Guideline
National

Health New Zealand
Te Whatu Ora

National chest injury guideline

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Part A: Overview

Purpose of the guideline

1. The development of the chest injury guideline is part of Aotearoa New Zealand's major trauma quality improvement programme, delivered in partnership between Te Tāhū Hauora Health Quality & Safety Commission (Te Tāhū Hauora), Te Whatu Ora | Health New Zealand (Health New Zealand) Trauma National Clinical Network (the Network) and the Accident Compensation Corporation (ACC). This partnership has successfully delivered improvements in the areas of critical haemorrhage, trauma rehabilitation and serious traumatic brain injury since 2019.

2. The guideline was developed following extensive data analysis and research review, which highlighted the significant impact of serious chest injury on patient outcomes, with complex injuries often leading to longer hospital stays and more severe long-term problems.

3. An audit of chest injury care guidelines currently in use in Aotearoa New Zealand found significant variation in management of these patients between facilities. Very few guidelines contained guidance around the management of at-risk populations, such as older adults and Māori, ACC navigation and support to facilitate a smooth transition to the community. There was also wide variation found in the resources handed out to patients across the country.

4. The purpose of the national chest injury guideline is to provide a foundation of clinical guidance that hospital services can adapt for use within the context of their local infrastructure, capacity and capability.

5. The overall aim is that all people who experience chest injury receive evidence-based comprehensive care, intentional discharge planning, and consistent advice on how to care for their injury, to support successful rehabilitation and a return to their pre-injury way of life.

Applies to

6. This guideline applies to everyone employed by Health NZ involved in the care of trauma patients. Some components of the guideline are service-specific.

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Part B: Guideline

Initial assessment of a patient with a chest injury

7. The severity of a chest injury is proportional to:

- number and extent of rib fractures
- morphology of fractures (multiple, flail segment, bilateral injury, sternal fracture, etc)
- patient's age and frailty
- patient's co-morbidities and medications
- associated injuries.

8. Failure to appreciate the severity of a chest injury may have serious consequences both in the short-term (inadequate analgesia, insufficient allied health support, development of complications) and the long-term (failure to return to normal activities, re-presentations and readmissions).

Risk assessment and severity scoring

9. It is strongly recommended that any patient presenting with a chest injury and suspicion for rib fractures should have their injury severity calculated objectively using any of the risk assessment tools available.

10. This guideline is not directive about *which* scoring tool is used and two examples of risk assessment tools are included in Appendix B. Others are available online.

11. Use of a risk assessment tool and objective scoring system:

- reduces the likelihood of underestimation of injury
- stratifies patients into severity classes
- allows for a common language between healthcare providers
- facilitates discussions between hospital services (general surgery, cardiothoracics, high dependency unit (HDU), intensive care unit (ICU), etc) and by members of the primary care community (general practitioners (GPs), nurse practitioners, urgent care, etc) with their local referral facility.

12. Stratification of a patient into a mild, moderate or severe group will also act as a prompt to:

- escalate analgesic options
- discuss the patient with the local admitting service
- consider additional imaging – most commonly CT (computed tomography)
- involve other services (pain team, anaesthetics, HDU, ICU, cardiothoracics). Even if these services are not available locally, the guideline will remind practitioners to initiate these discussions when indicated.

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Proposed flowchart for initial assessment

On initial assessment complete a **risk assessment and/or severity score** (ie, STUMBL or rib fracture score)

Mild

- **Paracetamol** 1g PO/IV Q4H
  AND
- **NSAID** regularly (ibuprofen 400-600 mg TDS or Celecoxib 400mg STAT then 200mg OD-BD)
- **Consider adding short-acting opioid**

Consider discharge if the patient:
- can cough and deep breathe effectively
- adequate analgesia can be prescribed, dispensed and tolerated
- has appropriate supports in place at home.

Ensure the patient has:
- a clear 'return to medical care' plan in place
- a chest injury patient handout (see Appendix E)
- a follow-up appointment, to be scheduled ***ideally*** within one week of this contact with an appropriate healthcare service (this may be in-hospital outpatient service, GP or local urgent care facility).

For more information, see discharge section of guidance.

Moderate

As per **MILD PLUS**
- Urgent acute pain service review/ after-hours anaesthetic registrar on call review
- Consider regional anaesthesia
- **Tramadol** 50–100mg PO QID
  and/or
  strong opioid Q2H if alert (see older adults section for guidance)
- Consider PCA
- Consider discussion with critical care

Decision-making about admission should include the following:
- frailty score, or age greater than or equal to 65 (>55 if Māori or Pacific people)
- poor mobility or insufficient community support
- multiple rib fractures (three or more) or flail chest
- symptomatic injury (respiratory distress or moderate/severe pain) ***irrespective*** of radiological findings
- clinically significant (respiratory) comorbidities
- multi-system injury (polytrauma)
- sternal fracture (in which case, also consider serial troponins, electrocardiogram (ECG) + cardiac echocardiography and discussion with cardiology).

Severe

As per **MILD** and **MODERATE PLUS**
- Urgent acute pain service and anaesthetic review for consideration of early regional anaesthesia (do not wait for signs of deterioration)

In addition to those patients deemed to be at moderate or high risk following their risk assessment, intensive care review and/or admission should also be considered for patients requiring:
- respiratory management approaching the ceiling of ward-level care
- haemodynamic monitoring
- inotrope support
- concomitant injuries needing critical care

This guideline does not dictate when CT should be ordered, nor does the guideline itself rely on CT for the diagnosis of a chest injury. However, a chest CT may be considered for patients in the following circumstances:
- concern for concomitant injury based on mechanism of injury or concern for underlying parenchymal injury
- suspected unstable spine or scapular fracture(s)
- displaced sternal fractures(s)
- fractures of ribs 1-4 (may be associated with concomitant vascular injury)
- multiple (>two) rib fractures or bilateral rib fractures
- persistent cough or unexplained dyspnoea
- unable to undergo a thorough clinical assessment due to extra-thoracic injury (ie, head injury) sedation or intubation
- to support better anatomic location and pre-intervention planning for regional block insertion
- older adults (>65 years or >55 for Māori/Pacific people) or the clinically frail.

NB: Contraindications to prescribing medication is essential in decision-making

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Discussion with tertiary centre and/or transfer to major trauma centre

In addition to those patients who are deemed to be in the high risk or severe category following their risk assessment (as a discussion with these services should be ***mandatory*** for this group), the following type of patient should be discussed with the nearest tertiary referral service.

Emergent (immediate referral)

- Tracheobronchial injury
  - high volume air leak/significant pneumothorax post chest drain insertion/ severe surgical emphysema/large volume or massive haemoptysis
- Cardiac injury
  - haemopericardium/cardiac tamponade/cardiac contusion
- Thoracic aortic injury
  - ascending/aortic arch (cardio-thoracic surgery referral) or descending (vascular surgery referral)
- Penetrating chest injury (especially within the anatomical 'box of danger')
  - haemothorax (large volume, or active bleeding with extravasation of CT contrast, or high intercostal volume drainage – greater than (>) 1500ml immediately or >200ml/hour for two consecutive hours)

Urgent (within working hours referral)

- Multiple ribs fractures for consideration of surgical stabilisation and rib fixation (SSRF)
- Displaced or comminuted sternal fracture

Surgical stabilisation and rib fixation guidance

A CT will be required for consideration of rib fixation. Where clinically possible and appropriate, rib fixation should be performed within 72 hours of the index injury (the Chest Wall Injury Society guidelines for SSRF may be used to guide referral). An early referral (in 'working hours') for SSRF should be considered in a patient with the following:

Respiratory failure

Deteriorating respiratory observations:

- respiratory rate >20 despite adequate analgesia
- incentive spirometry <50% of predicted
- numerical pain for >5/10 despite adequate analgesia
- poor cough
- escalating respiratory support requirements
- requirement for mechanical ventilation
- failure to wean from mechanical ventilation

- unable to progress to a spontaneous breathing trial after 48 hours
- able to progress to a spontaneous breathing trial for 60 minutes but develops >2 of the following:
  - increased respiratory rate >35
  - increased heart rate >140
  - reduced oxygen saturations <90 percent
  - rapid shallow breathing index (RSBI) >150
  - diaphoresis
  - agitation

Chest wall instability

Flail chest (radiological or clinical):

- radiological flail - three or more ipsilateral consecutive ribs with fractures in two locations
- clinical flail - paradoxical chest wall motion

Rib fractures with severe displacement:

- three or more ipsilateral rib fractures with displacement of 100% of rib width on axial CT
- severe pain despite optimal analgesia

Exclusion criteria for surgical stabilisation and rib fixation

- Shock/ongoing resuscitation
- Severe traumatic brain injury – Glasgow coma scale <8 or signs of intracranial hypertension
- Unresolved abdominal injuries
- Acute myocardial infarction
- Rib fractures of ribs 1-3

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Pain management of a patient with a chest injury

13. Adequate pain management forms one of the cornerstones of care for a patient with a chest injury. To underestimate and under-manage this aspect of care will cause patient suffering, prolong their admission, delay discharge, and risk re-presentation and readmission for pain or medical complications (atelectasis, pneumonia etc).

Discharge from emergency department, urgent care or general practice

14. Any patient deemed fit for discharge from an acute care facility (whether an emergency department (ED), GP or urgent care) should be able to mobilise and cough effectively.

15. They should:

- receive a prescription for adequate analgesia and laxatives if opioids are prescribed
- be given clear instructions on how to take their medication
- be given clear instructions on when to seek medical advice, especially if analgesia is inadequate.

16. Table 1 provides an example of a post-discharge pain management regimen, with the usual contraindications and concomitant medicines to be considered by the prescriber.

Table 1: Example of post-discharge pain management regime for chest injury

Medication	Dose
Paracetamol	1 g PO QID (1g PO TDS if weight <50 kg)
AND	
Anti-inflammatory agent **Not if CrCL < 30ml/ml**	Celecoxib 100 mg PO BD **OR** Ibuprofen 400mg PO TDS
CONSIDER	
Tramadol	50–100mg PO QID
Sevredol	10–20 mg PO q2hrly PRN maximum total daily dose of 80mg (consider age and renal function)
Oxynorm	5–10 mg PO q2hrly PRN maximum total daily dose of 60mg (consider as 2nd line to Sevredol due to high addictive potential)

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Admission to inpatient services

17. A patient who is admitted to hospital with pain following a chest injury may require escalating analgesic strategies, regular review by the in-patient team, and consultation with the local pain service. Do not wait for review by the acute pain service before escalating pain management.

