

# **Regional Networks for Major Trauma**

**NHS Clinical Advisory Groups Report**

September 2010







# Contents

Summary .....	3
1 Case for change .....	5
1.1 Definitions.....	5
1.2 Context.....	7
1.3 The trauma pathway.....	8
1.4 Rationale for change – stage by stage.....	9
2 Pre-hospital care .....	19
2.1 Overview .....	19
2.2 Clinical Advisory Group report summary.....	19
2.3 Clinical Advisory Group recommendations .....	21
2.4 Stakeholder support and challenge .....	28
3 Acute care .....	31
3.1 Overview .....	31
3.2 Clinical Advisory Group report summary.....	31
3.3 Clinical Advisory Group recommendations .....	33
3.4 Stakeholder support and challenge .....	41
4 Ongoing care and reconstruction.....	43
4.1 Overview .....	43
4.2 Clinical Advisory Group report summary.....	43
4.3 Clinical Advisory Group recommendations .....	47
4.4 Stakeholder support and challenge .....	63
5 Rehabilitation .....	67
5.1 Overview .....	67
5.2 Clinical Advisory Group report summary.....	68
5.3 Clinical Advisory Group recommendations .....	69
5.4 Stakeholder support and challenge .....	81
6 Network organisation.....	83
6.1 Overview .....	83
6.2 Clinical Advisory Group report summary.....	83
6.3 Clinical Advisory Group recommendations .....	86
6.4 Stakeholder support and challenge .....	96
7 Appendices .....	99
Appendix A – Pre-hospital Major Trauma Triage Tool .....	99
Appendix B – ATMIST.....	101
Appendix C: System and Network Formation .....	102
Appendix D: Quality Improvement Programmes.....	109
Appendix E: Emergency Preparedness.....	117
Appendix F: Research in Trauma Systems .....	118
Acknowledgements.....	119
References .....	123



**Abbreviations**

A&E – Accident & Emergency

DH – Department of Health

ED – Emergency Department

ITS – Inclusive Trauma System

CAG – Clinical Advisory Group

LEH – Local Emergency Hospital

MTC – Major Trauma Centre

MTOS – UK Major Trauma Outcomes Study

NAO – National Audit Office

NCEPOD – National Confidential Enquiry into Patient Outcome and Death

NHS – National Health Service

PACS – Picture Archiving and Communications Systems

PROMs – Patient Recorded Outcome Measures

PCT – Primary Care Trust

QI – Quality Improvement

RCSEng – Royal College of Surgeons in England

SHA – Strategic Health Authority

TARN – Trauma Audit and Research Network

TCP – Trauma Care Pathway

TN – Trauma Network

TU – Trauma Unit

UH – Undesignated Hospital

This document contains advice offered by the NHS Clinical Advisory Groups (CAG) for Major Trauma to their colleagues in the NHS. Strategic Health Authorities (SHAs) declared their intentions to support the establishment of improved regional services for Major Trauma, primarily through the development of regional Trauma Networks in 2008. The Revised Operating Framework of June 2010 confirmed that the expectation that these commitments would be fulfilled, despite the recent change of Government.

The NHS Clinical Advisory Groups hope that SHAs, commissioners, providers, local Trauma Network leads and project managers will find this advice useful. It is intended to assist local planning for the main elements of the Major Trauma pathway from pre-hospital care to rehabilitation and to ensure the best fit of local service configurations, geography, patient expectation and needs.

The document is also informed by stakeholder evidence gathered through Major Trauma engagement work (see supporting documentation 'stakeholder engagement').

### **Clinical Advisory Group Membership**

Members of the CAG were drawn from medical, nursing, health professionals, NHS managers and those with a strong patient / carer involvement. They were appointed from across all SHAs for their personal experience and expertise, and not to represent any organisation or faction. The diversity of membership was intended to enrich contributions and provide a soundly based patient-focused approach to improving services and outcomes for people suffering from Major Trauma. Please see Acknowledgements towards the end of this report for the members who contributed to this report.



## Summary

The NHS Clinical Advisory Groups investigated the evidence, national and international guidance and research required to assist regions in the successful design and implications of regional trauma networks. The document provides advice on delivering treatment for everyone which is based around the needs of individuals irrespective of where they suffer those injuries; delivers the patient as rapidly and safely as possible to the hospital that can manage the definitive care for their injuries either directly or by expedited inter-hospital transfer; and moves the responsibility for definitive patient care from the receiving clinical team to the trauma network when the initial receiving unit is incapable of that care. The document defines a comprehensive picture of the issues and lack of focus to date on rehabilitation.

This document is structured to follow the patient pathway from pre-hospital care through to Rehabilitation. Advice is provided for each stage of the pathway and is intended to assist bespoke local planning. Following the case for change, which includes the trauma care pathway and the rationale for change, each section of the care pathway holds an overview of the chapter, CAG recommendations and advice, weaved together with stakeholder support and challenge.

This document deals largely with Adult Trauma – specific advice related to Children will follow as an appendix to this document. Equally, the implications for the workforce and training curriculum, burns patients, and spinal cord injury are currently being considered and will be released in due course.

This report should be read in conjunction with the following supporting documents:

- Literature review (TARN)
- TARN Activity Analysis (both National and SHA specific)
- ICNARC Activity Analysis (both National and SHA specific)
- Planned Development of the Tariff Structure
- Executive Summary of Stakeholders' Views
- Stakeholder Engagement Strands



# 1 Case for change

This section lays out the CAGs case for change. It defines the components of a regionalised approach to trauma care, examines the overall need for reform in the NHS context and then examines the rationale for change at each stage of the trauma care pathway.

## 1.1 Definitions

In this document the definitions used are as follows.

**Clinical Advisory Groups (CAGs)** – Five clinical advisory groups were established in order to produce this advice, each covering a separate aspect of the care pathway as follows:

- Pre-hospital and inter-hospital transfers
- Acute Care and Surgery
- Ongoing Care & Reconstruction
- Rehabilitation
- Network Organisation (incl. governance)

**Major Trauma** – NHS Choice defines ‘Major Trauma’ as multiple, serious injuries that could result in disability or death. These might include serious head injuries, severe gunshot wounds or road traffic accidents. Major Trauma is defined in the scientific literature using the Injury Severity Score (ISS), which assigns a value to injuries in different parts of the body and totals them to give a figure representing the severity of injury. An ISS greater than 15 is defined as Major Trauma. This would include serious injuries such as bleeding in the brain or a fracture of the pelvis and cases of multiple injuries; however, this definition does not include all those who should benefit from the regionalisation of trauma care.

This document refers to severely-injured patients, meaning those who have suffered potentially life-threatening or life-changing physical injuries, i.e. all those who could benefit from regional networks. Psychosocial consequences of such injuries are common but patients suffering such symptoms in isolation without injury as a result of a “traumatic experience” are not covered.

**Inclusive Trauma System** – An Inclusive Trauma System (ITS) describes a model in which commissioners; providers, public health representatives and other stakeholders of trauma care in a geographical region collaborate to plan, provide and manage the treatment of people injured as a result of Major Trauma.

The ITS is responsible for all aspects of trauma care, from the point of injury to rehabilitation, as well as for injury prevention. Each ITS comprises of one or more ‘Trauma Networks’ (see definition below). The ITS also features:

- a population-based approach to the assessment of need and the provision of treatment.
- a role for every hospital and provider of care.
- provision for the speedy transfer of patients between facilities, particularly where the severely injured have been under triaged away from the Trauma Centre.
- a quality assurance structure that penetrates across the region and to each stage of care, which underpins providers’ clinical governance processes, identifies inadequate performance in order to support its correction and ultimately can apply sanctions where this does not occur. It also informs commissioners about the quality of care being delivered.

The Royal College of Surgeons advises that the ITS should have in place a plan which sets out the

detail of the 'Trauma Care Pathway' (TCP) for the region.

**Trauma Care Pathway** – This is the process through which care is provided for patients who have suffered Major Trauma; specifically, it describes the 'the location and capability of each trust/hospital within the ITS and outlines ambulance bypass protocols and thresholds for transferring patients to more specialist units'.

**Trauma Network** – A Trauma Network (TN) is the name given to the collaboration between the providers commissioned to deliver trauma care services in a geographical area. At its heart is the 'Major Trauma Centre'. A TN should include *all* providers of trauma care, particularly: pre-hospital services, other hospitals receiving acute trauma admissions (Trauma Units), and rehabilitation services. The TN has appropriate links to the social care and the voluntary/community sector. While individual units retain responsibility for their clinical governance, members of the Network collaborate in a Quality Improvement programme.

**Major Trauma Centre** – A Major Trauma Centre (MTC) is a multi-specialty hospital, on a single site, optimised for the provision of trauma care. It is the focus of the Trauma Network and manages all types of injuries, providing consultant-level care.

- It is optimised for the definitive care of injured patients. In particular it has an active, effective trauma Quality Improvement programme. It also provides a managed transition to rehabilitation and the community.
- It takes responsibility for the care of all patients with Major Trauma in the area covered by the Network. It also supports the Quality Improvement programmes of other hospitals in its Network.
- It provides all the major specialist services relevant to the care of major trauma, i.e. general, emergency medicine, vascular, orthopaedic, plastic, spinal, maxillofacial, cardiothoracic and neurological surgery and interventional radiology, along with appropriate supporting services, such as critical care.

The Royal College of Surgeons cite research advising that such centres should admit a minimum of 250 critically injured patients per year

**Trauma Unit** – A Trauma Unit (TU) is a hospital in a Trauma Network that provides care for most injured patients and:

- is optimised for the definitive care of injured patients. In particular, it has an active, effective trauma Quality Improvement programme. It also provides a managed transition to rehabilitation and the community.
- has systems in place to rapidly move the most severely injured to hospitals that can manage their injuries.
- may provide some specialist services for patients who do not have multiple injuries (e.g. open tibial fractures). The Trauma Unit then takes responsibility for making these services available to patients in the Network who need them. Other Trauma Units may have only limited facilities, being able to stabilise and transfer serious cases but only to admit and manage less severe injuries.

**Local Emergency Hospital (not designated as TU)** – The Local Emergency Hospital (LEH) is a hospital in a Trauma Network that does not routinely receive acute trauma patients (excepting minor injuries that may be seen in an MIU). It has processes in place to ensure that should this occur patients are appropriately transferred to an MTC or TU. It may have a role in the rehabilitation of trauma patients and the care of those with minor injuries.

## 1.2 Context

Major Trauma is a serious public health problem; it is the leading cause of death in all groups under 45 years of age and a significant cause of short- and long-term morbidity. In England, the most common cause is a road accident. The NAO estimate that there are at least 20,000 cases of Major Trauma each year in England resulting in 5,400 deaths and many others resulting in permanent disabilities requiring long-term care. There are around a further 28,000 cases which, although not meeting the precise definition of Major Trauma, would be cared for in the same way.<sup>1</sup>

The NAO estimate that trauma costs the NHS between £0.3 and £0.4 billion a year in immediate treatment. This does not include the cost of any subsequent hospital treatments, rehabilitation, home care support, or informal carers. In addition the NAO estimate that the annual lost economic output as a result of Major Trauma is between £3.3 billion and £3.7 billion. Care of Major Trauma, however, is 'a minor element of emergency department work equating to less than 0.2 per cent of total activity'<sup>2</sup> rendering many hospital staff unable to maintain optimal skills in trauma care.<sup>3</sup>

The National Audit Office (NAO) cites a number of studies which highlight deficiencies in trauma care in the NHS.<sup>4</sup> In 1992, for example, the UK Major Trauma Outcomes Study (MTOS) of almost 15,000 patients, showed continued unsatisfactory care; patients were typically attended to by junior staff, their treatment was delayed and mortality was high compared with international comparators.<sup>5</sup> The NHS responded by introducing Advanced Trauma Life Support training and the use of trauma teams. MTOS developed into the Trauma Audit and Research Network (TARN) which published a paper in 2002 that attributed improvements in mortality rates seen between 1989 and 1993 to the initiatives. There was no further improvement noted between 1993 and 2004, despite ongoing advances in medical technology, training and care<sup>6</sup>.

Internationally, the establishment of Trauma Systems has been founded on Trauma Centres. These hospitals specialise in, and are designated for, the treatment of the severely injured. They see such patients with sufficient frequency to gain expertise in their management. Over several decades the evidence that this model improves trauma outcomes has become substantial. Their effect has been assessed using several methodologies and a consistent picture has emerged. Severely injured patients are 15-20% less likely to die if admitted to a Trauma Centre than if admitted to other hospitals.<sup>7</sup> Such benefits are restricted to those who are admitted to the Trauma Centre and it is not sufficient to have a single hospital with all the trauma specialties represented. A Trauma System should have regard to the needs of all injured persons in its area.<sup>8</sup> Benefits to the whole injured population will derive from an Inclusive Trauma System (ITS) that provides for the needs of all injured patients in its region by moving patients to the hospital best able to provide suitable care, freeing resources at other units. . The benefits of Trauma Systems may take 3 years or more to be realised<sup>9</sup> and depend upon an iterative process of needs analysis, service organisation and Quality Improvement

Such regionalisation of the provision of trauma care in England has been proposed in a number of reports over the last 20 years<sup>10</sup> but until now there has been no large-scale change programme implemented. Stakeholder feedback suggests this may have been because the scale of the change needed is significant and there can also be misconceptions that reorganisation is about 'taking trauma away' from Emergency Departments.

*"[There is] a reluctance at central government level to grapple with the big issues...people have won and lost seats over it...it's difficult to effect major service change...people just don't get the message...There is entrenchment but there's also lack of political will needed*

*to effect change at all levels and lack of resources. It's hard to see how whole scale improvement can be achieved."*

***Representative from a professional association***

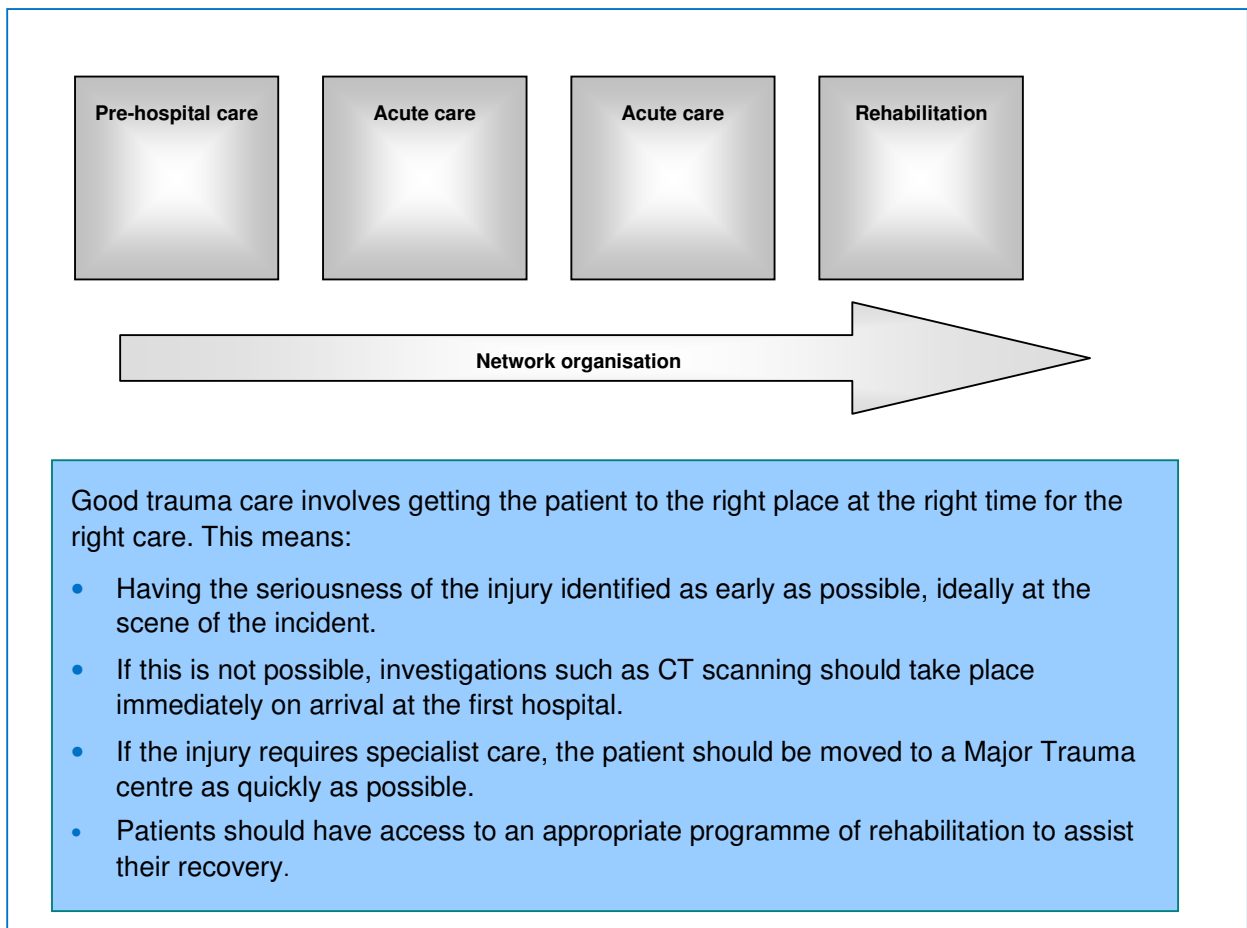
*"And I also think there should be really clear messages that we are not talking about A&E – if an organisation is not a designated Trauma Unit that doesn't mean that they won't have A&E."*

***Representative from a Royal College***

In 2007 the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) produced a major report<sup>11</sup> that gave new impetus to this process. As a result the NHS is now committed to reforming trauma care services<sup>12</sup> and the regions are developing change programmes to introduce regional Trauma Networks across England, a policy endorsed by the NAO.<sup>13</sup> It is anticipated that regional Trauma Networks will be in place across the country by the end of 2011.<sup>14</sup>

### 1.3 The trauma pathway

The diagram below displays the stages along the major trauma care pathway.



Each stage of the pathway can be defined as follows:

- **Prevention:** In the first instance, an effective ITS can serve to prevent trauma. It will do so by providing the infrastructure for the co-ordinated sharing of detailed data, expertise and best practice between providers, key experts and multi-agency partners. The ITS will also co-ordinate activities in primary, secondary and tertiary prevention.
- **Pre-hospital care:** This encompasses from the response to the call to emergency services, the on scene elements of care, triage, primary transfer to MTC or TU and inter-hospital transfer within a Network.
- **Acute trauma care & surgery:** This is the phase of care from the hospital reception of the patient through to the completion initial assessment and acute stabilisation of physiology and injuries. This includes all immediate trauma care and urgent surgical interventions provided within an acute setting.
- **Ongoing care and reconstruction:** The ongoing care and reconstruction phase of the trauma patient's pathway starts immediately after any resuscitation and urgent surgery following admission, and continues until discharge from the acute setting.
- **Rehabilitation:** This is the process of re-ablement and therapies restoring patients to optimal mobility, independence and employment following injury and includes
  - **Level 1 – Specialised:** serves a population of >1 million and deals with a high proportion of patients with complex rehabilitation needs.
  - **Level 2 – Local specialist rehabilitation services:** serves a population of 250,000 to 1 million and deals with fewer complex cases.
  - **Level 3 – Non-specialist rehabilitation services:** serves a local population (usually <500,000) and is led by therapists or non-rehabilitation medicine consultants.

## 1.4 Rationale for change – stage by stage

There is a rationale for change at each stage of the care pathway, and widespread stakeholder support for improving the trauma care system. Whilst acknowledging recent clinical improvements, stakeholders, including patients have commented that standards of care are not universally high, and that the system continues to be fragmented and uncoordinated, particularly in regards to rehabilitation. As a result outcomes for patients are inconsistent.

*“It is widely accepted that trauma services in the UK are poor in comparison to international best practice – that’s the current situation. If you and I were to have a Major Trauma accident we would get care below the international standards, that’s clearly a tragedy and an embarrassment with very real and negative consequences for the patients. The system is broken.”*

**Stakeholder from a Royal College**

The evidence supporting the case for change has not been disputed by any stakeholders represented on the CAGs.

### 1.4.1 Rehabilitation

In report after report, and not just those about Major Trauma, rehabilitation has been either a closing recommendation or simply ignored. The CAGs recommend that improving rehabilitation should specifically be given more priority, on the grounds that the need to improve both acute and specialist rehabilitation, and community or generalist rehabilitation, is one of the biggest considerations informing trauma care pathway redesign.

*“The problems highlighted in the other pathway areas are minor compared to the major problem of specialist rehab. [It is a] major problem because there is no provision for acute rapid access to rehab both locally and nationally... Rehab is delayed or never happens. It seems pointless to spend all this effort on the front end of fast responsive care if we then do not provide rehabilitation.”*

***Representative from a professional association***

Following traumatic injury, rehabilitation is essential for patients to address any physical and psycho-social needs as a result of their injuries and experiences. Without such input, patients are unlikely to return to their maximum levels of function which has significant implications for them, their formal and informal carers and society as a whole. Furthermore, given that user-centred services have been at the heart of health and social care policy and planning for several years now, respecting the patient journey should be a fundamental principle that informs the development of a new Major Trauma care pathway.

*“There is strong evidence to suggest patients, carers and professional stakeholders alike are highly concerned about, and/or dissatisfied with the rehabilitation stages of trauma care”.*

***Stakeholder from a professional association***

To sustain the development of regional Trauma Networks and effective patient flow, rehabilitation needs to be seen as a core component that serves to improve outcomes for patients, not just survival but also their quality of life.

**The case for change in respect of acute/specialist and community/generalist rehabilitation** should be founded on:

- Significantly changing the focus of funding to this stage of the pathway.
- Ensuring provision is more consistent and coherent.
- Planning and delivering acute or specialist rehabilitation services much earlier in the pathway.
- Address ‘the whole patient’ far more effectively; in particular making sure that rehabilitation is factored into the patient’s care planning as early as possible in the pathway.
- Delivering complex rehabilitation care in a more ‘joined-up’ and managed way, rather than categorising services on the basis of specific injury patterns, leaving those with complex, multi-faceted needs to fall through the gaps.
- Ensuring that rehabilitation in acute care dovetails with community care so that discharge and out-of-hospital support is both planned and involves a smooth transition.

**Lack of focused funding** – Rehabilitation for trauma patients has been described as a ‘Cinderella service’: a lower priority, less glamorous and less well-resourced than other elements of the pathway. Stakeholders agreed that it has been seriously underfunded historically and can be addressed as *“an afterthought”*.<sup>15</sup> This type of care is generally not seen as being part of the whole, integrated care pathway, and several stakeholders commented on how difficult it is to access dedicated specialist rehabilitation services for young patients with complex needs. Funding and capacity difficulties lead to delays in access and ‘bed-blocking’, which can have a negative impact on long-term outcomes, as well as putting strain on the acute receiving units who need to place patients for ongoing care.



*“Invest to save – by spending more on acute rehab it will help prevent patients ending up back in the system or needing ongoing care.”*

***NHS health professional***

Patients and their families in particular appear to have serious concerns about the community/generalist element of the trauma pathway.

**Inconsistent and incoherent provision – The CAGs reported that** services of this type are fragmented and unevenly distributed at present. They lack a strategic approach, having often been developed independently and without a national plan for coherent provision.<sup>16</sup> This can be exacerbated by the limited resources available; patients often have to receive care and/or rehabilitation away from their local area. This can strain links with family and friends, and can make discharge planning more difficult due to a lack of local knowledge within the care teams. With community/generalist rehabilitation there is felt to be an absence of consultants’ input and insufficient support to address the full range of patients’ needs, particularly psycho-social needs.

**Need for earlier planning and implementation** more consistently implemented and to start much earlier on in the pathway. The CAGs recommended that more investment in planning acute and specialist rehabilitation earlier on in the patient journey would produce better patient outcomes as well as prove more cost-effective: not providing rehabilitation at the appropriate intensity during the acute phase of care results in patients not achieving their optimum level of physical and social function, which leads to increased overall costs of care.<sup>17 18 19 20</sup> Several people, particularly patients, identified that lack of early intervention is a result of the lack of capacity in the system to deliver specialist rehabilitation problems.

*“If rehabilitation was thought about earlier it would be easier to plan for what that person might need and how it might be provided...where you’ve got dedicated team and resources [to do this] it works well.”*

***Stakeholder from a Royal College***

**Lack of focus on ‘the whole patient’** – There is a wealth of stakeholder feedback conveying the view that in order for redesigned trauma pathways to consider the whole patient, rehabilitation services – in particular psycho-social and psychological care – need to be better planned, and to address far more explicitly all aspects of trauma care.

**Addressing complex rehabilitation in a more ‘joined up’ and managed way** – Specialist services have historically been established on the basis of specific injury patterns, such as brain, spinal or burn injuries and therefore often exclude those with other, or not clearly categorised injuries. The CAGs commented that those with complex rehabilitation needs as a result of severe musculoskeletal or multi-system injuries consistently fall between the gaps in current services. This group of patients often have rehabilitation provided by teams who do not have the breadth of skills, capacity or facilities to meet their needs, which in turn extends the duration of rehabilitation and leads to poorer outcomes.

Both professional stakeholders and patients/carers noted the lack of connection between trauma care delivered in the acute services (including any rehabilitation provided in that setting) and, primary and community-based services. This can result in poor care following discharge and in some cases re-admission. There is clearly, therefore, an economic and efficiency-related case for change in respect of community/generalist rehabilitation, in addition to the need to improve the patient’s experience.

## 1.4.2 Pre-hospital care

The need to deliver the patient to a unit able to provide their definitive care in a timely fashion is a major driver of change to the current trauma pathway. Injury can occur anywhere and at any time; however, 24-hour specialist services are provided at only a small number of locations. There is an inherent challenge, therefore, in ensuring patients are transferred not simply to a place of safety but to a unit that is most likely to manage their care in the best way. At present, the trauma pathway is not set up in a way that ensures the most appropriate transfer of patients.

*“It costs nothing at all to change [the] pathway and to take them to ... a Trauma Centre. A change in patient pathway could have major effect on patients.”*

**Stakeholder from a professional association**

The care provided to the trauma patient in the first few hours can be absolutely critical in terms of predicting longer-term recovery. It is also, therefore, essential for ‘first responders’ to assess patient needs effectively, then to be clear about where best in the region will meet those needs. At present, there is considerable variability in the pre-hospital care stage of the pathway – and an over-focus on response time alone – which, as a result, means that patients are at risk of receiving sub-optimal care.

*“(The) focus is on the time taken to get to the patient...but unfortunately there is no emphasis placed on what happens after the first contact.”*

**Stakeholder from a Royal College**

*“[The quality of care] depends on the lottery of the right patient going to the right place first. If you follow the standard guidelines about going to the nearest hospital it might be like going to mortuary ...If the right patient gets to the right hospital the results can be stunning.”*

**Stakeholder from a professional association**

The **case for change in respect of pre-hospital care** should be founded on:

- providing a consistent and coherent response irrespective of the time of day and geographical location at which Major Trauma occurs.
- improving further and maintaining the skill-set of the emergency responders to assess and manage Major Trauma at the scene of the incident.
- continuing to improve consistency and clarity in respect of decision-making during pre-hospital care, in particular ensuring emergency responders have the skills and devolved responsibility to make decisions, and that there are clear and consistent protocols in place that govern decision-making devolution.

**Inconsistent and/or variable pre-hospital response** – It is widely accepted that the management of Major Trauma is optimised by treatment in a specialist MTC.<sup>21 22</sup> At present, transfer – a period of vulnerability for the patient – can involve hugely variable practice. There is a rationale for improving trauma care in this respect such that the patient’s journey and reception are safe, efficient and planned, and supported by a smooth, safe handover in which critical information is passed on to the receiving unit. Put simply, transfer (both initial transfer and any later transfer within the TN) should be driven by the needs of the patient.

**Ensuring further improvements to the skill-set of emergency responders to assess and manage Major Trauma** – The initial contact stage of the Major Trauma pathway is an area which

has improved greatly in recent years, but there is still room for improvement. Pre-hospital care has been described as “a postcode lottery”.<sup>23</sup>

The highly specialised treatment available at MTCs cannot be focussed on those who will benefit from it unless such patients are identified accurately and rapidly following their injury. In some cases, specialist centres are too far away from the location at which critically injured patients sustain their time-dependent trauma. Evidence from military and other sources<sup>24</sup> demonstrates that in these cases a system for provision of advanced resuscitation skills at or near the scene of the incident is a crucial factor in improving mortality and morbidity.

**Inconsistency and/or lack of clarity about decision-making during pre-hospital care** It is recognised that there has been improvement in pre-hospital assessment by emergency services. There is, however, scope for improvement in this respect, as well as development of clear systems and protocols: deciding on the best way to provide care for an individual patient can involve complex decision making.

Factors to be considered include, for example: relative travelling times to a TU or MTC; the time it will take to get the enhanced care team to the patient; modes of transport available; feedback from patient assessment and treatment; and workload in receiving hospitals. At present, one of the key drivers of change is the need to agree standard procedures and processes for the assessment, movement and care of patients within and around trauma services in a geographical area, to ensure best practice and reduce variations in care.

*“...One of the worst things that can happen is if [the patient is] taken to the wrong hospital in the first instance ... that first decision is vital.”*

**Stakeholder from a professional association**

### 1.4.3 Acute trauma care and surgery

Successive reports have found that there is a significant amount of variability in care once in the acute hospital setting. This has been attributed to: variability in acute staff’s exposure to Major Trauma; limited bed capacity; staffing shortages and pressures to reduce length of hospital stay. This is supported by patient feedback suggesting quality of care is variable.

*“I am aware of senior pre-hospital doctor who was so appalled by the care the patient would receive at a peripheral hospital that he moved the patient to a better hospital – variability of care depending on which hospital – this problem is extensive.”*

**Stakeholder from a Royal College**

The **case for change in respect of acute care and surgery** should be founded on:

- Ensuring that the receiving hospital has appropriately skilled staff available to meet the trauma patient’s needs.
- Addressing ‘the whole patient’ and acknowledge the importance of the whole pathway.

**Variability in staff skills in trauma care** – The relative infrequency with which Major Trauma occurs means that it can be difficult for acute staff to gain experience and skill in this area. Ensuring there is a critical mass of trauma cases to allow staff to build specialist expertise is an important driver of change.

*“...Training alone is not the answer, staff need experience, training can't translate into good care, teams who are more allied to trauma need to be operating.”*

***Stakeholder from a professional association***

*“...a lot of general district hospitals do not have much exposure to Major Trauma... The benefit of regular exposure is that you have a better skills base.”*

***Stakeholder from a Royal College***

**Lack of a structured, systematic approach** – this means that high quality and consistency are not always provided. While pre-arrival warnings are common they are not always part of a coordinated network structure which identifies further specialist care needs. Often there is poor senior involvement in the acute receiving trauma teams, resulting in poor or inappropriate decision-making, delays in treatment and avoidable disability and death. Acute care should address the care needs of all trauma patients in a locality, not only those able to access specialist MTC support. Those hospitals receiving trauma patients should be thinking about the ‘whole patient’ and acknowledging their role and importance in the whole pathway. Patient and family experiences and outcomes should also be considered and monitored more effectively.

#### 1.4.4 Ongoing care and reconstruction

The key change driver in respect of this phase of the pathway (which overlaps with both ‘acute care’ and ‘rehabilitation’) is that ongoing care, at present, can be disjointed and/or poorly coordinated. This has the potential to adversely affect care outcomes and patient experience. The CAGS reported that transfers of care from one professional to another, or one site to another, are not always driven by patient need, and the delays that can occur throughout the transfer process can adversely affect injured patients.

*“We haven't got our act together, fragmentation of trusts and services. Theming and pathways again need attention.”*

***NHS health professional***

The **case for change in respect of ongoing care and reconstruction** should be founded on:

- Developing a coordinated approach to trauma care planning and management within a health and social care system.
- Involving and engaging those within the patient's social network in care
- Delivering universal access to scanning, imaging and Picture Archiving and Communications Systems (PACS).
- Improving strategic planning, commissioning and management of trauma care at the multi-agency/area level.

**Uncoordinated approach to ongoing care planning** – Coordination of medical, nursing and rehabilitation packages of care is crucial, in both MTCs and TUs. At present, not all trauma patients receiving ongoing care will be under the management of a specialist trauma consultant, or in the appropriate care setting (e.g. a dedicated trauma ward or a specialist ward, as necessary). There is a balance, to allow staff to develop skill and expertise, there is a requirement of a ‘critical mass’ of patients – including trauma patients; having trauma patients dispersed across different wards within a hospital can make coordination and care management inefficient.

**Insufficient and/or inconsistent engagement of friends, family and carers** – Addressing the needs of, and opportunities for care support offered by, those in the patient’s immediate social network is not done sufficiently well within the current model of trauma care. This relates to previous points about addressing ‘the whole patient’ rather than simply their medical care needs. The CAG recommends that patient-centred services consider all of the health and well-being needs of people who have sustained traumatic injuries. The important role of family and friends, therefore, should be acknowledged and actively supported.

**Inter-hospital transfer** – As is the case for patient transfers from the location of the trauma incident to the first acute care setting, there is a want for more consistent approaches to transferring patients from one hospital to another for ongoing care. Referral pathways, at present, can be unclear and/or inconsistent which can compromise not only the quality of care received but also longer-term patient outcomes. There is also misplaced priority to vacate beds in specialist centres encompassed in the term “repatriation” which frequently represents an abrogation of ongoing responsibility for care.

**Lack of strategic commissioning, planning and management of trauma care services** – Effective trauma care relies on developing a system in which complex patient movements within and between geographical areas can be managed in a coordinated way. Current models of trauma care are not consistent in terms of the way services are commissioned, and there can be considerable lack of clarity, or disagreement about which service has responsibility for a particular patient, for example, during transfers of care.

### 1.4.5 Psychosocial and Mental Health Care

Patients and their relatives may undergo suffering, great upheavals, and short- and long-term changes in lifestyle as a consequence of patients’ injuries and their physical care, recovery and rehabilitation, and the effects on their families. They and professional staff are agreed that a vital part of major trauma services is a continuum of psychosocial and mental health care delivered within the trauma pathway for every person who is affected.

The continuum of psychosocial care should run in parallel with patients’ physical healthcare from first response until after patients’ discharges from trauma care. It includes recognising and responding to the needs of families. The approach outlined here builds on the Department of Health guidance for psychosocial care for people who are affected by emergencies, disasters and major incidents.<sup>25 26 27</sup>

#### **Patients’ psychosocial responses to serious injury**

The majority of people who suffer major trauma are upset and/or distressed soon afterwards. Some may have troubling emotional, psychological, social and physical experiences for variable periods of time or at intervals after events.

Nonetheless, a substantial majority of people are resilient and remain so if they are offered support. This means that, despite experiencing distress, people may spring back quite rapidly: good psychosocial resilience is not about absence of short-term upset or brief distress but about how people recover afterwards. There is a great deal that all practitioners and family members can do to accelerate this process.<sup>28</sup>

A smaller number of people may suffer more severe or prolonged distress and they require more specialised assessment and/or treatment. A small proportion of people who are injured develop mental disorders and require specialist care.

## Definitions

'Psychosocial' describes *"the psychological, emotional, social and certain physical experiences of particular people and of collectives of people (in families, communities, and leisure, education and work groups as well as groups of strangers who are thrown together) in the context of particular social and physical environments"*. In this context, 'psychosocial' refers to the psychological and social processes that occur within and between people and across groups of people who are exposed to emergencies, major incidents and disasters.

Psychosocial care describes the emotional and social support and other care that single persons or groups of people may require as a result of their injuries. Mental healthcare refers to psychiatric, psychological, and specialised neuropsychological assessments and interventions that patients may require as a consequence of their injuries, care and treatment and any pre-existing mental health needs.

Psychosocial resilience has two components: personal and collective resilience.

- Personal psychosocial resilience describes *"a person's capacity for adapting psychologically, emotionally and physically reasonably well and without lasting detriment to self, relationships or personal development in the face of adversity, threat or challenge"*.<sup>29</sup>
- Collective psychosocial resilience refers to the way in which groups of people and crowds of people *"express and expect solidarity and cohesion, and thereby coordinate and draw upon collective sources of support and other practical resources adaptively to deal with adversity"*.<sup>30</sup>

## A stepped model of psychosocial and mental health care

The Department of Health's guidance advises a stepped programme of psychosocial and mental health care that begins at the scenes of injury and in which services are titrated against recurrent assessments of the needs of the people affected and their progress over time thereafter.

