West Yorkshire
Major Trauma Network

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PRINCIPLES

Pain in major trauma patients varies according to the different type and extent of injury, as well as the individual's perception of pain and response to analgesics. Pain has physical, psychological, social, spiritual and emotional components. Pain management therefore must be individualised for each patient.

- All trauma is painful and management of pain is a critical part of trauma care.
- Untreated or inadequately treated pain intensifies the effect of trauma on respiration, hemodynamic stability, and renal and gastrointestinal function, leading to an increase in complications and mortality.
- The treatment of acute pain is also essential to facilitate recovery from trauma by enabling early mobilisation and avoiding complications such as the bed-bound risks of venous thromboembolism, pulmonary embolus, pressure sores and pneumonia.
- Poorly treated acute pain can also cause disabling chronic pain syndromes as the result of changes in the nervous system in response to repeated stimuli. There is a high prevalence of chronic pain after trauma. One US study reported a prevalence of 62% 12 months after the trauma[1].
- Principles of pain management in trauma include
    - Early initiation of appropriate treatment
    - Aggressive use of multimodal therapy
    - Treatment of the underlying cause
    - Assessment and management of psychosocial factors that may affect treatment or contribute to development of chronic pain

There is limited literature on the management of severe pain post trauma and trauma surgery in the civilian population as compared to the large amount of literature and guidance on the management of other forms of pain such as severe cancer pain. Trauma can cause severe and relatively long lasting pain (i.e. pain lasting several weeks, for example in extensive rib, pelvic and spinal fractures) in contrast to acute pain caused by surgery (which usually reduces quickly over a period of days). This guidance therefore draws on the cancer pain literature/guidance as well as military trauma guidance for pain management as it addresses the needs of individuals with severe pain who require analgesia for longer periods of time.

SCOPE OF THIS GUIDELINE

- This guideline covers the assessment and management of pain in the adult major trauma patient population in the ED, theatres and the major trauma ward.
- This guideline should be used in conjunction with
    - Acute Pain Management in Adults manual (LTHT)
    - Clinical Practice Guideline for Assessment, Treatment and Documentation of Acute Pain in Adults (LTHT)
    - Medicines Code (LTHT)
    - Injectable Medicines Code (LTHT)
    - Clinical Practice Guidelines for the Assessment, Treatment and Documentation of Acute Pain in Adults
    - Adult Acute Pain Management Analgesic Ladder & Table.

- Prescription and Administration of Strong Opioid Analgesia for the Management of Acute Pain in Adults
- Prescription and Administration of a Patient Controlled Analgesia system (PCAS) for the Management of Acute Pain in Adults
- Delivery of Epidural and Paravertebral Analgesia in Adult Acute Pain Management
- Clinical Practice Guidelines for the Delivery of Continuous Local Anaesthetic Wound Infusions for Postoperative Pain Relief in Adults.

PREVALENCE OF PAIN IN TRAUMA PATIENTS IN ED

- 91% patients with trauma present to the ED with pain
- Up to 15% of trauma patients receive inadequate analgesia and the mean time of getting pain relief is 60-90 minutes after the event
- Older patients are 12% less likely to be given pain medication than younger patients even when pain levels are the same
- As many as 2/3rd of the trauma patients leave ED without their pain being adequately controlled
- In one US study pain decreased in 37% of the patients, did not change at all in 46%, and actually increased in 17% of the patients at discharge from the ED[2,3]

Barriers to Pain Management in Trauma Population

- Fear of masking injuries
- Fear of impacting hemodynamic status
- Fear of respiratory compromise
- Lower priority compared to resuscitation and stabilisation
- Underuse of effective analgesic techniques
- Lack of pain protocols/order sets
- Lack of pain management knowledge by providers
- 40 to 60 per cent of trauma patients have other substances present on admission.
  - Alcohol
  - Street drugs
  - Prescription medications: i.e. Strong opioids

  Presence of these substances may modify administration of analgesics.