18. A multi-modal approach to pain management is favoured (see Appendix C for an example). If the patient's pain is uncontrolled or they are unable to meet functional goals due to pain, the management response must be escalated to the next step in the local pain management guideline.

Considerations

- **Adequate and appropriate analgesia must be prescribed regularly, not as PRN.** Due to the time involved to onset of action and maximal efficacy, if analgesia is not given regularly, it is of little benefit to a patient.
- **Opioids should have a maximum daily upper limit applied, taking into account the patient's renal function** (see Appendix D for an example).
- Concurrent prescription of laxatives with opioids (ie, Laxsol two tablets PO BD).
- Concurrent prescription of antiemetic with opioids (ie, Ondansetron 4mg PO TDS).
- Concurrent PPI (proton pump inhibitors) cover if NSAID (non-steroidal anti-inflammatory) is used.
- Sustained release tramadol could be considered at 100mg BD starting dose.
- Ketamine infusion alongside PCA above.

Criteria for referral to acute pain service or anaesthetics

19. Any patient admitted to hospital with a chest injury should receive a referral to the acute pain service or its local equivalent. The acute pain service should review the patient daily or be contacted by the in-patient management team daily.

20. Ensure multimodal analgesia is prescribed as above *prior* to the patient's admission to a ward.

21. An urgent referral needs to be completed for a high-risk patient:

- assessed as moderate to severe based on the admission chest injury severity score
- consider acute pain service or anaesthetic registrar review if the answer is 'yes' to any of the factors below, or there is inadequate analgesia and/or clinical deterioration:
  - > three rib fractures
  - flail segment
  - bilateral fractures

- frailty
- age ≥ 65 (≥55 for Māori and Pacific people)
- history of chronic respiratory illness and/or current respiratory illness
- evidence of pneumonia
- history of substance abuse
- history of chronic pain.

Regional anaesthesia

22. Regional anaesthesia should be considered for a patient who is experiencing moderate to severe pain, despite regular, multimodal analgesia (first and second line) and a PCA or ketamine infusion being administered (see Figure 3). This may require discussion with a local referral centre.

Figure 1: Proposed flowchart on regional anaesthesia

Patient is likely to benefit if:
- Unable to deep breathe or participate in physiotherapy
- Moderate to severe pain with coughing
- Intolerance of analgesia side effects – sedation, nausea and vomiting, constipation, confusion, respiratory depression

Unilateral Fractures				Bilateral Fractures	
Immobile	**Mobile – Anterior #s**	**Mobile – Lateral #s**	**Mobile – Posterior #s**	**Mobile**	**Immobile**
• Serratus Anterior block if fractures anterior/ lateral	• ESP in first instance • May require Paravertebral or Thoracic Epidural	• ESP in first instance • Serratus Anterior may be considered	• ESP in first instance	• Thoracic Epidural OR • Bilateral ESP blocks OR • Bilateral Paravertebrals	• Bilateral Serratus Anterior blocks if fractures anterior/ lateral

Source: Health NZ, Rotorua and Taupō Lakes

23. In a patient with multi-level fractures, consider referral for a thoracic epidural or appropriate level regional blocks – either erector spinae plane (ESP) catheters or serratus anterior.

24. ESP blocks are considered reasonable in an anticoagulated patient and are certainly preferable to an epidural or paravertebral in such cases.

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Nursing management of a patient with a chest injury

25. Although care of a patient with a chest injury is a multidisciplinary team effort, nurses play a critical role in ensuring that care is integrated and enduring due to the time spent at the patient's bedside.

26. Table 2 provides an overarching reference for the fundamentals of nursing interventions involved in supporting a patient with a chest injury.

Table 2: Overview of nursing interventions for patients with a chest injury

Analgesia • Regular assessment of pain (pre- and post-analgesic administration). • Integration of positioning and supported cough should be encouraged for patient comfort. • For intractable pain, consider advanced analgesic options and advocate for a pain service review. • See the section on pain management within this guideline.	**Adjunct medications** • To reduce complications, advocate for adjunct medications to be prescribed including antiemetics and laxatives. • For a patient with a chest injury who is at increased risk of venous thromboembolism (VTE), a VTE risk assessment should be documented and the patient prescribed VTE prophylaxis in line with local guidelines (unless the risk of bleeding is considered high).
Early mobilisation and respiratory support • Encourage regular deep breathing and supported cough. • Promote early and regular mobilisation unless contraindicated. • Address reason if unable to mobilise (eg, inadequate analgesia or disability). • Consider humidified high flow nasal oxygen as indicated.	**Monitoring parameters** • In addition to standard vital signs, ensure documentation of the: ○ oxygen saturation goal on the New Zealand early warning score (NZEWS) (adult) vital sign chart ○ prescription of supplementary oxygen in the national medication chart.
Escalation of care • Evaluate the NEWS chart for escalation with clinical reasoning based on patient condition (eg, analgesia inadequate despite maximum dosages, new or worsening oxygen requirements). • Follow local protocols for triggering a patient at risk (PAR) and/or intensive care team review.	**Patient and whānau support** • Ensure patient and whānau are updated and encouraged to engage with their plan of care. Allow time for discussion and explanation of any consumer information handout. • Need-based advocacy may be needed for underserved populations (see the under-served populations section within this guideline).
Referrals • To optimise recovery, ensure early referral to physiotherapy (including reviewing after-hours criteria) and the wider multidisciplinary team, as indicated (including cultural support services when appropriate).	**Safe and supported discharge** • See the discharge section within this guideline to support a safe discharge. • Explanation of the discharge summary, information handouts, and newly prescribed medications may be required.

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Physiotherapy and allied health management for a patient with a chest injury

Referrals

27. Refer any patient with a chest injury to physiotherapy within 24 hours of admission. The physiotherapist should conduct a daily review of the patient for the first 72 hours, as clinically indicated.

28. Note, not all patients with a chest injury will need to be seen by a physiotherapist; some will only require their clinical notes to be screened. To assist physiotherapy prioritisation, details of the patient's clinical need and/or risk assessment should be provided.

29. Preventing atelectasis, promoting deep breathing, clearing secretions and promoting return to function are key aims of physiotherapy following chest injury.

Assessment

30. Physiotherapy assessment should include:

- functional assessment (including mobility)
- cardio-respiratory status (including but not limited to breathing pattern, cough strength, oxygen saturation, auscultation, palpation, humidification)
- review of the effectiveness of analgesia prescribed
- objective measures to monitor clinical progression and effectiveness of treatment, and identify deterioration.

31. Physiotherapists should consider the requirement to assess for:

- falls (particularly based on frailty, mechanism of injury and in the older adult cohort)
- upper limb function (depending on the types of rib fractures or concurrent injuries).

Treatment and advice

32. **Physiotherapy treatment and advice will be tailored to the patient's specific injuries, tolerance and clinical presentation, with consideration of pre-existing or long-term conditions.**

33. Most patients with a chest injury will benefit from deep breathing exercises, unrestricted mobilisation, optimal positioning and supported cough.

34. These interventions (unless contraindicated) should be started prior to and be continued outside of physiotherapy. Physiotherapy can support the prescription of these interventions, as well as appropriate technique and self-management through education and written advice (see Appendix E for a patient information handout).

35. Adjunct interventions, such as incentive spirometry, bubble PEP (positive expiratory pressure), suctioning and positive pressure modalities should be used as clinically indicated by the physiotherapist. Noting that the availability of these adjuncts is likely to differ across services, considering precautions/ contraindications prior to use.

36. Upper limb stiffness and subsequent reduced function is a common complication following chest injury. Therefore (unless contraindicated), bilateral upper limb rehabilitation, within the limits of pain, should include:

- commencing active/passive range of movement
- scapular stability exercises
- upper limb weight bearing.

After-hours or weekend physiotherapy service

37. When a patient with a chest injury is admitted over the weekend, OR if the patient deteriorates after-hours (for example with worsening sputum retention, lobar collapse, increasing oxygen requirement), the on-call or weekend physiotherapy team should be contacted.

38. If an after-hours physiotherapy service is not available and the patient requires additional support during this time, the relevant local guideline for the acutely deteriorating patient must be followed.

Allied health involvement

39. If the patient requires input from the wider multidisciplinary team, early referral to the required allied health professional is recommended. This may include one or more of the services listed in Table 3.

Table 3: Allied health services to be considered for chest injury patients

Service	Support provided
Occupational therapy	Assess and treat impairments related to cognitive function and activities of daily living and involved in prescribing equipment where indicated.
Speech and language therapy	Support communication, swallowing and tracheostomy management.
Social work	Work with the patient and whānau, giving direction on health and financial matters.
Psychology	Assist with mood and adjustment to injury and provide ongoing psychological support.
Dietitian	Help ensure adequate nutrition is provided to support optimal recovery.

