG		
7.	Development of guidance and critical bleeding bundle of care	<ul style="list-style-type: none"> ▪ National guidance drafted and sector consultation ▪ National guidance and bundle agreed and published 	David, Kerry, Ian, Gabrielle and core ERG	May 2020	October 2020
8.	Visits to DHBs, ambulance, New Zealand Blood Service	<ul style="list-style-type: none"> ▪ Schedule of visits agreed by end August 2020 (informed by data and kept within budget) ▪ Visits with appropriate stakeholders 	David, Kerry and Ian	Through 2020	December 2020

Governance

This project fits within both the Commission’s trauma programme and the Network’s work programme, and the governance arrangements reflect this.

The core ERG advises on the development of the guidance, not the project approach, although from time to time the project team may choose to consult with the core ERG on implementation aspects, if appropriate.

Decisions about the project approach and management of risks and issues are made by the Commission’s internal trauma programme steering group (SG), which meets monthly and includes the project sponsor and representatives from both the Commission and the Network.

The SG determines if and when decisions, risks and issues need to be escalated to the ACC–Commission contract governance group (with input on whether this is appropriate sought from ACC on a case-by-case basis).

The Network representatives advise the SG if and when aspects of the project need to be escalated to the Network governance group and the Network operations group either for information or decision.

Reporting

The project team reports to the SG on progress, risks and issues at each meeting.

The need for other project-specific reports is determined on an ad-hoc basis.

The Commission reports on the wider trauma programme to the ACC–Commission contract governance group and the Network governance group on a regular basis. Updates on this project will be included in these reports.

Measurement

The project aim will be achieved by building quality metrics that support early identification and effective management of critical haemorrhage. These quality metrics will support trauma system performance review and identify opportunities for improvement. Most metrics will be process measures associated with the national guidance and critical bleeding bundle of care and will be confirmed by the core ERG in conjunction with the project team (see below for examples of likely process measures).

Quality measures will consider hospital system-level responses, initiation and management of MTP, types of blood and other products used, other numerical data and key timepoints in the process of care.

These measures will be captured via existing mechanisms, for example. the New Zealand Trauma Registry, ANZ-MTR and New Zealand Blood Service. Additional local hospital data collection is not expected to be required. However, additional measures may arise after both core and wider ERG input.

A dashboard of quality measures will be developed to provide feedback to trauma services across Aotearoa New Zealand.

Process measures include but are not limited to:

- proportion of patients receiving tranexamic acid within one hour of injury or hospital arrival
- proportion of patients in whom red blood cell (RBC) transfusion is initiated within 15 minutes of protocol activation
- proportion of patients with initiation of call for transfer to operating theatre/interventional radiology suite within 60 minutes of protocol activation
- proportion of patients with haemoglobin levels maintained between 60 g/L and 110 g/L during protocol activation, excluding certain paediatric populations (eg, neonates) that may require higher haemoglobin values
- proportion of patients transitioned to group-specific RBCs and plasma within 90 minutes of arrival/onset of haemorrhage
- proportion of patients with appropriate MTP activation (≥ 5 RBC units in first 24 hours, > 40 mL/kg per 24 hours of RBCs in paediatric patients) or before this level in patients dying due to haemorrhage within 24 hours
- proportion of patients without any blood component wastage (including plasma that is thawed and not used within the five-day limit on another patient).

Key outcome measures include:

- reduction in trauma critical haemorrhage deaths
- reduction in multiple organ failure deaths associated with critical haemorrhage caused by trauma
- reduction in variation of response for the above metrics.

The following table summarises measurement- and improvement-related questions the project team has considered in the development of this plan.