Best practice focuses on three main tasks: (a) sustaining the psychosocial resilience of people who are involved and promoting their recovery from upset and distress; (b) providing more substantial assessments and interventions for selected patients who suffer more severe and/or persistent distress; and (c) providing mental healthcare assessments and interventions for patients who have a pre-existing, or who develop a mental disorder, or who require specialised psychological or psychiatric assessments and interventions.

Sustaining people's resilience after major injuries requires staff of ambulance and trauma services to recognise and respond to how people, including patients, their families and friends, and staff delivering their healthcare, adapt to and recover from adverse events and/or circumstances. It is important that they are offered social support because:

- The abilities of people to accept and use social support and the availability of it are two of the most important features of sustaining peoples' psychosocial resilience and intervening to reduce their distress; and
- There is evidence that adequate support reduces the psychosocial and mental health effects of emergencies, physical injuries, or exposure to challenging events.

The Department of Health stepped model of psychosocial and mental health care, as adapted for the trauma pathway, is outlined in Figure 1.

**Figure 1: A stepped model for psychosocial and mental health care**

Intent	Nature of Activity	Level of Activity	Activity	Time Scale
Sustain Patients' and Families' Personal and Collective Psychosocial Resilience	Preparedness	1	Strategic design and planning to deliver the trauma pathway	Continuing
	Psychosocial Health and Social Care Delivered by Immediate Carers and Staff of the Trauma Services	2	Sustaining patients' and families' resilience and responding to distress through social support	
		3	Delivering Psychological First Aid and Welfare Aid	Immediate and continuing
Deliver responses to patients' and families' needs for specialised social, mental health, and psychological care	Specialised Social Care, and Psychological and Psychiatric Assessments and Interventions	4	Delivering specialised social care	Medium to long-term
		5	Delivering more specialised psychosocial and psychological interventions	
		6	Providing ease of access to specialist psychological and mental health assessment, intervention and care services	Medium and long-term

This stepped model of psychosocial care identifies the important roles that first responders play in initiating the continuum of psychosocial care and the vital roles of staff of trauma services in ensuring that the continuum is sustained. In most instances, they are able to provide what is required for most patients.

This work can be challenging and stressful for staff. Research shows that healthcare staff show remarkable resilience but are also at risk due to their repeated exposure to noxious events and their consequent needs for support.<sup>31 32</sup>

The stepped model means providing:

- Empathic, practical and pragmatic support for everyone that is delivered by and through professional first responders, staff of trauma services, families, and community groups whose actions and interventions should be in accordance with the principles of Psychological First Aid;
- Assessment of people who remain distressed at around a month after events accompanied by access to psychological therapies if and as they are required;
- Access to the full range of mental health services for people who develop a mental disorder, or who have severe symptoms earlier than 28 days after their injury;
- Management and training of staff, their working environments, and their training so as to sustain and develop their psychosocial resilience and reduce the potential psychosocial impacts on their health and wellbeing; and
- Access to services for responders and staff of the rescue, recovery, and major trauma services because of their direct and indirect exposure to risk.

Psychological first aid is an approach that is designed to respond to people's psychosocial needs after major incidents or disasters which comprises of a number of elements. Staff of Major Trauma Centres are likely to find helpful in their work the principles and practices of the CALMER model during the immediate and ongoing phases of assessment, care and intervention.

#### **Implementation consideration:**

- *Levels 1 to 3 of psychosocial care should be integral to the services available within services that deliver immediate and pre-hospital care, Major Trauma Centres and should be provided by*

*the staff of ambulance services and Major Trauma Centres, or in the case of meeting staff needs, by staff support programmes and occupational health services.*

- *Some patients may require more focused interventions because their distress is more severe and/or more persistent. They should be delivered by specialist social care, mental health and psychology staff (levels 4 & 5). Social workers, liaison clinical psychologists, neuropsychologists, and psychiatric nurses should be able to advise on and/or deliver these interventions.*
- *Patients who have pre-existing, or who develop mental disorders usually require access to specialist mental healthcare (at Level 6). Arrangements for liaison psychology and psychiatric services should be in place in Major Trauma Centres.*

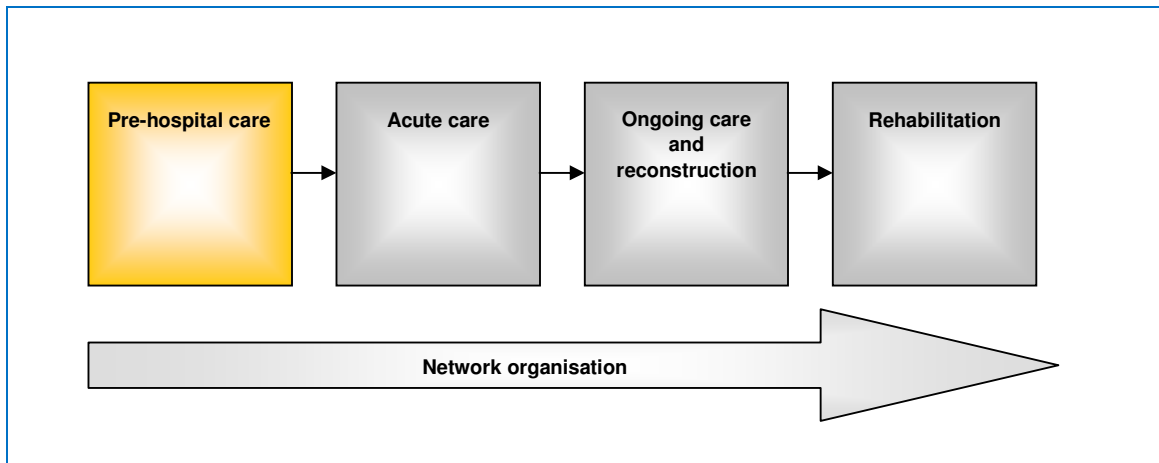
The **case for change in respect of psychosocial and mental healthcare** is that the trauma pathway should be founded on:

- Developing a coordinated continuum of psychosocial and mental healthcare that is an integral part of trauma care service design, planning, management and service delivery within a health and social care system.
- Involving and engaging patients and their families in their care.
- Delivering universal access to social support, welfare aid, psychological first aid, assessment and intervention from the point of injury to after patients' discharge from trauma care.
- Engaging the staff who deliver immediate care and trauma care, including staff of the ambulance and trauma services in delivering psychosocial care and enabling them to do so through training and support.
- Delivering ready access to specialised social care, psychological and psychiatric services on the basis of patients' assessed needs that are titrated against those needs.
- Responding to the psychosocial needs of staff who engage in delivering trauma care.
- Improving strategic planning, commissioning and management of trauma care at the multi-agency/area level.



## 2 Pre-hospital care

### 2.1 Overview



Pre-hospital care consists of:

- Prevention.
- Initial contact.
- Pre-hospital assessment and initiation of treatment.

A major driver of change for pre-hospital care is the need to deliver patients quickly to a suitable trauma care unit at any time of day and in any location. But, there are only a small number of 24 hour specialist care services. At present the trauma pathway is not structured in a way that ensures effective transfer of patients.

There is also a need to further improve and maintain the skill-set of the emergency responders to assess and manage Major Trauma at the scene of the incident. In particular the decision-making of emergency responders needs more consistency and clarity. Clear and consistent protocols also need to be in place to govern the devolution of decision-making.

### 2.2 Clinical Advisory Group report summary

It is important that Major Trauma patients are identified accurately and rapidly so that they are able to benefit from Major Trauma Centres. Patient transfer is a time when they are particularly vulnerable. Journeys and reception should be safe, efficient and planned. All of those involved in these transfers should work to protocols and be specifically trained and equipped for their task. Geographical constraints will mean that some critically injured patients will have long journeys to hospital. Evidence from military and other sources demonstrates that in these cases a system for provision of advanced resuscitation skills at or near the scene of the incident is a crucial factor in improving mortality and morbidity.<sup>33</sup>

The CAGs recommended that all Major Trauma cases should be audited to include the pre-hospital phase. Data should be submitted to a national trauma database and all those involved in managing the case are to be involved in the process.

### 2.2.1 The key themes are:

The CAG working group feel there are a number of key themes for pre-hospital care:

- Identify Major Trauma in the pre-hospital setting.
- Pathways of care.
- Enhance care of the severely injured in the pre-hospital phase.
- Hospital pre-alert and hand-over.
- Secondary emergency department inter-hospital transfers.
- Audit and feedback.

### 2.2.2 Summary Recommendations:

The CAG working group's suggestions are:

- Patients involved in Major Trauma should be identified accurately and rapidly following their injury. Trauma Triage Tools should be used to identify such patients.
- A paramedic to be present in the Ambulance Control room 24 hours a day to advise and support the on scene team and coordinate the transfer pathway to a Major Trauma Centre. Trauma Network coordination should be an integral part of Ambulance Service dispatch operations.
- The frequency of Major Trauma is insufficient to justify the permanent presence of a doctor in the ambulance control centre. However, a consultant level doctor with extensive pre-hospital experience of the management of Major Trauma could be available 24/7. They would be able to advise medically on the best care provision of each patient.
- Patients with injuries suggestive of Major Trauma should be taken to a Major Trauma Centre. Those who are within 45 minutes travelling time from the centre, should be taken there directly, bypassing other units.
- Some patients will be further than 45 minutes travel from a Major Trauma Centre; or be trapped; or will have an injury pattern or airway compromise that means that enhanced care needs to be provided before they can get to the Major Trauma Centre. This could be through an Enhanced Care team or via a closer designated Trauma Unit.
- Enhanced Care teams should be available 24/7 to provide care to the Major Trauma patient.
- Patients with Major Trauma who are taken to a local Trauma Unit should be transferred promptly to a Major Trauma Centre after initial assessment and optimisation in the Emergency Department.
- The patient's onward journey and reception should be safe, efficient and planned. All those involved in these transfers should work to protocols and be specifically trained and equipped for their task.
- Patients who need urgent definitive care at the Major Trauma Centre and those with a serious head injury should be transferred without delay.
- Secondary Emergency Department transfer to a Major Trauma Centre should be provided by an appropriately trained team.
- Emergency Departments (EDs) should be pre-alerted of the arrival of patients with Major Trauma. On arrival at the hospital, a structured handover should be given to the pre-assembled receiving trauma team.
- Regular auditing should be carried out to assess the nature and quality of pre-alert.

- A structured checklist and standardised documentation should be used and included in the patient's clinical record.
- All components of the Trauma Network including Pre-hospital services should be mandated to submit data for all Major Trauma patients to a National Trauma Dataset.

## 2.3 Clinical Advisory Group recommendations

This section describes:

- Detailed recommendations.
- Reasoning for these recommendations.
- Implementation considerations, where necessary.

### 2.3.1 Identifying Major Trauma in the Pre-hospital setting

It is widely accepted that the management of Major Trauma is optimised by treatment in a specialist Major Trauma Centre. Such highly specialised treatment, however, cannot be focussed on those who will benefit from it unless such patients are identified accurately and rapidly following their injury<sup>34 35</sup>.

Transfer is a period of vulnerability for patients. Handovers should be carried out safely, and information passed on. The patient's journey and reception should be:

- Safe.
- Efficient.
- Planned.

The CAGs recommend that anyone involved in transfers should work to protocols and be specifically trained and equipped for their task. All Major Trauma cases should also be audited to include the pre-hospital phase. The data collected should be submitted to a national trauma database.

#### Key recommendations

- 1) A Trauma Triage Tool should be used to identify patients with Major Trauma.
- 2) A paramedic should be present in the Ambulance Control room 24 hours a day. Their role is to identify potential Major Trauma patients and coordinate the response.

Currently UK Ambulance services triage Emergency 999 calls using the Advanced Medical Priority Dispatch System (AMPDS), or the NHS Pathways triage system. These systems can be ineffective in correctly identifying the likelihood of Major Trauma, by under-scoring some injury scenarios.

A number of trauma triage tools have been developed for use in identifying patients who have suffered Major Trauma. These have been reviewed by the working group. The system that appears best suited for use in the UK is the *American College of Surgeons (ACS) 2006 'Guidelines for Field Triage of Injured Patients'*. The working group has made some minor modifications to the mechanism of injury categories to reflect UK injury demographics. This is shown in Appendix A. It is expected that use of a single system will facilitate safe working across each regional Trauma Network.

**Implementation consideration:** *uniform adoption of the American College of Surgeons Guidelines for Field Triage (UK modified) for use in identifying patients for selection for a Major Trauma Centre.*

Experience from London HEMS has shown that clinical input is a key component of tasking. This input allows the identification of trauma victims who require specialist care and who may have been missed using the triage system above. It also allows the appropriate focussing of resources on those that need them. Some ambulance services provide medical advice to tasking desks, but such arrangements are still rare.

The CAG do not believe that the frequency of Major Trauma is sufficient to justify the permanent presence of a doctor in the ambulance control centre. However, it considers that the permanent presence of a paramedic is necessary to triage, coordinate and support the response to a Major Trauma incident. This person should, at other times, be a member of the enhanced care team.

**Implementation consideration:** *there should be a paramedic in ambulance control to triage, coordinate and support the response to a Major Trauma incident.*

All the available information necessary to trigger a Major Trauma alert may not be available when the first call is made. Further information may become available by further questioning of the caller, or from the first emergency service response on scene. Monitoring of the development of incidents as further information becomes available is a vital component of an effective response.

**Implementation consideration:** *Once Major Trauma has been confirmed, or if the possibility of Major Trauma is raised, the control room paramedic should be responsible for helping co-ordinate the pre-hospital response and ensuring that the receiving hospital has received an alert and proper clinical information about the patient.*

Deciding on the best way to provide care for an individual patient can involve complex decision making. Factors to be considered include:

- The relative travelling times to a Trauma Unit or Major Trauma Centre;
- The time it will take to get the enhanced care team to the patient;
- Available modes of transport;
- Feedback from patient assessment and treatment; and
- The current workload in the receiving hospitals.

**Implementation consideration:** *A consultant level doctor with extensive pre-hospital experience of the management of Major Trauma should be available 24/7 to provide expert medical advice on the way to provide the best care for an individual patient. This person could also be used to provide medical advice in other situations. They should be appropriately commissioned to ensure an effective service which is not distracted by other duties. They will require access to the clinical details of the patient, available pre-hospital resources, travel times and capacity of the receiving hospitals and needs to be able to speak directly to the staff treating the patient. Ambulance services should ensure that Terrestrial Trunked Radio (TETRA) communications are available to the doctor.*

## 2.3.2 Pathways of care

### Key recommendations

- 3) All patients identified as Major Trauma should be taken to a Major Trauma Centre. Those who are within 45 minutes travelling time from the Centre, should be taken there directly, bypassing other units.
- 4) Patients who are further away or who are critically unstable should be subject to further guidance on an individual basis.

Immediately-available advice from a Consultant Level Pre-hospital Care Doctor may allow a patient to be taken to the Major Trauma Centre, even if the patient is more than 45 minutes away. The presence of the enhanced care team may allow some unstable patients to proceed to the Major Trauma Centre, even if a local Trauma Unit is closer. Otherwise, such patients should be taken first to the closest local Trauma Unit.

### Key recommendation

- 5) Patients with Major Trauma who are taken to a local Trauma Unit should be transferred to a Major Trauma Centre after initial assessment and optimisation in the Emergency Department.

The Duty Consultant at the Major Trauma Centre should be made aware of any Major Trauma patients taken to a Trauma Unit in their network. Those who are taken to the Trauma Unit because of critical instability should have their imaging transmitted immediately to the Major Trauma Centre. The Duty Consultant in the Major Trauma Centre should be involved in the decision making process.

The Ambulance control paramedic trauma co-ordinator who has been overseeing the case should make provisional preparations for onward transfer to the Major Trauma Centre, unless stepped-down by the Trauma Team Leader at local Trauma Unit.

Some of those taken to the local Trauma Unit on the basis of the Trauma Triage Tool will turn out to be less severely injured and will not need to be transferred to the Major Trauma Centre.

Occasionally, immediate life-saving, damage control interventions may be required to be done at the Trauma Unit. Some patients will be stabilised sufficiently after damage control interventions that they won't need to be transferred to the centre (e.g. isolated splenic bleeding). Others may need further optimisation before they can be transferred. Patients who need urgent definitive care at the Major Trauma Centre and those with a serious head injury should be transferred on without delay.

It is essential to have pre-determined pathways of care which are dynamic and flexible, with all health professionals involved. These pathways should cover all elements of the patient's trauma care process and journey, on an ongoing basis and seamlessly, starting from the first call for help until final outcome.

Each Regional Trauma Network region could have both a Major Trauma Centre and a number of Trauma Units. The CAG considered what travelling time from scene to Major Trauma Centre would justify bypassing a local Trauma Unit in order to deliver the patient directly to a Major Trauma Centre. It is considered that in most cases a travelling time of 45 minutes is acceptable. The CAG recommends that a mapping process should be performed to pre-define geographical areas that are within 45 minutes driving time (under emergency conditions) of a Major Trauma Centre. Similar mapping should be done for Air Ambulance transfer times which will include the time taken to

transfer the patient from the helipad into the receiving hospital. For examples of mapping see Appendix A.

**Implementation consideration:** *a mapping process should be performed to identify 45 minute isochrones for travel time by road/air/other to each Major Trauma Centre.*

Some patients will be further than 45 minutes travel from a Major Trauma Centre, or be trapped, or will have an injury pattern, or airway compromise that means that enhanced care needs to be provided before they can get to the Major Trauma Centre. These should be dealt with on an individual case by case basis according to their injury pattern, physiological state, available resources (e.g. pre-hospital enhanced care team, nearer Trauma Unit), and relative travel times to Trauma Unit and Major Trauma Centre. The Ambulance control paramedic trauma co-ordinator should collate all the information and should have rapid access to the duty pre-hospital care consultant to decide on the best pathway of care for the patient.

**Implementation consideration:** *patients outside of the 45 minute drive time or with critical clinical need should have their pathway of care decided on an individual basis by senior clinicians based on clinical condition, incident location and available resources.*

### 2.3.3 Enhanced Care of the severely Injured in the Pre-hospital phase

#### Key recommendations

- 6) Enhanced Care teams should be available 24/7 to provide care to the Major Trauma patient.
- 7) Major Trauma patients should be transferred to an appropriate Major Trauma Centre when indicated.

It is essential to provide enhanced clinical care to the severely injured as soon as possible and in a seamless fashion.

Severely injured patients can have complex injury patterns and their condition can change rapidly. Experienced assessment may indicate the requirement for advanced airway techniques including Rapid Sequence Induction (RSI) in order to secure their airway, and provide optimum care. Relatively few patients require pre-hospital RSI but this can result in unnecessary morbidity and mortality if performed poorly.

Assessment by the Enhanced Care team may also indicate techniques such as; advanced analgesia, thoracotomy, resuscitative thoracotomy, amputation, regional nerve blocks or procedural sedation.

**Implementation consideration:** *commissioners should ensure that NHS Career Framework Level 8 practitioners are available on a 24/7 basis to provide advanced assessment and treatment skills in the pre-hospital setting across its area of operations. Level 6/7 practitioners with extended training to assist with advanced procedures should also be continuously available. If enhanced procedures are to be performed, this should be done only by appropriately trained and competent practitioners working in a properly structured system. These practitioners could form part of a dedicated “enhanced care team” which could be deployed on a contingent basis to cases identified or confirmed by the paramedic in ambulance control as involving Major Trauma injuries.*

The working group accepts that only a small number of patients will suffer Major Trauma injuries each day in any one Ambulance Service region and even fewer in whom on-scene intervention is required. The group recognises that the deployment of an enhanced care team will present logistical and financial challenges for those services which cover a large geographical area. There

is an obvious skills overlap with other NHS requirements such as MERIT and critical care transfer teams, which may assist operational planning.

**Implementation consideration:** *the provision and deployment of enhanced care pre-hospital teams for Major Trauma may be considered in conjunction with other regional network demands (e.g. critical, vascular where there is also a need to move critically ill patients).*

*The transport available to the Enhanced Care team will impact on their effectiveness e.g. helicopter delivery might be the optimal solution to wider geographical coverage, depending on the availability of landing sites and secondary transport options .*

Currently in some areas an enhanced care provision is offered by volunteer Immediate Care Practitioners (BASICS), or by teams coming out from receiving hospitals. However, the cover and skills provided country wide are variable with many areas having no provision.

**Implementation consideration:** *in areas where the Enhanced Care team is required and formed by local providers, such care should be formally commissioned and appropriately supported.*

In circumstances when the Enhanced Care team is some time away from an incident the Ambulance Control trauma co-ordinator is formally tasked in discussion with the pre-hospital care consultant in determining whether the:

- a) Patient should be transferred to hospital directly;
- b) Enhanced Care Team should attend the scene of the accident, or
- c) Enhanced Care Team should meet the transferring ambulance en-route to or at Trauma Unit (or a Local Emergency Hospital) in order to initiate critical care before proceeding to the Major Trauma Centre in a Retrieval Team capacity.

Thus, Enhanced Care teams may be responding either directly to the incident, as Intercept teams, or Hospital Retrieval teams. The over-riding principle is that the seriously injured patient should not be delayed from being transferred from the scene.

### 2.3.4 Hospital Pre-alert and Hand-over

#### Key recommendations

- 8) A structured pre-alert should be given to the receiving hospital as early as possible.
- 9) On arrival at the hospital a structured handover should be given to the receiving team.

It is essential that receiving Emergency Departments (EDs) are pre-alerted about the arrival of patients with Major Trauma, or with injuries that raise the possibility of Major Trauma. They require sufficient time to ensure that space is available in the resuscitation area and that specialist staff are expecting and awaiting the patient's arrival. This pre-alert is the responsibility of the ambulance control paramedic trauma co-ordinator and could be done by the means of a dedicated "alert" phone.

Handover of accurate standardised information is essential. A useful acronym to ensure that this is done is ATMIST (see Appendix A).

Provision of information from the scene of an incident or en route to hospital is important tool to ensure the correct hospital response. Telemetry of vital signs monitoring from the scene or ambulance to hospital can aid the provision of seamless care.

**Implementation consideration:** *means should be made available in every trauma receiving emergency department to allow direct and ongoing communication with ambulance service personnel and vehicles and staff should be trained in the use of this equipment.*

On occasions, a patient may be assessed and treated at scene by one ambulance crew, but transported to hospital by a different crew (for example an air ambulance). In these circumstances, the ambulance crew who knows the patient best should communicate with the hospital. In order to enhance proper assessment, evaluation and follow-up, while at the same time respecting patient confidentiality and data protection as appropriate and necessary, all communication should be through the ambulance control paramedic trauma co-ordinator,

**Implementation consideration:** *regular auditing should be carried out to assess the nature and quality of pre-alert.*

When an emergency department has been pre-alerted to expect a casualty, the ambulance crew bringing a patient should be met timely by an appropriate trauma team.

**Implementation consideration:** *the hand-over of a patient should be done in a standardised way. It is usual to do this in parts: firstly an initial short verbal hand-over to whole trauma team; a more detailed verbal hand-over of additional information and documentation hand-over.*

An initial short verbal hand-over should be made to the trauma team leader so that all trauma team members can hear. There should be no distractions during this period and all members of the hospital trauma team should pay attention while the handover is being given. The ATMIST mnemonic can be used.

Additional vital information to be given to the trauma team leader or lead nurse which will include social and personal background data e.g. whether relatives or carers are aware of the incident; whether the police are involved; and whether other casualties should be expected.

A legible comprehensive ambulance report form should be completed for every patient and a copy of this should go into the hospital patient records. This data could be standardised nationally in order to facilitate uniform data comparison and audit and governance across the whole care pathway. Other documentation may include digital photographs, or electronic downloads of digital physiological information from monitoring equipment.

To avoid ambulance personnel being delayed, or unnecessary patient handling, for equipment such as splints or immobilisation devices to be removed from patients, emergency departments and ambulance services could work together to ensure a supply of replacement equipment is available to ambulance crews arriving with trauma patients. Standardised equipment should be used within a Trauma Network.

### 2.3.5 Secondary Emergency Department inter-hospital transfers

#### **Key recommendations**

- 10) Secondary Emergency Department transfer to a Major Trauma Centre could be provided by an appropriately trained team.
- 11) For time-critical conditions, the transfer should be performed without delay.
- 12) A structured checklist and standardised documentation should be used and included in the patients' clinical record.

This section only considers the secondary transfer from an Emergency Department in one Hospital to a Major Trauma Centre of patients who have suffered Major Trauma. It does not cover later



transfers such as from one Intensive Care Unit to another. The later should follow established protocols developed by local critical care networks.

If a patient requires secondary transfer to a Major Trauma Centre, early contact should be made with both the Major Trauma Centre and the Ambulance Control Trauma Co-ordinator so that a decision can be made on the most appropriate team and transport method for there to be a timely transfer.

**Implementation consideration:** *a standardised checklist, both for the patient and the transfer team, should be used as part of the pre-departure routine and on arrival at the receiving Major Trauma Centre. Robust communications should be available to enable any change in the patient's condition to be passed to the receiving hospital.*

Major Trauma patients who are being transferred from a Trauma Unit to a Major Trauma Centre in the early stages of treatment may be unstable and the same skill set should be available on the transfer team as the Enhanced Care Team who attend an incident. In addition to these skills they need to be able to manage infusion pumps, arterial lines and portable ventilators.

**Implementation consideration:** *all doctors and other personnel undertaking transfers should have the appropriate competencies, qualifications and experience and be trained to undertake transfers.*

To provide a robust and flexible system, it would be desirable that the Ambulance Service and the Major Trauma Centres both have teams that are able to perform secondary inter-hospital transfers. In the case of the Ambulance Service the duty Enhanced Care Team could be used. For Hospital staff, additional pre-hospital training and experience would be required.

**Implementation consideration:** *the Major Trauma Centre hospital should have robust arrangements to ensure that sending personnel on a transfer does not jeopardise other work within the hospital. Hospitals should be required to ensure that employees sent on transfers have adequate insurance cover and are made aware of the terms and limitations of this cover.*

### 2.3.6 Audit & Feedback

#### Key recommendations

- 13) All components of the Trauma Network including Pre-hospital services should submit data for all Major Trauma patients to a National Trauma Dataset (currently TARN).
- 14) Regular audit of the pre-hospital phase of trauma care is essential. Pre-hospital care providers should be given feedback on the patients they manage and should attend audit and other meetings in the MTC and network as part of good clinical governance.

Robust audit and feedback to members of the Pre-hospital team are vital components of clinical governance

**Implementation consideration:** *all Major Trauma cases should be audited and this could include all aspects of the Pre-hospital care including timelines and transport decisions. Feedback should be given to the pre-hospital and hospital based clinicians who managed the patient to compare suspected and actual injuries. All Ambulance Service NHS trusts should establish a trauma audit capability. This should include personnel and support including IT facilities. All Ambulance Services should become members of a National Trauma Dataset (currently TARN) or a similar national program.*

## 2.4 Stakeholder support and challenge

When discussing this stage of the pathway stakeholders recognised that there has been improvement in **pre-hospital assessment by emergency services** but they had a number of concerns. The main worries that stakeholders had are about:

- Delays in decision-making and treatment;
- Patients being taken to the wrong hospital;
- Uncoordinated care; and
- Insufficient paramedic crews in many ambulance services.

One professional association identified four different reasons for inconsistencies in the initial contact stage:

- Time of day at which Major Trauma occurs;
- Skill-set of the emergency responders;
- Location at which the Major Trauma occurs; and
- Decision-making skills (and amount of decision-making devolution) of the emergency responders.

Some stakeholders said that skills are not just learnt in the classroom, they are also based on experience:

*“Although there is a good paramedic base, the average paramedic may only see a Major Trauma once every 18 months – the system needs to get those with the experience to the scene, and training needs to improve. Training alone is not the answer, staff need experience, training can’t translate into good care, teams who are more allied to trauma need to be operating.”*

**Representative from a Royal College**

Stakeholders are in broad agreement with the CAG that improvements need to be made, particularly around ensuring there is high quality and consistency across the country:

*“The other aspect is that so much enhanced support is voluntary and variable across the country – in this regard there is a postcode lottery operating.”*

**Representative from a professional association**

A further weakness identified was that the focus on improving initial contact has not extended to thinking about how it links to other stages of the pathway to make a seamless patient experience. An example of this is that initial contact has focused on improving response times to incidents rather than also thinking about what should happen next:

*“I think that because there are no defined Trauma Systems in place, where you take people and having a clear idea where you go with it is patchy. If there was a defined system it would be much easier, currently it’s just a case of taking them to the nearest place. Trauma care gets done, the first contact system works but having the tools – that’s what missing. It gets done despite deficiencies of the current system.”*

**Representative from a Royal College**

*“(the) focus is on the time taken to get to the patient so it connects, but unfortunately there is no emphasis placed on what happens after the first contact.”*

***Representative from a professional association***

Decision-making skills (and amount of decision-making devolution) of the emergency responders. Most feel it is now of a reasonably good quality. Ambulance control and dispatch have well trained paramedics in place and are able to call on additional on-scene support. This is seen as an improvement on what previously happened:

*“There is very good ambulance control system and paramedic dispatch; there is good medical oversight of the protocols used. In some areas there is the ability to call upon enhanced skills and effectively bring the hospital to the patient – this is achieved by pre-hospital doctors or helicopter services.”*

***Representative of a Royal College***

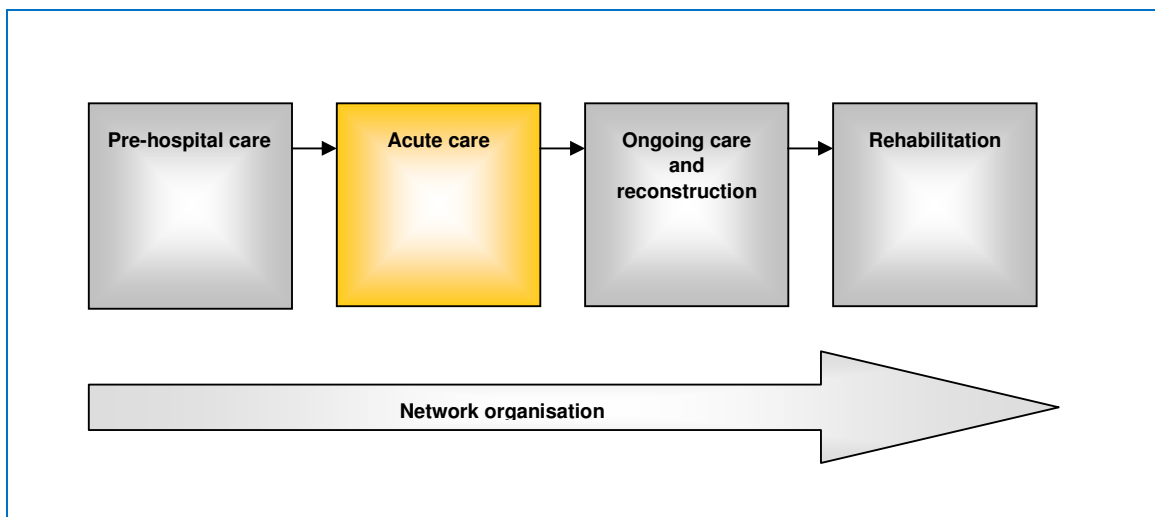
*“(Initial contact has) seen a huge improvement with the introduction of paramedics in comparison with previous set-up where there was just an ambulance driver”*

**NHS Clinical Staff Member**



## 3 Acute care

### 3.1 Overview



The acute care stage of the pathway includes all emergency trauma care provided within an acute receiving hospital following reception of a seriously injured patient from pre-hospital practitioners or after urgent transfer from another hospital.

Change is necessary within acute care to remedy a lack of a structured, systematic approach to providing high quality and consistent care. Pre-arrival warnings are common but not as part of a coordinated network structure anticipating further specialist care needs. Too often, limited senior involvement in the acute receiving trauma teams results in poor or incorrect decision-making, delays in treatment, and avoidable disability and death. Acute care needs to be able to address the care needs of all trauma patients in a locality, not only those able to access specialist MTC support. All hospitals receiving trauma patients should have appropriately skilled staff in place and acute care should take account of the ‘whole patient’ and acknowledging its importance along the whole pathway. Patient and family experiences and outcomes also should be considered and monitored more effectively.

### 3.2 Clinical Advisory Group report summary

The Acute Care and Surgery group addressed the issues in relation to: reception of trauma patients (and staffing to support this); assessment, including radiology and imaging; emergency and specialist surgical intervention, including neurosurgery and spinal cord injury; and, critical care.

#### 3.2.1 Key themes

The CAG working group has identified a number of key themes for acute care and surgery:

- Alert system and interface.
- Configuration of the trauma team.
- Resuscitation.
- Documentation.

- Diagnostic imaging including radiology facilities, plain films, FAST scan, CT scan, access to MRI, provision of reports, and networks and teleradiology.
- Acute Intervention including theatre availability, theatre team, surgical seniority, damage control surgery, general surgery, orthopaedics, cardiothoracic surgery, vascular surgery, interventional radiology, haemorrhage control, neurosurgery, access to neurosciences, neurosurgical intervention, spinal assessment and blood transfusion.
- Critical care including general ICU facility/access and audit in the ICU.
- Interaction with patient's support (relatives, friends, other).
- Organ donation.
- Discharge planning including a network protocol.

### 3.2.2 Summary Recommendations

The CAG working group's recommendations are as follows:

- A pre-alert system with effective communication between pre-hospital and in-hospital teams as part of a region-wide network.
- Standard operating procedures and written criteria for trauma team activation and patient handover.
- Trained trauma team present 24 hours a day for the immediate reception of the patient.
- 24-hour access to a fully staffed and equipped emergency theatre.
- For Emergency Radiology facilities:
  - CT co-located in the emergency department. For patients who are stable, whole-body CT scanning could be provided;
  - MRI scanning available 24 hours a day at Major Trauma centres;
  - Agreed timelines and competencies for reporting and documentation;
  - Agreed teleradiology facilities between all Trauma Units and the Major Trauma centre within a network.
- For Emergency Trauma Surgery:
  - Should be performed by a consultant surgeon with appropriate skills and experience;
  - All surgeons must understand the principles and techniques of damage control surgery;
  - All patients requiring acute intervention for haemorrhage control must be in a definitive management area (operating room or intervention suite) within 60 minutes.
- For neurosurgery and spinal cord injury:
  - Neurosurgery consultants should be available for consultation to the Trauma Network 24 hours a day.
  - Patients with severe head or spinal cord injury should be managed in a neurosciences centre, irrespective of the need for surgical intervention.
  - A consultant should be involved in all decisions to operate for traumatic brain injury.
  - There should be a network protocol for assessing the whole spine in patients with Major Trauma.
- Appropriate major haemorrhage protocols should be in place across the network and activations regularly audited. In the Major Trauma centre, a clinical transfusion lead and a transfusion specialist should be available for advice 24 hours a day.

### 3.3 Clinical Advisory Group recommendations

#### Reception and staffing

##### Key recommendations

- 1) There should be a pre-alert system with effective communication between pre-hospital and in-hospital teams as part of a region-wide network and documented criteria for trauma team activation and patient handover.
- 2) There should be a trained trauma team present 24 hours a day for the immediate reception of the patient. The trauma team leader should be a consultant in the MTC and, in the TU, should be at least ST4 or equivalent competency who will attend within 30 minutes by a consultant.
- 3) There should be surgical and resuscitative thoracotomy capability within the receiving trauma team.
- 4) For the acute management of injuries, consultants should attend within 30 minutes.

There is a need to integrate the reception stage of acute care with the pre-hospital stage (see chapter 2). It is important that there is clarity about pre-alert, activation of the trauma team and 'ownership' of the patient, to ensure that handover from the pre-hospital care team to the acute care team is smooth, fully informed and efficient. To this end:

- Hospital pre-alert calls could come direct from the pre-hospital team as part of a region-wide network response.
- There should be a dedicated trauma phone within the ED and all calls should be recorded and subject to review and audit, including inappropriate and/or failed activations.
- Calls from the Pre-hospital team or referring TU should be taken by the duty consultant.
- The pre-hospital care team should hand over the patient directly to the trauma team leader in the receiving hospital.