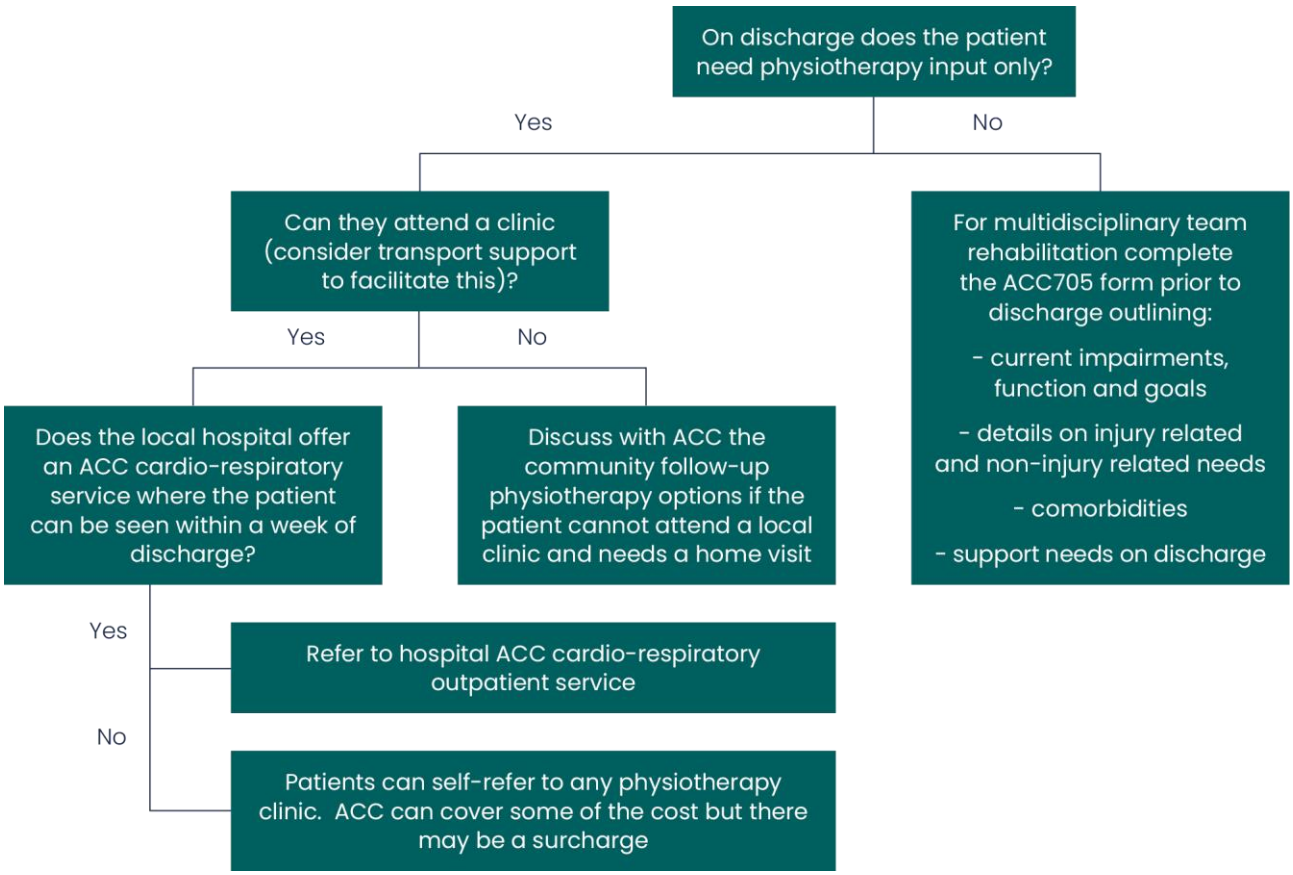
Cultural support team	Work with patients and whānau to facilitate their recovery throughout their inpatient stay, providing navigation and supporting cultural wellbeing.
Pharmacy	Review medication regime (particularly analgesics) and educate on medication plan at discharge.

Community physiotherapy on discharge

40. At discharge, a patient with isolated chest injury or multi-trauma may need a referral to a community physiotherapist if they have ongoing issues with respiratory, mobility or upper limb function. A patient with high-level functioning needs, such as returning to work, sports or manual labour, should also be referred to community rehabilitation, with these needs highlighted to ACC.

41. The flowchart in Figure 2 is a guide to follow in this process. It is important to inform the patient of any referrals made. Even if the patient has not been referred, they must be made aware that they can access physiotherapy via ACC once discharged if needed.

Figure 2: Process for referral to community physiotherapy



Discharge planning and community follow-up

42. Discharge planning should begin soon after a patient's admission and needs to involve relevant members of the multidisciplinary team to ensure a smooth transition into the community for the patient and their whānau.

43. Inadequate discharge planning can result in prolonged hospital stay, heightened stress for a patient, and their whānau, higher rates of re-presentation to hospital and increased risk of complications.

Enablers of effective discharge planning

44. Proactive referral to allied health can facilitate early rehabilitation and prevent unnecessary delays in discharge planning. Early engagement with ACC during hospital admission can also enhance the discharge process. Whānau can play an important role in supporting discharge and facilitating the transition into community services; engaging with them is, therefore, a crucial component of effective discharge planning.

Patient information

45. The patient and whānau should be given information providing an overview of the injury (or injuries) they have sustained, and advice on recovery and how to seek help if needed.

46. See Appendix E for a patient information handout. The handout has been co-designed with patients to be used in collaboration with this guideline. It is also available in te reo Māori, greyscale, and text versions.

Community follow-up

47. It is recommended that all patients with a chest injury be followed up by a medical professional within one week of discharge to support their ongoing recovery and prevent avoidable re-presentation to hospital. Follow-up options include the patient's GP, local urgent care services, the trauma team follow-up clinic or the hospital admitting team follow-up clinic.

48. For a patient on pain medication, particularly those prescribed opioids on discharge, it is recommended that there is a documented plan to reduce this medication that is shared with and understood by the patient and their whānau. This plan should also be shared with the health professional completing the post-discharge follow up.

Onward referrals

49. For a patient requiring community-based support, it is suggested that a referral to ACC be made at least 48 hours prior to hospital discharge. The ACC705 form (see Appendix F) should be used to refer the patient for home and community support, interim care, equipment and rehabilitation.

50. For information about facilitating optimal collaboration with ACC, see Appendix F.

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Discharge checklist

51. The discharge checklist in Table 4 (adopted from Health NZ, Southern) has been designed to support health professional decision-making around the safe discharge of a patient with a chest injury.

52. Components of this checklist also support effective processes for transition into the community, aimed at making this as streamlined as possible for the patient and their whānau.

Table 4: Example of discharge checklist

Preservation in lung volume	**Yes or no**
Is the patient getting adequate analgesia on oral agents sufficient for them to cough effectively and take a deep breath?	
Has the patient information handout been provided and explained? (See example in Appendix E)	
Has the patient received instructions and a written handout on breathing exercises?	
Analgesia	**Yes or no**
Does the patient have a prescription for regular paracetamol, celecoxib (if not contraindicated) and oral morphine (if needed)?	
Does their pain relief prescription cover them until their follow-up review (ideally the script should cover 7–10 days post-discharge)?	
Does the patient have ongoing advice about pain management (including a documented plan to reduce analgesia)? This plan should be passed on to the GP or another lead health professional.	
Does the patient have a prescription for antiemetics (if needed) and Laxsol (if taking opioids)?	
Is the patient clear about what to do if pain management is inadequate (see their GP, return to ED or attend urgent care)?	
Is the patient aware of the possible side effects of the analgesic agents they've been prescribed, and been given advice on how to manage these?	
Discharge assessment	**Yes or no**
Has the patient been cleared by the relevant members of the multidisciplinary team and are they functionally deemed safe for discharge?	
Has any equipment needed been ordered and is it available at home for the day of discharge?	

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Are all of the patient's contact details correct?	
Is the patient fit to drive and/or operate heavy machinery, taking into account the impact of any medications and injuries that may limit their movement in a vehicle?	
For advice on travelling by plane following a chest injury, see the relevant airline website.	
ACC information	**Yes or no**
Has the ACC45/46N injury claim form been completed?	
Has an ACC18 form been completed if: • a medical certificate for time off work is required • additional injuries (not included on the ACC45) have been identified.	
Has an ACC7422 early cover form been completed, if the patient requires a one-to-one recovery team member to be allocated to them?	
Does the patient know how to contact ACC? Ensure the following information has been documented in the patient information sheet: either the recovery team member name and contact if known, or via 0800 101 996 if a recovery team member has not been allocated or their name is not known.	
Follow-up	**Yes or no**
Has the patient been booked for a follow up within one week of discharge? Suitable follow-up options include: • GP • urgent care • trauma service. Note that telehealth options can be provided if transport is an issue (ACC may also be able to support transport costs if needed). Discuss this as an alternative with the patient.	
Has a letter been given to the patient to provide to the health professional booked to complete their follow up?	
Is the patient or other support person aware of the need to return to ED if they become more breathless, get a temperature, feel unwell or become confused?	
Is the patient over 65 or have they been assessed as clinically frail? If so, should they be referred to a local falls and fracture prevention team? If the patient requires community physiotherapy, refer to the physiotherapy section of this guideline for advice on referral options.	

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Management of chest injury in special populations

Paediatrics

53. Appropriate management of paediatric trauma requires health professionals to recognise and appreciate the physiological differences between adults and children and how this reflects in the pattern of injury.

54. In cases of chest injury, a key difference is the compliance of the chest wall, which is more elastic in children due to the greater flexibility of the ribs. This increased elasticity allows greater deformation of the chest wall before fracturing of the ribs occurs. As a result, significant internal injuries can occur even in the absence of visible damage to the external chest wall. Additionally, isolated chest injury is rare in children, with chest injury often associated with injury to other systems such as the head or abdomen.

55. Children also vary in their ability to understand and participate in assessment depending on their age, development and response to trauma.

56. For the specific management of chest injury in the paediatric population, refer to the Starship Hospital guidelines.

Active management of pain

57. Adequate analgesia is important in paediatric trauma. Early use of appropriate analgesia will help to reduce the distress of the child and make physical assessment more accurate.

Pain assessment tools for children

58. The choice of pain assessment tool depends on the child's age and level of development. There is no single method of pain assessment that has been validated for children of all ages.

59. The tools recommended by Starship Hospital for use in Aotearoa New Zealand are:

- visual analogue scale and/or numerical rating scale
- faces pain scale (revised) – FPS-R
- face, legs, activity, crying and consolability – FLACC
- revised FLACC.

60. Refer to local guidelines or consult with your local paediatric service for pain assessment tools in use at your facility.

Analgesia for children

61. Dosing regimens for paediatric analgesia are weight-based, so a weight for the child should be recorded as soon as possible.

62. **Multimodal analgesia –** a combination of analgesics, including paracetamol, NSAID and opiates – is the most effective approach to pain management in children. The most common routes of administration are oral and intravenous.

63. Refer to local guidelines for dosing regimens, preparations and prescribing considerations; and consider referring to Starship Hospital's analgesia overview for pain guideline.