Factors associated with the development of persistent pain after Trauma [4,5]

- Younger age
- Multiple surgeries
- Poorly managed acute pain
- Nerve injury
- Duration of disability (time to return to work)
- Psychological - ↑ anxiety, depression, stress

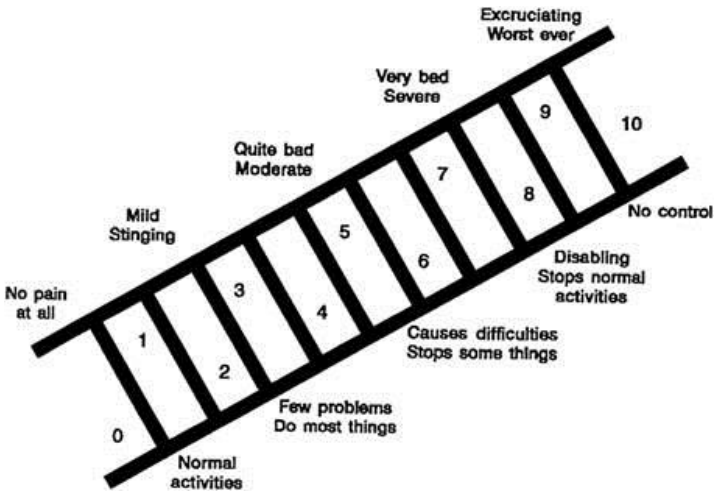
Injury/related Surgery	Incidence of persistent pain
Amputation	30-85%
Thoracotomy/Chest wall trauma	5 - 67%
Spinal Cord Injury	› 50%
Traumatic Brain Injury	32 – 51%
Vertebral fractures	› 25%
Burn Injuries	35- 52%
Complex Regional Pain	1-5%

ASSESSMENT OF PAIN

There are several scales for pain assessment such as numerical pain scale and the 0-10 scale. Please refer to the Clinical Practice Guidelines for the Assessment, Treatment and Documentation of Acute Pain in Adults, which incorporates the Adult Acute Pain Management Analgesic Ladder & Table.

The scales recommended for use in LTHT for adults are

ED: Triage Pain Ruler



Wards: 0-3 pain intensity score, where 0 is no pain and 3 is worst possible pain.

Caveats in pain assessment

- All Pain scales are subjective and there is wide variation between individuals for a similar degree of trauma
- Age, sex, ethnicity can affect pain perceptions
- Pain management is challenging in patients with pre-existing pain problems

PAIN MANAGEMENT[5]

PREHOSPITAL ANALGESIA[6]

- Many patients may have been given some form of pain relief before reaching hospital. This will depend on the skills and experience of the pre-hospital staff and local protocols. *Check what has been given in the field before topping up pain relief.*
- Morphine is the first line analgesic for major trauma, patients may have been given up to 10 mgs pre-hospital.
- Entonox may have been used for moderate pain.
- If the pre-hospital team has a physician, patients may have been given ketamine.
- Oral medications such as paracetamol/NSAIDs/codeine are unlikely to have been administered pre-hospital in the major trauma population.

EARLY PAIN MANAGEMENT IN ED

Aggressive use of multimodal therapy in all stages

- Assess patients pain on presentation to ED using appropriate tools
- **Morphine intravenously** is the gold standard for pain relief in trauma. Small doses of 2-5 mgs may be given at 5-minute intervals, titrated to the patients' pain scores.
- **Ketamine** is a useful adjunct for pain relief in doses of 0.1-0.3mgs/kg. Ketamine may depress level of consciousness and cause delirium, which may complicate the clinical picture. This is unlikely in the doses suggested above. Ketamine also modifies the pain response, reduces opioid requirement and has been suggested to prevent development of chronic pain.
- Shorter acting opioids such as **fentanyl and alfentanil** may be used for rapid pain control. These can depress ventilation and hence should only be used by clinicians with competency in airway management and familiarity with their use.
- **Paracetamol** may be given iv and is a useful adjunct to other stronger drugs.
- NSAIDs do not normally have a role in major trauma due to their deleterious effects on coagulation.
- **Splinting** of broken bones will aid in pain relief.
- **Peripheral nerve blocks**. These may be performed for specific conditions as detailed below, by trained personnel, with full monitoring and under sterile conditions. The drug of choice is bupivacaine to a maximum of 2mg/kg. This analgesic option will have limited duration (approximately 6-8 hours), so additional analgesia will need to be implemented thereafter.
    - Femoral nerve block or fascia iliaca block: fractures of the femur
    - Brachial plexus blocks: upper limb injuries
    - Intercostal nerve blocks: rib fractures
- Reassess pain scores at regular intervals and top up pain relief as needed

THEATRES

Surgical options:

Surgical fixation of fractures, internal or external, in itself aids pain relief.