Question	Indicative answer
What is the concern we are seeking to address?	Potentially avoidable trauma deaths from haemorrhage
What is the evidence base?	International examples of best practice and quality improvement success, the NZ-MTR, hospital data, ANZ-MTR
What is the scale of problem?	Number of haemorrhage deaths
What will the project deliver (outputs)?	National guidance for the recognition and management of critical haemorrhage plus an agreed MTP and critical bleeding bundle of care, and buy-in to these from key stakeholders
What are the possible outcome measures?	<ul style="list-style-type: none"> • Reduction in haemorrhage deaths caused by trauma • Reduction in multiple organ failure deaths associated with critical haemorrhage
What changes in behaviour do we wish to see?	<ul style="list-style-type: none"> • Adherence to best practice guidance and adoption of critical bleeding bundle of care • Clinical audit (adverse event review) or morbidity and mortality review on all haemorrhage deaths
Does a tried and tested measure exist?	Yes, case fatality rate from haemorrhage
Does the data exist? If so, who holds it?	Yes, NZ-MTR, prehospital data and ANZ-MTR
Do we have a baseline?	Yes
Do we have an international comparator?	Yes, multiple comparators including London (with caveats that direct comparison is not always possible)
What are the potential process measures?	<ul style="list-style-type: none"> • Measures might need to be 'proxy' measures that demonstrate that the right systems and processes are in place, eg, time to computerised tomography scan, time to theatre • Ideally data that is already collected will be used • One potential measure is whether the new national guidance is adopted/ adhered to, and that the associated MTP and critical bleeding bundle of care are implemented in all acute trauma receiving hospitals • Process quality measures to be confirmed by the core ERG in conjunction with the project team
What changes in practice do we wish to see?	<p>Adherence to new, best practice guidance and bundle as demonstrated by aspects such as:</p> <ul style="list-style-type: none"> • effective clinical leadership and enhanced decision-making during care of patients with critical haemorrhage

	<ul style="list-style-type: none"> • improved planning, preparation, inter-departmental communication and coordination by clinical care teams to better manage trauma patients with critical haemorrhage • notification of a patient with critical haemorrhage to the right staff at the right time • effective resuscitation by staff with the right skills • no delay to key clinical interventions in patient management
Does a tried and tested measure exist?	Internationally measures exist – these need to be adapted for the Aotearoa New Zealand context

Alignment with the Commission’s strategic priorities

At the time of developing this plan, the Commission’s strategic priorities for 2017–21 were set out in its then-Statement of Intent. They are:

- priority 1: Improving consumer/whānau experience
- priority 2: Improving health equity
- priority 3: Reducing harm and mortality
- priority 4: Reducing unwarranted variation in patterns of care

Mapping the project’s planned activities back to each of these strategic priorities is part of demonstrating how the project will give effect to the priorities.

Strategic priorities	Project activities
Priority 1: Improving consumer/whānau experience	Put communication pathways that impact the critically bleeding trauma patient in place across relevant services, including with patient, family and whānau
Priority 2: Improving health equity	Produce national guidance document (and associated MTP and bundle) with a 'dashboard' of system quality measures to help identify inequities
Priority 3: Reducing harm and mortality	Develop and introduce nationally consistent MTP and critical bleeding bundle of care that align with appropriate use of resources
Priority 4: Reducing unwarranted variation in patterns of care	<ul style="list-style-type: none"> • Put in place a nationally consistent (adapted for size of hospital) MTP • Support all hospitals to implement a nationally agreed critical bleeding bundle of care that integrates with each hospital’s acute trauma response system • Support trauma team education using in-situ simulations for prehospital and hospital trauma team members (although delivery of the simulations is outside the scope of this project)

Key stakeholders

Below are listed the key stakeholders and organisations that will need to be involved in the project if it is to be successful.