#### Implementation considerations

**Table 3.1 Implementation consideration for Reception and Staffing**

Trauma Network	Major Trauma Centre	Trauma Unit
<ul style="list-style-type: none"> <li>• <i>A consultant clinical coordinator should be available for advice &amp; liaison with pre-hospital teams, secondary transfers and retrieval.</i></li> <li>• <i>Pre-hospital documentation should be standard across the network, incorporated into hospital documentation, and</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Consultant-led trauma team</i></li> <li>• <i>Consultant trauma team leader resident on-site 24/7 and immediately available</i></li> <li>• <i>Trauma team leader to have undergone training and demonstrated competence in team management and leadership</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Consultant-led trauma team, where consultant with appropriate skill available, otherwise, team led by suitably trained registrar of ST4 level or above, with a consultant attending within 30mins as required.</i></li> <li>• <i>The trauma team should be configured to manage,</i></li> </ul>

Trauma Network	Major Trauma Centre	Trauma Unit
<p><i>should:</i></p> <ul style="list-style-type: none"> <li>– include a standardised trauma resuscitation documentation, fully completed for all patients.</li> <li>– include clear criteria that determine when the hospital trauma team is activated.</li> <li>– be audited as part of the clinical governance process.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Receiving trauma team should include doctors from:</i> <ul style="list-style-type: none"> <li>– Emergency Medicine</li> <li>– Anaesthesia/intensive care</li> <li>– General Surgery</li> <li>– Trauma and Orthopaedic Surgery</li> </ul> </li> </ul> <p><i>Team could also include an individual with capacity to undertake resuscitative thoracotomy.<sup>36</sup></i></p>	<p><i>at any time, arrival of patients from the following three groups:</i></p> <ul style="list-style-type: none"> <li>– those considered to have injuries not requiring expertise of MTC.</li> <li>– those critically injured for whom transfer to MTC could adversely affect outcome.<sup>37</sup></li> <li>– those who are not critically unstable but who would benefit from specialist care.<sup>38</sup></li> </ul>
	<ul style="list-style-type: none"> <li>• <i>All trauma team members to have completed course in trauma management (ATLS, ATNC, or equivalent) and demonstrate competence.</i></li> <li>• <i>The trauma team leader can call consultants from relevant other specialties as required who will attend within 30mins.</i></li> <li>• <i>Each trauma team member to have responsibility for pre-defined tasks to be undertaken simultaneously (to include ABC tasks).</i></li> </ul>	

There should be a dedicated trauma team member to liaise with the relatives of trauma patients.<sup>39</sup> Relatives of critically ill/ injured patients will value honesty and reassurance about their relative so that they know what to expect.

**Implementation considerations:** *The relatives nurse should work to ensure relatives: know that everything that can be done is being done; can be with or near the patient, and have as much interaction with them as possible; and, receive frequent information about what is happening and why.<sup>40</sup>*



## Radiology

### Key recommendations

- 5) Emergency radiology facilities including CT should be co-located in the emergency department.
- 6) Whole-body CT is the diagnostic modality of choice where patients are stable enough for transfer to CT.
- 7) MRI scanning should be available 24 hours a day at Major Trauma centres.
- 8) There are agreed timelines and competencies for reporting and documentation.
- 9) There are teleradiology facilities between all Trauma Units and the Major Trauma centre within the network.
- 10) At Major Trauma centres interventional radiology capability will attend within 60 minutes 24 hours a day. Interventional suites should be ideally co-located with operating rooms and/or resuscitation areas.

The MTC should have dedicated radiology facilities within the resuscitation room, with CT scanning immediately available and co-located in the emergency department – and ideally within the resuscitation suite. For Trauma Units, radiology facilities should be rapidly available for the resuscitation room with CT immediately available and staffed 24 hours a day, and both FAST ultrasound and plain films immediately available<sup>41 42</sup>. In all hospitals receiving Major Trauma patients, CT should be the primary imaging modality where indicated and not delayed by plain films or ultrasound.

CT should include facilities for continued monitoring, anaesthesia and resuscitation along with adequate space for transfer of Major Trauma patients<sup>43 44 45 46 47 48</sup>. Patients requiring MRI should be transferred to the MTC, where MRI should be available 24 hours a day and should include equipment and facilities to enable the scanning of anaesthetised and ventilated patients.<sup>49 50 51</sup>

**Implementation consideration:** *Networks should agree standardised imaging and reporting protocols for patients, to facilitate communication and transfer of patients within the network. Practice should conform to recognised standards.<sup>52</sup>*

It is essential that data transfer within and across networks should be of high quality and as close to real time as possible.<sup>53 54 55 56 57</sup> To this end, MTCs and TUs must work collaboratively to develop links for reporting and referral, as well as standardised imaging protocols between centres. IT infrastructure for radiology departments should be in place to provide high quality real-time teleradiology for immediate review and reporting of trauma images. This may need to include to the home of the designated cross sectional imaging radiologist. There should also be systems in place for the trauma teams to confirm and document receipt of images/reports.

**Implementation considerations** are summarised in table 3.2 below.

**Table 3.2 Implementation consideration for ‘Radiology’**

Major Trauma Centre	Trauma Unit
<ul style="list-style-type: none"> <li>• <i>Provisional communication of any life-threatening injuries should be made immediately to the trauma team leader.</i></li> <li>• <i>A primary written structured report covering life-threatening abnormalities should be issued within one hour by an appropriately trained radiologist.</i></li> <li>• <i>A final and complete report should follow within 12 hours of the scan.</i></li> <li>• <i>Radiologists issuing final reports must have achieved documented competence in trauma diagnostic imaging.</i></li> <li>• <i>Any significant variations between provisional and final reports should be communicated to the senior responsible clinician treating the patient.</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>A structured report should be issued as soon as possible and within the hour by the on call cross sectional radiologist. Within a well organised network this might be a local radiologist, a radiologist from another regional Trauma Unit or a radiologist from the Major Trauma unit.</i></li> <li>• <i>This report should be communicated by telephone and electronically.</i></li> <li>• <i>Locally agreed receipts of acknowledgement should be in place but at the very least, a record of the reports recipient should be made.</i></li> <li>• <i>A full electronic report should be issued within 12 hours and any further urgent findings communicated to the theatre or ICU again with a record of receipt.<sup>58 59 60 61 62</sup></i></li> <li>• <i>Any significant variations between provisional and final reports should be communicated to the senior responsible clinician treating the patient.</i></li> </ul>

Interventional radiology (IR) taking place within an MTC should be available 24 hours a day. Patients requiring acute intervention for haemorrhage control should be in a definitive management area (operating room or IR suite) within 60 minutes of arrival.

**Implementation consideration:** *IR rooms should be co-located with the resuscitation/CT area and operating rooms where possible<sup>63 64 65</sup> and must be staffed by an appropriately skilled team.<sup>66</sup> The IR rooms must be of theatre standard, which may include theatre lighting and a dual-purpose table. IR rooms should have full anaesthetic facilities and access to appropriate drugs and fluids.*

**Key recommendations**

**Emergency trauma surgery**

- 11) Emergency trauma surgery should be performed by a consultant surgeon with appropriate skills and experience;
- 12) All emergency trauma surgeons should understand the principles and techniques of damage control surgery;

All hospitals receiving trauma patients should ensure there is access to emergency theatres. In the MTC this means 24-hour access to a fully staffed<sup>67</sup> emergency theatre with

equipment/instrumentation and supplies readily available before the patient arrives; in the TU, there should be 24-hour access to a CEPOD emergency theatre<sup>68</sup>. Within theatre teams, the Senior Nurse/ODP must rely on knowledge and expertise to coordinate and facilitate an interdisciplinary team approach to meet the over-arching goal of decreasing morbidity and mortality<sup>69 70 71 72</sup>. Trauma surgery itself must be performed by a consultant surgeon with appropriate skills and experience.<sup>73 74</sup>

**Implementation consideration:** *Rotation of theatre teams to the MTC from the TUs should be encouraged to develop skills, provide education and ensure that all staff involved in trauma care maintains proficiency. This should be in addition to continuing education and training, updating of skills, basic and advanced competencies.*<sup>75</sup>

All surgeons involved in the management of Major Trauma should understand the indications for and techniques of damage control surgery and have undergone appropriate education and training courses e.g. DSTS.<sup>76 77</sup> MTC surgeons should be fully competent in the techniques of damage control surgery.

**Implementation consideration:** *There should be an individual in the Trauma Team who is capable of applying Damage Control Surgery. For the thorax, this should include the ability to: relieve or exclude cardiac tamponade using a left antero-lateral thoracotomy (LAT); rapidly control hemorrhage which may require definitive access by converting the LAT to a bilateral anterior thoracotomy (clamshell); and to control a massive air leak.*

### Key Recommendations

#### **General, orthopaedic, vascular and thoracic surgery**

- 13) There should be 24-hour access to a fully staffed and equipped emergency theatre.
- 14) General surgery and orthopaedic surgery senior trainees should be on site 24 hours a day. Consultants should attend within 30 minutes for the acute management of injuries.
- 15) Vascular and cardiothoracic consultants should be available for consultation to the Trauma Network 24 hours a day, and must attend within 30 minutes to the Major Trauma centre.

Surgeons should have documented training / experience in the management of Major Trauma (e.g. The Definitive Surgical Trauma Skills Course).

#### **Implementation consideration:**

- **General surgery**<sup>78 79</sup>: *A consultant should be available within 30 minutes for the acute management of injuries and a general surgical SpR should be available on-site 24/7. The MTC consultant should be free of all elective responsibility when on-call for Major Trauma.*
- **Orthopaedics**<sup>80 81</sup>: *A consultant should be available within 30 minutes for the acute management of injuries. An orthopaedic SpR should be available on-site 24/7. Within the MTC, the consultant must be documented as competent in the management of Major Trauma including the unstable pelvic fracture and have competence / understanding of the principle and practice of damage control orthopaedics.*
- **Cardiothoracic surgery**<sup>82 83</sup>: *A consultant cardiothoracic surgeon should be available to the network for consultation for patients with chest injuries, and within 30 minutes to the MTC for the acute management of cardiothoracic injuries. The MTC should also ensure that there are protocols in place for the management of patients with cardiothoracic injuries to ensure optimum care before the arrival of a cardiothoracic surgeon.*

- **Vascular Surgery**<sup>84 85</sup>: A consultant vascular surgeon should be available for consultation for patients with vascular injuries, and within 30 minutes to the MTC for the acute management of vascular injuries. This consultant should be documented as competent in the management of Major Trauma, e.g. having undertaken the DSTS course.

### Key Recommendations

#### **Neurosurgery, neurosciences and spinal cord injury**

- 16) Neurosurgery consultants should be available for consultation by the Trauma Network 24 hours a day. At the MTC, there should be a senior trainee on-site and a neurosurgery consultant available within 30 minutes.
- 17) Patients with severe head or spinal cord injury should be managed in a neurosciences centre, irrespective of the need for surgical intervention.
- 18) A consultant should be involved in all decisions to operate for traumatic brain injury. Patients requiring acute neurosurgical intervention for isolated brain injury should receive this within 4 hours of injury and 1 hour of arriving in the major trauma centre. The patient should be appropriately resuscitated to prevent hypoxia and hypotension.
- 19) There should be a network protocol for assessing the whole spine in patients with Major Trauma.
- 20) Network protocols should ensure the safe and rapid transfer of patients to specialist care. The effective referral for transfer is the responsibility of the neurosciences centre. The key point here is to ensure responsibility and ownership, which currently is imprecise leading to inconsistency.
- 21) There should be a network protocol in place for assessing the whole spine in patients with Major Trauma. Spinal imaging and assessment should be completed and reviewed by an appropriate consultant within 24 hours of admission.

In referring patients across the network, the referral pathway for the patient should be the responsibility of the neurosciences centre, not the referring hospital. A neurosurgical consultant should be involved in all decisions to accept or decline patients across the network.

**Implementation consideration:** *Trauma network protocols should be in place to ensure rapid, safe transfer of patients and appropriate management before, during and following transfer. Patients with severe head or spinal injury, irrespective of the need for surgery, should be transferred to the neurosciences centre. Patients deemed unsuitable for transfer should be discussed with a consultant neurosurgeon.*<sup>86 87</sup>

A consultant neurosurgeon should be available to the network for consultation for patients with traumatic brain injuries and available to the MTC within 30 minutes for the acute management of injuries, and for telephone consultation to the specialist neurosurgical TU. At the MTC there should be a specialty neurosurgical trainee on-site. The trainee should be appropriately trained and signed-off in decision-making and emergency operative management of neurotrauma.<sup>88 89</sup>

**Implementation consideration:** *Within the MTC and specialist neurosurgical TU, all patients with severe head injury should be managed in consultation with a Consultant Neurosurgeon. Similarly, all patients with severe spinal injury should be managed in consultation with a named Consultant Spinal Surgeon. Access to Consultant advice should be available 24hrs/day.*

*In the TU, all patients with moderate head injuries (GCS 9-13) should be discussed with the neurosciences centre and management plans agreed between the referral hospital and the*

neurosciences centre. Formal protocols should be in place to ensure appropriate management whether the patient remains in the local hospital or is admitted to the neurosciences centre.

In both the MTC and the neurosurgical TU, a consultant should be involved in all acute decisions to operate for traumatic brain injury.

**Implementation consideration:** *Patients requiring neurosurgical intervention should have this within four hours of injury. Patients requiring acute neurosurgical intervention should have this within 60 minutes.*

Within both the MTC and the specialist neurosurgical/spinal Trauma Units, appropriate spinal imaging and assessment should be completed and reviewed by a consultant in radiology, neurosurgery or orthopaedics within 24 hours of initial hospital admission.<sup>90</sup>

**Implementation consideration:** *There should be a network protocol in place for clearing the whole spine in all patients with major injuries.*

### Key recommendations

#### **Critical care**

- 22) Intensive care units should be on-site and comply with minimum generic standards of the Intensive Care Society and Department of Health.
- 23) Transfers should be appropriately staffed and affected in a timely and safe manner.

All hospitals receiving trauma patients requiring critical care should have on-site appropriately equipped and staffed ICU facilities.<sup>91 92 93 94</sup> Transfer of severely injured patients between ICUs in different hospitals within networks should be properly funded and staffed and not degrade the intensive care provision for other patients.

The Trauma Network should ensure that transfers for non-clinical reasons are contained within the network and occur only following consultant-to-consultant discussion and agreement. Any patient who has to be sent outside the Trauma Network should be regarded as an adverse incident and appropriately investigated. Special agreements should be reached for transfers between hospitals at the borders of adjacent Trauma Networks.

**Implementation consideration:** *General ICUs should comply with the minimum generic standards published by the Intensive Care Society and Department of Health.<sup>95</sup> Consultant staffing within both MTCs and TUs should be consistent with guidance in ICS standards for consultant staffing of ICUs (ICS,2008).<sup>96</sup> Nurse staffing should be consistent with RCN guidance for nurse staffing in critical care (RCN, 2003).<sup>97</sup>*

The Trauma Network should support a data collecting culture promoting an evidence base. All ICUs within the network should participate in the Trauma Audit Research Network<sup>98</sup>, Intensive Care National Audit and Research Centre Case Mix Programme<sup>99</sup> and Risk Adjustment In Neurosciences<sup>100</sup> programmes.<sup>101</sup>

**Implementation consideration:** *Developing and promoting a culture of ICU data-collection will require dedicated staff and funding at network level.*

### **Key recommendations**

#### ***Blood transfusion and haemorrhage control***

- 24) Appropriate major haemorrhage protocols must be in place across the network Trauma Units and activations regularly audited.
- 25) In the Major Trauma centre there should be clinical transfusion leadership and a transfusion specialist is available for advice 24 hours a day.
- 26) All patients requiring acute intervention for haemorrhage control should be in a definitive management area (operating room or intervention suite) within 60 minutes.

Blood transfusion is life-saving but patient outcomes are dependent on both timely access to blood components and optimal and safe use of component therapy. Transfusion policies should be agreed and in place at Trauma Centres and Trauma Units, supported by training and audit. It is important that the Hospital Transfusion Committee reviews the local protocols for requesting and obtaining blood in emergencies, and agrees massive transfusion protocols (including out-of-hours); policies should re-iterate the necessity for early communication to the blood transfusion laboratory.

**Implementation consideration:** *Although guidelines will largely relate to practice at individual Trauma Centres/units, there is scope to rationalise policies: for example, the creation of a common regional or network major haemorrhage/massive transfusion protocol. Protocols at Trauma Centres should be shared regionally through the network. The two main principles which should underpin the development of local protocols are: timely access to blood components; and, optimal and safe use of blood components. Blood Transfusion laboratories should review staffing resources to support agreed local policies, including for out-of-hours support.*

Within both MTCs and TUs there should be appropriate laboratory transfusion support in place underpinned by appropriate policies and protocols. Clinical transfusion leadership is required, including on-call advice, support for test calls of activations of massive haemorrhage protocols or audits (e.g. to review appropriate use, wastage of blood components, and research e.g. awareness of new developments such as use of PCC, fibrinogen concentrates).

**Implementation consideration:** *MTC policies should include:*

- *Policies for activation of calls or protocols, early provision of uncross-matched red cells and liquid plasma (e.g. blood fridges, use of trauma transfusion 'packs' or ready thawed FFP), transport of samples and blood, and strategies for effective communication and co-ordination.*
- *Laboratory policies which support rapid release of uncross-matched blood, and continued high demand for group-specific components including cryoprecipitate, platelets and plasma (e.g. bulk-thawing).*
- *Protocols to address: traceability of blood in trauma/ED, the need for quality data collection systems (e.g.) IT blood tracking), and procedures for patient identification in emergencies.*
- *Support for point of care/near patient monitoring and cell salvage (e.g. intra-operative) is good practice to achieve optimal use of blood components and blood conservation, and will depend on local geographical factors and resources.*
- *A trauma-specific major haemorrhage/massive transfusion protocol, including strategies for effective and timely communication with the hospital transfusion laboratory must be in place. Protocols should acknowledge the recent literature describing the need for severely injuries trauma patients to be initially resuscitated with a mixture of red cells and plasma. Protocols should provide direction for initial rapid provision of (uncrossmatched) blood components*

without laboratory monitoring, and taking into account local factors e.g. location of Blood Bank and ED/trauma department.

- Local protocols should be reviewed by the Hospital Transfusion Committee, be available in all relevant clinical and laboratory areas, be supported by a programme of training, and be subject to audit. The laboratory staff and resource implications should be considered, particularly out-of-hours.

Within the TU, there should be:

- Laboratory transfusion support for trauma as in the MTC, but reflecting the need to balance fewer numbers of cases with needs for wider transfusion services in the Trust.
- A requirement for trauma-specific major haemorrhage/massive transfusion protocol.
- A requirement for clinical transfusion leadership and advice.

### 3.4 Stakeholder support and challenge

Stakeholders were aware that the **management of patients into and once in the acute system** is variable and needs to be improved. This links to recommendations about the reception of patients, initial assessment and the necessity for a coherent network approach; some stakeholders felt that quality of care initially provided to a patient was dependent on the area in which they lived.

In **acute care and surgery**, there appears to be significant variability of care once in the acute hospital setting. The limited or variable amount of exposure to Major Trauma of some acute staff can produce delays in care, inappropriate treatment and poor quality of outcomes. Although there have been improvements, it remains the case that ongoing management of Major Trauma in the acute setting can be truncated because of limited bed capacity, staffing shortages and pressures to reduce length of hospital stay. Several patients commented on their experience of poor quality of care. In addition, many stakeholders acknowledged there were political and cultural tensions around 'taking trauma away' from emergency departments:

*"...it's difficult to effect major service change...people just don't get the message...There is entrenchment but there's also lack of political will needed to effect change at all levels and lack of resources. It's hard to see how whole scale improvement can be achieved."*

***Representative from a professional association***

As was the case with Ongoing Care and Reconstruction' (see Chapter 4, section 4.4), **decision-making about, and leadership of patient care was a key theme** in stakeholder feedback.

Feedback suggested that the limited availability of senior clinical specialists in trauma within the acute (especially out-of-hours) meant that decisions about patient care could be delayed. Many comments suggested that senior doctors were not sufficiently available and that decisions were either left to more junior staff or referred to consultants not present in the treatment room, thereby causing delays.

On the area of assessment, stakeholder feedback suggested that were there were good links between specialist professionals and units within acute care, e.g. **radiography, CT scanning, MRI, blood transfusion, radiology, general surgery, ITU and anaesthesia**: this led to patients being seen quickly and care pathways being more efficient.

There was support for the use of guidelines and basic training in managing the care of trauma patients. However there were concerns that, without introducing mandatory training for general surgery staff and ED nurses, these guidelines alone are not enough to ensure consistent, high-quality care.

*“ATLS is not enough for early management of severe trauma training – it does not train an individual to be a team leader, and the programme changes slowly and inflexibly (unable to keep up with contemporary changes in trauma care practice).”*

**Professional body**

Related to issues of both staff training and specialist clinicians, there were comments from stakeholders about the notable variability in acute trauma care, depending for example upon the particular hospital and/or time of day/week at which the patient is first admitted. Stakeholders felt that a more consistent level of service was required. This might be facilitated by encouraging collaboration between hospitals and regional Trauma Centres with different specialisms and capacities; however, it was felt by one orthopaedic surgeon that *‘effective networking between units is discouraged by the Trust system’*.

As regards the care of relatives/friends of trauma patients, stakeholder feedback again suggested, that experience was variable and supported the recommendation that there should be a named individual within the trauma team who assumes this responsibility.

*“Radiographers have found themselves ....picking up very distressed relatives at the same time as trying to provide the required imaging. Major Trauma is also a difficult experience for health care staff, and good practice in Major Trauma should extend to properly caring for the staff involved as well as the patients.”*

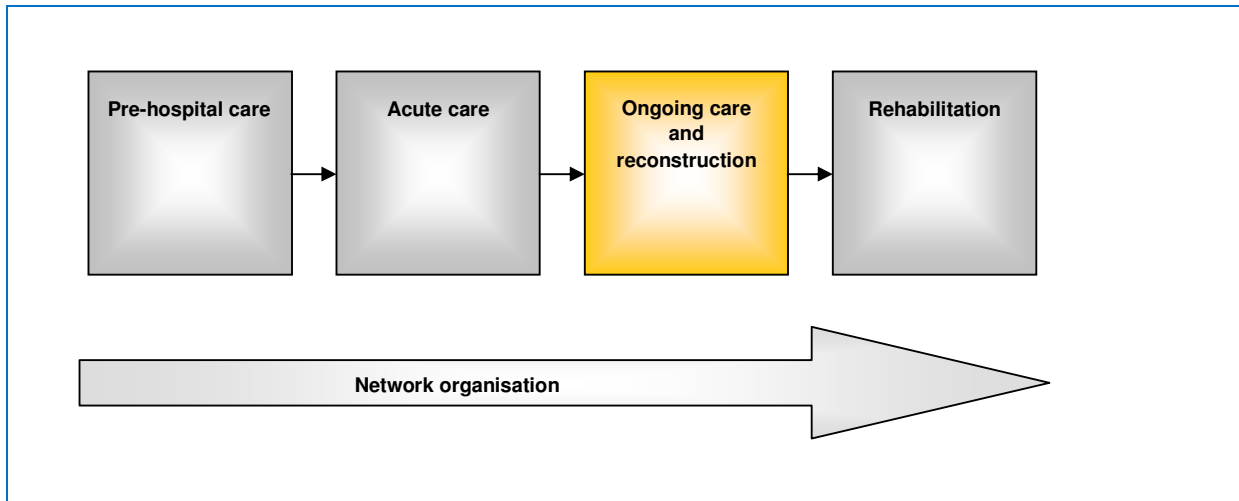
**Professional body**

On the question of the ongoing inclusion of and care for relatives/carers of trauma patients, comments overlapped significantly with those about the need for a holistic view of care and rehabilitation (see: Chapter 5); there is a need for better recognition of the key role played by patients’ loved ones in their care and of the importance of keeping them informed throughout. Stakeholder feedback suggests staff may benefit from training in this area.



## 4 Ongoing care and reconstruction

### 4.1 Overview



The ongoing care and reconstruction stage of the pathway starts immediately after any urgent surgery immediately following admission, and continues until discharge from the acute setting.

This is an important time as competing and challenging issues may threaten the effective progress of patients as they move from the initial resuscitation and surgery phase to early rehabilitation and surgery to restore function. This is particularly the case with a multiply injured patient who will have many different specialist teams contributing to their care creating communication, logistic and prioritisation problems.

The effective management of this phase of care is crucial in optimising surgical, diagnostic and therapy input and resources. Handled well, complication rates, operating theatre visits and unnecessary periods of immobilisation will be minimised and rehabilitation will commence promptly. This clarity in management is of considerable benefit to the patient and family as they face the considerable stress of providing support and coping with the socio-economic disruption that is a consequence of major trauma to a family member.

The ongoing care and rehabilitation should reflect the patients' needs. In some cases that will be in a specialist facility; if there is repatriation to a local hospital from the specialist centre this must be capable, with the Trauma Network, of satisfying those care and reablement needs.

### 4.2 Clinical Advisory Group report summary

#### 4.2.1 Key themes

The CAG working group believe that there are a number of key themes for ongoing care and reconstruction:

- Delivering patient centred services.
- Coordination of Care.
- Cross-speciality support services and facilities including nursing, radiology, anaesthesia and theatres, critical care, rehabilitation, pain management, neuropsychology and neuropsychiatry, psychosocial and mental healthcare and equipment.

- Injury specific care including pelvic and long bone fractures, complex intra-articular injuries, open fractures and soft tissue injuries, amputation, spinal column and cord injury, burns, hand injuries, maxillofacial injury, craniofacial injury, traumatic brain injuries, other neurological injuries, vascular injuries, thoracic injuries and respiratory care and abdominal injuries.
- Other care considerations including extremes of age, concurrent medical conditions and follow-up and outpatient services.
- Policies, protocols and standards including discharge summary and rehabilitation prescription, patient transfer, nutritional management and having other relevant policies in place.
- Governance.

### 4.2.2 Summary recommendations:

The CAG working group identified the following recommendations as a priority:

- **Development of trauma care coordination structures.**
- **Co-location of patients with multiple or complex injuries** in a dedicated major trauma ward.
- **Development of rehabilitation services** to optimise outcomes for traumatically injured patients.

In addition to the priority issues above, the CAG stakeholders identified a comprehensive set of recommendations, grouped in this section as follows, and discussed in full in section 4.3:

- Delivering patient-centred services (see: 4.2.2.1 below)
- Coordinating care (see: 4.2.2.2 below)
- Cross-specialty supporting services (see: 4.2.2.3 below)
- Injury-specific care (see: 4.2.2.4 below)
- Other care considerations (see: 4.2.2.5 below)
- Policies, protocols and standards (see: 4.2.2.6 below)
- Governance (see: 4.2.2.7 below)

### 4.2.3 Delivering patient centred services

Across networks there should be a focus on delivery of patient centred services which consider all the health and well-being needs of people who have sustained major injuries. The important role of family and friends should be acknowledged and actively supported.

Coordination of medical, nursing and rehabilitation packages of care is crucial, in both Major Trauma Centres and Trauma Units.

#### 4.2.3.1 Coordination of Care

Within Major Trauma Centres, patients' care should be overseen and coordinated by a Trauma Service. All major trauma patients should be admitted under the primary care of one of the Trauma Service consultants. The Trauma Service should include a care and rehabilitation coordinator who is responsible for coordination and communication regarding the patient's current and future care and rehabilitation.

Within Trauma Units, patient care should be overseen by speciality teams with a designated responsible consultant for each patient.

#### 4.2.3.2 Cross speciality supporting services

- **Nursing**
  - In the Major Trauma Centre, patients with multiple injuries should be located within dedicated trauma wards. Some patients with single system injuries may have their care needs best met by the appropriate speciality ward.
  - Crucial to the delivery of safe, high quality care for trauma patients is the establishment of a critical mass of experienced staff. This requires a highly trained and experienced nursing workforce with the appropriate staffing levels, skills mix, ongoing education and leadership.
- **Radiology**
  - In Trauma Units there should be 24-hour availability of CT scanning facilities.
  - In Major Trauma Centres there should be 24-hour availability of imaging including CT, MRI, ultrasound, interventional radiology and angiography.
  - Across networks there should be universal access to imaging and Picture Archiving and Communications Systems (PACS). All network organisations should use compatible systems.
- **Anaesthesia and theatres**
  - In Major Trauma Centres it is important that there is access to dedicated, separate, fully resourced daytime operating theatres for trauma and reconstructive surgery. Trauma units should have sufficient and flexible theatre access to allow necessary treatment during normal working hours.
- **Critical care**
  - There should be 24 hour care from dedicated intensive care consultants with experience in trauma management and full multi-disciplinary support.
  - Critical care units should form part of a constituted critical care network and subscribe to a nationally recognised audit process.
- **Rehabilitation**
  - All patients who are admitted to hospital following traumatic injury should be reviewed to establish their rehabilitation needs.
  - Rehabilitation services in Major Trauma Centres should be enhanced to ensure delivery of rehabilitation that can meet the complex needs of major trauma patients.
  - Trauma units should have the required skills and capacity to ensure they can deliver the rehabilitation required by those patients admitted directly and those who are repatriated.
- **Pain management**
  - Analgesia should be initiated early in the pre-hospital phase and should continue throughout the trauma management process.
  - All hospitals taking trauma patients should have a specialist acute pain service.
- **Neuropsychology and neuropsychiatry**
  - Post-traumatic amnesia (PTA) symptoms are the most robust predictor of long-term outcome, superior to GCS and imaging variables. PTA screening and monitoring should be routine in all major trauma patients.
- **Psychosocial and mental health care**
  - Psychosocial resilience of all patients should be sustained.

- There should be more substantial interventions for selected patients who suffer more significant and/or persistent distress.
- Mental healthcare should be provided for those patients who have a pre-existing, or who have developed a mental disorder.
- **Equipment**
  - Equipment is an important adjunct to delivery of care and rehabilitation and should be routinely available.
  - Care teams should be able to demonstrate the skills and competencies required to use equipment safely and appropriately, and a maintenance programme should form part of their management.

### 4.2.3.3 Injury-specific care

- Individual specialities required to manage injuries will exist in some Trauma Units. Where they do not, or where there are multiple injuries, clear referral pathways to Major Trauma Centres should be defined.
- Facilities should exist that allow early definitive fixation of pelvic and long bone injuries.
- Treatment planning and surgery for complex intra-articular injuries should both be performed by an orthopaedic trauma specialist.
- Compliance with published standards for the management of open fractures relies on daily access to appropriate theatres that can be simultaneously staffed with both senior orthopaedic and plastic surgeons with the requisite skills to treat these challenging cases.
- Definitive planned surgery for amputations should be performed in consultation with rehabilitation and prosthetic services.
- The prevention of complications arising from spinal instability or neurological compromise must begin immediately and involves all members of the multi-disciplinary team. If there is significant spinal cord injury, early contact should be made with a spinal cord injury centre for advice and to plan strategy.
- Burn care should be managed through the designation of specialist centres, supporting burns units and some local burns' services. Multi-professional outpatient burns services are essential to ensure optimum ongoing management and outcomes after discharge.
- For hand injuries there must be expertise in microvascular surgery and the management of tissue loss. Major Trauma Centres should have a combination of plastic surgeons and orthopaedic surgeons in the hand surgery team. A hand therapy unit manned by specialist therapists is fundamental to achieving a good result following hand trauma.
- For maxillofacial injuries, there is a requirement for both Trauma Units and Major Trauma Centres to provide round the clock consultant led care with immediate specialist maxillofacial technical support.
- Craniofacial trauma should be concentrated in Major Trauma Centres, usually co-located with neurosurgical units.
- Traumatic brain injuries should be managed as per published recommendations. Opinions should be sought from neurology and neuroradiology with a clear definition of areas of clinical responsibility amongst the various neurological specialties.
- Complex peripheral nerve injuries, such as brachial plexus injuries, should be managed in specialist units.

- Facilities should be in place in Major Trauma Centres to provide major vascular and endovascular surgery.
- Pneumothoraces, chest drain and tracheostomies should be managed in line with published guidelines. There should be twenty-four hour access to respiratory physiotherapy, including out of hours on call service.
- Injuries to the kidney and urinary tract are often complex and should be identified early and managed in conjunction with urologists as per published recommendations.

#### **4.2.3.4 Other care considerations**

- In addition to the treatment of injuries, children and older people require specific age related considerations. Joint care with paediatric or ortho-geriatric support is important.
- Pre-existing medical conditions should be considered and other specialists involved in care as appropriate.
- Organisations and network structures should facilitate follow up appointments to take place in the most appropriate setting, be this in the Major Trauma Centre, Trauma Unit or community.

#### **4.2.3.5 Policies, protocols and standards**

- Discharge summary and rehabilitation prescription: a discharge summary describing the patient's injuries, care received and ongoing needs and plans should be provided at the time of discharge or transfer from a Major Trauma Centre or Trauma Unit. This should include a rehabilitation prescription.
- Patient transfer: there should be cross-network agreements and adequate resources to ensure that once specialist medical care has been completed, patients can be transferred to the care of a service which is able to meet their ongoing care and rehabilitation needs.
- Nutritional management: effective nutritional management is crucial to recovery and rehabilitation following traumatic injury. Policies for nutritional management should be in place in Major Trauma Centres and Trauma Units.

#### **4.2.3.6 Governance**

- Any hospital receiving trauma patients should have associated governance structures in place.

### **4.3 Clinical Advisory Group recommendations**

Once trauma patients have been identified accurately and rapidly following their injury, they require specialist trauma care in a coordinated, holistic way. Their psychosocial and mental health needs should be addressed, in addition to their trauma-related injury-specific needs. This care provision should take active account of the informal care support structures which surround the patient.

This section presents the CAG's:

- Detailed recommendations;
- Reasoning for these recommendations.
- Implementation considerations, where necessary.

### 4.3.1 Delivering patient-centred services

#### Key recommendations

- 1) Across networks there should be a focus on delivery of patient centred services which consider all of the health and well-being needs of people who have sustained traumatic injuries. The important role of family and friends should be acknowledged and actively supported.
- 2) Coordination of medical, nursing and rehabilitation packages of care is crucial, in both Major Trauma Centres and Trauma Units.

Coming into contact with the NHS as a result of trauma renders the patient vulnerable and disorientated; they can feel extremely powerless. Experience of care delivered while in this setting can have as significant an impact on the patient and his/her family as the traumatic event itself. Effective, sensitively-delivered, patient-centred healthcare can go some way to mediating and minimising the distressing effects of injuries and related experiences, and can promote psychosocial recovery and lay the foundation for vocational rehabilitation.

**Implementation consideration:** *Implementing the vision for healthcare delivery, set out by the DH means: providing good treatment in a comfortable, caring and safe environment, delivered in a calm and reassuring way; offering information to enable patients to make choices, and to feel confident and in control; ensuring patients are talked and listened to as equals, and treated with honesty, respect and dignity.*<sup>102</sup>

For welfare goals to be achieved, more emphasis needs to be put on the integration of services that deal with non-medical requirements of patients and their families. This should include an overall understanding of their values/culture, as well as how their financial, legal or social situation has been impacted by the trauma and needs to be addressed in the aftermath of hospitalisation<sup>103</sup>  
104 105 106

**Implementation consideration:** *Realising holistic patient-led services relies on:*

- **Communication:** *routine involvement of the patient and their family/carers – including thorough early and repeated case meetings – wherever possible, to discuss all care and injury management decisions, including coordination and planning of interventions.*<sup>107</sup>
- **Leadership:** *development of a ‘patient-welfare-centred’ framework that permeates all stages of care for trauma patients. This should start with training of all medical and non-medical staff regarding the ethos of such a service and how it relates to personnel infrastructure.*
- **Coordination:** *development of a framework where all aspects of patients’ health, well-being, medical and non-medical needs are overseen by one team, and specifically coordinated by one member of this team (see also: section 4.3.2 below and chapter 5 on Rehabilitation).*
- **Infrastructure & Processes:** *consideration of the impact of the physical environment and care processes (ward rounds, discussions about medical and non-medical requirements) on patients, with paramount importance given to promotion of patient privacy and dignity.*
- **Measurement:** *Evaluation of services must go beyond mortality rates and focus more on assessing patients’ well-being in the hospital environment and achievement of optimum function in the context of their personal preferences.*<sup>108 109 110</sup>

Trauma patients’ psychosocial resilience relies on effective integration of NHS care with that provided by the patient’s family and friends. In the immediate aftermath of a trauma incident, family and friends may be the only way of establishing a patient’s values and personal requirements. They may also become deeply implicated in post-discharge recovery stages, and as carers they

might require as much attention and support as the patients themselves. A holistic trauma framework should, therefore, include family and friends in service design.<sup>111</sup>

**Implementation consideration:** *To ensure family and friends are involved in ongoing care and reconstruction while the patient is in the acute phase of care, the trust could work to: make visiting hours as flexible as possible; consider the transport and accommodation needs of visitors (e.g. providing car parking and accommodation for close relatives who have to travel a reasonable distance to the Trauma Centre; and, incorporate the support services of relevant voluntary sector organisations in individual care plans from the outset.*

### 4.3.2 Coordinating care

#### Key recommendations

- 3) Within Major Trauma Centres, patients' care should be overseen and coordinated by a Trauma Service. All major trauma patients should be admitted under the primary care of one of the Trauma Service consultants. The Trauma Service should include a care and rehabilitation coordinator (Major Trauma Coordinator) who is responsible for coordination and communication regarding the patient's current and future care and rehabilitation.
- 4) Within Trauma Units, patient care should be overseen by speciality teams with a designated responsible consultant for each patient.