64. **Regional analgesia –** regional anaesthetic techniques can be prescribed by an anaesthetist or acute pain service. Children receiving regional anaesthesia must be cared for by a registered nurse who is appropriately trained in the safe management of these techniques.

65. **Non-pharmacological pain management** – non-pharmacological measures to manage pain are also important, this includes caregiver presence, explanation and distraction techniques. Play-based distraction strategies are recommended where possible and a paediatric physiotherapist or play specialist, if available, may be able to assist and recommend a range of strategies and appropriate communication.

66. Moving children out of their hospital room and into a treatment room for procedures where possible will help a child associate their own room with a feeling of safety.

Recognition of deterioration

67. Children are more at risk of rapid physiological deterioration than adults. Regular assessment and documentation of vital signs are essential for the early recognition of clinical deterioration.

68. Use of the national paediatric early warning system (PEWS) helps identify children who have deviated from acceptable, age-appropriate limits. The PEWS is a tool to identify signs of deterioration but does not replace skilled clinical assessment and decision-making.

Admission and shared care

69. The decision on the appropriate admitting service is dependent on local guidelines.

70. Most management of major trauma in children falls under the specialty of paediatric surgery in Aotearoa New Zealand. However, this is a tertiary service and is not available at all hospitals expected to manage a child with a chest injury.

71. For services that do not have a paediatric surgery admitting service, a shared care model between general surgery and paediatrics may be considered. This allows for operative and non-operative management of traumatic injury by a surgeon, as well as expertise from a paediatrician on other facets of patient care including medication and fluids.

Clear referral guidelines

72. Clear guidelines must be in place and readily accessible for referral from a non-tertiary service to a tertiary paediatric surgical service. These guidelines should be mutually discussed and agreed between services to reduce barriers to appropriate transfer of care.

Parents, caregivers and whānau

73. Parents, caregivers and whānau play a key role in the safe and effective management of trauma in a child. They should be involved in the assessment and care of their child, where appropriate, and provided with opportunities to ask questions, express concerns and make informed decisions.

Psychosocial support

74. The child needs to be monitored for signs of emotional distress, such as changes in behaviour, sleep disturbances or withdrawal from activities and social interactions. Early identification of psychological distress can help ensure appropriate and timely psychological support is provided.

Rehabilitation

75. Rehabilitation for a child after a chest injury should start as soon as possible to improve respiratory function and prevent deconditioning. The child should be encouraged to sit up and start moving around as soon as analgesia has been optimised and they have been medically cleared to do so.

76. Any child with a chest injury should be referred to a physiotherapist to optimise respiratory function and status. Upper limb stiffness can be common after chest injury and, as such (if not contraindicated by concurrent injuries), a child should be encouraged to play to maintain their range of movement. Paediatric physiotherapists should be involved early to instigate play-based therapy, and further support can be sought through a referral to the local hospital play team, in accordance with local policy.

Non-accidental injury

77. Child abuse and neglect are serious health issues in Aotearoa New Zealand and healthcare providers need to be alert for signs and symptoms that require further assessment or are indicative of violence and/or abuse. If staff suspect that a child's injuries are non-accidental in nature, they should immediately notify and work in collaboration with appropriate senior staff and follow their local policy on the management of suspected child abuse and neglect.

Older adults and the clinically frail

78. Providing optimal trauma care for older adults and the clinically frail with a chest injury requires consideration of any comorbidities and diminished physiological reserves. Minor forces applied to the chest wall of an older adult can still result in significant injury with high associated morbidity and mortality (eg, following a fall from standing height).

79. The use of shared goals of care is particularly important for the management of this group of patients to facilitate conversations between health professionals, patients and their whānau that:

- explore values
- review the care and treatment options available
- agree upon the goal of care for the current admission
- provide direction if the patient deteriorates.

80. Shared goals of care should be discussed early during an unplanned or acute admission, such as for chest injury. Table 5 outlines important considerations in managing chest injury for those with frailty or older adults.

Table 5: Considerations in managing chest injury for patients with frailty and older adults

Early frailty assessment and referral to specialist services • Frailty is characterised by reduced physiological reserve across multiple organ systems, and can be more predictive of outcome in trauma than age. Patients should be assessed for frailty with a validated tool. For example, the Rockwood clinical frailty scale is a validated tool for people aged over 65 years. • Early identification of frailty in a patient with a chest injury and the early involvement of the multidisciplinary team is essential to provide targeted management to reduce the likelihood of adverse health outcomes. Frailty should not be used as a barrier to accessing care.	**Lower threshold for CT imaging** • Early identification of chest and chest wall injury in an older adult is recommended. CT scan is the preferred diagnostic tool, due to the failure of X-ray alone to detect fractures and identify lung contusions. • Undiagnosed injuries can significantly impact prognosis and the development of the appropriate treatment plan. • Rib fractures resulting from a fall from standing height are considered a fragility fracture and bone health assessment should be undertaken, with consideration given to starting bisphosphonate therapy.
Appropriate analgesic strategies • The older adult is at risk for under-treatment of pain. Prompt analgesia and regular assessment of pain is important for the older adult to encourage and enable deep breathing, coughing and early mobility. These techniques contribute to a lower risk of complications such as atelectasis and pneumonia. • Creatinine clearance should be calculated using lean body weight (Cockroft-Gault calculator) to guide prescribing, rather than using eGFR which usually over-estimates renal function in older adults. Paracetamol dose should be reduced to TDS if weight <50kg. • Discussion with anaesthetics and/or the acute pain team, and the geriatric or general medicine team, can help to guide analgesic decision-making for the plan of care.	**Adjunct medications** • The prescription of various adjunct medication has already been described in the nursing section of this guideline. • In addition, it is important to consider that dosage and timing may need to be adjusted if the older adult is receiving regional anaesthesia, and this should be discussed with anaesthetics and/or the pain service. • Consider high protein supplement drinks between meals particularly if there are any wounds or the patient is malnourished. Beware of re-feeding syndrome if they are malnourished. Early referral to the dietetics service is encouraged.
Delirium • Delirium is a common complication of trauma in the older adult, and it is recommended that a 4AT score is administered regularly for early detection. 30% of delirium can be prevented. Ensuring sensory aids are in situ, such as glasses and hearing aids, providing access to natural light, minimising bed changes, maintaining oral hygiene, and maintaining adequate hydration and nutrition are all important. • PINCHES ME is a tool to investigate causes if delirium occurs.	**Frailty in Māori** • Early frailty assessment for injured Māori is especially important, as Māori experience frailty at a younger age than non-Māori. Te ao Māori (the Māori world view) holds a strength-based perspective of ageing rather than focusing on deficits. The focus of care should be on who the person is and what they are still able to do, while recognising that there are a number of factors that can have a positive effect on recovery such as: o feeling engaged and connected to people o feeling useful and having a purpose

• Abbey pain score can be used to assess pain if the patient is not communicating. Hearing assist devices can dramatically improve patient engagement and prevent or treat delirium. Consider providing written information or a communication book to aid recall.	○ maintaining a sense of autonomy, mana and confidence ○ holding a strong cultural identity and spiritual wellbeing. • The clinical team can contribute to the above factors by: ○ involving whānau in care and encouraging visiting ○ practising tikanga (understanding and following the correct way of doing things according to Māori customs and beliefs) ○ supporting spiritual needs through offering referrals to Māori health or chaplaincy services.
Early engagement with whānau • Next of kin should be contacted with urgency in the older adult chest trauma patient, as they may have important information regarding the cause of the trauma, the person's previous function and their cognition, and this will inform care planning and trajectory. • Next of kin can also be important care partners, for example by reminding the patient to do deep breathing exercises hourly when awake, encouraging early mobility (patients can experience 3% muscle loss per day in a hospital bed), preventing and treating delirium, advocating for their needs, assisting with nutrition and hydration, and recognising deterioration.	**Thorough work up of cause of trauma** • If chest trauma was the result of a fall, a falls assessment should be undertaken including ECG, lying and standing blood pressures, review of polypharmacy (Beers Criteria identifies potentially inappropriate prescribing), footwear, gait exam, considering cognition and alcohol history, and assessing for neuropathy. • If trauma was the result of a motor vehicle event, consider cognition and disability that may trigger a safety to drive review once recovered.

Discharge planning

81. For any patient over 65 years with comorbidities, frailty, functional impairment, cognitive impairment or advanced age (> 80 years), consider referral to older people's health services prior to discharge from the emergency department.

82. Specific considerations for older adults on discharge should include an assessment of medical co-morbidities, cognitive function, osteoporosis and access to follow-up services.

Under-served populations

83. Caring for under-served populations requires a thoughtful, informed approach to address their unique needs. Without specific consideration of the needs of these populations, healthcare systems risk perpetuating existing health inequities and failing to provide effective, compassionate and culturally competent care. Examples of populations in Aotearoa New Zealand that are known to experience disparities in healthcare outcomes include:

- Māori and Pacific people
- the disabled community
- migrant communities and those who speak English as a second language
- those who live in low socioeconomic areas or rural or remote locations
- those with mental health comorbidities.

84. Although inequities exist due to a complex combination of factors at all levels of the health system, health professionals can make a difference to the experience of care by prioritising these populations for specific needs-based advocacy and support in navigating a health system that is not designed for them.

Key objectives in caring for under-serviced populations with chest injury

Proactive approach to ACC

85. ACC provides an extensive range of support services to people who experience injury in Aotearoa New Zealand. However, navigating the ACC system can be confusing for patients and health professionals, and incomplete or missed steps within the process can result in patients missing out on services they are eligible for.

86. For a guide to navigating the process of notifying ACC of a patient's injury, see Appendix F.

87. Once familiar with the ACC navigation process, health professionals should ensure the required forms have been completed for all patients. This is especially important for under-served populations as they are often overrepresented in lower-socioeconomic brackets. As such, early and correct completion of required ACC claim forms is crucial for ensuring compensation for time off work and reducing delays in receiving support services.

- **Service navigation** – ACC funds several services that patients with accepted ACC claims can self-refer to, for example community-based physiotherapy or rongoā Māori (traditional Māori healing practices) services. As navigating the self-referral process may be challenging, health professionals should consider taking a role in assisting with this, so appointments are booked prior to a patient's discharge.
- **Travel and transport costs** – In some circumstances, support is available from ACC if a patient is required to travel for treatment or rehabilitation for their injury. This support may need to be approved prior to travel. Health professionals arranging outpatient or community rehabilitation appointments may need to help patients navigate the cost reimbursement process; this is especially important for those who live in rural or remote areas, and for those who live in low socio-economic circumstances for whom travel costs are a financial burden.