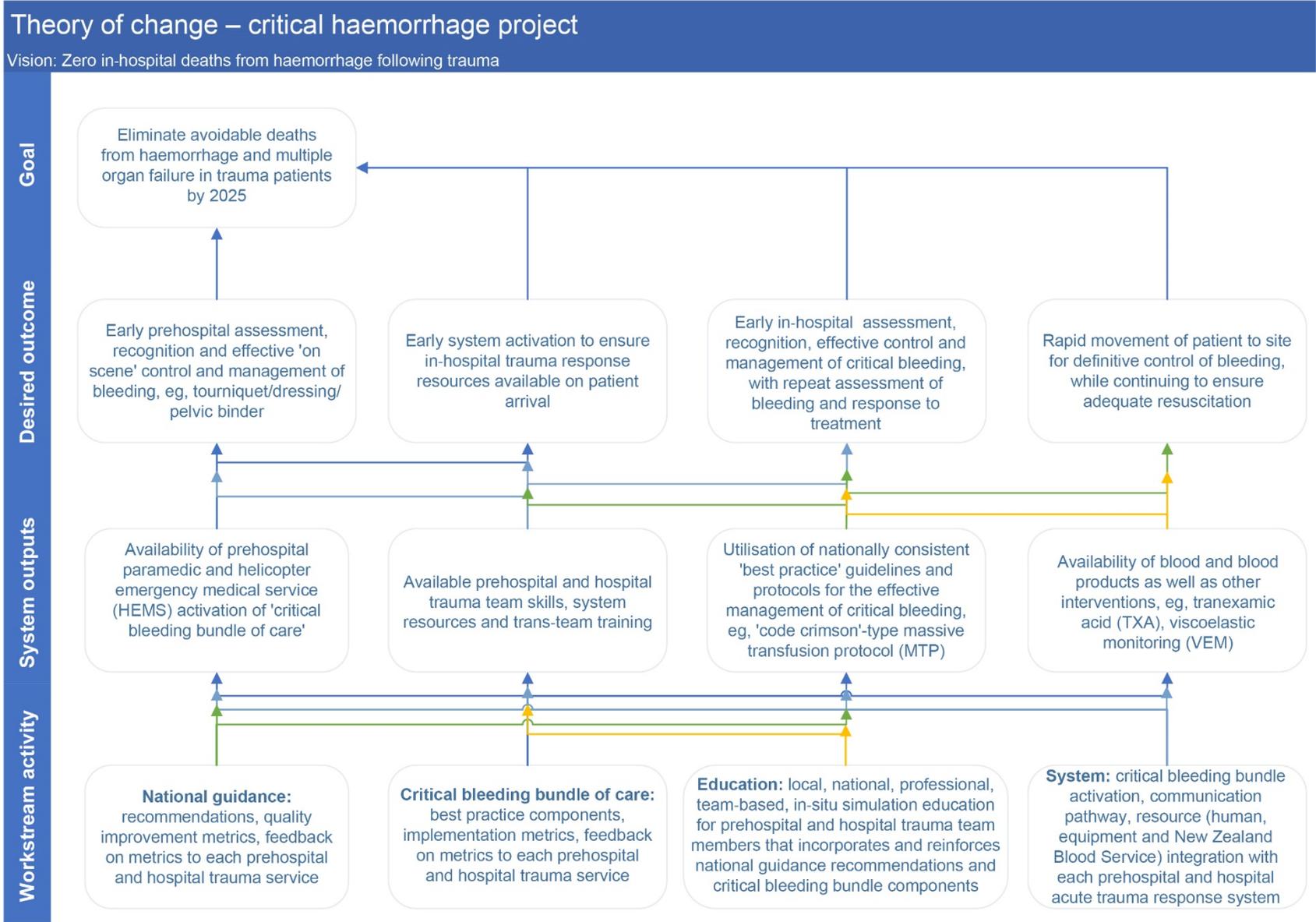
Name	Influence	Involvement	Comment
National Trauma Network	High	ERG representative	Support and endorse project deliverables
ACC	High	ERG representative	As funders of in-hospital trauma services, via Public Health Acute Services, ACC needs to influence approach and endorse the national guideline
Ministry of Health	High	TBC	TBC
DHBs	High	ERG representative	Involve all trauma receiving acute hospitals, support project deliverables
DHB funding and planning	TBC	TBC	TBC
Regional trauma networks	High	ERG representative	Support and endorse project deliverables
New Zealand Blood Service	High	ERG representative	Hospitals, labs and national blood service, support project deliverables and measures
Ambulance services (St John and Wellington Free)	High	ERG representative	Prehospital data and impact of time to hospital and prehospital treatment
Consumers, families and whānau	High	ERG representative	TBC
New Zealand Resuscitation Council	High	ERG representative	Support and endorse project deliverables
Australian and New Zealand College of Anaesthetists	High	Input via college	Support and endorse project deliverables
College of Intensive Care Medicine of Australia and New Zealand	High	Input via college	Support and endorse project deliverables
Royal Australasian College of Surgeons	High	Input via college	Support and endorse project deliverables
Royal Australian and New Zealand College of Radiologists	High	Input via college	Support and endorse project deliverables
Interventional Radiology Society of Australasia	High	Input via society	Support and endorse project deliverables
Australasian College for Emergency Medicine	High	Input via college	Support and endorse project deliverables
College of Emergency Nursing Australasia	High	Input via college	Support and endorse project deliverables