Coordination is an important part of delivering patient-centred trauma care services. Different coordination structures may be required for Major Trauma Centres and Trauma Units.

In Major Trauma Centres, the Trauma Service should comprise a team of multi-disciplinary senior clinicians with a special interest in trauma who understand the complex medical, surgical, nursing and rehabilitation issues associated with major trauma and promote a holistic approach to care. All major trauma patients should be admitted under the primary care of one of the Trauma Service consultants.

Trauma Services should also include care and rehabilitation coordinator(s) with a nursing or allied health background. They are specifically responsible for coordination and communication regarding the patient's current and future care and rehabilitation, and for the collection of patient related data for submission to a trauma performance management system.

**Implementation consideration:** *The Trauma Service in Major Trauma Centres should be responsible for:*

- *Overseeing and coordination of all aspects of care, rehabilitation and discharge management with input from other specialist teams as required.*
- *Overseeing governance structures related to the care of trauma patients, and coordinating related audit, research and service development.*
- *Completing and documenting a tertiary trauma survey within 24 hours of admission to hospital. This should include a thorough clinical examination (top to toe) and a review of all x-rays and reports, with the Trauma Service then ensuring that all identified injuries are reviewed by the appropriate specialist team within 24 hour of admission or identification, whichever is the sooner.*
- *Conducting daily ward rounds in collaboration with other teams, e.g. critical care.*
- *Coordinating and conducting regular, frequent multi-disciplinary/specialty team meetings, supported by access to Picture Archiving and Communications Systems (PACS) and electronic records, including facilities for image viewing.*

In Trauma Units, patient care should be overseen by speciality teams with a designated responsible consultant for each patient. Teams looking after trauma patients in Trauma Units should have governance structures in place, including audit and service development processes.



### 4.3.3 Cross-specialty supporting services

#### Key recommendations<sup>112</sup>

- 5) Nursing
  - Co-locate patients with multiple injuries in dedicated trauma wards.
  - Establish critical mass of experienced, trained staff with appropriate skill-mix.
- 6) Radiology
  - Provide 24-hour access to CT, MRI, ultrasound, interventional radiology and angiography in Major Trauma Centres.
  - Provide universal access to PACS across networks, using compatible systems.
- 7) Anaesthesia and theatres
  - Ensure access to dedicated, separate, fully resourced daytime operating theatres for trauma and reconstructive surgery in MTCs, and appropriate access to theatres during normal working hours in TUs.
- 8) Critical care
  - Provide 24-hour care from dedicated intensive care consultants, supported by multi-disciplinary staff.
  - Critical care units should be part of critical care network and audited nationally.
- 9) Rehabilitation
  - Establish patients' rehabilitation needs.
  - MTCs to provide enhanced rehabilitation services to meet needs of complex trauma patients.
  - TUs to have skills and capacity to deliver rehabilitation.
- 10) Pain management
  - Initiate analgesia early in the pre-hospital phase, and on an ongoing basis throughout trauma management process.
  - All hospitals taking trauma patients to have a specialist acute pain service.
- 11) Neuropsychology and neuropsychiatry
  - Post-traumatic amnesia (PTA) screening and monitoring to be routine in all major trauma patients.
- 12) Psychosocial and mental health care
  - Psychosocial resilience of all patients should be sustained.
  - There should be more substantial interventions for selected patients who suffer more significant and/or persistent distress.
  - Mental healthcare should be provided for those patients who have a pre-existing, or who have developed a mental disorder.
- 13) Equipment
  - Appropriate equipment to be routinely available.
  - Care teams to be skilled in using and maintaining equipment.

Services described in this section span all groups of trauma patients. In many cases the specific requirements of these services will need to reflect the types of surgery carried out within the

organisation and should therefore be locally tailored. Where it is felt that there are clear differences in the services required between Major Trauma Centres and Trauma Units, these are described explicitly.

### **Nursing**

Trauma is a composite speciality requiring wide-ranging expertise, in particular in caring for patients with complex musculoskeletal injuries, maintaining skin integrity, and delivering wound care. An emphasis on system characteristics such as team functioning, staffing levels and skill mix is also an important determinant of outcome.<sup>113</sup>

Crucial to the delivery of safe, quality care for trauma patients is the establishment of a critical mass of experienced staff.<sup>114 115</sup> This requires a highly trained and experienced nursing workforce with the appropriate staffing levels, skills mix, ongoing education and leadership.<sup>116 117</sup> Specialist roles undoubtedly have a place, but not at the expense of deskilling ward staff. Ward staff should routinely have the skills required to meet the range of needs of the majority of major trauma patients, with support from specialist teams to manage more complex needs as required.

#### **Implementation consideration:**

- *In the Major Trauma Centre, patients with multiple injuries should be located within dedicated trauma wards<sup>118 119</sup> However, some patients with single system injuries may have their care needs best met by the appropriate speciality ward.*
- *Nursing staff should contribute to patients' rehabilitation in the acute phase at a level commensurate with their competence and experience. This input should commence on admission to the ward thus providing rehabilitative continuity in the absence of therapists during and outside standard working hours.*

### **Radiology**

The delivery of effective ongoing trauma care and management relies upon appropriate availability of imaging techniques.

#### **Implementation consideration:**

- *In Trauma Units there should be a minimum of 24 hour availability of CT scanning facilities. In Major Trauma Centres there should be 24 hour availability of imaging including CT, MRI, ultrasound, interventional radiology and angiography. There must be the ability to give general anaesthesia with full monitoring in these areas if necessary. MRI requires specialist anaesthetic equipment.*
- *Across networks there should be universal access to imaging and Picture Archiving and Communications Systems (PACS) for all imaging modalities. This is to avoid unnecessary road transport of images causing delay in patient management. All hospitals in a Trauma Network should use compatible PACS.*

### **Anaesthesia and theatres**

Twenty-four hour emergency theatre provision is essential in any hospital that takes trauma, and all emergency patients should have prompt access to theatres. In addition, in MTCs it is essential that dedicated, separate, fully resourced daytime operating theatres for trauma and reconstructive surgery are available – along with appropriately skilled staff – to allow timely treatment without elective surgical operating lists being interrupted.<sup>120 121</sup> The number of theatre sessions required each day will depend on the expected workload of the hospital. Theatres should be appropriately

equipped to meet patients' needs<sup>122</sup> along with appropriately skilled staff experienced in the various surgical subspecialty requirements.

Patients with major trauma need an average of 6 hours reconstructive surgery for musculoskeletal trauma.<sup>123</sup> The MTC must make provision for this surgical workload which should not disadvantage local patients who suffer isolated injuries that require surgery.

#### **Implementation consideration:**

- *A medical arbitrator should decide the relative priority of theatre cases.*
- *Trauma units should have sufficient and flexible theatre access to allow necessary treatment during normal working hours.*
- *All patients should be seen and assessed by an appropriate anaesthetist prior to surgery, ideally the one giving the anaesthetic.<sup>124</sup> Facilities for safe transfer of these critically ill patients (transfer trolley, monitoring, etc) are needed if coming from critical care.*
- *Full monitoring, resuscitation equipment and drugs should be immediately available and checked.<sup>125</sup> A trolley for management of the difficult airway and equipment for rapid blood transfusion must be available. A haematological service able to provide urgent blood results and cross matching is required 24 hours a day. Appropriate point of care testing equipment should be available.*
- *An appropriately trained and experienced anaesthetist and a dedicated anaesthetic assistant with an appropriate nationally recognised qualification must be present throughout the entire anaesthetic procedure.<sup>126</sup>*
- *All trauma patients should be anaesthetised by an appropriately trained career grade anaesthetist.*

#### **Critical care**

Critical care units should form part of a constituted critical care network and subscribe to a nationally recognised audit process such as the Intensive Care National Audit and Research Centre.<sup>127</sup> Across the network, there should be the required number of critical care beds to meet the needs of the network. There should also be 24-hour care provided by dedicated intensive care consultants with experience in trauma management and full multi-disciplinary support.

#### **Implementation consideration:**

- *Staffing and equipment standards should meet the Intensive Care Society guidelines.<sup>128 129 130</sup>*
- *Transfers within or between hospitals should be conducted to the standards described in the Intensive Care Society guidelines.<sup>131</sup>*
- *There should be brain stem testing where brain death may become a reality. Organ donation should be considered with all brain stem dead patients, or patients for whom treatment withdrawal is being considered.*

#### **Rehabilitation<sup>132</sup>**

The levels of rehabilitation typically provided in acute hospitals at present are inadequate to deliver the services required during the acute phase of care to optimise outcomes.<sup>133 134</sup> Acute hospital rehabilitation services have traditionally focused on preparing and planning for patient discharge. Those who have sustained major traumatic injuries require more intensive and specialised services from the very early stages of their care.<sup>135 136 137 138 139 140</sup>

Rehabilitation services currently provided within MTC will need to be enhanced and multi-disciplinary rehabilitation teams should be considered a core part of the service in both Major Trauma Centres and Trauma Units. Other health and social care teams, such as nurses, should have a key role in the management of rehabilitation.<sup>141 142</sup> The skills and facilities required within a TU will vary depending on the surgical specialisms represented e.g. if amputations are performed, associated rehabilitation will be required. As a baseline, TUs should have the range of rehabilitation skills and associated facilities for the management of simple or isolated complex injuries.

### **Implementation consideration:**

- *Rehabilitation should start as soon as possible after admission and be provided across all levels of acute care, from critical care to the ward environment.*
- *All patients who are admitted following traumatic injury should be reviewed to establish if they have any rehabilitation needs. Any patient who is considered to have a need for rehabilitation should have a full assessment of these needs by the appropriate rehabilitation team members. A rehabilitation prescription should be developed for any patient with identified needs. Further details on this can be found in section 7.1 of this chapter and in the Rehabilitation chapter.*
- *In MTCs, the range of rehabilitation skills and associated facilities should include management of the following injury/patient groups:*
  - Spinal column and cord injury.
  - Traumatic brain injury (including assessment and monitoring of Post-traumatic amnesia).
  - Complex musculoskeletal injuries (e.g. joint and soft tissue injury).
  - Vascular injuries and amputations.
  - Abdominal trauma (including intestinal failure).
  - Cardiothoracic injuries (including endovascular surgery for aortic injury).
  - Brachial plexus injuries and peripheral nerve injuries.
  - Complex hand injuries.
  - Maxillofacial injuries.
  - Burns.
- *There should be agreements within networks, in particular between acute and rehabilitation providers, to ensure that patients are transferred to the care of the service which can best meet their needs as soon as is medically appropriate.*

### **Pain management**

The aim of pain management is to provide relief, restore function and avoid chronic debilitation. All hospitals taking trauma patients should have a specialist acute pain service to support the optimal management of those with complex pain issues.

### **Implementation consideration:**

- *Analgesia should be initiated early in the pre-hospital phase and should continue throughout the trauma management process.*
- *Multimodal therapy is increasingly recognized, when combined with early nutrition and ambulation to improve functional recovery and decrease chronic pain. This includes regional analgesia, analgesic drugs and if necessary anticonvulsants, antidepressants, and anxiolytics.*

- *All hospitals taking trauma patients should have a specialist acute pain service to support the optimal management of those with complex pain issues.*

### **Neuropsychology and neuropsychiatry**

Neurologists and neuropsychologists are required to assess higher cortical functioning as well as basic sensory-motor processes.<sup>143 144 145</sup> The duration of post-traumatic amnesia (PTA) symptoms is the most robust predictor of long-term outcome, superior to GCS and imaging variables, and thus provides useful indicators for therapeutic intervention, risk management, and long-term rehabilitation needs. As such, PTA should be routinely screened for, and if present, monitored in all major trauma patients.<sup>146</sup> Patients who have sustained traumatic brain injuries or who have experienced PTA have an unpredictable recovery trajectory. Consideration should be given, therefore, to the most appropriate timing of assessments and future care planning, allowing sufficient time for resolution or stabilisation of symptoms before deciding on the most appropriate course of action.<sup>147 148</sup>

### **Implementation consideration:**

- *Clinical neuropsychologists should be available within Major Trauma Centres to participate in<sup>149</sup>*
  - assessment of cognitive function, and management of cognitive impairment.
  - assessment and treatment of mood and emotion.
  - management of behavioural difficulties.
  - education for relatives, carers and other professionals on traumatic brain injury (TBI) and its consequences.
  - support to health professionals in the psychological and psychosocial management of TBI.
  - research and audit, including evaluations of outcome of rehabilitation.
- *Neuropsychiatric consideration should be given to alterations in personality, mood, and behaviour which may be organically based, or reactive to the trauma and sequelae, or a combination of both process.<sup>151</sup>*
- *Consideration should be given to premorbid conditions, psychological sequelae, and other variables that may exacerbate or misrepresent the cognitive presentation.<sup>152 153</sup>*

### **Equipment**

Equipment is an important adjunct to delivery of care and rehabilitation. Care teams should be able to demonstrate the skills and competencies required to use these items safely and appropriately, and a maintenance programme should form part of their management.

**Implementation consideration:** *The following list outlines equipment and tools that should routinely be available for use within a Major Trauma Centres and Trauma Units. Equipment should be available in a range of sizes to meet all patients' needs, including bariatric versions. This list should be considered a starting point but is not exhaustive:*

- *Specialist beds, e.g. rotating, electrically adjustable and profiling.*
- *Armchairs in a range of seat heights and styles e.g. drop down arms.*
- *Pressure relieving devices for beds and chairs.*
- *Moving and handling equipment e.g. sliding sheets, hoists and slings, sliding boards, transfer belts.*
- *Pain management equipment e.g. syringe drivers, patient controlled analgesia machines.*

- *Standard and specialist mobility aids.*
- *Wheelchairs in a range of sizes and styles e.g. self propelling, attendant propelled, extended wheelbase, and accessories e.g. cushions, stump boards, elevating leg rests.*
- *Other medical devices e.g. negative pressure dressings, traction systems.*
- *Other rehabilitation equipment e.g. gym balls, weights, resistance therapy bands, cognitive and perceptual assessment tools, controlled passive mobilisation (CPM) machines, post-traumatic amnesia screening tools, assistive equipment for activities of daily living.*

*In addition to the above, Major Trauma Centres, and some Trauma Units depending on the types of patients seen, should also have access to the following:*

- *Pre-prosthetics aids and amputee rehabilitation equipment.*
- *Specialist seating solutions e.g. tilt-in-space, reclining, trauma chair.*

#### 4.3.4 Injury-specific care

##### Key recommendations

- 14) Individual specialities required to manage injuries will exist in some Trauma Units. Where they do not, or where there are multiple injuries, clear referral pathways to Major Trauma Centres must be defined.
- 15) Facilities should exist that allow early definitive fixation of pelvic and long bone injuries.
- 16) Treatment planning and surgery for complex intra-articular injuries should both be performed by an orthopaedic trauma specialist.
- 17) Compliance with published standards for the management of open fractures relies on daily access to appropriate theatres that can be simultaneously staffed with both senior orthopaedic and plastic surgeons with the requisite skills to treat these challenging cases.
- 18) Definitive planned surgery for amputations should be performed in consultation with rehabilitation and prosthetic services.
- 19) The prevention of complications arising from spinal instability or neurological compromise must begin immediately and involves all members of the multi-disciplinary team. If there is significant spinal cord injury, early contact should be made with a spinal cord injury centre for advice and to plan strategy.
- 20) Burn care should be managed through the designation of specialist centres, supporting burns units and some local burns' services. Multi-professional outpatient burns services are essential to ensure optimum ongoing management and outcomes after discharge.
- 21) For hand injuries there must be expertise in microvascular surgery and the management of tissue loss. Major Trauma Centres should have a combination of plastic surgeons and orthopaedic surgeons in the hand surgery team. A hand therapy unit manned by specialist therapists is fundamental to achieving a good result following hand trauma.
- 22) For maxillofacial injuries, there is a requirement for both Trauma Units and Major Trauma Centres to provide round the clock consultant led care with immediate specialist maxillofacial technical support.
- 23) Craniofacial trauma should be concentrated in Major Trauma Centres, usually co-located with neurosurgical units.
- 24) Traumatic brain injuries should be managed as per published recommendations. Opinions should be sought from neurology and neuroradiology with a clear definition of areas of clinical responsibility amongst the various neurological specialties.
- 25) Complex peripheral nerve, such as brachial plexus injuries, should be managed in specialist units.
- 26) Facilities should be in place in Major Trauma Centres to provide major vascular and endovascular surgery.
- 27) Pneumothoraces, chest drain and tracheostomies should be managed in line with published guidelines. There should be twenty-four hour access to respiratory physiotherapy, including out of hours on call service.
- 28) Injuries to the kidney and urinary tract are often complex and should be identified early and managed in conjunction with urologists as per published recommendations.

Individual specialities required to manage injuries will exist in some Trauma Units. Where they do not, or where there are multiple injuries, there should be clear referral pathways to Major Trauma Centres, where all these specialties are available. Surgery must be carried out by a surgeon and a

team familiar with these interventions. Complication rates and later problems are much greater in the hands of the occasional practitioner.<sup>154</sup> This section provides a summary of specific injury types and Implementation considerations in each case.

### **Pelvic and long bone fractures**

Facilities must exist that allow early definitive fixation of pelvic and long bone injuries.

**Implementation consideration:** *Where temporary stabilisation techniques (damage limitation) have been used the opportunity to convert to definitive fixation should be available within 3-5 days.*<sup>155</sup>

### **Complex intra-articular injuries**

The long-term functional outcome of these injuries is very dependent on the quality of the initial management. The timing of each stage in the optimum treatment is variable. A proportion of injuries will benefit from immediate surgery while other injuries may require a delay of up to two weeks to allow the skin and subcutaneous tissue sufficient time to recover.

**Implementation consideration:** *Treatment planning and surgery should both be performed by an orthopaedic trauma specialist.*

### **Open fractures and soft tissue injuries**

Clear guidelines for the management of these injuries already exist.<sup>156 157 158</sup> Specialist centre management produces better outcomes of these challenging injuries.<sup>159</sup> A high dependency unit near the theatre complex manned by nurses competent in the care of free-tissue transfer is essential.

**Implementation consideration:** *Compliance with recognised standards relies on daily access to theatres that can be simultaneously staffed with both senior orthopaedic and plastic surgery specialists, with the skills and facilities to perform reconstructive microsurgery on a regular basis.*<sup>160</sup>

### **Amputation**

Amputation has a massive physical and psychological impact. Maximising patients' rehabilitation potential involves definitive planned surgery being performed in consultation with rehabilitation and prosthetic services.

**Implementation consideration:** *There should be on-site access to multi-disciplinary rehabilitation services and facilities. When emergency amputations are performed, only de-vitalised tissue should be removed in order to maximise the reconstructive options available at the time of definitive surgery.*

### **Spinal column and cord injury**

The prevention of complications arising from spinal instability or neurological compromise must begin immediately and involves all members of the multi-disciplinary team.<sup>161</sup> Nursing staff, allied health professionals and other staff groups should be trained in the management of the threatened cord. Particularly important are skin integrity and bladder and bowel care. Specialist equipment, such as turning beds and hoists, are needed and there should be access to skeletal skull traction, halos, collars etc.

**Implementation consideration:**



- *Urgent primary spinal surgery to stabilize the spine and/or decompress threatened neural structures may be required. This is sometimes followed by second stage intervention if needed e.g. delayed anterior fusion following posterior stabilization.*
- *Surgery must be carried out by a spinal surgeon and team familiar with spinal trauma interventions.<sup>162</sup> Surgery is usually urgent rather than immediate though secondary operations can be planned. However, early stabilization may facilitate the management of other injuries.*
- *If there is significant spinal cord injury, early contact should be made with a spinal cord injury centre for advice and to plan strategy. Early transfer to such a centre is recommended and has been shown to reduce complications.<sup>163</sup>*

## **Burns**

In the National Burn Care Review in 2001<sup>164</sup> there was agreement that burn care be managed through the designation of seven specialist centres, a number of supporting burns units and some local burns' services within district general hospitals e.g. outreach dressing care. Networks of burns services should be linked into regional Trauma Networks. The burns centre should be appropriately manned by skilled medical and nursing staff with daily access to theatre. Multi-professional outpatient burns services e.g. for dressings, scar management and ongoing rehabilitation, are essential to ensure optimum ongoing management and outcomes after discharge.

### **Implementation consideration:**

- *Ventilated burns victims will need co-ordinated care and need single occupancy ICU rooms.*
- *Access to a skin bank and the facility to grow skin in a culture lab is a part of modern burns centres.*

## **Hand injuries**

Poor management of an injured hand leading to a less than optimum functional outcome may ruin the return of function in a patient who has sustained complex and/or multiple injuries. It has been estimated that 20% of polytrauma patients have a complex hand injury.<sup>165 166</sup> A hand therapy unit manned by specialist therapists is fundamental to achieving a good result following hand trauma.<sup>167</sup><sup>168</sup>The requisite equipment for managing hand fractures includes modern fracture fixation devices and fluoroscopy.

**Implementation consideration:** *There must be expertise in microvascular surgery and the management of tissue loss. Major Trauma Centres should have a combination of plastic surgeons and orthopaedic surgeons in the hand surgery team.<sup>169170</sup>*

## **Maxillofacial Injury**

A population of 500,000 yields in excess of 4,000 facial injuries per year. Excluding simple nasal fractures, 250 of these will be facial fractures. The incidence of facial fractures continues to rise.<sup>171</sup>

There is a mandatory requirement for both Trauma Units and Major Trauma Centres to provide round the clock consultant led care with immediate specialist maxillofacial technical support.<sup>172</sup> Injuries to the maxillofacial area routinely require surgery using a variety of micro, mini and reconstruction plating systems.<sup>173</sup> This has led to early restoration of function and rapid rehabilitation but there is no doubt that many serious facial injuries cause permanent facial disfigurement and psychological distress with extensive soft tissue scarring presenting a particular challenge to the oral and maxillofacial surgeon. Maxillofacial surgeons are well placed to provide ongoing treatment in life threatening poly trauma and also to schedule long term facial

reconstruction with flaps, including micro-vascular free tissue transfer, facial prostheses and dental implants.

**Implementation consideration:** *The optimal treatment of facial injuries requires the coordination of a number of specialists. Oral and maxillofacial surgeons should instigate and plan initial and long term care of bone and soft tissue injuries to the face. Orbital fractures require close integration of maxillofacial surgeons, ophthalmologist and radiologist. All these senior specialists should be available 24 hours per day, 7 days per week. Optometry services should also be routinely available.*

### **Craniofacial Injury**

In collaboration with neurosurgeons, simultaneous management of severe craniomaxillofacial trauma has now become possible. Modern oral and maxillofacial surgical techniques have resulted in early restoration of function and return to work, and have reduced the need for secondary reconstruction and scar revisions.

**Implementation consideration:** *Craniofacial Trauma should be concentrated in MTCs which are usually co-located with neurosurgical units. Advanced imaging techniques such as CT scan, MRI and Stereolithography should be used to demonstrate the pattern of cranial and facial bony injuries and to better plan primary treatment.*

### **Traumatic brain injuries**

Trauma networks should define care pathways between elements of the network, to ensure that people with acquired brain injury can move through the system effectively and efficiently.

**Implementation consideration:** *Traumatic brain injuries should be managed as per recommendations from the Brain Trauma Foundation<sup>174 175</sup> and the European Brain Injury Consortium.<sup>176</sup> Opinions should be sought from neurology and neuroradiology with a clear (local) definition of areas of clinical responsibility amongst the various neurological specialties.*

### **Peripheral nerve injuries**

Specialised rehabilitation will be required during both the acute and post-acute phases of care.

**Implementation consideration:** *Complex injuries, such as brachial plexus injuries, should be managed in specialist units with access to electromyography, neurophysiological investigations and specialist opinions regarding reconstructive surgery.*

### **Vascular injuries**

Major vascular and endovascular surgery will take place in MTCs.

**Implementation consideration:** *Facilities should be in place in Major Trauma Centres to provide major vascular and endovascular surgery for the management of injuries such as blunt aortic injury or carotid dissections that are not identified during the early acute phase of care.*

### **Thoracic injuries and respiratory care**

Chest injury is common in trauma resulting in rib fractures, pneumo/haemothoraces and underlying pulmonary contusions. Effective epidural analgesia reduces complications and often avoids the need for ventilation. Surgical fixation of flail segments is rarely required. Twenty-four hour access to respiratory physiotherapy is required, including out of hours on call service.<sup>177</sup>

**Implementation consideration:** *Chest drains should be inserted and looked after in line with the British Trauma Society guidelines.<sup>178</sup> If positive pressure ventilation is required use the 'open lung'*

and ARDSnet ventilation and fluid strategies and consider early tracheostomy. Tracheostomies should be cared for according to the Intensive Care Society guidelines.<sup>179</sup>

### Abdominal injuries

There should be facilities for the measurement of abdominal compartment pressures, as well as facilities and supporting services for stoma management.

**Implementation consideration:** *Where damage control laparotomy or laparostomy for abdominal compartment syndrome has been performed, there should be protocols for management of the open abdomen. Management should include negative pressure dressings, and the involvement of plastic surgeons in reconstruction of the anterior abdominal wall.*

### 4.3.5 Other care considerations

#### Key recommendations

- 29) In addition to the treatment of injuries, children and older people require specific age related considerations. Joint care with paediatric or ortho-geriatric support is important.
- 30) Pre-existing medical conditions should be considered and other specialists involved in care as appropriate.
- 31) Organisations and network structures should facilitate follow up appointments to take place in the most appropriate setting, be this in the Major Trauma Centre, Trauma Unit or community.

In delivering trauma care, it is important to acknowledge the particular, age-specific needs of key groups.

**Implementation consideration:** *Jointly planning and delivering trauma care with paediatric services (for children and young people) and ortho-geriatric services (for older people) is important.*<sup>180 181 182</sup>

It is also important to take into account any pre-existing medical conditions which may affect the management of a patient's care following injury. Such conditions might include, for example, diabetes mellitus, pregnancy or mental health problems.

**Implementation consideration:** *It is important to involve other appropriate specialists when delivering trauma care to people with pre-existing conditions.*

Some patients will need to be followed up by specialists at the MTC and services should be organised to allow this. In other cases, where acute care has been provided by the MTC, follow up by the TU will be appropriate. In some areas, outreach or peripatetic services may be more appropriate than bringing patients to the hospital for their follow up appointments.

**Implementation consideration:** *There is a need to consider communication and funding structures that underpin the delivery of trauma care in order to plan and manage trauma follow-up appropriately.*

### 4.3.6 Policies, protocols and standards

#### Key recommendations

- 32) Discharge summary and rehabilitation prescription: A discharge summary describing the patient's injuries, care received and ongoing needs and plans should be provided at the time of discharge or transfer from a Major Trauma Centre or Trauma Unit. This should include a rehabilitation prescription.
- 33) Patient transfer: There should be cross network agreements and adequate resources to ensure that once specialist medical care has been completed, patients can be transferred to the care of a service which is able to meet their ongoing care and rehabilitation needs.
- 34) Nutritional management: Effective nutritional management is crucial to recovery and rehabilitation following traumatic injury. Policies for nutritional management should be in place in Major Trauma Centres and Trauma Units.

The items described below are considered to be particularly pertinent to the management of trauma patients within a regional network. It is assumed that policies required for general patient care and management, not specific to trauma patients, should be in place and used in the delivery of services to this group.

#### Discharge summary and rehabilitation prescription

A discharge summary describing the patient's injuries, care received and ongoing needs and plans should be provided at the time of discharge or transfer from a Major Trauma Centre or Trauma Unit. This should include a rehabilitation prescription.

**Implementation consideration:** *A rehabilitation prescription describes the patient's physical, cognitive and psycho-social needs and goals, framed in the context of their pre-injury life, and states how these will be addressed. It will empower the patient and ensure that they, and health and social care teams have shared objectives. The patient will hold their prescription, which will have as its ultimate aim achievement of their optimum functional potential, including return to work where possible.*<sup>183</sup>

#### Patient transfer

Once patients have received all of their specialist medical care, there has been a tendency in the past to repatriate them back to their local hospital. Where ongoing care and rehabilitation needs are complex, these local hospitals are not typically able to provide the skills and facilities required to meet these needs. This approach is contrary to the principle which drives escalation during the early stages of care, i.e. that responsibility should not lie with the unit least capable of meeting the patient's needs, and is likely to compromise long term patient outcomes.<sup>184</sup>

Some patients' rehabilitation needs will not exceed the capability of local services. For these patients it is logical, once they have received the care needed from a Major Trauma Centre, to transfer them to services closer to home for discharge, and ongoing rehabilitation planning and management. This requires adequate specialist post-acute rehabilitation provision to ensure that patients can be transferred to a suitable service as soon as is medically appropriate.

Where emergency surgery and care has been provided in a hospital which is unable to carry out the definitive reconstructive surgery or care required, there should be network agreements to facilitate transfer to an appropriate unit.

**Implementation consideration:** *Agreements, policies and service standards should be developed in conjunction with all network services to ensure that timely patient transfer is achieved. These should be monitored as part of the network's performance management framework, and any unmet need or delayed transfer highlighted. Standards for timescale of transfers should be established and enforced by Trauma Systems, and should reflect published guidance on the optimum timing of the required surgery or interventions.*

### **Nutritional management**

Effective nutritional management is crucial to recovery and rehabilitation following traumatic injury. Policies for nutritional management should be in place in Major Trauma Centres and Trauma Units.

**Implementation consideration:** *Policies should include consideration of the placement of nasal-jejunal and percutaneous endoscopic gastronomy (PEG) tubes, management of enteral and parenteral feeding, and other strategies to minimise nutritional compromise.*

### **Other relevant policies**

As a minimum, policies and clear documentation should be in place in both Major Trauma Centres and Trauma Units for the management of the following:

- Thromboprophylaxis.
- Prophylactic antibiotics.
- Tetanus prophylaxis.
- Compartment pressure measurement, including limbs and abdomen.
- Spinal clearance.
- Intercostal drain management and removal.
- Tertiary survey documentation.

### **4.3.7 Governance**

#### **Key recommendations**

35) Any hospital receiving trauma patients should have associated governance structures in place.

There should be in place an active programme of multi-disciplinary audit, morbidity and mortality meetings with adequately funded audit support.

**Implementation consideration:** *Audit data should be submitted to the Trauma Audit and Research Network (TARN)*

## **4.4 Stakeholder support and challenge**

When discussing ongoing care and reconstruction, there were a number of themes emerging, most notably the need to:

- **streamline the patient's journey through the system**, and between different services or specialties. In particular, there is a need to: improve handovers of care; make clearer who has ownership of and accountability for care at any one time; and address the issue of variable incentives to share responsibility for the patients care. Disjointed working, lack of consistent and/or clear protocols and guidance and 'competition' or mistrust between services can lead to fragmented care that feels chaotic.

- **improve the quality of the patient’s experience.** In particular, there is a need to ensure that the patient is at the centre of his/her trauma care and that services work to inform patients about their options, provide personalised responses to their needs and actively involve friends and family in care planning and management.
- **improve rehabilitation planning and support.** Related to the previous two points, there is a perceived need among stakeholders – both those working within/ with trauma care, and patients/carers – to develop more holistic approaches to trauma care, that actively take into account long-term rehabilitation needs.
- **ensure staff dealing with trauma patients are appropriately skilled.** There was recognition among stakeholders of the challenges posed by staff not being involved in a sufficient amount of trauma cases to maintain and improve skills. There were also concerns about limited capacity to undertake specialist trauma training given competing demands on staff time.

Each of the points above will be addressed in turn in this section.

### **Streamlining the patient journey**

Where trauma care works well, this was attributed to clear and senior leadership, and well-coordinated multi-disciplinary teams enabling a holistic approach to patient care in which there are clear lines of accountability for care. In general, however, there was an identified need for better communication and coordination along all stages of the major trauma pathway between health professionals within a single hospital, and between hospitals and sectors (i.e. health and social/community care)

*“When you do deliver a patient to a well set up hospital and there is a rapid handover to a coordinated team, the patient receives seamless care.”*

#### **Representative from professional association**

*“There is better leadership in EDs and more consultants leading trauma care and leading trauma teams. This has been shown to be effective and further investment would be valuable because there needs to be more consultant led care in respect of major trauma.”*

#### **Representative from a Royal College**

The issue of ‘ownership’ of care is significant. Lack of clear leadership – and/or lack of comprehensive trauma-specific protocols and procedures – was said to lead to confusion about care management. This was said to create a ‘chaotic’ environment around the patient and delay access to appropriate treatment. Related to this is the issue of out-of-hours care: there was agreement that providing 24-hour trauma care (including access to theatres and scanning) is a particular challenge. Currently, lack of ‘round-the-clock’ coverage can lead to delays in treatment and/or disjointed care.

*“... whilst in intensive care I managed to climb out of bed. I managed to pull the halo off. In intensive care there is supposed to be someone with you 24 hours but they are so short staffed. After this incident my wife ended up staying most nights.”*

#### **Male, involved in a road traffic accident**

### **Improving the quality of the patient’s experience**

There was agreement among stakeholders that patients can have a hugely variable experience, in keeping with the significant variability in Trauma Service delivery from one organisation, service, or geographical area to another.

*"I would have preferred to have gone to [X hospital] sooner, the treatment and healing would have been quicker. Once the consultant realised he couldn't fix my legs he should have transferred me sooner. The just could not deal with my leg injuries at [Y hospital]"*

**Female, involved in road traffic accident**

There was agreement that better information should be provided to patients, families and carers. Patients and carers were keen that they maintain access to consultants for ongoing clinical information about their care but identified that it could sometimes be very difficult to obtain information.

*"I felt totally disempowered – I could see [my husband's] x-ray and had to confront a young doctor in A&E to get a some sort of explanation...to talk me through it...this took him aback. I recognise that not everyone would want to be as involved but I felt I had to fight the system to be treated as a partner."*

**Wife of male involved in road traffic accident**

Patients and carers who were kept informed spoke more positively about their experience of care.

*"When I got [to the hospital] a consultant and nurse came to talk to me and gave a really good account of what the injuries were. The way they dealt with me was really good, very factual and informative. No improvements could be made to that the communication was strong."*

**Wife of male involved in road traffic accident**

In addition, it is extremely important to them that they also have access to support for their psychosocial needs, and to therapies and services not directly related to their acute medical needs, e.g. occupational health, advice on returning to work or public benefits. They suggested that there could be greater involvement of voluntary organisations at this stage.

Ongoing care should be more flexible and sensitive to the needs of trauma patients and their immediate social/familial networks but stakeholders recognised that there can be tensions between patient choice and care coordination.

**Improving rehabilitation planning & support**

The need to improve rehabilitation care and address patient needs early and on an ongoing basis, was a recurring theme throughout stakeholder feedback. There was significant concern expressed by patients, healthcare professionals and other trauma stakeholders alike about the relatively poor rehabilitation provision at present.

Related to the challenges associated with moving the patient around the trauma care system, there are difficulties planning and coordinating rehabilitation in a holistic way, that not only addresses acute medical reconstruction work but also medium- and longer-term community- and/or home-based rehabilitation.