Early engagement with other services

88. Health professionals should be aware of what local services are available to provide additional support for patients and how to refer to these services. See the allied health section of this guideline for information on relevant allied health referrals.

- **Māori health services** are established at most hospitals across Aotearoa New Zealand to provide whakawhānaungatanga (relationship building, connection) and support for Māori patients and whānau during their hospital and healthcare journey. These services work collaboratively with health services to promote equitable care and outcomes, where possible, assist with connecting whānau with appropriate community support services, and support health services to meet the needs of Māori whānau.
- **Pacific health services** empower Pacific people in their recovery and support a culturally responsive health system for all Pacific people in hospital and in the community.
- **Interpreting services** should be made available to a patient who does not speak English as a first language, or who has hearing loss and uses New Zealand Sign Language. It is best practice to offer use of interpreting services early in a patient's admission to assist in providing safe and adequate healthcare, and to empower them to participate in their health decision-making.

Service access assistance

89. Under-served populations often experience greater barriers to healthcare access. Consider the following points to optimise how these populations are supported through their recovery.

- **Is the patient enrolled with a primary healthcare provider?** And are they able to make an appointment with their practice? For those not enrolled with a GP, they will need tailored advice around follow-up for their injury. This may include options such as hospital outpatient clinics, the national telehealth service or being seen in-person at an urgent care clinic. Health professionals should also take the time to provide advice on how to find a primary healthcare provider that is enrolling new patients.
- **Does the patient live in a rural and/or remote location?** If so, provide alternatives to face-to-face appointments to facilitate their ability to engage with healthcare facilities. This can be provided through phone consults or via video calling. Patient preference, phone connectivity, Wi-Fi coverage and general access to these adjuncts needs to be discussed with the patient prior to discharge.
- **Has the patient been supported with self-management techniques?** For those patients who are likely to struggle to access services on discharge this is a particular priority. Integration of self-management and education for a patient and their whānau should be explicitly covered with them before discharge. Patient information (see Appendix E) should be provided to facilitate this, considering a multimodal approach to sharing information.

National chest injury guideline

Part C: Supporting information

Definitions, translations and acronyms

Term	Definition
<	Less than
>	Greater than
≤	Less than or equal to
≥	Greater than or equal to
ACC	Accident Compensation Corporation
ACU	Acute care unit
APMS	Acute pain management service
APS	Acute pain service
BD	Twice a day
CrCL	Creatinine clearance
ECG	Electrocardiogram
ED	Emergency department
HDU	High dependency unit
HTX	Haemothorax
ICU	Intensive care unit
IV	Intravenous
LOS	Length of stay
MAOI	Monoamine oxidase inhibitors
NSAID	Non-steroidal anti-inflammatory
NZEWS	New Zealand early warning score
PAR	Patient at risk
PCA	Patient-controlled analgesia
PEWS	Paediatric early warning system
PO	Per oral / by mouth
PPI	Proton pump inhibitor

PRN	As required
PTX	Pneumothorax
Q2hrly	Every two hours
QID	Four times a day
SC	Subcutaneous
SSRF	Surgical stabilisation and rib fixation
SSRIs	Selective serotonin reuptake inhibitors
STUMBL	STUdy of the Management of BLunt chest wall trauma
TDS	Three times a day
VTE	Venous thromboembolism

Roles and responsibilities for this guideline

Role	Responsibilities
Health NZ staff involved in the care of trauma patients	Make themselves familiar with this guideline and the recommendations.
Local trauma leads	Dissemination of the guideline and supporting any local adaptation and implementation. Complete 12- and 24-month survey following introduction of the guideline.

Monitor and review of this guideline

90. A key performance indicator that measures and demonstrates the execution, compliance and/or effectiveness of this guideline is incorporated into routine audits/evaluations undertaken by, or on behalf of the Owner.

91. The KPI is:

> the number of Health NZ trauma services that have a comprehensive care guideline in place for patients with a chest injury at 12- and 24-months following introduction of the national chest injury guideline. This allows Te Tāhū Hauora to reach out to sites who may need assistance in developing and implementing a bespoke local pathway.

92. Having this KPI in place allows Te Tāhū Hauora to reach out to sites and services that may need assistance in developing and implementing a bespoke local pathway.

National chest injury guideline

Associated documents

Associated policies, procedures and resources

Chest injury guideline component checklist

Caring for your chest injury patient information handout

Expert advisory group and wider expert reference group member list

References / useful websites

Paediatrics

NICE (National Institute for Health and Care Excellence), ***Rehabilitation after traumatic injury*** – https://www.nice.org.uk/guidance/ng211

Royal Children's Hospital Melbourne, *Chest injury* – https://www.rch.org.au/trauma-service/manual/chest-injury/

Royal Children's Hospital Melbourne, ***Pain management*** – https://www.rch.org.au/trauma-service/manual/Pain_Management/

Starship Hospital, *Abuse and neglect* – https://starship.org.nz/guidelines/abuse-and-neglect/

Starship Hospital, ***Chest injury* – https://starship.org.nz/guidelines/chest-injury/**

Starship Hospital, ***Paediatric pain assessment*** – https://starship.org.nz/guidelines/paediatric-pain-assessment

Starship Hospital, ***Pain: analgesia overview for pain* – https://starship.org.nz/guidelines/pain-analgesia-overview**

Starship Hospital, ***Regional infusions for pain*** – **https://starship.org.nz/guidelines/regional-infusions-for-pain**

Older adults and the clinically frail

BPAC NZ, *Frailty in older people: A discussion* – https://bpac.org.nz/2018/frailty.aspx

National Library of Medicine, *Number of rib fractures thresholds independently predict worse outcomes in older patients with blunt trauma* – https://pubmed.ncbi.nlm.nih.gov/27932031/

Our Hub, *Shared goals of care: Ngā whāinga tauwhiro* – https://ourhub.hawkesbay.health.nz/app-and-links/shared-goals-of-care/

Science Direct, *Frailty is associated with long-term outcomes in older trauma patients: A prospective cohort study* – https://www.sciencedirect.com/science/article/abs/pii/S0020138323009828

Te Tāhū Hauora, *Frailty: Te wairuhi (Frailty care guides 2023)* – https://www.hqsc.govt.nz/resources/resource-library/frailty-te-wairuhi-frailty-care-guides-2023/

Under-served populations

ACC, *Issuing medical certificates* – https://www.acc.co.nz/for-providers/treatment-recovery/issuing-medical-certificates

Health NZ, Capital, Coast and Hutt Valley, *Pacific health* – https://www.ccdhb.org.nz/our-services/a-to-z-of-our-services/pacific-health/

Health NZ, Capital, Coast and Hutt Valley, ***Social work*** – **https://www.ccdhb.org.nz/our-services/a-to-z-of-our-services/allied-health/social-work**

Health NZ, Capital, Coast and Hutt Valley, ***Whānau care services Hutt Valley* –** https://www.huttvalleydhb.org.nz/your-health-services/whanau-care-services-hutt-valley/

Further information

93. For further information about this guideline, email NationalTraumaNetwork@TeWhatuOra.govt.nz.

Disclaimer

94. This document has been developed by Health New Zealand | Te Whatu Ora specifically for its own use. Use of this document and any reliance on the information contained therein by any third party is at their own risk and Health New Zealand | Te Whatu Ora assumes no responsibility whatsoever for any issues arising as a result of such reliance.

Review history

Version	Updated by	Date	Description of changes

National chest injury guideline

Appendix A – Chest injury guideline component checklist

Chest injury guideline component checklist	Yes or no
Use of risk assessment or severity scoring system	
Indications and/or referral processes for: • intensive care team review • acute pain service review • cardiothoracic or rib fixation • physiotherapy • CT guidance	
Prescription and management of: • oxygen therapy • oral analgesia • antiemetics • laxatives • VTE prophylaxis • proton pump inhibitor	
Commencement of: • breathing exercises • mobilising	
Role of: • admitting team • trauma nurse • allied health team	
Vital sign monitoring	
Discharge planning	
Supporting the over 65 year old	
Patient information handout	
Red flags	
Promoting health equity	

National chest injury guideline

Appendix B – Example risk assessment tools

Example rib fracture score

Rib Fracture Score: (Breaks x Sides) + Age Factor

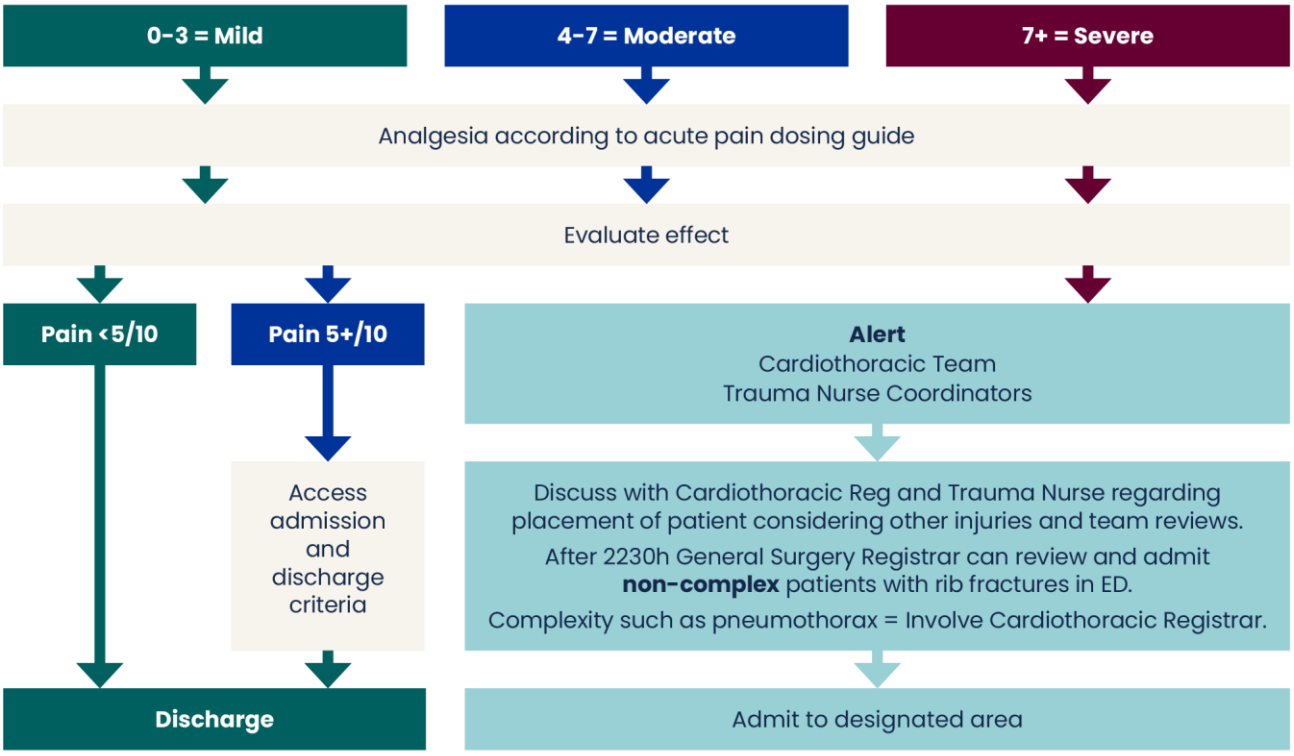
Breaks:	Number of fractures
Sides:	Unilateral = 1, Bilateral = 2
Age Factor:	<50 years = 0 51-60 years = 1 61-70 years = 2 71-80 years = 3 >80 years = 4