Communication activities

Tool	Audience	Purpose	Responsibility	Frequency
Commission and Network websites	Public, consumers and sector	<ul style="list-style-type: none"> Pages should include background and current information Updates should include information focusing on 'in the moment' developments or best practice examples 	Project coordinator	Six-weekly
Commission e-digest (email) and Network eNewsletter (email)	Public, consumers and sector	Inclusion in the e-digest is automatic if new Commission web content is provided	Project coordinator	Six-weekly
Letters	Targeted to audience such as chief executives, directors of nursing, quality and risk managers, etc	<ul style="list-style-type: none"> Topic-specific and driven by new developments across the programme, eg, request for participation To be used sparingly 	Team draft with appropriate sign-off	As required
Emails	Targeted to audience	Topic-specific and driven by new developments across the programme, eg, request for advice, requests for speaking slots, sending papers for meetings	Team draft with appropriate sign-off (if required)	As required
Commission blog	Public, consumers and sector	Website tool to promote thought-pieces	Team, clinical lead, Network representatives and ERG members	As required
Webinars (Zoom) and teleconferences	Targeted to audiences	<ul style="list-style-type: none"> Engage stakeholders on topic to encourage sharing, learning and discussion Can also be used to support development and implementation activities 	Team	As required
Site visits, in-person meetings	Targeted to audiences – often clinical teams	<ul style="list-style-type: none"> In-person engagement will be required as new initiatives are implemented across the sector Clinical lead visiting hospitals for presentations and meetings to support local implementation 	Clinical lead, Network reps	As required
National and regional meetings	Targeted to audiences	In-person networking days where representatives are brought together for a specified purpose	Clinical lead, Network reps	As required

Tool	Audience	Purpose	Responsibility	Frequency
Publications	Targeted to audiences	Writing articles for submission to peer-review journals, association/other organisations' newsletters and other media, such as magazines and television	Team, Carl Shuker, communications team	As required and workstream dependent

Appendix 1: Theory of change diagram



Appendix 2: Core expert reference group

The core expert reference group (ERG) was formed in early 2020 and had its first meeting in March 2020.

Its terms of reference define its purpose as being: ‘a “safe” group that the project team can consult and debate with, in confidence. It will also be an “expert” group and members have been appointed because their knowledge and skills are recognised in the sector (both locally and internationally). Finally, it will be a group that champions the project and its deliverables in the sector, both during their development and during their implementation.’