*"Rehab is delayed or never happens. It seems pointless to spend all this effort on the front end of fast responsive care if we then do not provide rehabilitation."*

**Representative from a professional association**

It was also thought that the low profile and poor resourcing of rehabilitation services within the trauma environment could lead to a lack of momentum for change. In actuality, this was agreed to be one of the top priority areas for improvement and, indeed, was thought to have potential to benefit other parts of the pathway: stakeholders suggested that early initiation of rehabilitation could help minimise secondary complications associated with delays and handovers.

*“Rehabilitation is a major difficulty ...the morbidity aspect [of trauma] could be reduced by having more rehabilitation services....”*

***Representative from a Royal College***

**Ensuring staff dealing with trauma patients are appropriately skilled**

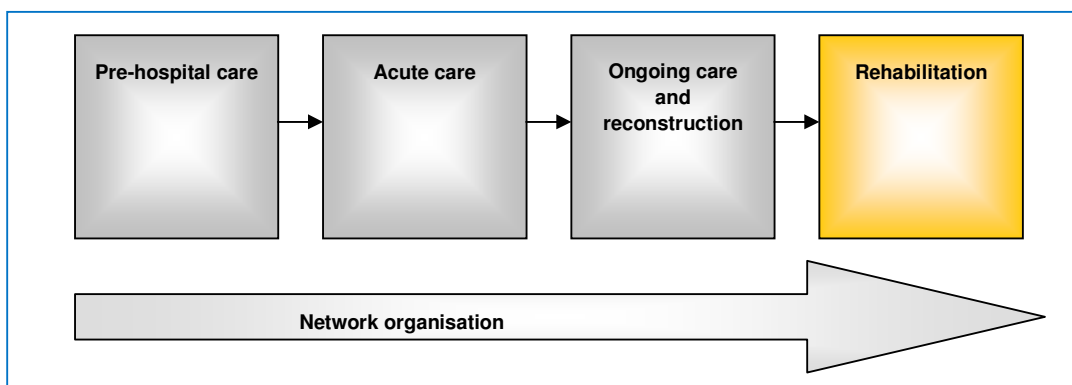
Related to the issue of leadership/ownership of care, stakeholders called for more specialist senior involvement in trauma care, particularly in terms of leadership and decision-making. Survey respondents, for example, felt that senior doctors were not sufficiently available and that therefore decisions were being left to more junior staff, such as senior house officers (SHOs) and registrars, who are less capable of making rapid and informed decisions about the care of trauma patients. One said that decisions were often deferred to consultants who were not present in the resuscitation room, causing a delay. Related to this, there was a need to improve decision-making in respect of prioritisation of trauma care/surgery and to ensure that suitable clinicians deal with trauma care-related decisions.

‘Trauma drills’ were cited as being a useful way to enable staff to develop well-rehearsed responses and also build confidence in their skills in trauma care delivery. There was also thought to be a need to make better use of available technology and to up-skill staff in utilising such equipment.



## 5 Rehabilitation

### 5.1 Overview



There are three recognised levels of rehabilitation service provision:

**Level 1 – Specialised:** serves a population of >1 million and deals with a high proportion of complex cases.

**Level 2 – Local specialist rehabilitation services:** serves a population of 250,000 to 1 million and deals with fewer complex cases.

**Level 3 – Non-specialist rehabilitation services:** serves a local population (usually <500,000) and is led by therapists or non-rehabilitation medicine consultants.

Following Major Trauma rehabilitation is essential for patients to address the physical and psychosocial needs that result from their injuries and experiences. Without such input, patients are unlikely to return to their maximum levels of function, which has significant implications for them, their formal and informal carers and society as a whole.

**The principle of a patient receiving specialist care appropriate for their injuries is fundamental to Networks of Trauma Care. To abandon this principle at the point at which rehabilitation is required is illogical and compromises patient outcomes. It is wrong to assume that specialist rehabilitation techniques will be carried out on a general orthopaedic or surgical ward in a district general hospital.**

The case for change in the way acute/specialist and community/generalist rehabilitation is provided recognises that this the area of the Major Trauma pathway most need of improvement. Funding needs to focus more on this stage of the pathway.

There are limited facilities for the rehabilitation of patients who suffer Major Trauma. Those that exist are fragmented and rarely well-integrated within a complete, managed patient pathway. Rehabilitation services are unevenly distributed around the country. Specialist rehabilitation services have developed independently and without a national strategic plan for provision<sup>185</sup>.

Rehabilitation care should be more joined up, as opposed to the current categorisation of services on the basis of specific injury types which often leaves those with complex, multi-faceted needs to fall through the gaps; this is particularly true for those with multiple musculoskeletal injuries without brain or spinal cord injury.

Acute or specialist rehabilitation services need to be planned and delivered much earlier along the pathway than is often currently the case. Rehabilitation needs to address 'the whole patient' far more effectively. This will involve making sure that acute services have robust effective links with community care so that discharge and out-of-hospital support is both planned and involves a smooth transition.

## 5.2 Clinical Advisory Group report summary

The working group considered how new rehabilitation pathways should be designed, how this can be achieved and what levers should be used to achieve the pathway required. The group recognised the necessity for radical changes in healthcare prioritisation and clinical and commissioning cultures if the benefits from improved acute care are not to be lost subsequently.

The delivery of effective rehabilitation following injury depends on three key principles: access, coordination, and resources.

### 5.2.1 Key themes

The CAG working group identified a number of key themes for rehabilitation:

- Definition and principles of rehabilitation.
- Proposals for the rehabilitation pathway including pathway structures and movement of patients within the system.
- Meeting rehabilitation needs including identifying the needs of the rehab patient, a personal prescription for rehabilitation and the role of vocational/educational rehabilitation.
- Rehabilitation coordination.
- The rehabilitation services required within a Major Trauma centre, a Trauma Unit, and tertiary 'specialised' rehabilitation services, specialist rehabilitation services, general rehabilitation services, other services within the network and voluntary and third sector organisations.
- Personalised equipment and care.
- Levers for change including funding structures data management and outcome measures.
- Regional / national directory of services.
- Non-entitled patients.

### 5.2.2 Summary recommendations

The CAG working group's recommendations are as follows:

- Rehabilitation should start as soon as is appropriate after admission, typically in the critical care setting, and continue at the intensity required, and for as long as is necessary, to enable patients to achieve their functional potential.
- Patients who have not been admitted to a Major Trauma centre should not be disadvantaged in accessing the level of rehabilitation they require.
- The delivery of effective rehabilitation following injury should include three key principles: access; coordination; and resources.
- All stages of care, including the rehabilitation and transfer aspects of the patient's pathway, should be the responsibility of the network.
- There should be an appointment of a Trauma Network Director of Rehabilitation.

- There should be an appointment of a Clinical Lead for Acute Trauma Rehabilitation Services in every Major Trauma Centre (Consultant in Rehabilitation Medicine).
- There should be adequately skilled and resourced multi-disciplinary rehabilitation teams in all of a network's services.
- There should be rehabilitation and care coordinator posts throughout the network.
- Every patient should receive an assessment of their rehabilitation needs.
- A personal prescription for rehabilitation should be provided to all trauma patients with identified needs.
- Trauma patients should receive appropriate levels of care and rehabilitation at all points along their care pathway.
- Many trauma patients are of working age and vocational rehabilitation should, therefore, be a key component of rehabilitation.
- There should be a country-wide review of all services providing rehabilitation to patients who have sustained traumatic injuries.
- A directory of services and resources should be developed relating to rehabilitation and ongoing care to facilitate referral and access to these services within a regional network and nationally.
- Appropriate funding structures should be developed to ensure timely and comprehensive rehabilitation.
- There should be coordinated development of rehabilitation services and long-term support in the community, which can deliver comprehensive and effective rehabilitation to meet the needs of traumatically injured patients, irrespective of their age.
- There should be a review of the applicability of the UK National Dataset for Specialist Rehabilitation Services to all Major Trauma patients.

### 5.3 Clinical Advisory Group recommendations

#### Key recommendation

- 1) Rehabilitation should start as soon as is appropriate after admission, typically in the critical care setting, and continue at the intensity required, and for as long as is necessary, to enable patients to achieve their functional potential.

Rehabilitation should start as soon as is appropriate after admission, ideally in the critical care setting. It should continue at the necessary intensity for long enough to enable patients to achieve their maximum functional potential. This does not occur in many cases, rehabilitation is not provided at the appropriate intensity during the acute phase of care and there are often substantial delays or barriers to accessing the rehabilitation services subsequently required. This results in patients not achieving their optimum level of physical and social function and leads to increased overall costs of care and social support<sup>186 187 188 189</sup>. The individual and societal costs including family breakdown, unemployment and continuing social care input are unquantifiable, but significant and long term in this predominantly young cohort.

Specialist services have historically been established on the basis of specific injury patterns such as brain, spinal cord or burn and therefore often exclude those with other or less clearly categorisable injuries (e.g. multiple limb fractures, crushed pelvis, flail chest). Those patients with complex rehabilitation needs as a result of severe musculoskeletal or multi-system injuries

consistently fall between the gaps in current services. This group of patients often have rehabilitation provided by teams who do not have the breadth of skills, capacity or facilities to meet their requirements, which in turn extends the duration of rehabilitation and leads to poorer outcomes.

Where appropriate rehabilitation services do exist, there are frequently issues of funding and capacity that lead to delays in access. These delays result in poorer long-term outcomes, and in pressure being placed on the acute units who need to place patients for ongoing care.

The Armed Forces have recently had to contend with repeated influxes of battle casualties from the conflicts in Iraq and Afghanistan. The structured approach developed to manage these cases is directly applicable to the civilian trauma population<sup>190 191</sup>. Having a single unit to provide most forms of rehabilitation services on one site has enabled holistic delivery of care to all patients. The organisation of rehabilitation services as Complex Trauma Teams coordinated by a senior, experienced manager makes delivery of the service more effective. There is a strong focus on vocational outcome in this approach, with occupational therapists tasked specifically with reintegrating service personnel back in to military employment.

Patients' needs for physical and psycho-social rehabilitation do not necessarily correlate with the severity of their injuries<sup>192 193 194</sup>. As a result, some patients whose injuries do not require escalation to a Major Trauma centre for acute care may still need have complex rehabilitation. It is important that patients who have not been admitted to a Major Trauma centre are not disadvantaged in accessing the level of rehabilitation they require.

### 5.3.1 Principles

#### **Key recommendations:**

- 2) Patients who have not been admitted to a Major Trauma centre should not be disadvantaged in accessing the level of rehabilitation they require.
- 3) Trauma patients should receive appropriate levels of care and rehabilitation at all points along their care pathway.
- 4) There should be coordinated development of rehabilitation services and long-term support in the community, which can deliver comprehensive and effective rehabilitation to meet the needs of traumatically injured patients, irrespective of their age.

Rehabilitation should be based on the following principles:

- Equity of access.
- Early assessment and intervention by a multi-disciplinary team.
- Timely access to rehabilitation reflecting patient need, at all stages of their pathway.
- Development of a Prescription for Rehabilitation by a multidisciplinary team.
- Patient and family involvement in all aspects of planning and delivery of care and rehabilitation.
- Consideration and active management of physical, cognitive, emotional and social need, and the effects of symptoms and treatment regimes e.g. pain, mobility restrictions.
- Vocational and educational rehabilitation routinely provided.
- Rapid access to further specialist opinion.

Critical to its effectiveness is a holistic approach and appropriate interdisciplinary practice (working across professional boundaries).

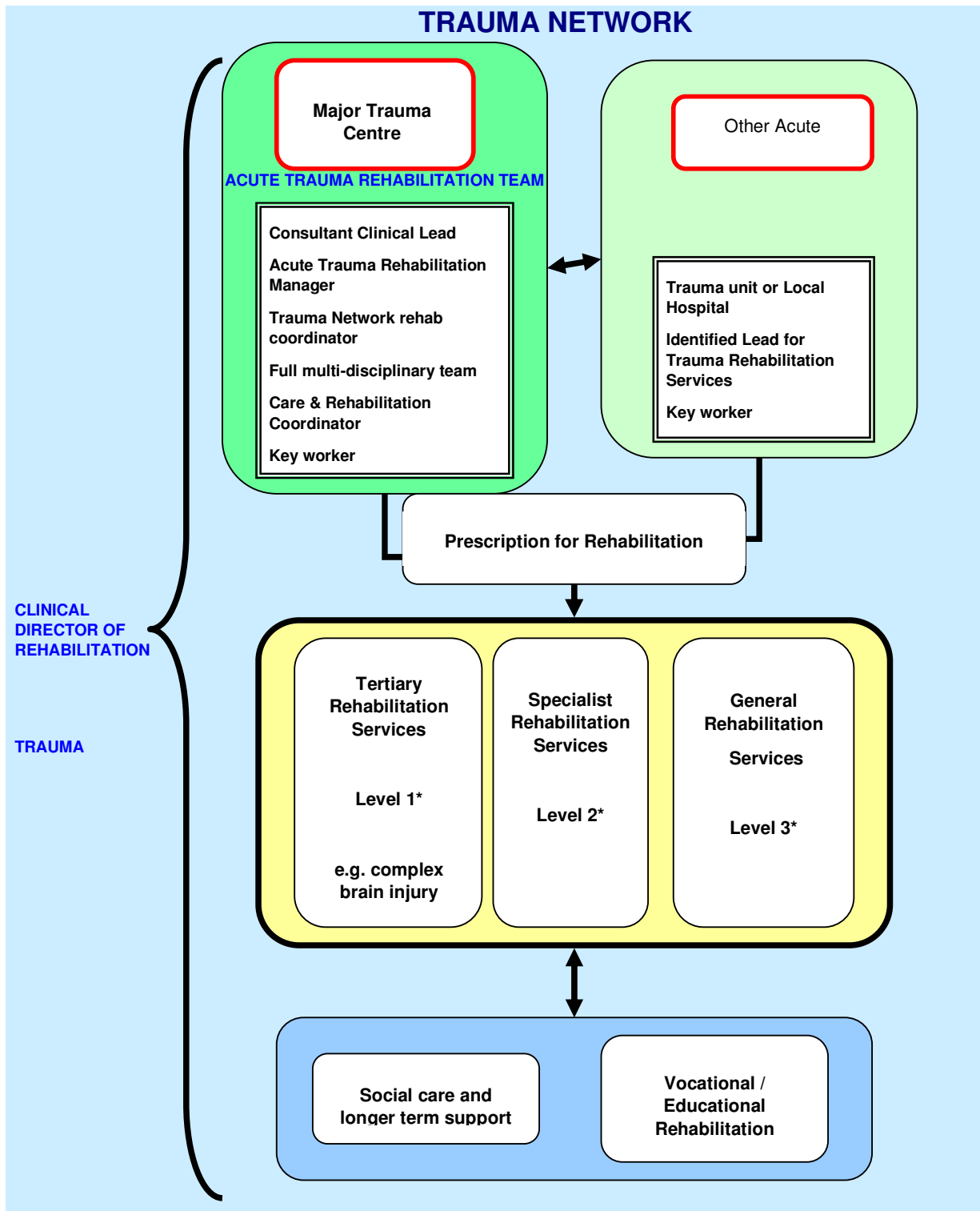
### 5.3.2 Rehabilitation pathway structures

**Key recommendations:**

- 5) All stages of care, including the rehabilitation and transfer aspects of the patient's pathway, should be the responsibility of the network.
- 6) There should be an appointment of a Trauma Network Director of Rehabilitation Services.
- 7) There should be an appointment of a Clinical Lead for Acute Trauma Rehabilitation Services in every Major Trauma Centre (Consultant in Rehabilitation Medicine).
- 8) There should be adequately skilled and resourced multi-disciplinary rehabilitation teams in all of a network's services.
- 9) There should be rehabilitation and care coordinator posts throughout the network. Each patient should have an identified key worker to be a point of contact for them, their carers or family doctor and to ensure delivery of their personal prescription for rehabilitation.

Below is an outline of the proposed structure required for the rehabilitation of seriously injured patients (Figure 2). They may enter the system at Major Trauma Centre or Trauma Unit levels.

Figure 2: proposed structure required for the rehabilitation of seriously injured patients



Without an appropriately co-ordinated service there will be significant consequences for patients which may include:

- The quality of care provided remaining unacceptable;

- Delays in moving patients on from acute services;
- Unsupported and unguided “repatriation” of patients to their local hospitals; and
- The potential for there to be critical performance failure of Trauma Networks resulting in avoidable costs to the individual patient and society as a whole.

The CAG recommended that each Trauma Network should have a Director of Rehabilitation with a relevant clinical background, but who need not be medically trained. This person will co-ordinate the whole process by which patients pass from acute care to rehabilitation services across the Trauma Network. In particular, they need to develop a seamless pathway between hospitals but crucially from the inpatient to community-based rehabilitation services, which may include vocational and educational rehabilitation services, re-ablement, social care and voluntary sector services.

The CAG also proposed that at each Major Trauma centre there is a full multi-disciplinary rehabilitation team, with a manager and a Care and Rehabilitation Coordinator, led by a consultant accredited in Rehabilitation Medicine. This person will have overall clinical responsibility for the rehabilitation of patients in the Major Trauma centre and during their transition to post-acute rehabilitation services.

These roles are discussed in more detail later in this chapter.

### 5.3.3 Movement of patients within the system

There is a tendency to view patients with Major Trauma as ‘bed blockers’ once their specialist surgical treatment has been completed. The concept of repatriation of a patient from the specialist unit back to a local unit is currently the model by which specialist units maintain their throughput. The CAG believes that this model is fundamentally wrong.

The principle of a patient receiving specialist care appropriate for their injuries is fundamental. To abandon this principle at the point at which rehabilitation is required is illogical and compromises patient outcomes. It is wrong to assume that specialist rehabilitation techniques will be carried out on a general orthopaedic or surgical ward in a district general hospital. To underline this point, the CAG points to the introduction of specialist units for stroke rehabilitation, taking patients off general wards, which has demonstrated proven clinical and financial benefits.

Repatriating patients to services which have limited resources and staff without the skills required will compromise their long-term outcomes and the success of the Trauma Networks. Quality requires the provision of appropriately staffed post-acute specialist rehabilitation services that can be accessed as soon as the patient no longer needs to be in an acute setting.

Some patients’ rehabilitation needs will not exceed the capability of local services. Once they have received the care needed from a Major Trauma centre, it is logical for these patients to transfer to services closer to home for discharge and ongoing rehabilitation. Network structures and agreements should ensure these transfers can be made without unnecessary delay. But such transfers should only be made supported by the clearest of documentation relating to their rehabilitation needs.

### 5.3.4 Identifying the needs of the rehabilitation patient

**Key recommendation:**

10) Every patient should receive routine screening of rehabilitation needs.

In order to meet patients' rehabilitation needs, all trauma patients should have their rehabilitation needs actively identified irrespective of whether they are in a Major Trauma centre or a Trauma Unit. This will lead to the development of a rehabilitation prescription. Injuries requiring rehabilitation will range from the apparently modest, such as flexor tendon injuries of the hand or mild head injury, to the obvious and severe – such as traumatic amputation. This is in line with the recommendation of the NICE guidance for rehabilitation after critical illness<sup>195</sup> and the personalised care planning approach supported by the National Service Framework for Long Term Conditions<sup>196</sup>.

### 5.3.5 Rehabilitation prescription

**Key recommendation:**

11) A rehabilitation prescription should be provided to all trauma patients with identified needs.

A rehabilitation prescription describes the patient's physical, cognitive and psycho-social needs, framed in the context of their pre-injury life, and states how these will be addressed. The prescription is an extension of a discharge/transfer summary and should include ongoing health and social care plans (see section 4.3.6 within Ongoing Care and Reconstruction chapter).

The prescription will empower the patient and ensure that the patient and the health and social care workers have shared objectives. The patient will hold their prescription, which will have as its aim the achievement of their optimum functional potential.

The rehabilitation prescription should be developed by the multi-disciplinary team in conjunction with the patient and their family/carers. The prescription should be created early in the rehabilitation process and then be reviewed and evolve throughout the patient's pathway until such time as there is no outstanding rehabilitation or care needs.

In particular, the prescription should ensure that patients' needs, and the plans made to address these, are clear as patients move from one setting to another. This will help to minimise the risk of these plans failing. The prescription should allow the identification of any unmet needs and the reasons for this to enable system evaluation and targeted service development.

### 5.3.6 Vocational/educational rehabilitation

**Key recommendation:**

12) Many trauma patients are of working age and vocational rehabilitation<sup>197</sup> should therefore be a key component of rehabilitation.

There has been a lack of focus on vocational outcomes as a measure of the success of rehabilitation. The CAG proposes that vocational activity is seen as an important outcome following injury and recommends that resource is invested into return-to-work support for patients.



Vocational and educational rehabilitation should focus on enabling trauma patients of all ages to return to a productive and fulfilling life; this may be returning to their pre-injury occupation or an alternative life choice.

Vocational and educational rehabilitation services should work with other relevant organisations including the Government's Access to Work.

### 5.3.7 Implementing change: coordination and services

#### 5.3.7.1 Rehabilitation coordination

Best practice includes active case management of the clinical, social and psychological needs of the patient following injury. A Care and Rehabilitation coordinator should be assigned to each patient in the Major Trauma centre who has serious injuries and requires multidisciplinary input. This coordinator should be part of the Major Trauma centre's Trauma Service (see section 4.3.2 in Ongoing Care and Reconstruction chapter, section 3).

Early multi-disciplinary team meetings, with the patient and their carer should be considered a mandatory element of patient care. These meetings should take place at an appropriate frequency throughout a patient's care pathway<sup>198</sup>.

There should be a Trauma Network Rehabilitation Coordinator (working to the Clinical Director of Trauma Rehabilitation) to manage the smooth passage of patients through the network. This role would ensure the coordination and management of those patients who continue to have rehabilitation needs once they have left the Major Trauma centre or Trauma Unit.

The Trauma Network Rehabilitation Coordinator should provide follow-up for all patients who have rehabilitation needs identified during the acute phase of their care, and they should also facilitate the collection of data regarding patient outcomes.

The Trauma Network Rehabilitation Coordinators should ensure that there is a seamless handover of patients with continuing needs to the appropriate teams providing long-term condition or case management.

#### 5.3.7.2 Services required

##### ***Considerations and conclusions***

There are extensive guidelines from both the UK and international sources on the services and personnel required to provide satisfactory levels of rehabilitation for trauma patients<sup>199 200 201 202 203 204 205 206</sup>. It is not the CAGs aim to identify and review these standards. However, it is clear the guidelines can be adhered to, modified and improved once an appropriate management and clinical structure is in place.

Guidelines for the best practice in the management of these patients are frequently not adhered to because of lack of resources. The focus should be on provision of adequate resources rather than reinventing further standards.

At present the Group is unable to determine the extent to which the services outlined in this section exist, nor to what extent they are meeting the needs of those who have sustained traumatic injuries. In the experience of the experts on the Clinical Advisory Group, access to rehabilitation and social care services is variable due to limited resources, restrictive eligibility criteria and difficulties in securing funding for patients with complex needs. Where it is provided, rehabilitation is often delayed and of inadequate duration or intensity.

The Clinical Director of Trauma Rehabilitation for the network should identify the services required and available for trauma patients. As data management systems are developed, a review of

delayed provision and unmet need should be undertaken leading to the targeted development of services. There should also be a cross-network education programme concerning the rehabilitative management of patients with complex injuries.

Trauma patients with concurrent mental health problems or challenging behaviour, perhaps from brain injury, should have their needs considered at all stages of rehabilitation. Effective management may require extra resources such as the provision of a specialist mental health nurse to provide one-to-one support. Mental health problems or behavioural difficulties may significantly complicate the rehabilitation of trauma patient particularly if in-patient mental health care is indicated. Psychiatric units may not be able to support the physical access, nursing and rehabilitation needs of the patient.

Patients who have sustained traumatic injuries should have access to legal guidance, throughout their care and rehabilitation pathway. This may bring advantages in terms of interim payments for personal injury and therefore aid treatment planning.

### ***Services within a Major Trauma centre***

Within a Major Trauma Centre there should be an acute trauma rehabilitation team that is part of the wider Trauma Service (see also section 4.3.2 in Ongoing Care and Reconstruction chapter). It should include a Rehabilitation Medicine consultant and the appropriate representatives from allied health and social care services including:

- Physiotherapists.
- Occupational therapists.
- Speech and language therapists.
- Dieticians.
- Social workers.
- Psychologists.
- Associated support staff.

Such staff should all have the specialist skills needed to provide acute phase assessment and management of physical and non-physical morbidity<sup>207</sup> occurring in Major Trauma patients. Physical morbidity includes muscle loss, muscle weakness, musculoskeletal problems including contractures, respiratory problems, sensory problems, pain, and swallowing and speech problems. Non-physical morbidity covers psychological, emotional and psychiatric problems, language and cognitive dysfunction.

The levels of rehabilitation currently provided in acute hospitals are often inadequate to deliver the services required during the acute phase of care to optimise longer-term outcomes. Acute hospitals' rehabilitation services have traditionally focussed on planning and preparing patients for discharge as rapidly as possible: those who have sustained Major Traumatic injuries often require more intensive and specialised services from the very early stages of their care than these traditional models are able to offer. With this in mind, rehabilitation services currently provided within Major Trauma centres will need to be enhanced.

Within a Major Trauma centre the acute trauma rehabilitation team should be responsible for the organisation and delivery of rehabilitation services to patients with multiple injuries or complex rehabilitation issues as a result of trauma. There should be an acute trauma rehabilitation team manager with experience in trauma and of multi-disciplinary management; this role will require a commitment to interdisciplinary working, to coordinate these activities.

Rehabilitation should be provided across all levels of care within the acute setting, from critical care to the ward environment and should be focused on:

- Maximising early rehabilitation gains.
- Optimising rehabilitation potential.
- Reducing secondary complications.
- Planning and facilitating transition from the Major Trauma centre to home or another healthcare or rehabilitation facility.

The range of rehabilitation skills should include acute management of the following injury/patient groups:

- Spinal column and cord injury.
- Traumatic brain injury.
- Complex musculoskeletal injuries (e.g. pelvic fracture, soft tissue injury).
- Soft tissue reconstruction (e.g. skin grafts, free flaps).
- Vascular injuries and amputations.
- Abdominal trauma (including intestinal failure).
- Complex hand injuries.
- Brachial plexus and peripheral nerve injuries.
- Maxillo-facial injuries.
- Burns.

Deploying these skills effectively will require specialist inter-disciplinary planning and delivery of care in order to meet needs associated with multiple injuries<sup>208</sup>. Adequate facilities and resources will also be required. These will include sufficient numbers of skilled professional and support staff, and rehabilitation equipment and space. It is important to note that rehabilitation is a round the clock process and should not be restricted to traditional office hours.

In addition, the following services should be represented or accessible at the MTC:

- Therapy/rehabilitation case coordinator, to facilitate rehabilitation planning and delivery, and the movement of patients from the Major Trauma centre.
- Psychiatry.
- Twenty-four hour access to respiratory physiotherapy.
- Prosthetics services, including the capacity to give a timely pre-surgical opinion regarding the level of amputation.
- Orthotics, surgical appliances, assistive technology, communication aids, and seating and wheelchair services.
- Other services which may be required for the rehabilitation and care of Major Trauma patients including specialist nursing teams (for the management of issues such as external fixators, stoma care), pharmacy, pain management, audiology, optometry and podiatry.

All specialist services available at the Major Trauma centre should also have the capacity to provide guidance about rehabilitation and care regimens to the patient, family and teams in other settings, once a patient has moved from the Major Trauma centre.

### ***Trauma unit rehabilitation***

There should be a named lead for trauma rehabilitation at each Trauma Unit.

There should also be a rehabilitation team<sup>209</sup> which comprises specialists from allied health and social care services. This team should include:

- Physiotherapists.
- Occupational therapists.
- Speech and language therapists.
- Dieticians.
- Social workers; Psychologists.
- Associated support staff.

Trauma units should accept patients being transferred from Major Trauma centres without delay where those patients who have needs which do not exceed the capability of the Trauma Unit.

Outreach sessions should be provided to Trauma Units by rehabilitation medicine consultants from the linked Major Trauma centre. These sessions should provide support and assist in the management of patients with complex rehabilitation needs.

### ***Tertiary 'specialised' rehabilitation services (level 1)***

These are high cost/low volume services, which are provided for patients with highly complex rehabilitation needs that are beyond the scope of their local services. These specialised services should be provided through co-ordinated service networks planned over a regional population of 1-3 million through collaborative specialised commissioning arrangements. Typically they would include units specialising in spinal cord injury, brain injury etc, but some units could cater for a range of conditions, including polytrauma<sup>210</sup>.

It is recognised that access to such units is problematic due to a lack of capacity, especially for those with polytrauma or complex musculoskeletal injuries; it is recommended that this be addressed. Improvements in the collection of data will assist in determining the shortfall, through which the development of services can be appropriately targeted.

### ***Specialist rehabilitation services (level 2)***

Specialist rehabilitation services are led or supported by a consultant trained and accredited in rehabilitation medicine, who may work in both hospital and community settings. These services often support rehabilitation across a range of conditions including neurological, musculoskeletal, amputee rehabilitation and provide advice and support for local general rehabilitation teams<sup>211</sup>.

### ***General rehabilitation services (level 3)***

General rehabilitation teams provide general multi-professional rehabilitation and therapy support for a range of conditions within the context of acute services, intermediate care or community services<sup>212</sup>.

### ***Other services within the network***

In addition to the multi-disciplinary rehabilitation teams described above, a range of other services will be required to meet trauma patients' rehabilitation, health and social care needs can be met. These services can be provided at either a local or network level. They include:

- Rehabilitation coordination and/or case management services.

- Integrated equipment services, for temporary or permanent provision of assistive equipment and technologies, including telecare and communication aids (see section 8).
- Social work and social care services.
- Psychology and psychiatry services, including drug and alcohol services.
- Vocational and educational rehabilitation services.
- Prosthetics, orthotics, surgical appliances, and seating and wheelchair services.
- Uni-disciplinary or stand alone rehabilitation services e.g. outpatient physiotherapy, hand therapy, pain management.
- Specialist and community nursing services.
- Sensory impairment teams.

### ***Voluntary and third sector organisations***

Voluntary and third sector organisations have an important role to play in the rehabilitation of trauma patients. They can often provide additional support to patients and their families, friends and carers. Any teams delivering health and social care services should liaise with those voluntary and third sector organisations which may be relevant and distribute the necessary information about them to patients and their families, friends and carers. These organisations should feature in the proposed directory of services.

### **5.3.8 Implementing change: A country-wide review**

#### **Key recommendation:**

- 13) There should be a country-wide review of all services providing rehabilitation to patients who have sustained traumatic injuries.

There should be a country-wide review of all services providing rehabilitation to patients who have sustained traumatic injuries. This review should include, but not be limited to, the current boundaries between health, social care and housing. This should include the provision of equipment, adaptations and care for patients being discharged from in-patient services.

It is essential to ensure the timely availability of appropriately qualified and experienced therapists and technicians to comprehensively assess patients' individual needs. This is required in both the in-patient and community settings to ensure pre-discharge preparation and post-discharge follow up can take place even where the patient has crossed geographical boundaries during their transition home.

### **5.3.9 Implementing change: levers for change**

This section describes some of the levers that should be used to support the required change for rehabilitation services in the Major Trauma pathway.

### 5.3.9.1 Funding structures

**Key recommendation:**

- 14) Appropriate funding structures should be developed to ensure timely and comprehensive rehabilitation.

Current funding and payment structures do not incentivise the delivery of rehabilitation in a timely or comprehensive manner. A funding structure which reflects and supports desirable patient pathways is essential.

### 5.3.9.2 Data management and outcome measures

**Key recommendation:**

- 15) There should be a review of the applicability of the UK National Dataset for Specialist Rehabilitation Services to all Major Trauma patients.

Effective data management is imperative: in the past commissioners have often been unwilling to pay for expensive services without evidence that they improve outcomes.

Outcome measures in rehabilitation are complex because they need to reflect a variety of different functional outcomes, as well as provide a global measure of outcome. Nevertheless, data needs to be collated at a national level to look at long-term outcomes following injury.

Concentration on survival as a measurement of success ignores the long-term impact of Major Trauma on patients, their families and society more broadly. Furthermore, the approach fails to acknowledge the requirement for and potential contributory effect of properly organised rehabilitation.

It has already been acknowledged that unmet needs and delayed access to rehabilitation, at all stages of the pathway, are not routinely recorded and as such the scale of the problems in provision of appropriate rehabilitation is unknown. This should be redressed through the development of routine data collection regarding rehabilitation for trauma patients. The rehabilitation prescription may provide the source of some of the data required to establish the level of delayed and/or unmet needs.

Data should be collected in a coherent manner across entire patient pathways so that the efficacy and performance of different elements of networks, and networks as a whole can be evaluated.

There is some well established national work in the field of long term neurological conditions<sup>213</sup> which includes measures of needs, inputs and outcomes. The applicability of extending this data set to all trauma patients should be considered.

Data collected needs to link with the Performance Framework established for Major Trauma Systems which is managed by the Trauma Audit and Research Network (TARN). This will help to ensure that long-term outcomes and other factors associated with rehabilitation are included in the performance management of networks as a whole.

### 5.3.9.3 National directory of services

#### Key recommendation:

- 16) A directory of services and resources should be developed relating to rehabilitation and ongoing care to facilitate referral and access to these services.

There are many NHS and non-NHS rehabilitation services and facilities around the country. Access is often denied to patients owing to a lack of awareness of their existence. This can particularly be a problem for teams in specialist centres at some distance from the patient's local area. All services which may contribute to the rehabilitation and care of trauma patients should be recorded and entered on to a directory to facilitate cross-boundary referrals. This will also assist in the process of identifying gaps in services.

### 5.3.10 Non-entitled patients

There are a number of issues associated with patients who are ineligible for post-acute care. Patients who are immigrants or international visitors can be managed in the acute services, whereas funding lines are less clear following medical stabilisation which leads to ethical and practical dilemmas for health care teams. The funding of, or arrangements for meeting the rehabilitation needs of these patients requires clarification.

## 5.4 Stakeholder support and challenge

There was recognition from stakeholders that rehabilitation is in urgent need of improvement. It is felt to be the most neglected part of the pathway. The perception is that rehabilitation has been massively underfunded, is a lower priority and less glamorous than other parts of the pathway. The main problems are felt to be:

- Availability of and access to services.
- Quality of services.
- Co-ordination of services and care planning.
- Poor communication to patients and carers.
- Lack of support for returning home and to work.

This type of care is generally not seen as being part of the whole, integrated care pathway, and several comments were received about how difficult it is to access dedicated specialist and community rehabilitation services.

Stakeholders frequently commented about the need to provide non-medical support and psychological support, again taking a holistic approach to trauma care.