Severity scoring

0-3	Mild
4-7	Moderate
>7	Severe

Source: Health NZ, Capital, Coast and Hutt Valley

Manage rib injuries



Discharge criteria and plan

- **Physio review - If the patient is either:**
  - Age ≥ 65 years, or
  - Māori and age ≥ 55 years, or
  - Rib Fracture Score = 4-7, or
  - Impaired function
- **All patients:**
  - Complete and give ACC documents
  - Give prescription and discharge documents
  - Give Chest Trauma information sheet

Admission criteria (any one)

- Rib fracture score = 7 or more
- Uncontrolled pain
- Increased respiratory rate: > 25
- Decreased SpO_2: <91% on room air
- Chest drain
- Unable to mobilise
- Unable to discharge from ED in 6 hours

Source: Health NZ, Canterbury | Waitaha

National chest injury guideline

Appendix B – Example risk assessment tools

Example STUMBL score

On admission ALL patients need:

1. Surgical Registrar review
2. Registrar to calculate STUMBL score and enter into box
3. Risk assessment:
   - Calculate STUMBL score and stratify patient into stream below. **CIRCLE** the stream
   - Flail segment, Pulmonary contusion on imaging or STUMBL score >30: **Proceed to RED box**
4. Referral to Physiotherapist
5. Refer all patients >65 to geriatric services

STUMBL SCORE:

+ 1 for every 10 years over the age of 10
+ 2 per 5% drop in Sa02 under 95%
+ 3 per individual rib # (2 #s on 1 rib = +6)
+ 4 pre-injury anticoagulant/ antiplatelet
+5 Chronic lung disease

SCORE 1-10	SCORE 11-30	SCORE >30
Paracetamol 1g PO/IV Q4H and **NSAID** regularly (Ibuprofen 600-800mg TDS, Celecoxib 400mg STAT then 200mg bd) **Consider adding short-acting opioid.**	As per **GREEN** block **PLUS** - Urgent APS/After hours anaesthetic Reg on call review - **Tramadol** 50-100mg PO QID and/or **Strong Opioid** Q2H if alert. (**Sevredol** 10-20mg/ **Oxycodone IR** 10mg) Half dose in elderly. - **Consider PCA** - **Mandatory discussion with HDU/ICU/ACU** **Regional Analgesia Assessment** Patient likely to benefit if: 1. Unable to take deep breath 2. Unable to mobilise to chair 3. Moderate - Severe Pain on Coughing 4. Intolerance of analgesia side effects **Prescribe bowel care, Anti-emetic, Oxygen and VTE prophylaxis**	As per **GREEN** and **ORANGE PLUS** **Mandatory discussion with HDU/ ICU/ACU.** **Strongly consider discussion with Waikato Cardiothoracic surgeon.** **Urgent APS and Anaesthetic review for consideration of early regional anaesthesia.** (Do not wait for signs of deterioration.) **Patients are high risk for developing secondary morbidities (80% Pneumonia, PTX, HTX, Effusion, empyema, LOS > 7 days, ICU, death).**
• If <50kg or frail/elderly reduce dose. • Consider STAT dose Parecoxib 40mg IV if unable to tolerate orals. • Short courses of NSAID have been shown to decrease respiratory morbidity. • Consider co-charting PPI. • Caution with NSAID if hepatic failure or CrCL <30.	• Caution with Tramadol: aged >65, renal impairment, epilepsy or SSRIs. Consider halving dose. • Contraindicated if taking MAOI. • Oxycodone preferred if significant renal impairment. • Long-acting opioids are discouraged in acute settings, escalation is preferable. • Unable to tolerate orals PCA/ regional techniques.	• **EARLY referral to APS/Duty Anaesthetist or after hour Anaesthetist is essential.** • **Duty Anaesthetist (Tga)** • **Duty Anaesthetist (Whk): Via operator.**

Source: Health NZ, Bay of Plenty | Hauora A Toi

National chest injury guideline

Appendix C – Multi-model approach to pain management

Oral, intravenous, patient-controlled analgesia regional blocks

First line analgesia (all patients unless contraindicated)	
Paracetamol	1g PO/IV QID, charted in regular section
	AND
Celecoxib	First dose 400mg PO stat then 200mg PO once daily (regular)

Notes:

- Use IV paracetamol if not able to tolerate oral intake
- <50kg reduce paracetamol dose
- Stat dose IV parecoxib 40mg an option if unable to tolerate oral intake
- Celecoxib is also funded for outpatient management
- Short course of Celecoxib is well tolerated – avoid if CrCl<30ml/min, severe hepatic impairment; cautious use if high elevated cardiac risk – discuss with acute pain management service (APMS) if unsure

Persistent moderate pain on deep breathing or coughing	
Tramadol	50–100mg q4-6h PRN
	AND/OR
Sevredol	20mg q2hrly PRN, dose titration as required (start with 10mg in the older adult)
Consider PCA	
Consider catheter-based regional analgesia	

Notes:

- Avoid using tramadol if >65 years unless discussed with APMS; if tramadol is used in an older patient, start at 50mg dose
- >75 yrs or CrCl<30ml/min: consider reducing dose and/or increasing dose interval of both tramadol (q8-12h) and Sevredol (q4-6h) and monitor for adverse reactions
- Tramadol contraindicated with MAOI use; caution with SSRIs, epilepsy
- Sevredol: should be alert, RR>/=12; in younger patients consider titrating dose upwards or utilising PCA
- Use of long-acting opioids including fentanyl patches is discouraged without APMS review

Moderate–severe pain despite above
Urgent APMS/anaesthetic registrar review
Catheter-based regional anaesthesia

Notes:
APMS will consider adding ketamine infusion especially in younger patients

Source: Health NZ, Capital, Coast and Hutt Valley

National chest injury guideline

Appendix D – Opioid maximum daily upper limit

Estimated CrCl	15 to 75 years old	>75 years old
>45 mL/min	Morphine 10 to 20 mg (PO) OR Morphine 5 to 10 mg (SC)	Morphine 5 to 10 mg (PO) OR Morphine 2.5 to 5 mg (SC)
30 to 45 mL/min	Morphine 5 to 10 mg (PO) OR Morphine 2.5 to 5 mg (SC) OR Fentanyl 25 to 50 micrograms (SC)	Morphine 2.5 to 5 mg (PO) OR Morphine 1 to 2 mg (SC) OR Fentanyl 12.5 to 25 micrograms (SC)
<30 mL/min	Fentanyl 25 to 50 micrograms (SC)	Fentanyl 12.5 to 25 micrograms (SC)

Source: Health NZ, Capital, Coast and Hutt Valley

National chest injury guideline

Appendix E – Patient information handout

Consumer representatives have been actively engaged with the process of designing a new information handout for people who experience chest injury in Aotearoa New Zealand.

Their lived experience of injury and recovery has shaped the resource below, which has also been through a consultation phase with health professionals and ACC. This resource is free for use across the country.

The patient information handout is available in English, te reo Māori, greyscale, and text-only (for accessibility) at National chest injury project | National Trauma Network.

National chest injury guideline

Caring for your chest injury

Name: ..... ACC claim number: .....

Contacting ACC: Call **0800 101 996** or Recovery Team Member number (if known): .....

Next booked follow up appointment (if known): / / with .....

About your injury

Your rib cage is part of your respiratory (breathing) system and is always moving as you breathe in and out. When you have a chest injury, it may include damage to your ribs, heart, lungs, blood vessels, muscles and/or nerves. It is possible to break more than one rib at a time. A rib can also break in more than one place.

If you injured a bone in your arm or leg, you would normally have a cast around it to keep it still, relieve pain and allow the bone to heal. It isn't possible to use a cast for injuries to your chest. This means it is common to have pain and discomfort during your stay in hospital and for several weeks after you are discharged. However, the pain will ease steadily as your injury heals.

Pain relief

A chest injury is painful. Pain relief is the most effective and most important way of treating it. Take your pain relief regularly at the times the label states, not just when your pain is bad. Aim to stay on top of your pain so that you continue to be comfortable. That is a better way of managing pain than waiting until you get sore and then trying to get comfortable again.

With enough pain relief you should be able to:

- breathe deeply
- cough
- move comfortably throughout your house to do your normal, everyday activities.

Deep breathing, coughing and moving around all help to prevent chest infections. If you cannot do these things, you need to see a health professional to improve your pain management.

As you get better, you will need less pain relief. A health professional can help you to get the right amount of pain relief for as long as you need it.

Pain relief medications can have side effects such as feeling sick, having difficulty going to the toilet and feeling confused. Please contact a health professional if you get any of these symptoms.