Anaesthetic options:

There are several options for pain relief in theatre; these will depend on the experience and preference of the individual anaesthetist.

- **Continuous opioid infusions**-most polytrauma patients will be managed on a continuous opioid infusion, usually of remifentanil, an ultra-short acting opioid. This provides excellent operative analgesia, but is not useful post operatively due to its very short (few minutes) half life.

- **Peripheral nerve blocks (PNB)**-single shot or continuous catheter techniques: There may be concerns with the use of PNBs in operative fixation of long bone fractures, especially in the case of high impact lower limb fractures. These fractures are at high risk of developing **compartment syndrome**, a devastating complication, the cardinal symptom of which is pain disproportionate to the injury. The worry is that the pain of compartment syndrome will be masked by the regional anaesthesia.
  However, pain is an unreliable indicator of compartment syndrome[7], being subjective and inconsistent. In established compartment syndrome, pain may even be absent. There is no convincing evidence that regional analgesia delays the diagnosis of compartment syndrome, provided patients are adequately monitored. In patients with high risk of developing compartment syndrome, there should be a practice of regular assessment, a high index of clinical suspicion and compartment pressure measurements, irrespective of the analgesic method.
  The decision for the PNB should be made after discussion with the operating surgeon.

- **Central neuraxial blocks (CNB)**-spinal or epidural analgesia for lower limb trauma. Central neuraxial blocks are not first line in major trauma for several reasons. Patients may have associated injuries which makes positioning for CNBs difficult. There may also be high risk of coagulation abnormalities if patients have had a massive transfusion. CNBs may be used for subsequent surgery.

- **Paravertebral blocks** for rib fractures-in case of thoracic injuries where a thoracotomy has been done, the surgeons may insert paravertebral catheters under direct vision and these may be used to provide post-operative analgesia via a local anaesthetic infusion.

- **Wound infusion catheters**- these are surgically inserted catheters, which are then connected to an infusion of local anaesthetic, usually bupivacaine. In the trauma scenario, they are mostly used after limb amputations where they provide good quality pain relief. An initial bolus of 0.25% bupivacaine between 0.5-2mgs/kg is given, followed by an infusion rate of not more than 0.5mgs/kg/hour of bupivacaine. For more details, see Clinical Practice Guidelines for the Delivery of Continuous Local Anaesthetic Wound Infusions for Postoperative Pain Relief in Adults.

- **Medication**

    - **Ketamine**: this is a non-competitive NMDA receptor antagonist, which inhibits the release of excitatory neurotransmitters and provides analgesia, amnesia and anaesthesia. It has a rapid onset of action in about 1 minute and lasts for 5-15 minutes. There is some evidence that it modifies the pain response, reduces opioid requirement and limits development of chronic pain[8,9]. These effects of ketamine last long after the direct effects have worn off. Ketamine is thus a useful drug in the severely injured patients, as they need high doses of opioids and have a high chance of developing chronic pain. Dose: 0.5-1mgs/kg.
    - **Clonidine**: this is an alpha 2 adrenoceptor agonist and works by enhancing the release of inhibitory neurotransmitters. It has potent analgesic and opioid sparing effects in doses of up to 3 microgrammes/kg. Side effects are sedation, hypotension and rebound hypertension[10].
    - **NSAIDS:** NSAID use is controversial in bone trauma, as they have been shown to delay bone healing in high doses in animal models. Their anti-inflammatory properties may suppress the inflammation needed for bone healing. There are no good quality studies in humans. There are studies to say that NSAID administration should be considered as a risk factor for delayed fracture healing equal to smoking, corticosteroids or diabetes[11]. A suggested protocol is that NSAIDS may be used in normal doses for durations of less than one week in patients with low risk of fracture non-union.