It was suggested that the investment of time and resources in planning acute and specialist rehabilitation earlier in the patient journey would produce better patient outcomes as well as prove more cost effective. Several people, particularly patients, commented on problems in system's capacity for specialist rehabilitation:

*"The problems highlighted in the other pathway areas are minor compared to the major problem of specialist rehab. This is a major problem because there is no provision for acute rapid access rehab both locally and nationally. The risk to the patient is that they will end up in general surgery or medical wards with their condition not addressed. Rehab is delayed or never happens. It seems pointless to spend all this effort on the front end of fast responsive care if we then do not provide rehabilitation."*

***Representative from a professional association***

Stakeholders also felt that community rehabilitation lacked consultants' input, as well as having insufficient support to address the full range of patients' needs, particularly psycho-social needs. Patients wished to be able to plan for their futures, and they were especially concerned about their lack of choices, uncoordinated care and ineffective communication about their care plans. A team approach to care, with a lead professional, was seen as desirable. Some professionals noted the lack of connection between rehabilitation and primary and community-based services, which often resulted in poor care following discharge and in some cases readmission. Patients' experience of multi-agency working and the quality of social care was also poor, especially where there were ongoing care needs:

*"What I needed was someone to make that cross over – a named district nurse who could be a lead or a team who could support me. I no longer had a consultant I was in between services – mentally and physically I slipped drastically – on my first appointment I saw a registrar who'd never seen a burns victim – he didn't know what to do with me and told me to come back in two months. When I saw the consultant in December I was at my lowest ebb. I wasn't getting the support I needed, the GP kept referring to hospital but I was not seeing a consultant... I got no advice or support and there was no one there to check I was still around."*

***A patient***



## 6 Network organisation

### 6.1 Overview

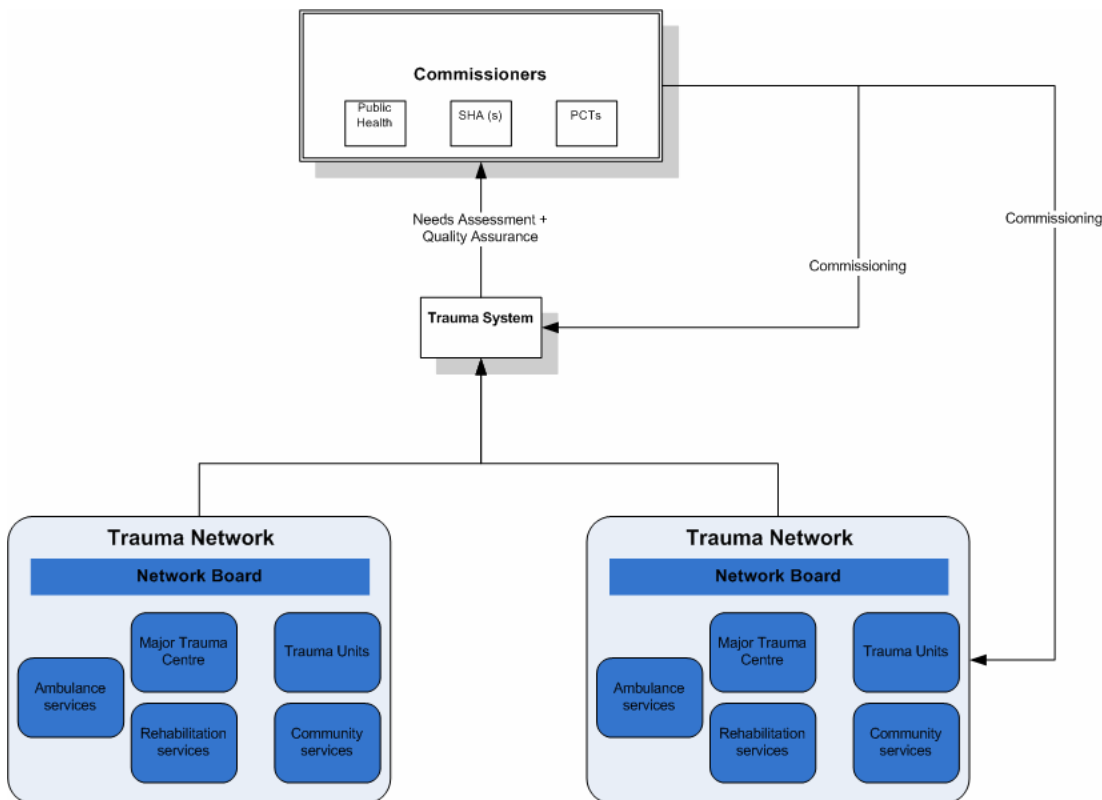
The challenge faced by a trauma network is two-fold. First, the patient must be moved in a timely manner to the location best able to provide for their needs. This applies at every stage from initial treatment to rehabilitation. Second, the care then given to the patient must be of the highest quality. The first is a challenge of co-ordination.. Meeting this will require a new model of responsibility for the care of the injured. The second is a challenge of governance. Without effective quality improvement programmes, networks will not realise the potential gains of regionalisation. This section describes how international experience of trauma networks could translate into the structures of the NHS.

### 6.2 Clinical Advisory Group report summary

This CAG report provides recommendations to commissioners on the regionalisation of trauma care. Regionalising trauma services involves developing Inclusive Trauma Systems – comprising one or more Trauma Networks – that bring together commissioners, providers, public health and other stakeholders to oversee the treatment of the injured. These Systems should be responsible for all aspects of trauma care, from point of injury to rehabilitation, and for injury prevention. Each System should consist of one or more Networks of providers. The centre of each Trauma Network will be a Major Trauma Centre, a multi-specialty hospital optimised for the provision of trauma care. A Network would include all providers of trauma care, particularly pre-hospital services, other hospitals receiving acute trauma admissions (Trauma Units), and rehabilitation services.

The CAG recommended that the key elements of a Trauma System be described and designated as shown below in the diagram below in Figure 3.

**Figure 3: Example of a Trauma System with more than one network**



Trauma Networks consist of the providers of trauma care, collaborating in the provision of that care and cooperating in Quality Improvement activities. One or more Networks come together to form a System. At the System level, providers, Networks, commissioners, public health and other stakeholders come together to assess the needs of the population and plan the provision of trauma care. These plans are implemented through commissioning. Finally, as an important byproduct of Quality Improvement data collection, the System is able to provide commissioners with a high standard of assurance of the Quality of care provided.

### 6.2.1 Key themes

The Group identified a number of key themes for network organisation:

- Elements of Trauma Networks including Major Trauma centres, Trauma Units and local emergency hospitals.
- Commissioning Trauma Systems and networks.
- Managing the patient journey in Trauma Networks including access to care, coordination of patient movements and network protocols.
- Monitoring and improving trauma care including Performance Framework and Quality Improvement programmes.
- Data.
- Trauma networks and prevention.
- Emergency Preparedness.

- Research in trauma care.
- National Trauma Board.
- The Defence Medical Services.

### **6.2.2 Summary Recommendations**

The CAG set out the following recommendations:

- The NHS should establish inclusive regional Trauma Systems across England.
- Commissioners should require Major Trauma Centres and Trauma Units to meet and maintain nationally accepted designation criteria. The latter should be developed.
- Commissioners should consider the appropriate level of resourcing for the various teams needed to establish Trauma Systems.
- The boundaries of Trauma Systems and Networks should be based on the needs of patients, not on current NHS structures.
- Networks should take responsibility for the transfer of patients between member units, enforcing appropriate standards at each stage of the patient journey.
- MTCs should be prepared to accept immediate patient transfers without prior warning.
- Network coordinators should be available 24/7 to manage the transfer of patients between providers.
- Submission of full, accurate data to TARN should be achieved by all trauma care providers for successful performance management and clinical governance.
- Each System should implement a Performance Framework to underpin Quality Improvement and to provide assurance to commissioners.
- Trauma Systems should have Quality Improvement programmes operating at all levels.
- Trauma Systems should be actively engaged in injury prevention.
- Trauma Networks should be integrated into Emergency Planning, which should take account of the changes in hospital status caused by regionalisation.
- Injury research should be integrated into the provision of trauma care.
- A National Trauma Board should be established.
- The NHS should utilise the experience of Defence Medical Services personnel.

## 6.3 Clinical Advisory Group recommendations

### Key recommendations

- 1) The CAG strongly supported the establishment inclusive regional Trauma Systems across NHS England as the means to achieve good practice.
- 2) Suitable designation criteria, based on evidence and professional consensus have been developed by those SHAs most advanced in the process of regionalisation. Systems should develop standards of this type and commission MTCs and TUs in line with these criteria. Where there is substantial variation between Systems, the CAG recommend this should be resolved, over time, by the proposed National Trauma Board.

A significant proportion of NHS injury deaths are preventable.<sup>214</sup> At present, trauma care in the UK is unsatisfactory: a major study of trauma outcomes found that patients were typically attended by junior staff, and that their treatment was delayed and mortality was high compared with international comparators. While there has been increased trauma-specific training in the NHS<sup>215</sup>, and improvements in mortality as a result<sup>216</sup>, there has been no improvement since 2004, with evidence of ongoing poor practice and unsatisfactory care in spite of advances in medical technology, training and care.

A recent NAO report<sup>217</sup> concluded that previous reports on Major Trauma failed to evoke an official response and that significant failures in the quality of care persist. The report concludes that trauma care should be reconfigured as a way of improving quality, efficiency and outcomes.

**Implementation consideration:** *Inclusive Trauma Systems should be implemented nationally, in line with the established strong consensus from clinicians, professional organisations and membership bodies.*<sup>218</sup>

The CAG recognised that the selection of MTCs and TUs will be affected by geography, traditional referral pathways and the existing distribution of services between hospitals. Some TUs may be more distant from an MTC. These units will need to be prepared to accept and stabilise some severely injured patients who in other circumstances would have been transferred directly to an MTC. In other cases, a TU may be able to provide definitive neurosurgical care to patients. Such Specialist Neurosurgical Trauma Units (SNSTUs) could be utilised in an enhanced role to some Networks.

In some regions it may be obvious which hospitals should become MTCs. However, this should not be automatic: there should be clear criteria for MTC status with adequate incentives available for meeting them. MTC and TU status should be regularly reviewed and may be withdrawn if the criteria are not maintained. This would be a measure of last resort, indicating a persistent clinical and managerial failure to meet the commissioned standard, with serious consequences.

**Implementation consideration:** *Suitable designation criteria, based on evidence and professional consensus have been developed by those SHAs most advanced in the process of regionalisation*<sup>219</sup>. *Systems should develop standards of this type and commission MTCs and TUs in line with these criteria. Where there is substantial variation between Systems, the CAG recommend this should be resolved, over time, by the proposed National Trauma Board (see below).*

In other regions there may not be a hospital with all the services necessary to qualify as an MTC. The CAG recognised this to be a difficult situation. The Group recommended that the patients' interests would be best served by establishing inclusive Trauma Systems based around MTCs, as described. Where an MTC is not currently possible, or where it will involve significant service redesign over several years, interim measures would be needed. One hospital should become the

lead centre within the Network, receiving the majority of patients, except where their injuries clearly demand that they travel to another unit which has an essential service. Local solutions must be found for multiply injured patients who require specialist facilities that are not on a single hospital site. In such circumstances it may be more appropriate for specialist clinicians to travel to the patient rather than to move the patient between hospitals. Significant benefits to the injured population should be achieved by this co-operative model. Nonetheless the CAG considered that it would be suboptimal and has no evidence base. The process and outcome of trauma care should be closely scrutinised while care continues to be delivered on this interim basis.

### **Key recommendations**

- 3) Commissioners should create adequately resourced teams to manage the establishment of Trauma Systems.
- 4) The boundaries of Trauma Systems and Networks should be based on the needs of patients, not on NHS structures.

SHAs should initiate the commissioning of Trauma Systems & Networks. Effective commissioning involves an iterative process in which regional-level activity data on the needs of injured people are analysed, and services designed to meet those needs. Services could then be purchased from providers who meet appropriate quality criteria, with commissioners monitoring the Quality Improvement processes. The CAG considered that this would need a dedicated, adequately resourced team with strong clinical leadership.

**Implementation consideration:** *Commissioning should take into account the advice in Appendix C on the management of the initial process based on the experience of the London Trauma System.*

Trauma systems should be patient-centred. In particular, commissioners need to assess the type, demography and location of injuries in their area, and where appropriate services are located.

Patients presenting near the borders of a SHA or network may be best served by being transported to hospitals within a neighbouring network. The boundaries of Trauma Networks and Systems should be drawn on this basis of patient need. It follows that a System may include commissioning from more than one regional area. Indeed the boundary may pass through the local commissioning geographical boundaries. Trauma Systems lying on the Welsh and Scottish borders should engage with all commissioners and providers that would naturally form part of their Networks.

**Implementation consideration:** *Data acquisition is the vital first step of the commissioning process in order to understand where it would be most appropriate to transport trauma patients in a region initially. It is important as well to ensure that patient flows and financial flows are aligned, by including all PCTs in the commissioning of the Systems that are likely to care for their patients, taking into account when patients may be transported across network and commissioning boundaries.*

### **Key recommendations**

- 5) Networks should take responsibility for the transfer of patients between member units, enforcing appropriate standards at each stage of the patient journey.
- 6) MTCs should be prepared to accept immediate patient transfers without prior warning.
- 7) Network coordinators should be available 24/7 to manage the transfer of patients between providers.

At present, injured patients are taken from the point of injury to the nearest Emergency Department (ED) where s/he can be assessed and onwards transfer to a specialist centre arranged, if appropriate. The initial ED takes responsibility for the patient until acceptance by, and transfer to the specialist centre. Transfers can take several hours.<sup>220</sup> This arrangement can mean that patients spend long periods in hospitals not established to manage their injuries during which time their condition can deteriorate. Some patients' outcomes can be improved by transfer to specialist care even when specialist surgery is not required<sup>221</sup> and, conversely, there can be reduced chances of a good outcome where specialist surgery is delayed even during later stages of care. To address this the CAG recommend that the responsibility for these patients should be radically altered.

### **Implementation consideration:**

- *Severely injured patients who require specialist care should be sent directly to an MTC or a TU with the necessary specialist services, with later hospital transfers arranged as necessary should the initial hospital be unable to provide their definitive care. Acutely ill patients must be moved immediately or directly after life-saving interventions such as abdominal packing to achieve prompt definitive specialist care. Specialist services should accept responsibility for injured patients wherever they are in the Network.*
- *The responsibility for ensuring patients are transported to and treated in the appropriate location should lie with the Network with protocols put in place to effect prompt, safe inter-hospital transfer as necessary.*
- *Transfers for definitive care and rehabilitation should occur to an agreed standard. Networks should monitor these processes as a key part of their Performance Frameworks.*
- *The Department of Health should design funding models that reflect this shift in responsibility and incentivise prompt transfer.*

A patient's journey after severe injury can be extremely complicated. It may include:

- Pre-hospital care.
- Transfer by ambulance or helicopter to hospital.
- Acute transfer between hospitals when initially under-triaged.
- Care delivered by many medical specialties and other professionals.
- Later transfer between hospitals to receive supraspecialist services such as pelvic reconstruction or major burn care.
- Transfer between hospitals after definitive care as part of rehabilitation.
- Transfer to specialist rehabilitation units.
- Transition to life back in the community, including access to outpatient rehabilitation and to local authority and third sector services.

The Network's success will therefore be critically dependant on its relationships with providers and other bodies; and on the mechanisms it develops to manage these relationships. This complexity

compounds the problem of delayed transfer already described, as well as the challenges of moving patients across administrative and/or geographical service boundaries.

**Implementation consideration:** *Networks should work collaboratively to develop an infrastructure that supports both local access and cross-boundary service delivery. The CAG recommends they should manage emergency transfers in one of the following ways with MTCs being prepared to accept emergency patients without warning:*

- **Send and call:** *TUs determine the needs for transfer to the MTC and immediately dispatch the patient by ambulance. The MTC is then informed that the patient is on their way. The MTC then manages consequent bed capacity issues as it would if the patient had presented to their own ED. This model is most appropriate where TUs have limited facilities, the MTC is very close, the requirement for MTC care is urgent or there is no choice of destination MTC.*
- **Call and send:** *TUs determine the need for transfer and this is agreed by the MTC (or SNSTU) before the patient moves. This is more suitable in less urgent cases where there is a choice of destination, e.g. between an MTC and a TU with neurosurgery.*

The CAG identified several ways in which coordination is required in the Network. These are:

- Pre-hospital coordination of patient movement.
- Coordination of inter-hospital transfers:
  - Acute, emergency transfers occurring at any time.
  - Transfers for definitive care.
  - Transfers for rehabilitation and discharge.
- Oversight and/or execution of data collection, QI processes and patient transfers – both at local and regional levels.

These functions combine clinical and logistical tasks. Some of these functions require paramedics based in the ambulance control and some require senior nurses or allied health professionals based in the MTCs. In the latter case, they will also be able to help coordinate the care of individual patients – especially important when there are multiple clinicians involved in a single case. There is more than one suitable way to provide some types of coordination. Systems should devise local solutions that meet their needs

**Implementation consideration:**

- *Trauma Networks should look for synergies between their need for the coordination of patient transfers and those in other patient groups, such as critical care and paediatrics. These can serve to make the employment of coordinators more economic.*
- *Inevitably, disputes will arise over the transfer of responsibility between providers. The Group considered that Networks should be able to resolve such disputes in most circumstances. Occasionally the System (representing commissioners) may have to arbitrate over a dispute and so we recommend the authority to do so should be established in the commissioning arrangements of all providers. Disputes between units in different Networks should be resolved by Networks on the basis of the patient's best interest. In the very rare case where agreement cannot be reached at either the Network or System level, or perhaps where there is no neighbouring System in place, some national framework for resolution should exist.*

Providers should work towards professionally agreed standards and protocols for care and movement of patients across the Network, in order to ensure consistent and coherent practice and provide assurance of care quality. The CAG recommend that quality standards should be enforced in protocols that can be derived from the System Performance Framework and should be narrow,

measurable goals. Protocols should have a wider remit, seeking full implementation of relevant national (NICE) guidance or local standards of care.

Protocols may operate in two domains: 'Network operational procedures' and 'Clinical care'.

### **Implementation consideration:**

- **Authority:** *Providers forming a Network should agree to be bound by Network protocols. A protocols group, empowered to approve protocols on behalf of Network members, would be an effective structure to establish in each Network*
- **Development:** *Network protocols should not be imposed by specialists at the MTC. They should be developed through partnership between clinicians and others across the Network. The CAG considered that this would ground protocols in the reality of available resources, promote acceptance of their contents, and promote professional linkages across the region. Professional acceptance of clinical protocols would be greatly enhanced by the explicit inclusion of the evidence base or national expert advice, such as this, where evidence is weak.*
- **Communication:** *All providers should make the current version of Network protocols readily available to all clinicians. Alterations to these protocols should be adequately explained to all staff.*

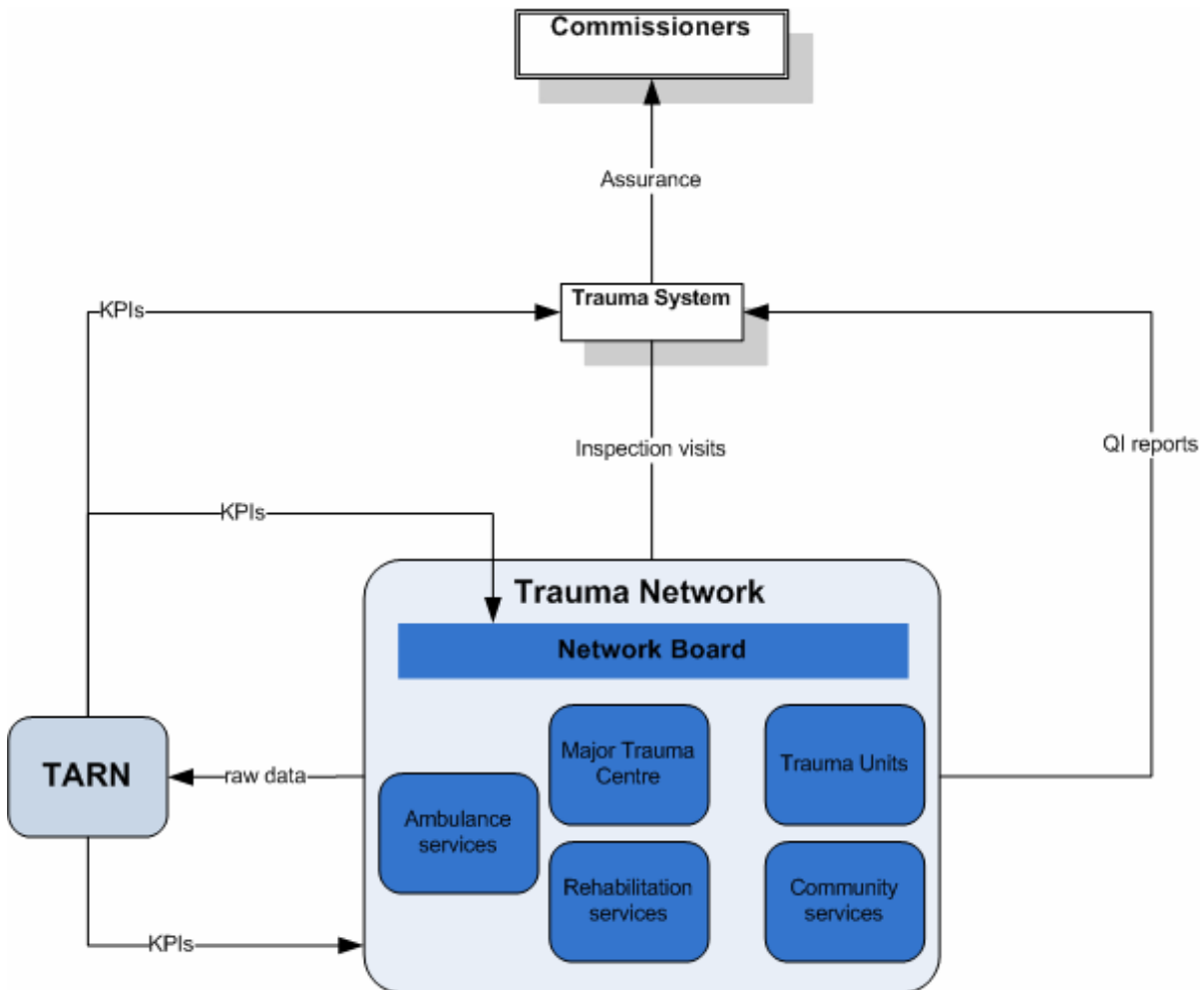
### **Key recommendations**

- 8) Each System should implement a Performance Framework to underpin Quality Improvement and to provide assurance to commissioners.
- 9) Submission of full, accurate data to TARN should be achieved by all trauma care providers to enable clinical governance.
- 10) Trauma Systems should have Quality Improvement programmes operating at all levels.

The CAG recommended that each element of the Trauma System should function within a clearly described Performance Framework defining key performance indicators, sentinel events<sup>222</sup>, processes for scheduled and unscheduled review, sanctions and incentives. Such a Performance Framework would become a key instrument for Quality Improvement and should be set at Trauma System level, drawing on national and international standards. Systems should report to the public and commissioners annually based on their Performance Framework. The assurance of quality of care that Systems should provide could become a benchmark for other parts of the NHS. Figure 4 illustrates the Performance Framework and information flow.



Figure 4: A recommended Trauma System Performance Framework



The Performance Framework would exist to facilitate and monitor Quality Improvement at every level of a Trauma System. The System would set the Framework, which is part of the commissioning arrangements for providers and Networks. Data from providers could be used to assess many KPIs, which themselves maybe intended to assess the performance of individual providers or of the Network. Other KPI data could be derived from reporting of QI activity or from inspection visits by the System to both providers and Networks. An important secondary benefit of the Performance Framework would be that it allows the System to supply a high grade of assurance of quality of care to commissioners.

The CAG recommended that Key Performance Indicators (KPIs) should form the basis of the Trauma System's Performance Framework and should include:

- **Descriptors:** Data that portray the volume, complexity, resource use and flow of cases across a given facility, unit, Network or System.
- **Process:** Data that describe the care received by patients.
- **Outcome:** Data that illustrate clinically significant effect and end-points.

The CAG recognised that high quality data was fundamental to the Performance Framework and to Quality Improvement programmes. TARN is the national clinical audit recognised by NCAAG as the UK national trauma registry. All providers of trauma care should submit data to TARN. TARN subscriptions have risen very substantially in recent months to 76%.<sup>223</sup> The CAG welcomed the

commitment by the Chief Executive of the NHS to make TARN membership compulsory for all trauma receiving hospitals by the end of FY2010/11.

The TARN database is flexible, allowing data fields to be added at a national or local level. Some data fields can be collected on a continual basis and some as part of time-limited, focused quality initiatives. TARN is able to benchmark an institution's mortality performance against validated large scale trauma outcome datasets and care processes against KPIs respectively.

Data on KPIs may be collected through TARN (i.e. as a contemporaneous activity based in the provider unit) or through inspection visits by the System. Most KPIs should be assessed on a continual basis. Additional KPIs may be mandated at a national or System level as part of time-limited, focused quality initiatives. KPI data should be used to drive Quality Improvement processes at every level of the Trauma System. An example of the Performance Framework of the London Trauma System is included appendix D (see page 110).

**Implementation consideration:** *The process of determining the KPIs within a Performance Framework should be a systematic multi-disciplinary exercise that is founded upon contemporary peer reviewed evidence, published guidelines and consensus statements. Apart from being clinically relevant the KPI matrix:*

- *should contain clear and unambiguous definitions and be readily measurable using appropriate generic or trauma-specific information systems.*
- *should also reflect elements of patient experience to ensure that patient-centred care objectives are met. The setting of such patient-centred metrics will benefit from input from patient groups and expert patients as required, co-opted on to standard-setting boards as required.*
- *should address the fact that, at present, Ambulance Services get little feedback on patient outcomes and their performance is chiefly measured using operational targets, such as response times. Systems should work with their Ambulance Service(s) to develop appropriate KPIs to aid learning and improvement in pre-hospital care.*

Regionalisation of trauma care has the potential to improve outcomes for injured patients. This benefit should be realised by instituting active processes to monitor the quality of care and drive improvements. A Quality Improvement (QI)<sup>224</sup> programme is a 'continuous evaluation of a Trauma System and trauma providers through structured review of the process of care as well as the outcome.'<sup>225</sup> These programmes involve a 'multi-disciplinary approach to problem solving, and which focuses not on individuals but on systems of care that may be the cause of variations'<sup>226</sup> Not having a QI programme has been shown to correlate to poorer post-trauma outcomes<sup>227 228</sup> and there is strong and enduring support for QI.<sup>229</sup>

QI programmes are fundamental to the success of the regionalisation of Trauma Care and, therefore, each NHS Trauma System should include a Quality Improvement (QI) programme that operates at every level, from providers to Network to System. Robust and consistent data collection is fundamental to QI (as well providing a range of benefits including supporting commissioning, and, informing injury prevention work and trauma research).

**Implementation consideration:** *Appendix D includes detail of a model for local and regional QI.*

The primary purposes of trauma data collection are to facilitate Trauma System commissioning and QI by monitoring the burden of trauma and the outcome and process of care for patients in comparison to agreed standards. Data collection may have some secondary objectives relating to injury prevention and trauma research; these may require extended projects which include pre-hospital deaths. These can be acquired from ONS or the coroner. This data would also form the basis of any claims for quality-related payments. Large scale collection of data through the TARN

registry allows the comparison of data between providers and Networks. Persistent (negative) outliers in outcome data represent a failure of the local QI programme to identify problems and require urgent action.

**Implementation consideration:** *In terms of data-gathering, Trauma Systems should work to the national standard for minimum data collection (that will need to be established), consistent with the European standard dataset.<sup>230</sup> Meaningful QI relies on data quality (accuracy should be assured by regular re-entry of 10% submissions) as well as a Performance Framework that gathers data on:*

- **Mortality:** *Case fatality is the outcome most commonly used by TARN and ICNARC<sup>231</sup>. This is a measure of the mortality rate of any institution or System against the national average for that case mix of patients. It is a useful indicator of outlying performance, which should be addressed by a Trauma System. Monitoring of case fatality implies collection of a minimum dataset that includes patient age, gender injury descriptors sufficient to allow calculation of the ISS, and physiology on arrival in the ED (currently the Glasgow Coma Score, systolic blood pressure, respiratory rate and pupillary reactivity should be collected and recorded); this allows each injured patient's survival probability to be calculated and then an institutional case fatality measure. These data will need to be collected continuously.*
- **Morbidity:** *Short term complication data can also be collected through TARN. Longer term outcomes such as disability e.g. Glasgow Outcome Score, Euro Qol 5D, are more meaningful. However it is difficult to get reliable data on disability without considerable resource. Further research and development in this area is needed. If rehabilitation services are submitting data to the UK national dataset for rehabilitation then this could be linked to the TARN outcomes.*
- **Data on process of care:** *The data collected on care processes are also important to the Performance Framework in order to monitor whether or not agreed standards are being adhered to. The data on care processes should allow identification of process failures before, on case fatality rates, a hospital or Network becomes an outlier. Data collection on processes can also be adapted locally to address local System priorities e.g. monitoring a reconfiguration. Other example process measures include:*
  - Time to CT for patients with ISS greater than 15.
  - Time to theatre for craniotomy.
  - Access to neurosurgery for TBI patients.
- **Patient Experience.** *No validated Patient Recorded Outcome Measures (PROMs) currently exist for trauma. These should be developed. Patient experience of the process of care is also rarely assessed at present. Collecting such data would provide the basis for a more patient-centred QI programme. There is some evidence from other disease groups that PROMs have higher rates of completion at earlier times post-incident. Collection of PROMs and patient experiences is costly and intensive. Universal collection would be appropriate as part of a focused national initiative but at most times could be done intermittently or on a subset or random sample of patients.*
- **Data Infrastructure.** *Data should be secure, web-based with patient identifiers being held only at the local-level. Case mix, outcome, and process data should be submitted to TARN as soon after the outcome is known as possible. Hospitals, Networks and Systems hold their own data locally including patient identifiers. Anonymised data is transferred to a secure national data set for benchmarking. The data system must be able to track patients transferred between hospitals and between Networks. Providers should be commissioned to permit the degree of data sharing between providers necessary for data collection and use.*
- **Public Reporting.** *Comparative performance reports against national process and outcome standards should be made available by TARN on a quarterly basis, by hospital, Network and*

*System. These should be publicly available. Additional national and local reports may be commissioned through TARN.*

- **Data Collection.** *Within each Trauma System and Network there should be a specification for data collection that allows data to be accurate, complete and as contemporaneous as possible with minimum resource. The specification should include:*
  - Protected Funding for data collection.
  - TARN data as a CQUIN.
  - Data handling standards and processes.
  - Data quality assurance.
  - National/regional compatibility.
  - Patient identifiables.
  - Tracking patient transfers.
  - Training for data collectors.
  - Information sharing agreements.
- *So long as tailored training is available it is not important whether data collectors are clinical or non-clinical; it is more important that appropriate time is available to collect a comprehensive, contemporaneous data set. The new tariff for Major Trauma being developed by the DH should include an uplift to cover the cost of TARN membership. Some TARN data collection assets, including personnel, could be shared between TUs. It is important to bring MTC / TU data collectors together at Network meetings for mutual support and to maintain standards.*

#### **Key recommendations**

- 11) Trauma Systems should be actively engaged in injury prevention.
- 12) Trauma Networks should be integrated into Emergency Planning, which should take account of the changes in hospital status caused by regionalisation.
- 13) Injury research should be integrated into the provision of trauma care.

An effective Trauma System can serve to prevent trauma. It should provide the infrastructure for the coordinated sharing of detailed data, expertise and best practice between providers, key experts and multi-agency partners. The System will need to coordinate activities in primary, secondary and tertiary prevention.

**Implementation consideration:** *The SHAs, Government and Public Health should consider including injury prevention in the next phase of the work on trauma. For Trauma Systems to be actively engaged in injury prevention, they should implement and monitor initiatives across the system, targeted at the areas and types of trauma identified as part of a continual process working with other organisations such as the voluntary/charitable sector and transport and education.*

In a major incident, the emergency health care system is put under extraordinary pressure and, by definition, is required to put in place special arrangements to manage the injured patient load and the consequences to public health that may follow. An involved Trauma System has a key part to play within the wider emergency response and should synchronise with and operate under the command and control arrangements established by the Health Service to manage the incident.

**Implementation consideration:** *Further guidance on Emergency Preparedness is given in Appendix E.*

Historically, research into injuries has suffered from low levels of funding and prestige. With the development of Trauma Systems there is a significant opportunity to strengthen the academic interest in injuries research and the capacity of the NHS to deliver both investigator-led and commercial research in this area. It is inevitable that research activity will play a stronger role in some Trauma Networks than others, however, all should, to some degree, have the capacity to deliver NHS portfolio injury research.

**Implementation consideration:** *Advice on the integration of research into Trauma System structures is given in Appendix F.*

### Key recommendation

14) A National Trauma Board should be established.

A National Trauma Board (NTB) should be created. The CAG propose that a NTB would not be involved in the running of trauma care. It should have advisory and oversight functions only. It recommends that representatives of the following groups should be considered for membership, for example:

- Trauma Systems.
- Patients.
- TARN.
- CQC.
- NIHR.
- NHS Medical Directorate.
- Public health.
- NHS Education England.
- Professional bodies.
- Defence Medical Services.

Its functions could be to:

- allow a forum for the strategic direction of Trauma System actions and policies where appropriate.
- provide a conduit for issues identified by Trauma Systems to be related to government, national bodies such as NICE and CQC and professional organisations such as Royal Colleges.
- select the national datasets for collection by TARN.
- set, when necessary, national QI initiatives.
- advise DH on:
  - Trauma care policy.
  - Status of trauma care regionalisation.
  - Structure, process and outcome at the national level.
  - Planning of supra-regional trauma services.
  - Finances of trauma care.
  - Education, training and workforce planning.

- Trauma prevention initiatives requiring government action.
- Support trauma research, liaising with NIHR and assisting the coordination of research.
- Oversee a system of peer review between Trauma Systems.

#### **Key recommendation**

15) The NHS should utilise the experience of Defence Medical Services personnel.

The regionalisation of trauma care has implications for the relationship between the NHS and the Defence Medical Services (DMS). The DMS delivers patients into the NHS for the definitive management of their injuries. The NHS is the source of all clinical experience and training for DMS secondary care personnel, regular and reserve, prior to their deployment. DMS personnel have extensive experience of treating the severely injured and of working within a successful Trauma System. This is a resource that the NHS should harness in making Trauma Systems a success.

**Implementation consideration:** *The NHS and the DMS will need to carefully assess the implications of the regionalisation of trauma care, particularly in respect of: the Reception Arrangements for Military Patients; the employment of DMS personnel in the NHS, including the selection of Ministry of Defence Hospital Units; the long term care of injured servicemen who are treated in the NHS after discharge from the Armed Forces.*

## **6.4 Stakeholder support and challenge**

There was a clear message from stakeholder evidence that **respecting the patient journey should be at the heart of a new Major Trauma care pathway**. Re-designed services should reflect the complexity of patients' needs and plan for rehabilitating the whole person, with particular attention paid to specialist care needs and the psycho-social element of recovery, earlier in the pathway. This relies on system re-design and Quality Improvement, through skilled commissioning:

*“The improvements we would like to see are less clinically focused and more around the configuration of services and the ways in which services receive pay and reward for performance. So our issues are around audit through TARN, so we can build a more accurate picture of what goes on. In addition services have to be configured appropriately for the needs of population, and that’s about SHAs and PCTs taking tough decisions on where services are provided.”*

***Representative from a Royal College***

There was acknowledgement, however, that **working differently will require strong clinical leadership and buy-in from trauma professionals, as well as effective management**, and will also challenge how health professionals communicate with patients, their family members and other carers. System redesign will also need to be backed up by political will; organisational cooperation in an increasingly competitive health system; and the alignment of incentives and sufficient resources in order for standards of treatment and care outcomes to improve. At present, there is thought to be in-built disincentives for hospitals and Trauma Centres to collaborate as much as they could:

*“...effective networking between units is discouraged by the Trust system.”*

***Health professional***

Effective strategic communications will be needed to help the public differentiate between the clinical rationale for reconfiguring Major Trauma services and reconfigurations of other local A&E services.

Stakeholders also identified that investment in workforce skills development, enhanced information systems, end-to-end governance and Quality Improvement systems (e.g., TARN) would be essential for the networks to succeed.

*“We need trauma patients to be included in good databases such as we now have for total joint arthroplasty. We do not have the resources to be able to check on our outcomes and know how we are doing compared to whatever might be the best standard.”*

**Clinician**

*“Poor end-to-end governance of Major Trauma system (morbidity and mortality reviews; clinical performance indicators). How do hospitals effectively feed back to ambulance service? How are lessons from post mortem fed back into continuing training requirements (individual and organisational)? What makes the real difference in the outcome of the patient and how is this assessed (pre-hospital intervention, A&E resus, early operation)? How are patient safety incidents used to enhance system performance--and how can lessons from one regional system Inform another?”*

**Representative from professional body**

There was support for the need for **redesigned Trauma Systems to coordinate more effectively the transfer to the initial hospital**, again, based on identifying the unit best equipped to respond to the patient’s condition.

*“Most triage (i.e. AMPDS/CBD) protocols are not able to assign the correct priority to Major Trauma patients, usually because the mechanism of injury, rather than the actual patient condition dictates the initial response. Similarly, these mechanisms are often assigned lower priorities for response even though it would be likely Major Trauma may result. Where it is likely a critically injured patient exists, dispatch protocols do not routinely specify immediate critical care team activation, usually because this (in most regions) does not exist as a core part of pre-hospital care.”*

**Emergency Department Nurse**

Related to the idea of **Trauma Systems being a vehicle to improve multi-agency working**, a number of survey respondents identified that this was an area that currently needs improving. Specifically, there is a perceived need for individual agencies involved in trauma care to develop a better understanding of ‘the big picture’ and how emergency services fit together.