Managing your day

When you have a chest injury, it is very important to **stay active** so you don't get chest infections, become too weak or lose fitness. How soon and how well you get moving again depends on your level of pain and nausea and whether you have other injuries.

It is normal to feel tired when you get home from hospital. **Plan rest** times during the day to give yourself a break. Try to stay out of bed during the day and aim to do your normal, everyday activities as much as possible (eg, walking, or making drinks or food).

You need to work out a comfortable **sleeping** position. It is normal to find it painful to lie flat for the first couple of weeks after your injury. You may need to use extra pillows to sleep upright or to support your arms for comfort when sleeping. At first, you may even find it easier to sleep in a reclining, supportive chair.

Returning to work

If your injury has stopped you from working, the Accident Compensation Corporation (ACC) may fund weekly payments from seven days after your injury (once it accepts your claim). This means for the first seven days, you will need to take sick or annual leave in order to receive your pay. After that, ACC may pay up to 80% of your income while you recover to a maximum salary amount.

Weekly compensation can be applied for via the **MyACC** portal at www.acc.co.nz or by contacting ACC and providing your ACC claim number (given at the top of this page and on any ACC paperwork).

When you can return to work depends on the type of work you do, how good your pain control is and what type of medication you are still taking (as you can't drive with some medications).

Discuss time needed off work with a health professional and make a plan for returning.

ACC may also be able to help with costs for travelling to get treatment or rehabilitation. Contact ACC to learn more about what support may be available.

Health New Zealand Te Whatu Ora

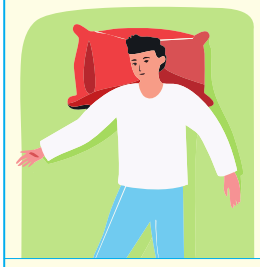
ACC

Te Tāhū Hauora Health Quality & Safety Commission

Tips to help your recovery

Avoid heavy lifting, pulling and pushing. When you are carrying things (eg, laundry or shopping), hold them close to your body.

To get up off a chair or toilet, you may find it more comfortable to avoid bending forward when standing. If you are struggling to get into a standing position, ACC may be able to provide you with aids to make it easier.



Getting out of bed can be hard. Try rolling onto your uninjured side first (if you have one). It's usually easier to use that arm to push up into sitting, as long as you don't have arm injuries that stop you from doing so.

Avoid driving until you can comfortably and safely stop the car suddenly. Some medications will also prevent you from driving – discuss this with your doctor. Check your insurance policy to find out if it sets any conditions on driving that might affect you.

You may find it more comfortable to dress while seated. Place your foot on your opposite leg or another raised surface to help you put on shoes and socks.

Sometimes pain relief medications can give you constipation. Drinking plenty of water and eating high-roughage foods (eg, kiwifruit, prunes) can help prevent this.

Contact sports can increase your pain and cause more injury. Do not play contact sports for at least six weeks. Your doctor can tell you when it is safe to play again.

Smoking can increase your risk of getting a chest infection. Seek help if you want to quit or call Quitline on 0800 778 778.

When to seek help:

From a physiotherapist

If your breathing remains painful or you are struggling to move around comfortably, you can get help from a local physiotherapy clinic. Contact them directly and give them your ACC number.

ACC can help pay for some of the cost of this treatment. (Before the treatment starts, the clinic will tell you if you need to pay a small surcharge.)

From a doctor or nurse (eg, your GP, practice nurse, Urgent Care or through a telehealth service)

Contact them:

- if you get a fever, are coughing up yellow or green phlegm (pronounced 'flem'), you have difficulty breathing or more pain on breathing, or swelling occurs in your chest area
- if you need help increasing or reducing your pain medication, or to get help managing side effects
- if you need more time off work due to your injury or need support returning to your job (eg, light duties). Doctors or nurse practitioners can write medical notes for this
- to check when it is safe for you to drive, fly and play contact sports.

In an emergency

If you suddenly become short of breath, start coughing up blood, or get severe chest wall swelling or more pain: **go to the nearest hospital Emergency Department or dial 111 for an ambulance.**

National chest injury guideline

Te tiaki tō wharanga poho

Ingoa: ..... ACC nama kerēme: .....

Whakapā atu ki a ACC: **0800 101 996** te Nama Recovery Team Member (ina mōhiotia: .....

Whakarite hui (ina mōhiotia): / / me .....

Mō tō wharanga

He wāhanga ōu kaokao o tō pūnaha arahau, ā, neke haere i tō pupuri hā, i tō tuku hā. Ka whara tō poho ka whara hoki pea ōu kaokao, tō manawa, ōu pūkahukahu, ngā ia-toto, ngā uaua, ngā ioio hoki. Ka āhei tētahi kaokao, ētahi kaokao rānei te whati i te wā kotahi. Ā, ka rua pea ngā whatinga o te kaokao kotahi.

Ina whati tētahi kōiwi i tō ringa, i tō waewae rānei ka uhia ki tētahi pāpāuku hei pupuri, kia mārō e whakaiti ai i te mamae kia mahu te koiwi. Tē taea te mahi tētahi pāpāuku mō ngā wharanga o tō poho. Nā konei he nui pea te mamae i te wā kei te hōhipera koe me ngā wiki a muri ake i tō putanga. Ka iti haere te mamae i tō wharanga e mahu ana.

Rongoā patu mamae

He tino mamae te wharanga poho. Heoi anō ko te kai i te rongoā patu mamae te mahi pai rawa hei haumanu. Kia auau te kai rongoā i ngā wā ka tohua i te tapanga, kaua anake i te wā ka tino mamae koe. Me āta whai tohutohu koe kia patua te mamae kia noho hāneanea koe. He huarahi pai hei whakahaere mamae atu i te tatari kia mamae anō koe.

Mēnā ka nui pai te rongoā ka āhei ai koe ki te:
- hā hōhonu
- maremare
- neke haere i tō whare kia mahia āu mahi o ia rā, o ia rā.

Mā te hā hōhonu, te maremare, me te neke haere ngā mahi pai hei ārai i ngā mate o te uma. Ki te kore e taea e koe ēnei mahi, me toro atu ki tētahi mātanga hauora kia whakapai ake i tō whakahaere mamae.

Ka ora haere, ka iti tō kai rongoā patu mamae. Mā tētahi mātanga hauora koe e āwhina kia tika te nui o te rongoā patu mamae hei kai māu mō te wā e tika ana.

He mate āpiti tō ētahi rongoā patu mamae pērā i te rongo māuiui, te uaua o te haere ki te wharepaku, me te rangirua. Me whakapā atu ki tētahi mātanga hauora ina pā mai ētahi o ēnei tohumate.

Te whakahaere i tō rā

Mehemea he wharanga poho tōu, he mea nui kia **pukumahi tonu** kia kore ai koe e pāngia ki tētahi mate poho, ka ngoikore haere, ā, ka iti tō pakari. Mō te piki kaha, piki ora kei te āhua kaha o te mamae, te paipairuaki me ētahi atu wharanga āu.

He mea noa te rongo ngenge i tō hokinga ki te kāinga mai i te hōhipera. **Me whakarite e koe he wā whakangā** i te rā hei whakatā. Me karo te hiahia noho moenga i terā, ā, ka aro kē atu ki te mahi i āu mahi o ia rā ina taea (arā, te hīkoi, te mahi inu, te mahi kai).

Me āta whakarite te āhua o te takoto **kia hāneanea te moe**. He mea noa te rongo mamae i a koe e takoto tīraha ana i ngā wiki whaimuri i tō wharanga. Ka hiahia pea koe ki ētahi atu urunga kia tika tō moe, kia tautoko rānei i ōu ringaringa e hāneanea ai tō moe. I te tīmatanga ka māmā ake pea te moe i tētahi tūru tīpapa, tūru tautoko.

Te hokinga ki te mahi

Ki te kore koe e āhei ki te hoki ki te mahi nā tō wharanga ka āwhinatia pea koe e te ACC mā te utu ā-wiki nei mai i te whitu rā i muri i tō wharanga, (ina mana tō kerēme). Nā reira, mō ngā rā tuatahi e whitu, me whakarite e koe ōu rā māuiui, ōu hararei ā-tau rānei e whiwhi tonu ai koe i tō utu.

Whaimuri i tērā, ka utu pea e ACC ki te 80% o tō utu ā-tau nōu e whakaora haere ana.

Ka āhei koe ki te tono utu ā-wiki mā te tāwaha **MyACC** kei www.acc.co.nz mā te whakapā rānei ki a ACC me te hoatu i tō nama kerēme (kei runga ake o te whārangi nei, kei ngā pepa ACC rānei).

Mō tō hokinga ki te mahi kei te āhua tonu o te momo mahi ka mahia e koe, tō āhei ki te whakahaere mamae, me te āhua o te rongoā e kai tonu ana koe (tē taea te hautū waka ina kai ana i ētahi tū rongoā).

Me kōrero tahi me tētahi mātanga hauora mō te wā whakatā i te mahi me te hokinga atu.

Ka taea hoki pea e ACC te āwhina i a koe mō te haere kia maimoa, kia haumanu rānei. Whakapā atu ki a ACC kia mōhio mai koe he aha ngā momo tautoko kei reira.

Tohu aroha kia ora koe

Kaua e hiki mea taumaha, te kume, te pana. Ina hari ana koe i ētahi mea (arā, mea horoi, mea hoko), me pupuri tata ki tō tinana.

Ina raru ana koe kia puta i te tūru i te wharepaku rānei, ka uaua pea te piko whakamua i a koe e tū ana. Mēnā he uaua te tū kei a ACC he taputapu hei āwhina.

Ka uaua pea te puta i te moenga. Me huri pea ki tō taha ora i te tuatahi (mēnā he taha ora). He māmā ake te mahi i tō ringa o tō taha ora kia noho ake, mēnā kāore he wharanga ringa hei aukati.

Kaua e hautū waka kia āhei rā anō koe ki te hautū me te whakatū ohorere i te waka. Kei ētahi rongoā te aukati i tō hautū waka – me kōrero ki tō rata. Tirohia tō kaupapa here inihua mō ngā tikanga e pā ana ki te hautū waka.