MODES OF PAIN MANAGEMENT ON WARD

The reverse pain ladder

The World Health Organisation (WHO) analgesic ladder was designed for progressive cancer pain. In trauma, pain is maximal at the beginning, and will decrease progressively, therefore the ladder may be used in reverse.There will be surgical and physiotherapy episodes that make this a dynamic process with analgesia being stepped up if required, but with an overall downward trend.[12]

PCAS

- Due to multiple site injury, most major trauma patients are initially prescribed an opioid PCAS. Refer to the trust guidance; Prescription and Administration of a Patient Controlled Analgesia system (PCAS) for the Management of Acute Pain in Adults. Ensure the infusion is prescribed on a trust approved PCAS prescription chart and that an observation chart to assess safety and efficacy of pain management is completed.
- A non-standard PCAS may be used for those patients with challenging pain requirements eg. Opioid tolerance, IV drug abuse and those with pain not

adequately controlled with a standard PCAS. Refer all non standard PCAS to the acute pain team. A non-standard PCAS may be either

- A higher bolus dose of morphine 1.5-2mgs with a 5 minute lockout
- A morphine background infusion: this should ideally be only in an HDU environment but may be considered in individual cases on the ward, after discussion amongst the clinical teams.
- A combined morphine ketamine PCAS may also be considered in individual ward patients after discussion amongst the clinical teams.
- Oxycodone PCAS (for patients with renal impairment or unacceptable side effects with morphine e.g severe nausea, itching, hallucinations). Oxycodone 1mg with 5 minute lockout does not need to be referred to the acute pain team.

SWAPPING FROM PCAS TO ORAL ANALGESIA – TITRATION TO ORAL OPIATES.

- The PCAS may be taken down after an appropriate interval (48 – 72 hours) when the patient is able to take oral medication.
- Patients' analgesic requirements will vary considerably so a standard approach is not possible and oral analgesia will be titrated to the individual's requirements and tolerance. In general, patients will be on regular paracetamol, NSAID (if appropriate) and a weak opioid such as dihydrocodeine or Tramadol.
- Sustained realease doses of the weaker opiods may be used at night if breakthrough pain at night is an issue. This could be in the form of 200mg MR Tramadol or 60 MR dihydrocodeine at night. Maximum dose of Tramadol is 400mgs and dihydrocodeine 120mgs in a 24 hour period.
- When converting to MR preparation the immediate release (IR) preparation may be continued for the first 12 hours as the MR preparation takes 24 hours to reach peak plasma levels.
- Patients on dihydrocodeine or tramadol can be prescribed a rescue dose range of 5 – 10 mg oramorph 2 hourly to allow nursing staff to administer rescue analgesia as appropriate according to their assessment of the patient's need[13].
- Opioid analgesia should be reviewed daily to avoid unnecessary discharge prescriptions.
- There will be a small number of patients who may not have their pain managed by the above medications, in whom oral SR strong opioids(e.g MST, Oxycontin) may be useful. The management of these patients should be decided by the muti-disciplinary team on a case-by-case basis. Points to note
    - The pharmacokinetic profile of sustained release opioids is such that they take 24 hours to reach steady state plasma concentration and provide adequate pain relief.

- Monitoring: All patients receiving strong oral opioids must have pain, sedation and nausea scores, and respiratory rate recorded and assessed at regular intervals. The Acute Pain Service or senior ward medical staff must be informed of any concerns.
- Discharge Advice: ideally no patient should be discharged on strong oral opioids. However, we recognize that this may occasionally be necessary. If discharged with strong opioids:
  - Patients need to be counselled about the side effects and the importance of reducing the doses and stopping as soon as possible. We are in the process of developing a patient information leaflet for this purpose.
  - The patient's GP should be informed when a patient is discharged with a sustained release opioid prescription and instructed to review and taper the dose regularly.

Laxatives and antiemetics

All weak and strong opioids should be prescribed alongside laxatives and antiemetics.

Laxatives:

- Bulk-forming laxatives are not recommended as their mode of action is to distend the colon and stimulate peristalsis, but opioids prevent the colon responding with propulsive action. This may cause abdominal colic and rarely bowel obstruction.
- Osmotic laxatives retain fluid in the stool making defecation easier, and docusate also has stool-softening properties.
- Stimulant laxatives overcome the reduced peristalsis caused by opioid medication.
- Naloxolgol is a specific laxative that may be used for opioid induced constipation, which has not responded to regular laxatives taken over a period of 4 days over the past 2 weeks. This is recommended by NICE[14].