---

# Appendices

## Appendix A – Pre-hospital Major Trauma Triage Tool

### 5) Pre-hospital Major Trauma Triage Tool

*The Major Trauma Triage Tool presented below is based on the American College of Surgeons Guidelines for Field Triage 2006 with minor modifications. In Step 2 'Flail chest' has been changed to 'Chest injury with altered physiology' and 'Paralysis' has been changed to 'Sensory or motor deficit (new onset following trauma)'. In Step 3 'feet' have been changed to 'metres' for distance fallen. 'Entrapment' has been added. Step 4 Burns are considered special if they are facial, circumferential or  $\geq 20\%$  Body Surface Area (BSA).*

Entry criteria for use of triage is a judgement that the patient may have suffered significant trauma

#### Step 1

- Physiological:
  - GCS < 14
  - SBP < 90 mmHg
  - RR < 10 bpm (20 bpm in infant) or > 29 bpm

If any of the above factors are present, activate Major Trauma Alert and definitive care to be from Major Trauma Centre, otherwise proceed to Step 2

#### Step 2

- Anatomical:
  - Penetrating to head/neck/torso/ limbs proximal to elbow/knee
  - Chest injury with altered physiology
  - 2 proximal long bone fractures
  - Crushed/degloved/mangled extremity
  - Amputation proximal to wrist/ankle
  - Pelvic fractures
  - Open or depressed skull fracture
  - Sensory or motor deficit (new onset following trauma)

If any of the above factors are present activate a Major Trauma Alert and definitive care to be from Major Trauma Centre, otherwise proceed to Step 3

#### Step 3

- Mechanism
  - Falls
    - Fall > 6 m / 2 storeys in adult
    - Fall > 3 m / 2 times height in child
  - Motor vehicles
    - Intrusion > 30 cm occupant site

- Ejection partial/complete
- Death in same passenger compartment
- Vehicle telemetry data consistent with high risk of injury
- Pedestrian/bicyclist *versus* motor vehicle thrown/run over/with significant (> 20 mph) impact
- Motorcycle crash > 20 mph
- Entrapment

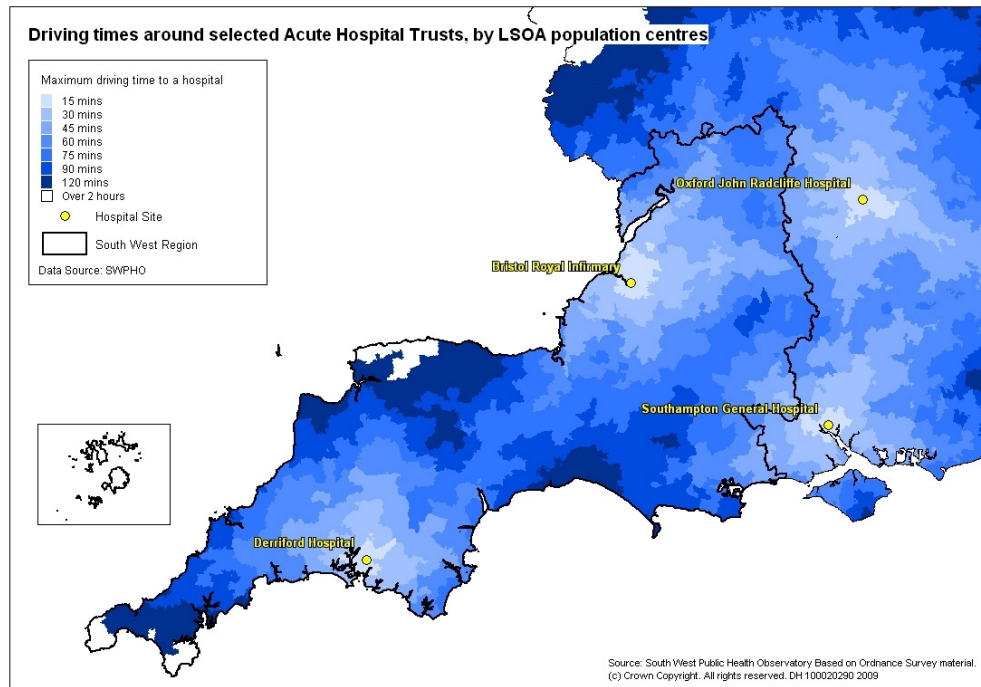
If any of the above factors present consider a Major Trauma Alert with further assessment by either Trauma Unit or Major Trauma Centre, otherwise proceed to Step 4

### **Step 4**

- Special considerations that should lower the threshold for a Trauma Alert
  - Older adults (age > 55)
  - Children (to Paediatric Trauma Centre)
  - Anticoagulation/bleeding disorders
  - Burns: Facial, circumferential or  $\geq 20\%$  Body Surface Area (BSA)
  - Time-sensitive extremity injury
  - Dialysis-dependent renal disease
  - Pregnancy > 20 weeks
  - EMS provider judgement

If any of the above factors present consider Major Trauma Alert with further assessment by either Trauma Unit or Major Trauma Centre

The diagram below is an example of 45-minute isochrones by road (adjusted for ambulance road speed rather than regular driver i.e. 10-20% quicker) showing the possible major centres only in south west



England

## Appendix B – ATMIST

### ATMIST

- Age of casualty
- Time: expected time of arrival, time of incident
- Mechanism of incident. This should include:
  - The gross mechanism of injury (e.g. motor vehicle crash or stab wound to the chest) and also details of other factors known to be associated with major injuries e.g. entrapment, vehicle rollover, occupant ejected from vehicle.
- Injuries suspected
- Signs
  - Vital signs including heart rate, blood pressure, respiratory rate, oxygen saturation and Glasgow Coma Score
  - An indication as to whether the physiological state of the patient has improved or deteriorated since first seen.
- Treatment given

## Appendix C: System and Network Formation

This appendix gives further guidance on the process and resources required for the establishment of a Trauma System. It is chiefly based on the experience of the London Trauma System. That process culminated in the establishment of four Networks in a fully urbanised context with multiple potential MTCs and TUs. Local population, geography, providers and stakeholders will substantially alter the process required in other parts of England.

### Strategy Development

To begin the process of regionalisation, commissioners will be required to develop a strategy for trauma based on local need, leading to a Project Initiation Document. The strategy should set out the case for change, which can use national sources of information and local data where available. A high level view of possible patient pathways and options for implementation should also be included to account for the current local provider landscape. However, this should not prevent the strategy from describing a future System that would require a degree of service reconfiguration to deliver the desired end state. The strategy should articulate its aims very simply in relation to improvement in trauma care. Difficult issues such as the provision of paediatric and burns care should be addressed early.

### Resources

#### System Level

To undertake a large scale change of all trauma care across a population requires a fully resourced project team. The skills required within the team are:

- Project management
- Clinical Leadership
- Data and information gathering and analysis
- Financial analysis
- Stakeholder management – ability to engage with clinicians
- Commissioning expertise
- Communications expertise

A clinical champion should be appointed to link with the project and provide clinical leadership. This person will require secondment for a number of programmed activities per week to enable them to devote sufficient time to the project.

#### Network Level

As providers plan to form Trauma Networks, there is huge advantage in allocating resource to enable this development. For a potential MTC there will be internal discussion and change that need to be undertaken as well as liaison with potential Network partners. This will require both clinical and managerial resources.

### Governance

A large scale project across a region will require linkage to local PCT commissioners. It is helpful if the project is led by a senior commissioner such as a PCT Chief Executive who can act as a champion for the project and give valuable commissioning insight. A formal governance structure with a Project Board will be required to ensure there is agreement and sign-off of project deliverables.

## **Engagement with Stakeholders**

A vast number of stakeholders are involved in trauma including clinicians, providers and local commissioners. A formal stakeholder mapping process should be undertaken. Active engagement with key stakeholders is a key part of ensuring the success of the project. Once the strategy is agreed and planning and implementation phases are in progress, continued engagement with stakeholders through events, newsletters and other formats is essential.

## **Clinical Engagement**

The effective delivery of trauma care is complex and covers a number of specialities and disciplines. Gaining representation from across these disciplines in a clinical advisory group is essential. This group will be vital in pulling together the detailed clinical pathways agreed for the delivery of trauma locally, as well as the standards which will be required for the delivery of care. The clinical champion for the project is best placed to chair this group. As well as the hospital based acute services involved in trauma care, the group should include representation from ambulance services, major incident planning, psychology/psychiatry, rehabilitation and primary care. As well as delivering expert advice this process should help to ensure that local clinicians begin to buy in to the document.

Examples of detailed work this group will need to carry out include:

- Detailed pathway mapping for a number of different injury groupings
- Secondary transfer policy
- Protocol development for management of specific conditions (e.g. spinal injury)
- Development of a service specification, particularly MTC and TU designation criteria
- Agreement on pre-hospital pathways and triage arrangements
- Development of performance measures, including KPIs

It is essential that there is agreement on the pathway for those patients with the most serious injuries. This will need to reflect the local geography – for example, in urban areas the majority of patients will probably have a primary transfer to a MTC. In rural areas, distances and journey times will often necessitate a secondary transfer to a MTC: this will take place following assessment and optimisation at a Trauma Unit. The availability of helicopter services and retrieval teams will need to be factored into these pathways.

## **Patient Involvement**

Patient engagement can be undertaken through local LINKS and by representatives from some of the charitable organisations involved with people who have been seriously injured. There is no one charity which represents the views of all injured patients so it is important to have a breadth of patient input.

## **Data required for Trauma System development**

Across the region, an understanding of the health needs of the population in relation to trauma will be required. This will give an understanding of the potential numbers of patients who will be accessing the System both through Trauma Units and Major Trauma Centres. This will help in planning the number and location of MTCs and TUs within the region.

## **Incidence and Severity of Trauma**

There are a number of sources of data which support an understanding of trauma incidence and severity.

The Trauma Audit Research Network (TARN) is an organisation which collects data on the most seriously injured patients. Hospitals pay a fee to join TARN, and then require robust data collection systems in order to ensure data accuracy. TARN data indicates the severity of injury and can be linked back to the location of the incident where the person was injured. If the majority of hospitals in a region collect robust TARN data, this will assist enormously in understanding the patterns and severity of trauma in a region. As TARN data collection varies enormously by region it may be necessary to use other forms of data as proxies to help in this assessment.

Hospital Episode Statistics (HES) data will give a high level view of the number of attendances at a Trust for trauma but does not indicate injury severity. Likewise, Emergency Department attendance data will give the same information.

Ambulance service data may be used by cross-referencing dispatch codes with category A and B calls – CAD number and date. Again this gives a rough indication of numbers but is not linked in directly with the severity of trauma as the outcome data is not routinely linked in with ambulance data.

TARN data does not include patients who die at the scene of their injury. This data may be obtained through effective liaison with coroners and by cross referencing with police data. This is a time-consuming and difficult task to achieve and may be a longer-term goal.

## **Travel Times**

The regions in which trauma care will be vary from rural areas with sparse populations and poor road links, to urban areas with much higher population densities and good road networks. This is one reason why the agreed pathways must reflect local geography.

The definition of an acceptable travel time to an MTC is unresolved: the evidence is conflicting.<sup>232</sup> Within a region there will need to be agreement on what constitutes an acceptable travel time for primary transfer to a MTC. This will then determine which areas will have an initial triage to a TU with a secondary transfer to an MTC. A key factor which will change the landscape of trauma care is that once committed to involvement in a Network, TUs do not need permission from the MTC, but will be able to undertake critical, life saving interventions and then start the transfer to the MTC without requiring acceptance of the patient in advance. This would represent a step change improvement for patients outside the primary transfer catchment area.

Helicopter journeys are much faster and direct; but, as most are only able to fly during daylight hours and in good weather, the most journey time planning has to be use road ambulance based scenarios.

Once there is a sense of potential providers of major trauma services within a region, mapping of journey times from across the region into those candidate MTCs is essential. There will be a need to define pathways according to the journey time to the MTCs using a primary transfer (i.e. an ambulance crew takes the patients directly to a MTC.) The potential journey times may inform the number of MTCs that are required within a region in order to deliver major trauma care to a population. The secondary transfer pathways can then be agreed according to local need and geography.

If service reconfiguration is required, some regions will require a public consultation in order to commission a new model of trauma care. Explaining the impact of travel times on outcomes, and

the benefits of being in a Trauma Network with access to definitive trauma care are key to effective public engagement at these times.

### **Selection of MTCs**

At an early stage the prerequisites for becoming a MTC will need to be determined. This requires exploration of the case for co-location of key services such as neurosurgery: this is potentially the most challenging area which requires resolution at a local level. It may exclude current providers from becoming MTCs without the reconfiguration of services.

Developing an understanding of current services and interest in delivering major trauma care at an early stage is very helpful in deciding on whether to adopt a developmental approach to designation as a MTC or a more competitive approach based on a bidding process. In the latter scenario an assessment of ability to provide the service by an external panel is helpful in giving objectivity to the process. A similar distinction can be made in the process for choosing TUs and Networks: in London, MTCs and TUs were asked to form Networks and bid jointly; in East Midlands, potential Trauma Units competed individually, with Network formation coming later. Both models have their merits.

### **Requirements for ambulance and EMS services**

Changes in the assessment of injury and in bypassing to a destination hospital with major trauma facilities are pivotal to the success of a Trauma Network. It is important not to concentrate on the selection of MTCs and TUs to the exclusion of other providers.

### **Commissioner engagement**

Involving commissioners at an early stage is an important part of the process of Network formation. The first task is to work with them to develop an understanding of the issues around the delivery of trauma services by involving clinicians with trauma expertise. The adoption of learning from other areas of the country which have implemented trauma regionalisation will also be useful.

Once briefed on the issues around trauma care delivery, commissioners will be able to provide key input around specific aspects of the process, such as needs assessment, funding arrangements and establishment of the measures by which performance will be measured.

Ongoing relationships with commissioners are vital to ensure that the benefits realised by changes in trauma delivery are articulated across the commissioning bodies.

### **Financial modelling**

A new national tariff for trauma is being developed. Until this is agreed, local arrangements will apply. Delivering major trauma care is costly because of the breadth of specialties involved in any one patient's episode of care. Commissioners and providers will need to work together to draw up an agreeable interim tariff. Providers with service line reporting will be particularly well placed to be able to contribute to discussions around this issue.

### **Communications**

#### **Wider political engagement**

There will be a need for communication with a wide range of stakeholders. A project of this scale requires sufficient communications expertise to deal with a large number and diversity of stakeholders. This will involve regular and detailed communication in a variety of formats, as well as responses that may arise from individuals such as MPs.

Local councillors have the right to scrutinise how local health services are provided and developed for their constituents through overview and scrutiny committees (OSCs). The powers enable OSCs to consider local services by inviting senior staff to provide information and explanations about how local needs are being addressed. It is important to engage with such local OSCs to ensure there is sufficient opportunity for them to engage with and critically appraise the implications of any service changes.

### **Engagement with adjacent PCTs SHAs and ambulance services**

Every SHA shares a border with one or more SHAs and a number of PCTs. It is important to understand the flows of patients that may occur across these boundaries. In particular, it is important to model travel times from scene which may be significantly less if a patient crosses a boundary into another sector, giving advantage in terms of access to a Major Trauma Centre. The relevant ambulance services will need to be closely involved in any discussions on cross-border transportation as there will be implications for ambulance staffing and vehicle availability.

In addition, some Trauma Units which lie outside the geographical boundary of an SHA may be more logically linked into a Network in an adjacent area. In this situation, there needs to be early dialogue between the SHAs, PCTs and providers, as there may be historical referral patterns between hospitals which do not reflect the intentions of commissioners

### **Designation process**

If more than one provider could become the MTC, a number of options may exist. Commissioners may decide to commission a particular Trust to deliver major trauma for reasons such as an advantageous geographical location that gives better travel times to the MTC. If not, it may be worth running a preliminary process to test out interest in providing major trauma care. This may reduce the number of potential providers by raising awareness of the complex number of services that need to be in place to become a MTC.

If a number of potential providers remain, a process of bidding for designation as a MTC will be required. This process should be determined locally and be agreed by the clinical advisory group. The initial assessment will normally be on clinical quality alone and may give a relative rating or use pass/fail criteria. Other factors (e.g. geography, travel times to the centre from within the SHA region) can be incorporated if a public consultation on the options is required. Potential providers should be informed what the other factors will be, as this may serve to deter those who are aware that they are disadvantaged by these factors and may this preclude the need for a designation process.

Clarity over the process and the criteria for assessing bids is essential for the process to have credibility. There should be clear timelines for completion, submission and assessment of bids. A process for clarifying any questions from bidders may help to ensure the documentation is fully completed for the assessing panel.

It may be helpful to use clinical experts from outside the geographical area as assessors of the quality of bids. Involving local commissioners in the assessment process will help to bring in local knowledge and expertise. Visits to potential centres are invaluable in enabling the panel to have direct discussions with clinicians and senior managers. .

Once the visit has been undertaken the panel will need to agree the final rating between themselves. Feedback should be offered to potential bidders – this is particularly important if a pass/fail process has been used and there are providers who do not meet the quality criteria.



---

### **Developing consultation options (if necessary)**

If a formal process of bidding for designation has been undertaken and more than one provider is eligible to deliver the service, then a public consultation may be required. The need for this will be assessed by the SHA and PCTs. If it is to be undertaken it will require a substantial input from the communications department which will require robust resourcing.

The factors for developing consultation options should have been explained to the potential providers in advance. These may include

- Clinical quality (the score given by the independent assessment panel)
- Coverage of the area in relation to travel times
- Co-location with other services such as heart attack or stroke centres
- Ease of implementation (e.g. does one model require a complex reconfiguration?)
- Capacity (e.g. does one model give greater capacity for severely injured patients?)
- Effectiveness in delivering a Network
- Affordability
- Effectiveness in delivering major incident capability

### **Undertaking public consultation**

Each SHA will have its own strategies for undertaking public consultation, and expertise to draw upon.

### **Implementation planning**

It is important to have a lead-in time before the new System goes live in order to allow providers all elements of the System to implement their plans for delivering the new service. During this period, plans for implementation should be scrutinised by commissioners, usually in conjunction with the project team. Any risks to implementation need to be flagged and mitigation strategies identified and these risks communicated to the appropriate body with responsibility for the System (e.g. SHA).

For ambulance providers, the lead times to agree the pathways for patients within the geographical boundaries (which will usually include identifying the locations from which a secondary transfer will be required).

### **Establishing a Performance Framework**

In establishing a Trauma System, it is important to be able to measure the improvements in quality delivered by the System and the impact on patients. The nature of major trauma patients means that there is often involvement of a number of body systems, eg head and chest injuries. Ideally the measures that are used can be directly linked to outcome. There is no ideal collection of measures which has been identified which enable this to take place.<sup>233</sup>

In the absence of such measures, a pragmatic decision will need to be made as to which measurable aspects of trauma care are likely to produce the best quality of care. A number of these are in existence, eg NICE Head Injury Guidelines, BOAST guidelines for management of open fractures. The clinical advisory group will need to make a decision on which existing guidelines to use as they are numerous and measurement of all elements is unlikely to be practicable.

In the absence of any measures which can be directly related to outcome, a number of proxy measures which indicate how effectively patients are accessing the System may be helpful. For example, gaining clinical consensus on how long it should take for a patient to undergo CT scan after admission will demonstrate timely access to diagnostics which it can be assumed are helpful in improving outcomes.

Crude outcomes i.e. survival or death are not helpful in demonstrating overall effectiveness of care as they do not account for case mix severity. The probability of survival score, which is that used by TARN uses as combination of ISS, GCS, gender, age and their intubation status to include other factors such as age which may affect survival. They are then able to demonstrate the probability of survival at an institution which can be compared against others with comparable data quality.

### **Implementation and assurance**

Once a decision has been made about the configuration of a Trauma Network, the plans of all the players involved will need regular scrutiny by the project team, commissioners and expert clinical input. Proper governance of the process need to be established, to flag up issues which threaten the target go-live date to the appropriate Board with responsibility for implementation.

Clinicians from other areas and not directly involved in the delivery of service should be asked to give independent verification of the preparedness of services at key stages prior to the go-live date. This external assurance will give a further layer of scrutiny to ensure that the required quality of care will be provided.

### **Planning for sustainability and monitoring**

Prior to the System going live, plans will need to be agreed for how the System will be monitored. This will involve the use of data from TARN and the Performance Framework. It will need to articulate how regular discussions with service providers will take place to ensure there are robust plans to undertake continuous improvement of the service.

### **Building Networks**

Networks are groupings of providers and their success will be critically dependant on local clinical leadership. An interim Network director should be appointed once the shape and membership of potential Networks become apparent. Key early actions for building the Network include:

- Establishing who is interested among providers and where engagement may be more difficult
- Holding stakeholder meetings and giving clinicians a voice in the Network
- Producing meaningful early outputs with real impact on patient care, such as new protocols for the care and transfer of head injured patients

## Appendix D: Quality Improvement Programmes

NHS audit and clinical governance typically operate within the silos of individual departments. They therefore cannot address the needs of patients whose care is inherently multidisciplinary and who receive care before reaching the hospital and may require rehabilitation long after leaving it. Governance is typically fragmented across institutions and between multiple clinical teams, with partitioned ownership of assurance mechanisms, absence of holistic data analysis and stovepiping of corrective organisational or departmental effort. Trauma QI programmes are designed to overcome this.

The London Trauma System has embedded trauma QI within its organisational framework, as have the UK Defence Medical Services in providing trauma care for troops injured on deployed operations. Both organisations' mechanisms rely on robust data collection and analysis, clear pathways of responsibility and dedicated infrastructure to effect change. The London Trauma System QI process will include measures to reward quality care and to review the status of provider organisations if care falls beneath agreed norms. These will be based upon a TARN-led mandatory data collection/analysis process. The following outline of the operation of Trauma QI is based on this model. It chiefly refers to the operation of QI in acute hospitals: pre-hospital and rehabilitation QI should adapt these principles to their own structures. Trauma System QI must cover the whole patient journey.

**Philosophy.** The philosophy of the QI programme should acknowledge that sub-optimal delivery of trauma care is more often the result of system error rather than personal negligence. As such, fixes must always focus on processes and infrastructure rather than on "naming and blaming". Secondly, the programme should recognize extant governance architecture and harness this where local processes are established and effective. Thirdly, the programme should seek solutions from across multi-disciplinary medical, clinical and non-clinical professional groups. Fourthly, the bulk of governance activity and action outputs should be devolved to the individual providers in the Network. In this tiered model of trauma governance, the Network and System governance business is progressively focused on monitoring, compliance and designation activity rather than focused corrective actions, except where transfer and boundary/interface issues within and between Network or Systems have resulted in poor outcomes. Finally, the culture of Quality Improvement must be centred on patient experience as well as the clinical imperative. This will require early, active engagement of expert patients, patient representatives, appropriate patient organisations and other key stake-holders in setting goals and monitoring standards.

**Authorisation.** A Trust's QI programme must be mandated and supported by the Trust Board and governed by an appointed individual who carries the authority of the Medical Director. These arrangements must be clear and sanctioned at Trust Board level such that organisational commitment to effective governance is secured. Because the spectrum of remedial action crosses standard Trust directorate structure it is essential that supra-directorate lines of responsibility are established, and that all Directorate Leads confirm their engagement with and commitment to the trauma QI process.

**Scope and terms of reference.** The capacity and span of the trauma QI programme should be clearly articulated in a Terms of Reference document that defines the authorities, responsibilities, data collection arrangements, review processes, reporting provisions, quality metrics and loop-closure mechanisms to be used. The key QI tasks are listed in table 1. Terms of Reference should be articulated within each element or facility, unified by an over-arching Network and System-level paper (Key Performance Framework). Templates may be generic but modified according to each element's specific requirements.

Trauma Networks and Trauma Systems require authority over individual elements within Networks, particularly with regard to the administration of transfer and by-pass arrangements (Networks) and the endorsement of individual trauma elements as possessing the necessary governance arrangements to permit participation within the Network (Systems).

### **Responsibilities.**

**Local.** Within each provider, a nominated individual must be designated as governance lead for trauma. This appointment may be undertaken in conjunction with that of clinical lead for trauma in Trauma Units. In MTCs, the volume and complexity of major cases and treatment pathways militates against combining these appointments and these responsibilities are best separated. The trauma governance lead has responsibility for the administration of the QI programme, setting out loop-closure actions, monitoring compliance with such actions and reporting outcomes. The Clinical Lead for Trauma (or Director of Trauma) should hold operational responsibility for the arrangements that the hospital maintains for the treatment of injured patients. The medical director retains overall responsibility for the quality of care delivered and embodies the authority to ensure compliance of clinical teams with measures required to mitigate failing processes. None of these arrangements replace the individual duties and responsibilities of individual clinicians, working within defined clinical teams, to render timely and appropriate care of trauma patients using the infrastructure and processes available, to review outcome as part of existing governance structures, and to engage with QI remedial action plans when that is required.

**Network.** Network responsibilities – as embodied within an appointed Network governance lead – should centre on:

- Supporting the QI process within Network members. This includes
  - set up and mentoring of QI programmes
  - monitor the process of QI locally
  - intervention where units are not able to reach the required standard of QI process and output.
- Regular and scheduled review of the volume, complexity and outcomes of cases transferred within the Network, with particular regard to breach of performance indicators.
- Provision or “sign-off” of summary Network performance and quality data reports to the Trauma System. This includes both outcome data, derived from the TARN returns of Network members and information on the process of QI in the Network and its members.
- Implementation and completion of Network-wide action plans.

The Network Governance Lead should be supported by a Quality Board consisting of representatives from appropriate stakeholders (MTC, TU, Ambulance Service, rehabilitation unit, local commissioners) and patient representatives. Quality Board Meetings should be regularly convened and used to review activity and performance data, to examine selected cases (problems in transferred cases, bypasses), share examples of best practice, and develop solutions to Network-wide problems. These meetings will also provide opportunity to develop and deploy standardized Network-wide guidelines to reduce variability in care.

**System.** Trauma Systems also require a governance lead. This should not be the governance lead of one of the subordinate Networks. The System should:

- Set the Performance Framework against which providers and Networks are measured. This includes KPIs used in QI processes (see Figure 5).
- Inspect provider and Network QI processes to ensure they meet the required standards.

- Receive and assess summary reports of Network performance on behalf of commissioners, reporting the conclusions to them in turn.
- Intervene where QI programmes are not successfully implemented.

**Essential Governance Infrastructure.** Generic structures and assets are required at each level of care, although the depth of infrastructure will vary according to setting, case volume, mix and institutional complexity (table 2). The Major Trauma Centre should lead the governance process within its Network.

**Institutional QI mechanisms.** The bulk of trauma QI business is enacted within regularly scheduled review meetings (Figure 6):

**Trauma Mortality and Morbidity meetings**, held regularly and as frequently as case volume demands, are the primary review mechanism. These should be formally administered with adequate documentation and secretarial support. Open standing invitations to all teams (doctors, nurses, therapists, students) involved in trauma care permits maximal involvement and engagement of clinical cadres. In particular, it is advantageous to engage pre-hospital and ambulance service QI representation, as well as rehabilitation/therapist representation in order to ensure that the end-to-end process of trauma patient care is reviewed. They should:

- Review all trauma deaths and morbidity and categorise the preventability of these events (preventable, potentially preventable or non-preventable)
- Identifying opportunities for improved care that, if realized, would have resulted in better outcome
- Review unit data on trauma volume, outcome and KPIs
- Report to the Peer Review and Hospital Systems review meetings those issues that require further action.

**Peer Review meetings** should be constituted by a panel of senior and credible clinicians, nurses and therapists of consultant or similar status, tasked with executing the QI agenda:

- Focused action plans are generated in response to problems identified at mortality and morbidity meetings.
- Ongoing corrective actions are followed up and closed down once set objectives are achieved.
- Preventable deaths and sentinel events are reviewed.
- Risks (issues raised by any provider to Peer Review with respect to trauma care, including “near misses”, untoward incidents and patient safety concerns) are registered, reviewed, and mitigated.
- Trauma QI activity takes in to account and is aligned with NHS-wide governance initiatives (such as Patient Related Outcome Measures).

Chaired by the governance lead for trauma, these meetings should be attended by nominated consultant-level clinicians or other health professionals representing all the acute specialties involved in the treatment of trauma patients. Responsibility for implementation, audit and loop closure of a given action plan rests with the specialty representative assigned “ownership” of that particular issue.

Resources required include appropriate administrative support for paper or e-documentation, sourcing and availability of case records, provision of minutes, case logging and follow-up schedules.

**Hospital Systems Review meetings** are the managerial counterpart to the clinical Peer Review. These allow discussion of non-clinical matters that have been identified as opportunities for improved process. Examples include availability of theatre space, processes for optimal blood banking, imaging equipment, etc.

**Corrective outputs.** Improvement plans generated by QI meetings such as M&M, Peer and/or System review encompass a spectrum of activity ranging from targeted educational initiatives through to external peer review (see table 3). The type of improvement plan, domain of action (Pre-hospital, ED, Theatres, Critical Care, Ward, Specialty), ratio of “plans initiated” to “plans completed” (as signed off by the Director of Trauma or Governance Lead), together with median time to plan completion, should be considered activity/performance markers of the QI process that are included in the Annual QI Report submitted by the Director of Trauma to the Trauma Network Office.

### **National/Supra-regional QI Activity**

National actions relating to QI will be required where deficiencies in guidelines, policies or laws are identified. The existence of a National Trauma Board (NTB) will facilitate this, providing a conduit for issues identified by Trauma Systems to be related to government, national bodies such as NICE and CQC and professional organisations such as Royal Colleges. In particular, CQC representation on the NTB will ensure that there is a shared understanding of Trauma QI, which can be appropriately included in the criteria for CQC registration of individual providers.

The NTB should also oversee a system of peer review between Trauma Systems. This will encourage the spread of best practice and allow the identification of Systems that are failing to achieve the full benefits of regionalisation.

### **Incentives and Sanctions**

Hospitals seeking Trauma Unit/Major Trauma Centre status within a Trauma Network must demonstrate an effective plan setting out their QI strategy and planned infrastructure, together with an implementation plan and timeline. The absence of a specific, serviceable QI strategy should prohibit designation.

Once designated, hospitals must be able to robustly demonstrate QI activity and efficacy. Evidence of compliance would include:

- Nomination of Governance Lead (with assignment of appropriate programmed activities within job plan)
- Terms of reference for QI committees (Peer/System review, M&M)
- Minutes of QI meetings
- Attendance logs
- Action plan logs
- Ratio of “plans initiated” to “plans completed” and median time to plan completion

Hospitals meeting set criteria for QI could be eligible for financial payment/reimbursement as part of a quality supplement – complementing existing injury-specific tariffs – as part of the Commissioning and Quality for Innovation (CQUIN) payment scheme.

Hospitals or Networks failing to maintain QI standards would trigger review by the Trauma System Quality Board. Failure to comply with recommended remedial actions would result in the loss of designation. This should have severe reputational and financial consequences and be an action of last resort.

**Summary**

Effective Trauma Systems must ensure that Quality Improvement is wholly embedded within their operational infrastructures and processes. Without QI, Trauma Systems become sclerotic, no longer function as systems and cease to be fit for purpose. Proper QI requires dedicated time, personnel and resources and can not be relegated as sub-ordinate to direct clinical care activity. Investment in QI yields clinical benefit and this eventually reduces the health and economic burden of trauma.

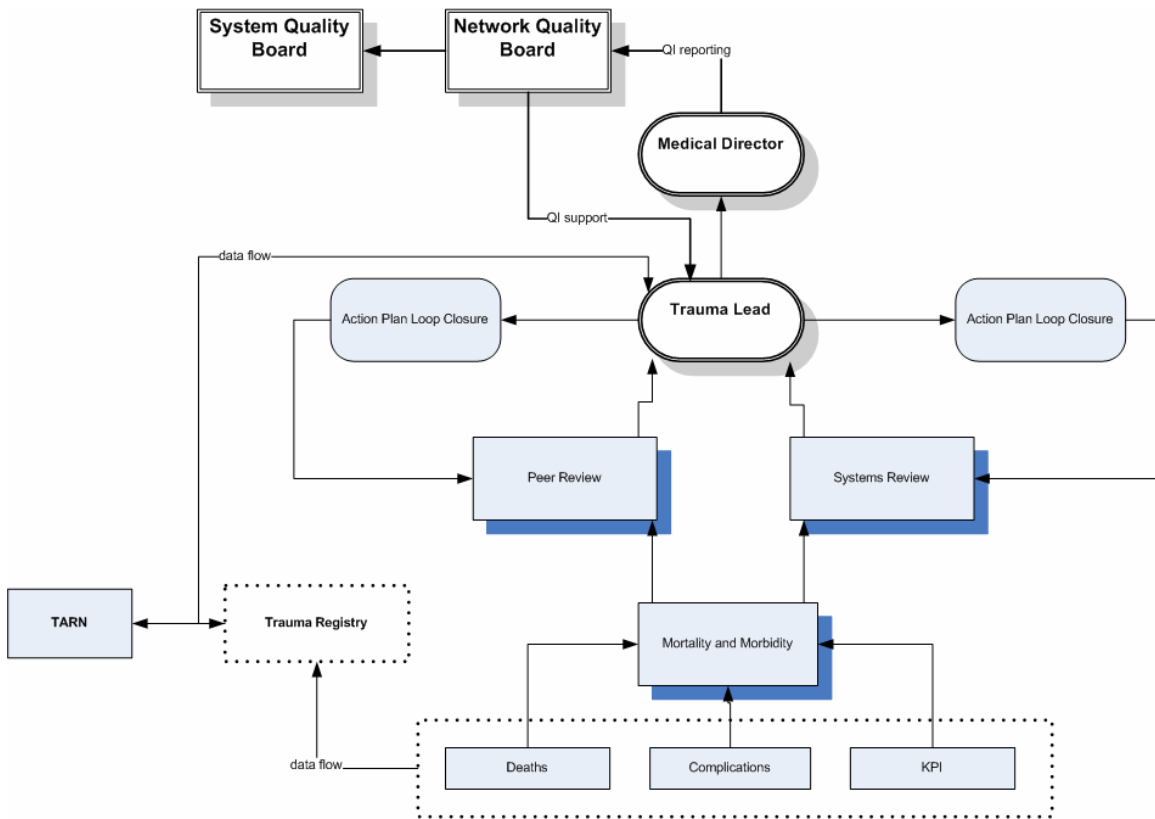
Figure 5: Example of Key Performance Indicators (London Trauma System)

Injury specific measure	Description	Source	Measured
Head	Patients with a GCS < 9 are intubated within 30 mins arrival in ED OR all patients requiring head CT have it undertaken within 1 hour OR CT within 1 hour following NICE guidelines	NICE/Victoria Trauma System/	TARN
	All patients with severe head injury discussion between trauma team leader, neurosurgical consultant within 90 mins arrival in A and E and documented in notes	London Neurosurgeons	TARN Perf visit
	Patient with epidural or subdural haematoma requiring craniotomy (as defined by the neurosurgical consultant on call): In theatre within 4 hours from the accident (excluding those requiring ICP monitoring alone)		TARN Perf visit
	Adverse changes in neurophysiology ( <i>DEFINE</i> ) – agreed management plan in place within 2 hours	London Neurosurgeons	To be confirmed
	A consultant neurosurgeon or a senior trainee/fellow, who has the required competences, should be present at all neurosurgical trauma operations	London Neurosurgeons	TARN Perf visit
	Evidence of continuity of care for patients with acquired brain injury – seen by neuroscience consultant (surgeon on neuro-intensivist) daily during ICU stay		TARN
Cervical spine	Cervical spine CT in all head injury patients with altered LOC, who require CT Head according to the NICE guidelines, reported by senior radiologist.	BOAST 2 NCEPOD	TARN
Spinal	Telephone consultation within 4 hours of arrival of patient with appropriate spinal cord injury centre on the management of the patient , if evidence of partial or complete spinal cord or cauda equina lesion.	South of England SCI Board	Audit
	Clearance of whole spine or management plan for spinal injury within 12 hours arrival in ED following BOAST2 guidelines	BOAST2	TARN
	Referral by e-mail / internet within four hours of arrival of patient , using South of England SCI Board referral format, if evidence of partial or complete spinal cord or cauda equina Lesion	South of England SCI Board	Audit
Thoracotomy	ED thoracotomy is carried out by staff trained to level of DSST– immediate identification pericardical tamponade with ready availability of equipment	Designation criteria	Performance visit



Figure 6 shows key data flows and relations in a Quality Improvement Programme. Deaths, complications and KPI data are reviewed in dedicated Trauma M&M meetings. Preventable deaths, process errors and other opportunities for improved care are then examined systematically in Peer Review and Systems Review meetings, convened by the Governance Lead for Trauma reporting to the Trauma Lead/Director of Trauma, who carries final responsibility for ensuring that action plans are implemented and completed. The Medical Director retains overall accountability for the quality of care. This process is underwritten by access to a managed trauma registry that is contemporaneously maintained, built around QI needs and available to the Trauma Lead/Medical Director for the purposes of data validation, audit and report generation. Individual hospital QI processes should be overseen by Network and System QI boards.