The Health Quality & Safety Commission and the National Trauma Network would like to thank the core ERG members for their efforts and enthusiasm in guiding the work to improve trauma care for critically bleeding patients. The members include the following:

Name	Role	Organisation
Andy Swain	Medical director	Wellington Free Ambulance
Caroline Gunn	Consumer representative	N/A
Chris Jephcott	Anaesthetist	Waikato DHB
David Drower	Quality improvement advisor	Health Quality & Safety Commission
David Lang	Emergency medicine specialist	Nelson Marlborough DHB
David O'Byrne	Emergency medicine specialist	Hutt Valley DHB, Wellington Free Ambulance
Dominic Fleischer	Emergency medicine specialist	Canterbury DHB
Dr Kerry Gunn (Chair)	Clinical lead, critical haemorrhage project (anaesthetist)	Health Quality & Safety Commission
Gabrielle Nicholson	Project manager	Health Quality & Safety Commission
Ian Civil	Clinical lead, National Trauma Network (vascular and trauma surgeon)	National Trauma Network
Jack Hill	Māori representative (anaesthetist)	Auckland DHB
James Moore	Intensivist	Capital & Coast DHB
Orla Fowden	Right Care advisor	St John Ambulance Service (South Island)
Paul McBride	Data scientist	Health Quality & Safety Commission
Renate Donovan	Trauma nurse	Capital & Coast DHB
Richard Aickin	Paediatric emergency medicine specialist, Starship Children's Hospital and representative for the New Zealand Resuscitation Council	New Zealand Resuscitation Council
Richard Charlewood	Transfusion medicine specialist	New Zealand Blood Service
Sandy Ngov	Project coordinator	Health Quality & Safety Commission

Susan Mercer	Transfusion nurse specialist (intensive care unit)	New Zealand Blood Service
Tony Smith	Medical director	St John Ambulance Service

Appendix 3: Wider expert reference group

Also crucial to the successful delivery of the critical haemorrhage project is the wider ERG, with which the project team consults via email to 'sense check' deliverables and proposals prior to them being publicly communicated.

The Health Quality & Safety Commission and the National Trauma Network would also like to thank the members wider ERG for their support of the core ERG and the project. The wider ERG members include the following:

Name	Role	Organisation
Andrew Holden	Head of interventional radiology, Auckland City Hospital	Auckland DHB
Angus Jennings	Orthopaedic surgeon	Nelson Marlborough DHB
Annemarie van der Slot-Verhoeven	Blood bank scientist	Wellington Blood Bank
Christopher Harmston	Surgeon	Northland DHB
Claire Hitchcock	Trauma coordinator	Nelson Marlborough DHB
Dean Bunbury	Anaesthetist/air retrieval	Paediatric anaesthetist at Middlemore Hospital (Counties Manukau DHB) and prehospital retrieval medicine (PHRM) in Auckland
Don Jenkins	Surgeon	Mayo Clinic
Emma Patrick	Anaesthetist	Chair Hospital Blood Transfusion Committee, Taranaki DHB
Fiona King	Transfusion nurse specialist	New Zealand Blood Service Wellington
Grant Christey	Surgeon	Waikato DHB
James La Ferve	Emergency medicine specialist	Auckland Rescue Helicopter Trust
James McKay	Trauma surgeon	Canterbury DHB
Jim Faed	Transfusion medical specialist/haematology	Southern DHB
Kaylene Henderson	Trauma team training	UniServices
Krishna Badami	Sponsor ANZ-MTR	New Zealand Blood Service
Laura Young	Haematologist	Auckland DHB
Mark Friedericksen	Emergency medicine specialist	Auckland DHB
Michael Kalkoff	Intensivist	Northland DHB
Michael Reade	Intensivist/Research/Military	Australian Defence Force and University of Queensland
Michael Shepherd	Paediatric emergency medicine specialist	Auckland DHB
Mike Hunter	Surgeon	Southern DHB
Murray Cox	Vascular surgeon	Taranaki DHB

Paul Blakemore	Emergency medicine specialist and prehospital physician	Tauranga emergency department and Auckland Rescue Helicopter Trust
Sarah Morley	Chief medical officer	New Zealand Blood Service
Scott Robinson	Anaesthetist	Waikato DHB
Tracey Clark	Blood bank team leader	New Zealand Blood Service
Zsolt Balogh	Orthopaedic Surgeon	John Hunter Hospital, Newcastle