Antiemetics:

The Trust guidelines on antiemetic use can be found by clicking on the link below:
http://www.leedsformulary.nhs.uk/docs/Antiemetic%20evidence%20update.pdf?UNLID=756234172201711161644 4

- Ondansetron (serotonin type 3 antagonist) is first line antiemetic for post operative nausea and vomiting. If ondansetron is ineffective/not tolerated /contraindicated, use the second line drugs as specified below
- Cyclizine (anticholinergic) can be used for nausea and vomiting caused by narcotic analgesics and by general anaesthetics in the post-operative period.
- Metoclopramide (dopamine, serotonin type 3 & 4 antagonist) is also a prokinetic and therefore will help with gastric stasis and constipation. Metoclopromide should be avoided in patients under the age of 18 due to high risk of extrapyramidal symptoms.

In patients who are high risk for PONV, prescription of regular antiemetics for 24-48 hours after surgery may be better than PRN doses of antiemetics, in helping them tolerate post operative opioids.

Opiate Induced Hyperalgesia (OIH) and opiate tolerance[15]

Two conditions to be aware of are OIH and Opiate tolerance.
OIH is seen particularly in patients who have been chronic opioid users. It is characterised by pain worsening as the opiate dose is increased. In OIH pain will improve when the opiate is reduced and withdrawn.
In contrast, some opiate users may have opiate tolerance, in which the drug has less effect, but pain improves with increased doses. (Lee M, Silverman S, Hansen H et al. A Comprehensive review of opioid induced hyperalgesia. Pain Physician 2011; 14: 145-161)

EPIDURAL AND PARAVERTEBRAL ANALGESIA

- **Epidural catheters:** an epidural catheter provides excellent analgesia but may be difficult to insert acutely in the multiply injured patient and contraindicated in the trauma patient with coagulation abnormalities. They are most likely to be used for second stage surgery and reconstructions.
- **Paravertebral catheters:** these are particularly useful for chest wall trauma (see Guidance for Management of Chest Wall Trauma)

All epidurals and paravertebral catheters should be clearly labelled and the drug dosages prescribed on a trust approved epidural/paravertebral prescription and observation chart. The patient details should be registered on the APIS epidural database so that the acute pain team can follow up these patients.

PERINEURAL CATHETERS AND LOCAL ANAESTHETIC INFUSIONS

- Continuous local anaesthetic wound infusion has been shown to be effective in management of pain relief and reduces morphine requirements.
- Surgical placement of a catheter in the subcutaneous tissues or perineural sheaths can offer good analgesic benefit. Refer to the Clinical Practice Guidelines for the Delivery of Continuous Local Anaesthetic Wound Infusions for Postoperative Pain Relief in Adults (LTHT). If you are in a trauma unit, please follow local guidelines.
- A bolus dose of 0.25% bupivacaine is administered down the catheter and an infusion prescribed at an hourly rate, not exceeding 0.5mg/kg/hr.
- All local anaesthetic wound infusions should be delivered via a trust approved elastometric infusion pump and prescribed on the trust Bupivacaine 0.25% Local Anaesthetic Wound Catheter Prescription Chart (LTHT). If you are in a trauma unit, please follow local guidance.
- Regular observations are needed as detailed in the prescription chart; these are in addition to routine NEWS observations.

OTHER PHARMACOLOGICAL TREATMENTS

The use of additional pharmacological agents may be useful in this group of patients as pain can be severe and there is often a neuropathic element. If patients have definite nerve injury and/or demonstrate neuropathic symptoms such as burning pain, allodynia, hyperalgesia, etc, they should be prescribed these medications.

All patients should be on regular *paracetamol* unless contraindicated.

- ***Gabapentin*** is the first line treatment for adult neuropathic pain. Start with 300mg once daily and titrate up to 300mg three times a day, over three days. The dose should be titrated more slowly in the elderly and reduced in renal impairment. The dose can be increased by 300 mg daily in 3 divided doses up to a maximum dose of 1200-3600mg per day (divided into three doses). Contraindicated in pregnancy & breastfeeding.
- ***Pregabalin*** is licensed for peripheral & central neuropathic pain. Commence at 150mg a day in two or three divided doses. Slowly increase to a maximum of 600mg. Reduce dose in renal impairment. Contraindicated in pregnancy & breastfeeding.
- ***Amitriptyline*** is an antidepressant widely used for neuropathic pain. Commence at 10-25mg once a day at night. It is useful if insomnia is a problem. Slowly increase to a maximum of 75mg/day.
- ***Clonidine*** is an alpha-2-adrenoreceptor agonist. This can be administered orally or subcutaneously at a dose of 50microgrammes three times a day upto a maximum of 150microgrammes/day. Discuss with acute pain team before starting this drug.
- ***Ketamine*** is an NMDA receptor antagonist which reduces opioid tolerance and enhances analgesic effect of opioids. It is especially useful in patients already on