He māmā ake pea te whakamau kākahu i a koe e noho ana. Waiho tō waewae ki runga o tērā atu waewae tauaroki tētahi papa teitei rānei hei āwhina mō te mau hū, tōkena rānei.

I ētahi wā ka whakararu ētahi rongoā patu mamae i te āhei ki te tiko. Me kaha inu wai me te kai i ngā kai weu (arā, huakiwi, paramumenge) hei aukati.

Ina tākaro hākinakina pā ka kaha ake te mamae ka whara anō koe. Kaua e tākaro hākinakina pā mō te ono wiki pea. Mā tō rata e kī atu āhea koe e hoki atu ki te tākaro.

Mā te kaipaipa ka piki te tūraru kia pokea te poho. Rapua he āwhina ki te hiahia whakamutu koe waea atu rānei ki a Quitline 0800 778 778.

Rapu āwhina:

Mai i tētahi Kaihaumanu koiri

Mēnā he mamae tonu kia hā koe, ā, he uaua te neke haere he āwhina kei tētahi whare haumanu koiri. Whakapā tōtika atu hei hoatu i tō nama ACC.

Mā ACC koe e āwhina ā-pūtea nei mō te utu o tēnei maimoatanga. (I mua i te tīmatanga o te maimoa ka whakamōhio atu te whare hauora mēnā he utu anō māu.)

Mai i te rata, te nēhi rānei (arā, tō ake rata, nēhi, Urgent Care, he ratonga hauora ā-waea rānei)

Waea atu:

- ki te pāngia koe ki tētahi kirikā ki te maremare wharo kōwhai, kākāriki rānei ('flem' te whakahua), he uaua te hā, he mamae rānei te hā, ka pupuhi rānei i te wāhanga o tō poho
- ki te hiahia āwhina koe kia piki ake te kaha o tō rongoā patu mamae, āwhina rānei hei whakahaere i ngā mate āpiti, hei whakaiti rānei
- ki te hiahia wā whakatā anō i tō mahinā tō wharanga, he tautoko kia hoki ki tō mahi (arā, mahi māmā). Kei ngā rata me ngā nēhi te mana hei tuhi kupu mō tēnei
- kia mōhio koe mō āhea hei hautū waka anō te rere, te tākaro hākinakina pā hoki.

Mō te ohotata

Mēnā ka ohorere te kore hā, te maremare toto, ka kino te pupuhi poho, ka kino iho rānei te mamae: me haere ki te Tari Ohotata o te hōhipera e tata ana, waea atu rānei ki a 111 mō tētahi waka tūroro.

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Appendix F – ACC notification process

ACC45 form

Patients who experience chest injury should have an **ACC45** form submitted as soon as possible, which will provide them with an ACC claim number for their injury. Those involved in the clinical care of these patients should ensure the **ACC45** has been completed correctly (often this is done in the ED or primary care or urgent care facility) and filed appropriately, according to local requirements, so that the claim is successfully received by ACC. The completion of an **ACC45** should also be checked by the receiving inpatient ward staff on admission as a safety net.

ACC18 form

Prior to discharge, any additional injuries that have been found upon tertiary survey or subsequent examination, which were not listed on the ACC45 form, should be included on an **ACC18** form (listing the severest injuries first), so that ACC is notified that the claim has expanded.

It is crucial that the claim sent to ACC reflects all injuries sustained by the patient to reduce any barriers or delays to accessing clinically necessary rehabilitation services.

The **ACC18** form also doubles as the medical certificate for those unable to return to work or who need to return at reduced hours beyond the first 14 days. Early and correct completion of medical certificate paperwork will help to ensure patients are compensated for any time off work and do not experience any delays in receiving compensation they are eligible for.

ACC705 form

Additional forms that may need to be completed in advance of patient discharge include the **ACC705,** which relates to referral for support services on discharge. This form describes the patient's injury (or injuries) and any other pre-existing medical conditions and details the community support services they require from ACC for a safe discharge.

This form should be sent to ACC at least 48 hours prior to the planned discharge date. This form can be submitted without the ACC18 having been submitted.

ACC7422 form

Patients who have complex multi-trauma and are likely to require significant support needs on discharge should be flagged early to ACC via the **ACC7422** (early cover application) form. ACC can then work with the hospital multidisciplinary team to assess the claim, assign an ACC recovery team member, if required, and contribute to planning the patient's specific support needs. Ideally the **ACC7422** form should be completed as soon as possible in the hospital admission.

This form can be submitted without the ACC18 having been submitted.

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Appendix G – Expert advisory group members

A call for expressions of interest for the chest injury expert advisory group was put out in late 2023 to the wider trauma sector.

A group of enthusiastic stakeholders from the sector was established through this call: see the list of members below. The group shaped a programme of work, with the development of this national guideline as the key deliverable.

Te Tāhū Hauora, Health NZ, the Trauma National Clinical Network and ACC would like to thank the expert advisory group members for their enthusiasm throughout this project and their dedication to improving care for patients who experience chest injury in Aotearoa New Zealand.

Name	Role	Organisation
Brecon Wademan	Cardiothoracic surgeon	Health NZ, Capital, Coast and Hutt Valley
Claire Hitchcock	Trauma nurse coordinator	Health NZ, Nelson Marlborough
Fiona Gutschlag	Physiotherapist	Health NZ, Bay of Plenty | Hauora a Toi (Whakatāne Hospital)
Hannah Watkin-Brown	Allied health consultant	Health NZ, Auckland | Te Toka Tumai
Harsh Singh	Cardiothoracic surgeon	Health NZ, Canterbury | Waitaha
Jacques Marnewick (Chair)	Clinical lead, serious chest injury project General surgeon Trauma medical director	Health NZ, Bay of Plenty | Hauora a Toi
James Moore	Co-lead, Trauma National Clinical Network Intensive care physician Anaesthetist	Health NZ, Capital, Coast and Hutt Valley
Jeremy Webber	Clinical director General practitioner	Rural Health Network
Jessica Drummond	Programme manager	Te Tāhū Hauora

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Jessica Lockett	Quality improvement advisor	Te Tāhū Hauora
Julie Wilson	Health partner	ACC
Kat Quick	Clinical lead, trauma rehabilitation	Te Tāhū Hauora
Keith Todd	Programme manager	Trauma National Clinical Network
Mandy Turner	Urgent care physician	Accident and Healthcare Tauranga
Max Raos	Co-lead, Trauma National Clinical Network Emergency medicine specialist	Health NZ, Counties Manukau
Michael Keane	Data analyst	Te Tāhū Hauora
Nicholas Longley	Emergency medicine specialist	Health NZ, Waitematā Northern Rescue Helicopter Trust
Pamela Fitzpatrick	Trauma nurse specialist	Te Toka Tumai Auckland
Sheila Malcolmson	Clinical lead, inpatient pain management service Anaesthetist	Health NZ, Hawke's Bay | Te Matau a Māui
Victoria Lai	Allied health critical care educator Lecturer Physiotherapist Chair of cardiorespiratory special interest group	Health NZ, Auckland | Te Toka Tumai Auckland University of Technology Physiotherapy New Zealand

We would also like to extend our thanks to past members of the expert advisory group.

Name	Role	Organisation
Ian Civil	Vascular and trauma surgeon	Health NZ, Auckland | Te Toka Tumai
Kendra Sanders	Programme manager, National Clinical Networks	Health NZ
Melissa Webb	Allied health team leader, trauma and orthopaedics	Alfred Health, Victoria
Orla Fowden	Critical care paramedic	Hato Hone St John
Tony Mottershead	Programme manager	Te Tāhū Hauora

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Appendix H – Wider expert reference group members

In addition to the expert advisory group, expertise and advice was sought from a range of health professionals and consumers across Aotearoa New Zealand while developing this guideline document.

Te Tāhū Hauora, Health NZ, the Trauma National Clinical Network and ACC would also like to thank the following people for supporting this work.

Name	Role	Organisation
Caroline Juniot	Health sector partnerships manager	ACC
Chris Nash	Physiotherapist	Health NZ, Canterbury | Waitaha
Colin Woodhouse	Consumer representative	N/A
Deborah Keane	Physiotherapist Clinical lead, trauma	Health NZ, Canterbury | Waitaha
Donna Smith	Professional practice fellow, School of Physiotherapy	University of Otago
Grant Christey	Clinical lead, Te Manawa Taki Trauma System General and trauma surgeon Co-chair trauma quality improvement rōpū Rangatira	Health NZ, Waikato
Holly Britton	General internal medicine physician Geriatrician	Health NZ, Hawke's Bay | Te Matau a Māui
Kat Fox	Senior clinical quality advisor	ACC
Lisa Starnes	Occupational therapist	Focus on Potential
Lizz Carrington	Lecturer, School of Physiotherapy	University of Otago
Maggie Robson	Provider education lead	ACC
Mark Rogers	Consumer representative	N/A
Matt Sawyer	Trauma nurse specialist	Health NZ, Auckland | Te Toka Tumai (Starship Hospital)

Maria Gibbons	Consultant geriatrician	Health NZ, Capital, Coast and Hutt Valley
Michelle Tonks	Physiotherapist	Health NZ, Waikato
Natasha Jones	Section head, occupational therapy	Health NZ, Counties Manukau
Rebecca Coats	Trauma nurse coordinator	Health NZ, Southern (Southland Hospital)
Sarah Shannon	Trauma service allied health clinical lead	Health NZ, Bay of Plenty | Hauora a Toi
Sarah Warren	Team leader, partnered recovery	ACC
Shanthi Ameratunga	Paediatrician Public health physician	Health NZ, Counties Manukau
Terry Mitchell	General medicine physician Geriatrician	Health NZ, Auckland | Te Toka Tumai

We would also like to extend our thanks to the various groups that contributed their thoughts and feedback during the development of the national guideline.

Group	Organisation
Australian & New Zealand Society for Geriatric Medicine	ANZSGM
Kōtuinga Kiritaki Consumer Network	Te Tāhū Hauora
Ngā Reo Māhuri Young Voices	Te Tāhū Hauora
Radiology national clinical network	Health NZ
Trauma national clinical network	Health NZ
Trauma nurse coordinators	Health NZ
Trauma quality improvement rōpū rangatira	Health NZ