opioids (such as chronic pain patients and IVDUs) and in patients with acute severe pain not managed by opioids alone (major trauma). The dose of ketamine is 20mgs - up to a maximum of 100mgs/day (given orally or sub-cutaneously) or intravenously in a PCAS with morphine. Discuss with acute pain team about the most suitable dose and route of administration.

SPECIFIC LONG-TERM ISSUES IN MAJOR TRAUMA PATIENTS

- Assess and manage psychosocial factors that may confound treatment or contribute to development of chronic pain. Those at risk are patients with pre-existing substance abuse and pre-existing chronic pain. These patients must be referred early to the acute pain team.
- Psychological support should be provided to these patients from an early stage. They should be educated about their condition, which has been shown to minimise apprehension and enables earlier return to normal function.
- Regular physiotherapy to maintain muscle strength.
- Occupational therapy to encourage early return to normal activity.
- Rehabilitation measures to be started ASAP.

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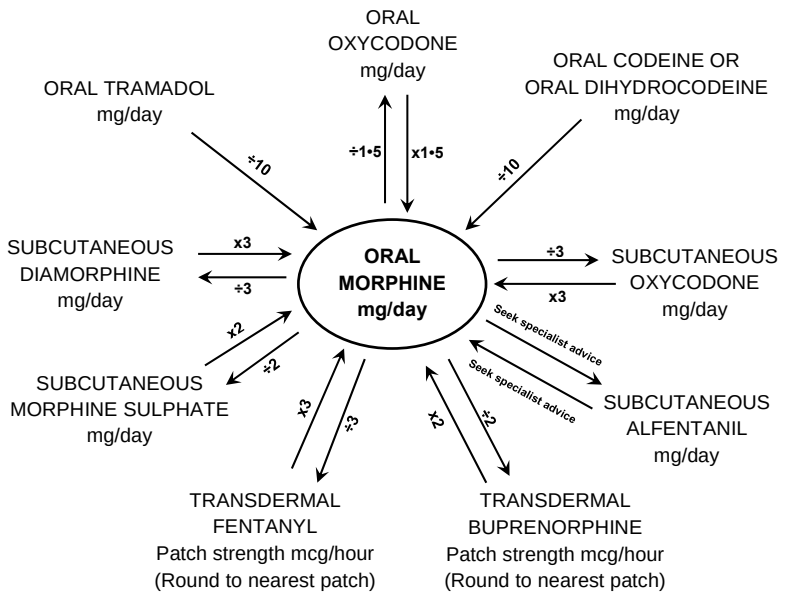
APPENDIX 1

OPIOID CONVERSION CHART

To convert between opioids always convert to equivalent dose of oral morphine first. Conversion rates are approximate. To avoid opioid toxicity when converting high doses under dose the patient but make sure adequate PRN analgesia is prescribed and titrate up if necessary. If patient dying do not remove fentanyl patches, just add syringe driver of appropriate medication on top. S/c = subcutaneous, iv -intravenous

The Leeds Opioid Conversion Guide For Adult Palliative Care Patients



Always go through the centre of the chart (via oral morphine) when converting between opioids.

NOTES : This chart is intended for guidance, prescribers are responsible for their own decisions.

All calculations and rationale must be documented in the patient's record, including those for prn doses.

Clinical judgement should be applied, considering: underlying clinical situation; comorbidity (e.g. renal or liver impairment); drug interactions, nature of pain and its opioid responsiveness; other pain interventions; symptoms being managed by opioid; toxicity of current opioid; previous opioid doses and adherence; rapidity of opioid escalation; use of larger doses; switches involving change of route; malabsorption issues; reason for switching. These factors **may** necessitate an empirical reduction in the dose of the replacement opioid and re-titration.

For further advice contact your local Specialist Palliative Care Service.

Conversions are based on Company Data, PCF5 and EAPC 2011 guidelines.

Adapted for Leeds city wide use April 2016 (Leeds Palliative Care MCN)