**Figure 6: Key data flows and relations in a Quality Improvement Programme**



**Table 1. Key Quality Improvement Tasks**

Assign responsibility and authority
Define scope of service
Identify indicators of quality
Collect and organise data
Evaluate service
Improve service
Re-assess
Communicate

**Table 2. Essential Trauma QI infrastructure and assets**

<i>Trauma unit/Major Trauma Centre/rehabilitation centre</i>
Governance Lead for Trauma
Trauma Governance Committee (multidisciplinary)
Trauma Registry and administrative support
Trauma (Nurse) Coordinator
Quality Assurance Meetings
– Mortality and Morbidity
– Peer/System Review
<i>Trauma Network</i>
Network Governance Lead
Network Quality Board
Trauma (Nurse) Coordinator (network remit)
Network Quality Improvement Meetings
<i>Regional System</i>
Regional Governance Lead
Regional Quality Board

**Table 3. Peer/System Review corrective outputs:**

Guideline, protocol, pathway development
Educational initiative
Enhanced resources or communication strategy
Implement a Process Improvement Team
Peer-to-peer counselling
Peer review presentation to Medical Director
Appraisal
External review

---

## Appendix E: Emergency Preparedness

The Department of Health Emergency Planning Guidance for England describes the incident command arrangements used by the ambulance and wider health service for the management of a major incident. The coordination of the response and flow of evacuated patients is overseen at a strategic command or “health Gold” level. The Trauma System should be represented at this command level to understand how many are injured and where they have been evacuated to.

The Ambulance Service manages the tactical command at a major incident scene and will oversee the evacuation and dispersal of the injured to designated hospitals. This is likely to include both Trauma Units and the Major Trauma Centre. Standard triage protocols fall in the remit of the pre-hospital care subgroup. These may be modified during major incidents. There is an intention that clinical assessment at the scene should allow for intelligent dispersal, with the injured triaged to hospitals that have the capability to deal with the injuries identified. In reality, the system is likely to break down and, in the time pressured surge environment of the casualty clearing station, triage errors are likely to occur. Patients will be both under- and over- triaged to receiving units.

Once intelligence on the nature of patients’ injuries begins to be fed into the command system, a controlled transfer to move patients to the most appropriate facility will be needed. Whilst increased hospital capacity can be created, it is essential that business continuity is also considered over the hours to days that follow. The Trauma System should be able to advise the command on the facility capacity, any developing blocks and queues and the needs of the facilities to deliver optimal patient care with the resources available.

It is a well established principle of emergency response that, to the extent possible, normal procedures and pathways should be retained. The personnel and systems that Networks have in place for the transfer of patients will therefore be of the utmost importance. These structures may be reinforced, but not replaced, by senior clinicians able to give clinical decision support to health Gold. Together they will be able to guide the movement of patients between units and manage the flow in the best interests of the greatest number of patients.

Through a thorough understanding of the regional trauma health economy and individual Unit or Centre capacity and capability, the network will be able to advise the strategic command when the local capacity has been exceeded and give advice on the level and extent of recruitment of mutual aid from adjacent Trauma Networks. Historically, emergency planning has paid insufficient attention to the difficult process of returning normal acute and elective services while simultaneously addressing the needs of resource-intense major incident patients over subsequent days and weeks. Networks will also have a role to play in addressing these issues.

## Appendix F: Research in Trauma Systems

### Research structures within the Trauma Network

- Each Trauma Network should have a 'Research Lead', who sits on the Network Board. This individual should also sit on the local CLRN 'Injuries and Emergencies' Local Specialty Group (or a neighbouring Group if the local CLRN has not declared an interest in this area).
- Participation in injuries research should be specified within the set of designation criteria for any Trust applying to become a Major Trauma Centre.
- 'Research' should be a standing agenda item on the Network Board agenda.
- Commissioners should consider the inclusion of 'participation in injuries research' as part of the Performance Framework for a Trauma Network.
- The Trauma Network Research Lead should link with higher education institutions within the Region to facilitate the inclusion of trauma care research in the University Research Strategies. The Trauma Network Research Lead should be the conduit from the Trauma Network to the HTA Research Suggestions system for areas of need that are highlighted in the Trauma Network Audit and Quality process.
- As part of its Annual Report each Trauma System Board should include accrual figures for NIHR Portfolio trials in trauma care.
- The Trauma Network structure should be linked to Academic Institutions, Funding Bodies, and NIHR Research Networks in order to give a co-ordinated approach to injuries research within the UK.

### Job Descriptions for Research Leads within the National Trauma System

- The National Trauma Board will have a National Research Lead, who will be responsible for:
  - Sitting as a co-opted member on the NIHR 'injuries and Emergencies National Specialist Group.
  - An annual trauma research prioritisation exercise, passing on the results as 'research suggestions' to the NIHR.
  - Horizon scanning for new developments / technologies which might need research before application in the UK context and making 'research suggestions' to the NIHR.
  - Point of contact for strategic advice to the funders of trauma care research.
- Each Trauma Network will have a Board level clinician who is the designated Research Lead. The Research Lead will be the point of contact and will have an active dialogue with:
  - Researchers – The Trauma Network Research Lead will be the point of contact for researchers (involved in academic and industry-funded studies) who want to use the Trauma Network to facilitate recruitment into research projects.
  - The Directors of the CLRNs within the operating area of the Network.
  - The Trauma Network Research Lead will be a member of the CLRN Injuries and Emergencies Local Specialty Group.
  - CLRN Local Specialty Groups – The Trauma Network Research Lead will be involved with the appropriate Local Specialty Groups, in particular Critical Care, Injuries and Emergencies, and Musculoskeletal.
  - The National Trauma Board – To feed the local priorities for trauma care research into the national agenda.
  - Research leads for each Trust within the Network (including the ambulance service)

## Acknowledgements

We would like to thank those who gave up their time to contribute to the development of this document, including:

### Clinical Advisory Group Steering Group Members

Maralyn Woodford (CEO, TARN), Dr Fionna Moore (Director, London Trauma System and Medical Director, London Ambulance NHS Trust), Professor Tim Coats (Professor of Emergency Medicine, University of Leicester), Sqn Ldr David O'Reilly (Clinical Advisor to the National Clinical Director for Trauma Care and Specialist Registrar in General Surgery, Royal Air Force), Dr John Heyworth (Consultant in Emergency Medicine, Southampton General Hospital), Professor Karim Brohi (Professor of Trauma Sciences, Barts and the London School of Medicine), Aidan Slowie (Nurse Advisor to the National Clinical Director for Trauma Care and Modern Matron, King's College Hospital NHS Foundation Trust Emergency Department), Professor Keith Porter (Professor of Clinical Traumatology, Queen Elizabeth Hospital Birmingham), Simon Brown (Divisional Medical Director, South Central Ambulance Service), Colonel John Etherington (Director of Defence Rehabilitation, Headley Court), Dr Stephen Brett (Consultant in Intensive Care Medicine, Imperial College Healthcare NHS Trust London), Beth Cordrey (Therapies Advisor to the National Clinical Director for Trauma Care and Clinical Specialist Occupational Therapist, Barts and the London NHS Trust), Dr Bob Winter (Consultant Intensivist, Queens Medical Centre), Professor Chris Moran (Professor of Orthopaedic Trauma Surgery, Queen's Medical Centre), Sue Wadsworth (Non Executive Director, Isle of Wight NHS Board and Patient Representative), Keith Young (Policy Lead for Critical Care, Department of Health), Professor Keith Willett (National Clinical Director, Trauma Care), Beth Horn (Secretariat, National Trauma Programme).

### Clinical Advisory Sub-Group Members

#### Rehabilitation

Professor Lynne Turner-Stokes (Consultant in Rehabilitation Medicine Director, NW Thames Regional Rehabilitation Service), Dr Charlie Nyein (Consultant Physician in Rehabilitation Medicine, Northwick Park Hospital), Professor Anthony Ward (Consultant in Rehabilitation Medicine, North Staffordshire Rehabilitation Centre), Lucy Silvester (Principal Physiotherapist in Trauma & Orthopaedics, St George's Hospital), Anne Brannagan (Complex Trauma Manager, Headley Court), Janet Reed (Senior Social Worker, Headley Court), Ginnie Hale (Clinical Lead Speech and Language Therapist, Derriford Hospital), Dr Matthew Jones Chesters (Senior Lecturer in Clinical Psychology, University of East London), Dr. S. Sooriakumaran (Douglas Bader Unit, Roehampton), Dr Angela Gall (Consultant in Rehabilitation Medicine RNOH), Dr Joanne L. Fallowfield (Head of Applied Physiology, Institute of Naval Medicine), Roy M Dudley-Southern (Associate Director, North West Specialised Commissioning), Dr Christopher Bass (Consultant in Liaison Psychiatry, John Radcliffe Hospital, Oxford), Dr A P Vickers, (Consultant Anaesthetist, Royal Lancaster Infirmary), Kelly Griffiths (Lay member, Kelly's Heroes).

#### Ongoing care and reconstruction

Dr Kieran Lennon (Consultant in Neuro Critical Care and Neuroanaesthesia, The Walton Centre, Liverpool), Dr Harry Walmsley (Consultant Anaesthetist & Divisional Director for Anaesthetics & Surgery, East Sussex Hospitals NHS Trust), Mr John McMaster (Orthopaedic Trauma Consultant, John Radcliffe Hospital, Oxford), Mr Umraz Khan (Consultant in Reconstructive Plastic Surgery, Frenchay Hospital, Bristol), Professor Richard Williams (Professor of Mental Health Strategy in the University of Glamorgan and Scientific Adviser on Psychosocial and Mental Health, Department of

Health), Tony Paterson (Consultant Oral and Maxillofacial Surgeon, North Cumbria University Hospitals NHS Trust), Mr Nigel Henderson (Consultant Orthopaedic and Spinal Surgeon, Stoke Mandeville Hospital), Debbie Langstaff (Matron, John Radcliffe Hospital, Oxford), Nicola Glossop (Clinical Specialist Physiotherapist in Limb Reconstruction, Northern General Hospital Sheffield), Monica Wirz (Patient Representative, Marketing consultant and researcher, University of Cambridge), Dr Mark Forrest (Consultant in Anaesthetics and Critical Care, Warrington & Halton Hospitals NHS Foundation Trust), Dr Howard Fine (Paediatric Clinical Psychologist, Barts and The London NHS Trust), Julie Upton (Therapy Services Manager, Nottingham University Hospitals NHS Trust).

### **Network organisation**

Dr Fiona Lecky (Senior Lecturer/Honorary Consultant in Emergency Medicine University of Manchester / Salford Royal Hospitals NHS Foundation Trust), Dr Darren Walter (Assistant Medical Director, North West Ambulance Service NHS Trust), Paul Sutton (Chief Executive, South East Coast Ambulance Service NHS Trust), Angela Walsh (Network Director, North West London Critical Care Network), Dr Suzanne Shale (Consultant in Clinical and Organisational Ethics & Senior Teaching Fellow, King's College London and Chair, College of Emergency Medicine Lay Advisory), Denis Franklin (Lay member), Sean Overett (Divisional Director, London Specialised Commissioning Group), Lt Col Nigel Tai (Governance Lead, NE London and Essex Trauma Network), Dr Julia Verne (Director, South West Public Health Observatory and Deputy Regional Director of Public Health), Mr Robert McFarland (Clinical Director for Trauma, St George's Healthcare NHS Trust), Tracy Parr (London Trauma System Manager), Dr Jane Eddleston (Clinical Director Critical Care, Manchester Royal Infirmary), Dr David Lockett (Consultant, Anaesthesia & Intensive Care Medicine/Clinical Trauma Lead, North Bristol NHS Trust), Dr Dave Bramley (Consultant in Emergency Medicine, City Hospitals Sunderland and Chair, Northern Trauma Network).

### **Acute care and surgery**

Mr Peter Driscoll (Consultant in Emergency Medicine, Hope Hospital Salford Royal NHS Foundation Trust), Dr Anne Weaver (Consultant in Emergency Medicine & Prehospital Care, Barts and The London NHS Trust), Toni Lynch (Nurse Consultant, Emergency Department, Barts and The London NHS Trust), Paula Bennett (Nurse Consultant, Emergency Department, Stockport NHS Foundation Trust), Dr Madeleine Sampson (Consultant Radiologist, Southampton General Hospital), Dr Sujit Vaidya (Consultant Musculoskeletal Radiologist, Barts and The London NHS Trust), Dr Tony Nicholson (Consultant Vascular Radiologist, Leeds General Infirmary), Dr Dan Ellis (Consultant in Emergency and Intensive Care Medicine, East and North Hertfordshire NHS Trust), Mr Patrick Nee (Consultant in Emergency and Critical Care Medicine, Whiston Hospital, Merseyside), Dr Peter Shirley (Consultant in Anaesthesia and Intensive Care Medicine, Barts and The London NHS Trust), Dr Jerry Nolan (Consultant in Anaesthesia and Intensive Care Medicine, Royal United Hospital Bath NHS Trust), Dr Simon Stanworth (Consultant Haematologist, John Radcliffe Hospital, Oxford), Mr Peter Hutchinson (Reader and Honorary Consultant Neurosurgeon, Addenbrooke's Hospital, University of Cambridge), Dr Andy Eynon (Director of Major Trauma, Southampton University Hospitals NHS Trust, Consultant in Neurointensive Care, Wessex Neurological Centre), Mr Adam Brooks (Consultant Hepatobiliary Surgeon, Nottingham University Hospitals NHS Trust), Dr. Niall Power (Consultant Radiologist, Barts and The London NHS Trust), Mr Andrew Cohen (Consultant Cardiothoracic Surgeon, Brighton and Sussex University Hospitals NHS Trust), Elizabeth Curran, (Senior Theatre Sister, Barts and The London NHS Trust), Mrs Heather Cairns (Lay member).

**Pre-hospital care and inter-hospital transfer**

Dr Wim Blancke (Chairman JRCALC), Professor Andy Newton (Consultant Paramedic; Director of Professional Standards & Innovation, South East Coast Ambulance Service NHS Trust), Carl Keeble (Community Paramedic East Midlands Ambulance Service NHS Trust), Lt Col Jeremy Henning (R.A.M.C. Consultant in Intensive Care Medicine, British Army. Medical Director, Great North Air Ambulance Service), Henry Guly (Consultant in Emergency Medicine, Derriford Hospital, Plymouth), Anthony Marsh (Chief Executive, West Midlands Ambulance Service NHS Trust), Dr Julian Mark (Assistant Medical Director, Yorkshire Ambulance Service NHS Trust), Col Ian Greaves (Defence Consultant Advisor in Emergency Medicine, Defence Medical Services and Consultant in Emergency Medicine British Army and James Cook University Hospital NHS Foundation Trust, Middlesbrough), Mr. Richard Steyn (Chairman British Association For Immediate Care (BASICS) and Clinical Director, Regional Department of Thoracic Surgery, Heart of England NHS Foundation Trust), Dr Rod Mackenzie (Consultant Emergency Physician, Leicester Royal Infirmary and Chairman, Curriculum Sub-committee, Intercollegiate Board for Training in Pre-hospital Emergency Medicine), Dr. Alison Walker (Medical Director, Yorkshire Ambulance Service and Consultant in Emergency Medicine and Prehospital care MidYorkshire NHS Trust), Jane Tippet (Acting Assistant Director of Nursing for Organisational and Practice Development, Chelsea and Westminster Hospital NHS Foundation Trust), Dr Juergen Klein (Consultant in Anaesthesia & Intensive Care Medicine, Derby Hospitals NHS Foundation Trust), Dr Peter A. Oakley (Consultant in Anaesthesia and Trauma, University Hospital of North Staffordshire), Jeremy Mauger (Paediatric Anaesthesia, West Suffolk Hospital NHS Trust), Dr Gareth Davies (Consultant Emergency Physician and Medical Director of London's Helicopter Emergency Medical Service, Barts and The London NHS Trust), Mark Ainsworth-Smith (Consultant Emergency Care Practitioner, South Central Ambulance Service NHS Trust)





## References

- <sup>1</sup> National Audit Office. *Major Trauma care in England*. London: The Stationery Office (2010). p4
- <sup>2</sup> National Audit Office. *Major Trauma care in England*. London: The Stationery Office (2010). p4
- <sup>3</sup> Nathens AB and Jurkowich GJ and Majer RV et al, relationships between Trauma Centre volume and outcomes. *JAMA* 2001; 285:1, 164-171
- <sup>4</sup> National Audit Office. *Major Trauma care in England*. London: The Stationery Office (2010). p4
- <sup>5</sup> Yates DW, Woodford M, Hollis S. (1992) Preliminary analysis of the care of injured patients in 33 British hospitals: first report of the United Kingdom Major Trauma outcome study. *British Medical Journal* 305:737-40
- <sup>6</sup> As indicated by the UK Trauma Audit & Research Network 2001-2004 dataset (US national Trauma Databank) cited in Royal College of Surgeons of England (2007) Provision of Trauma Care. Policy Briefing. [online] p2 Available at: <http://www.rcseng.ac.uk/news/docs/FINAL%20trauma%20statement%207%20sept%2007.pdf/> (Accessed: 16.07.2010)
- <sup>7</sup> Celso B et al. A Systematic Review and Meta-Analysis Comparing Outcome of Severely Injured Patients Treated in Trauma Centers Following the Establishment of Trauma Systems. *J Trauma*. 2006;60:371–378.
- <sup>8</sup> Utter GH et al. Inclusive Trauma Systems: Do They Improve Triage or Outcomes of the Severely Injured? *J Trauma*. 2006;60:529–537
- <sup>9</sup> Victoria State Trauma System. Trauma Towards 2014. State Government of Victoria 2009
- <sup>10</sup> For example: Royal College of Surgeons of England (1988) *The Management of Patients with Major Injuries* London: RCSI; Royal College of Surgeons of England/British Orthopaedic Association (2000) *Better care for the severely injured*. London: RCSI; Professor the Lord Darzi of Denham KBE (2008) *High quality care for all: NHS Next Stage Review final report* London: The Stationery Office. Crown Copyright
- <sup>11</sup> NCEPOD (2007) *Trauma – Who Cares?* London: NCEPOD. Available at: [http://www.ncepod.org.uk/2007report2/Downloads/SIP\\_report.pdf](http://www.ncepod.org.uk/2007report2/Downloads/SIP_report.pdf) (Accessed: 16.07.10)
- <sup>12</sup> Uncorrected Evidence before the Public Accounts Committee, 22 March 2010, available at <http://www.publications.parliament.uk/pa/cm200910/cmselect/cmpubacc/uc502-i/uc50202.htm>
- <sup>13</sup> National Audit Office. *Major Trauma care in England*. London: The Stationery Office (2010). p4
- <sup>14</sup> NHS (2010) *Emergency urgent care services. Major Trauma services*. [online] Available at: <http://www.nhs.uk/nhsengland/aboutnhservices/emergencyandurgentcareservices/pages/majortraumaservices.aspx> (Accessed: 16.07.10)
- <sup>15</sup> Comment from a Royal College stakeholder
- <sup>16</sup> Bradley LJ, Kirker SGB, Corteen E, Seeley HM, Pickard JD, Hutchinson PJ (2006) Inappropriate acute neurosurgical bed occupancy and short falls in rehabilitation: Implications for the National Service Framework, *British Journal of Neurosurgery*, 20(1): 36-39
- <sup>17</sup> Cope N, Hall K. (1982) Head injury rehabilitation: benefits of early intervention, *Archives of Physical Medicine and Rehabilitation*, 63:433–437;..
- <sup>18</sup> Wheeler L, Ansari S, Turner-Stokes L (1995) Proceedings of the Society for Research in Rehabilitation, *Clinical Rehabilitation*
- <sup>19</sup> Shiel A, Burn JPS, Henry D, Clark J, Wilson BA, Burnett ME, McLellan DL (2001) The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial, *Clinical Rehabilitation*, 15(5):501–514
- <sup>20</sup> Sirois MJ, Lavoie A, Dionne CE (2004) Impact of Transfer Delays to Rehabilitation in Patients with Severe Trauma, *Arch Phys Med Rehabil*, 85:184-191
- <sup>21</sup> Nathens AB and Jurkowich GJ and Majer RV et al, relationships between Trauma Centre volume and outcomes, *JAMA* 2001; 285:1, 164-171
- <sup>22</sup> Mackenzie EJ, Rivara FP, and Jurkowich GJ et al, A National Evaluation of the Effect of Trauma Centre Care on Mortality, and that is the *New England Journal of Medicine* 2006, 354: pages 366-378.
- <sup>23</sup> Comment from a Royal College stakeholder

- <sup>24</sup> Department of Health. Emergency Planning Guidance: Planning for the psychosocial and mental health care of people affected by major incidents and disasters: Interim national strategic guidance. London: Department of Health, 2009. At: [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH\\_103562](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH_103562)
- <sup>25</sup> Department of Health. Emergency Planning Guidance: Planning for the psychosocial and mental health care of people affected by major incidents and disasters: Interim national strategic guidance. London: Department of Health, 2009. At: [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH\\_103562](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH_103562)
- <sup>26</sup> NATO/EAPC. Psychosocial Care for People Affected by Disasters and Major Incidents: a model for designing, delivering and managing psychosocial services for people involved in major incidents, conflict, disasters and terrorism. Brussels: NATO/EAPC, 2009. At: <http://www.healthplanning.co.uk/nato>
- <sup>27</sup> Williams R, Bisson J, Ajdukovic D, Kemp V, Olf M, Rooze M, Alexander D, Hacker Hughes J, Bevan P. Guidance for responding to the psychosocial and mental health needs of people affected by disasters or major incidents. At: <http://www.healthplanning.co.uk/principles>
- <sup>28</sup> Department of Health. Emergency Planning Guidance: Planning for the psychosocial and mental health care of people affected by major incidents and disasters: Interim national strategic guidance. London: Department of Health, 2009. At: [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH\\_103562](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH_103562)
- <sup>29</sup> Department of Health. Emergency Planning Guidance: Planning for the psychosocial and mental health care of people affected by major incidents and disasters: Interim national strategic guidance. London: Department of Health, 2009. At: [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH\\_103562](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH_103562)
- <sup>30</sup> Williams R, Bisson J, Ajdukovic D, Kemp V, Olf M, Rooze M, Alexander D, Hacker Hughes J, Bevan P. Guidance for responding to the psychosocial and mental health needs of people affected by disasters or major incidents. At: <http://www.healthplanning.co.uk/principles>
- <sup>31</sup> DiMaggio C, Galea S. The behavioural consequences of terrorism: a meta-analysis. *Academy of Emergency Medicine* 2006;13(5):559-566.
- <sup>32</sup> Alexander DA, Klein S. First responders after disasters: a review of stress reactions, at-risk, vulnerability, and resilience factors. *Prehospital Disaster Medicine* 2009;24(2):87-94.
- <sup>33</sup> Department of Health. Emergency Planning Guidance: Planning for the psychosocial and mental health care of people affected by major incidents and disasters: Interim national strategic guidance. London: Department of Health, 2009. At: [http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH\\_103562](http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/DH_103562)
- <sup>34</sup> Nathens AB and Jurkowich GJ and Majer RV et al, relationships between Trauma Centre volume and outcomes, *JAMA* 2001; 285:1, 164-171
- <sup>35</sup> Mackenzie EJ, Rivara FP, and Jurkowich GJ et al, A National Evaluation of the Effect of Trauma Centre Care on Mortality. *New England Journal of Medicine* 2006, 354: 366-378.
- <sup>36</sup> To include competency to: relieve or exclude cardiac tamponade; rapidly control haemorrhage and control massive air leak
- <sup>37</sup> For example, those with airway obstruction or catastrophic haemorrhage
- <sup>38</sup> For example, those with spine, pelvis and/or facial trauma
- <sup>39</sup> Redley B, Beanland C & Botti M (2003) Accompanying critically ill relatives in emergency departments *Journal of Advanced Nursing* 44(1) 88-98
- <sup>40</sup> Redley B, Beanland C & Botti M (2003) Accompanying critically ill relatives in emergency departments *Journal of Advanced Nursing* 44(1) 88-98
- <sup>41</sup> Hilbert P, Zur Nieden K, Hoffman GO et al. New aspects in the emergency management of critically injured patients: a MSCT orientated care algorithm. *Injury* 2007. 38:552-558
- <sup>42</sup> Huber-Wagner S, lefering R, Kwick NM, et al Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study. *Lancet* 2009;373:1399-1494
- <sup>43</sup> Huber-Wagner S, lefering R, Kwick NM, et al Effect of whole-body CT during trauma resuscitation on survival: a retrospective, multicentre study. *Lancet* 2009;373:1399-1494
- <sup>44</sup> Okamoto K, Norio H, Kaneko N, Sakamoto T, Kaji T, Okada Y (2002). Use of early-phase dynamic spiral computed tomography for the primary screening of multiple traumas. *American Journal of Emergency Medicine* 20:528-534.

- <sup>45</sup> Willmann JK, Roos ER, Platz A (2002). Multidetector CT: Detection of active haemorrhage in patients with blunt abdominal trauma. *AJR* 179:437-444
- <sup>46</sup> The National Confidential Enquiry into Patient Outcomes and Death (2007). *Trauma: Who Cares*
- <sup>47</sup> Sundgren PC, Philipp M, Maly PV. Spinal trauma. *Neuroimaging Clinics of North America*. 17(1):73-85, 2007
- <sup>48</sup> Provenzale J. MR imaging of spinal trauma. *Emergency Radiology*. 13(6):289-97, 2007
- <sup>49</sup> Sundgren PC, Philipp M, Maly PV. Spinal trauma. *Neuroimaging Clinics of North America*. 17(1):73-85, 2007
- <sup>50</sup> Provenzale J. MR imaging of spinal trauma. *Emergency Radiology*. 13(6):289-97, 2007
- <sup>51</sup> Schoenfeld, Andrew J.; Bono, Christopher M. et al Computed Tomography Alone Versus Computed Tomography and Magnetic Resonance Imaging in the Identification of Occult Injuries to the Cervical Spine: A Meta-Analysis *The Journal of Trauma* 2010. 68:109-114
- <sup>52</sup> RCR Standards for Trauma Imaging (In preparation) *Making the Best Use of Departments of Radiology* 6<sup>th</sup> Ed. London: The Royal College of Radiologists 2010.
- <sup>53</sup> The Royal College of Radiologists. BFCR(08)13 Standards for providing a 24-hour interventional radiology service. London: The Royal College of Radiologists 2008
- <sup>54</sup> The Royal College of Radiologists BFCR(09)3 Standards for providing a 24-hour diagnostic radiology service. London: The Royal College of Radiologists, 2009
- <sup>55</sup> The Royal College of Radiologists. *National Strategy for Radiology Image and Report Sharing*. London: The Royal College of Radiologists, 2009.
- <sup>56</sup> The Royal College of Radiologists. *DICOM and HL7 standards*. London: The Royal College of Radiologists, 2008.
- <sup>57</sup> The Royal College of Radiologists. *Picture archiving and communication systems (PACS) and guidelines on diagnostic display devices*. London: The Royal College of Radiologists, 2008.
- <sup>58</sup> Gold et al. Trauma center imaging problems: Proposed solution with picture archiving communication systems. *Journal of Digital Imaging* 1991; 4: 79-86
- <sup>59</sup> National Strategy for Radiology Image and Report Sharing BFCR (09)6
- <sup>60</sup> Standards for the communication of critical, urgent and unexpected significant radiological findings BFCR(08)12
- <sup>61</sup> Standards for the Reporting and Interpretation of Imaging Investigations BFCR (06)1. London: The Royal College of Radiologists
- <sup>62</sup> Standards for the acknowledgment of urgent results. London: The Royal College of Radiologists (In Press)
- <sup>63</sup> Pryor J. The evolving role of interventional radiology in trauma care. *Journal of Trauma-Injury Infection & Critical Care* 2005; 59(1):102-104.
- <sup>64</sup> Kortbeek J, Saud A, Ali J, et al. Advanced Trauma Life Support, 8th Edition, The Evidence for Change. *Journal of Trauma Injury and Critical Care* 2008;64:1638-1651
- <sup>65</sup> The National Confidential Enquiry into Patient Outcomes and Death (2007). *Trauma: Who Cares*
- <sup>66</sup> i.e. consultant radiologists, and appropriately trained radiographers and IR nurses, available 24 hours a day.
- <sup>67</sup> The theatre team will be led by an experienced senior theatre nurse or operating theatre practitioner.
- <sup>68</sup> Resource document for nursing Care of the Trauma patient. The Trauma Nurse Coalition A.O.R.N.
- <sup>69</sup> The N.H.S. Knowledge and skills Framework {N.H.S. K.S.F.2004}
- <sup>70</sup> Resource document for nursing Care of the Trauma patient . Developed by the Trauma Nurse Coalition A.O.R.N..
- <sup>71</sup> Job description, competencies and education for perioperative Trauma Nurses.
- <sup>72</sup> A.O.R.N. Cecil A. King volume 64 issue 3 page 470-472
- <sup>73</sup> The National Confidential Enquiry into Patient Outcomes and Death (2007). *Trauma: Who Cares*
- <sup>74</sup> Royal College of Surgeons of England/British Orthopaedic Association. *Better Care for the Severely Injured*. London: RCS/BOA (2000)
- <sup>75</sup> Theatre staff should acquire competence in the practice of general/vascular, cardiothoracic , neuro-orthopaedic to effectively perform as a member of the team and must also be educated in the mechanism of injury theory and treatment principles.
- <sup>76</sup> The National Confidential Enquiry into Patient Outcomes and Death (2007). *Trauma: Who Cares*

- 77 Royal College of Surgeons of England/British Orthopaedic Association. Better Care for the Severely Injured. London: RCS/BOA (2000)
- 78 The National Confidential Enquiry into Patient Outcomes and Death (2007). Trauma: Who Cares
- 79 Royal College of Surgeons of England/British Orthopaedic Association. Better Care for the Severely Injured. London: RCS/BOA (2000)
- 80 The National Confidential Enquiry into Patient Outcomes and Death (2007). Trauma: Who Cares
- 81 Royal College of Surgeons of England/British Orthopaedic Association. Better Care for the Severely Injured. London: RCS/BOA (2000)
- 82 The National Confidential Enquiry into Patient Outcomes and Death (2007). Trauma: Who Cares
- 83 Royal College of Surgeons of England/British Orthopaedic Association. Better Care for the Severely Injured. London: RCS/BOA (2000)
- 84 The National Confidential Enquiry into Patient Outcomes and Death (2007). Trauma: Who Cares
- 85 Royal College of Surgeons of England/British Orthopaedic Association. Better Care for the Severely Injured. London: RCS/BOA (2000)
- 86 Society of British Neurological Surgeons Policy Statement Feb 2009
- 87 Seeley HM, et al. Standards for head injury in acute hospitals: evidence from the 6 million population of the Eastern region. *EMJ* 2006;23:128-32.
- 88 The National Confidential Enquiry into Patient Outcomes and Death (2007). Trauma: Who Cares
- 89 Royal College of Surgeons of England/British Orthopaedic Association. Better Care for the Severely Injured. London: RCS/BOA (2000)
- 90 EAST Practice Management Guidelines for the Evaluation of CS Injury *J Trauma*. 2009;67: 651–659
- 91 Health Building Note 57, Facilities for Critical Care
- 92 Comprehensive Critical Care 2000
- 93 ICS Standards for Consultant Staffing of ICUs 2008
- 94 ICS 2002 Guidelines for the Transportation of the Critically Ill Adult-Standards and Guidelines <http://www.ics.ac.uk/icmprof/downloads/icstransport2002mem.pdf>
- 95 Levels of Critical Care for Adults, Standards and Guidelines, The Intensive Care Society, 2010.
- 96 Standards for Consultant Staffing in Intensive Care Units, The Intensive Care Society, 2007
- 97 Standards for Nurse Staffing in Critical Care, British Association of Critical Care Nurses, 2009.
- 98 [www.tarn.ac.uk](http://www.tarn.ac.uk)
- 99 ([www.icnarc.org](http://www.icnarc.org))
- 100 Specifically for neurosciences patients
- 101 Publications from TARN and the ICNARC CMP
- 102 Department of Health (2005) Now I Feel Tall: What a Patient-led NHS Feels Like, London, Department of Health
- 103 Holtslag HR, Van Beeck EF, Lindeman E. & Leenen LP (2007) Determinants of long-term functional consequences after major trauma. *Journal of Trauma*, 62: 919-928
- 104 Lippert-Gruner M, Lefering R, & Svestkova O (2007) Functional outcome at 1 vs. 2 years after severe traumatic brain injury, *Brain Injury*, 21: 1001-1006
- 105 O'Toole RV, Castillo RC, Pollak AN, Mackenzie EJ & Bosse, MJ (2008) Determinants of patient satisfaction after severe lower-extremity injuries, *Journal of Bone & Joint Surgery, American Volume*, 90A: 1206-1212
- 106 Soberg HL, Bautz-Holter E, Roise O & Finset A (2007) Long-term multidimensional functional consequences of severe multiple injuries two years after trauma: a prospective longitudinal cohort study, *Journal of Trauma*, 62: 461-471.
- 107 Edwards C & Titchen A (2003) Research into patients' perspectives: relevance and usefulness of phenomenological sociology. *Journal of Advanced Nursing*, 44: 450-461
- 108 Edwards C & Titchen A (2003) Research into patients' perspectives: relevance and usefulness of phenomenological sociology. *Journal of Advanced Nursing*, 44: 450-461
- 109 Kurz AE, Saint-Louis N, Burke JP & Stineman MG (2008) Exploring the personal reality of disability and recovery: a tool for empowering the rehabilitation process. *Qualitative Health Research*, 18: 90-106

- <sup>110</sup> Horwitz DA & Schuerer DJ (2008) Trauma rehabilitation outcome scoring. *Current Opinion in Critical Care*, 14: 445-50.
- <sup>111</sup> American College of Critical Care Medicine Task Force 2004-2005 (2007) Clinical practice guidelines for support of the family in the patient-centred intensive care unit, *Critical Care Medicine*, 35: 605-622
- <sup>112</sup> This summarises the recommendations written in full in section 4.2.2.
- <sup>113</sup> Willett, K. (2000) Trauma Centres or Trauma Systems? Leadership in the context of acute care, in Langstaff, D. and Christie, J. (eds) *Trauma Care: A Team Approach*, Butterworth Heinemann, Oxford.
- <sup>114</sup> Griffiths, P., Jones, S., Maben, J., and Murrells, T. (2008) State of the art metrics for nursing: a rapid appraisal, National Nursing Research Unit, Kings College, University of London;
- <sup>115</sup> Tutton, E., Seers, K., and Langstaff, D. (2008) Professional nursing culture on a trauma unit: experiences of patients and staff, *Journal of Advanced Nursing*, 61(2), 145-153.
- <sup>116</sup> Langstaff, D. (2000) Leadership in the context of acute care, in Langstaff, D. and Christie, J. (eds) *Trauma Care: A Team Approach*, Butterworth Heinemann, Oxford;
- <sup>117</sup> Griffiths, P., Jones, S., Maben, J., and Murrells, T. (2008) State of the art metrics for nursing: a rapid appraisal, National Nursing Research Unit, Kings College, University of London.
- <sup>118</sup> Willett, K. (2000) Trauma Centres or Trauma Systems? Leadership in the context of acute care, in Langstaff, D. and Christie, J. (eds) *Trauma Care: A Team Approach*, Butterworth Heinemann, Oxford;
- <sup>119</sup> Hums, W. and Williams, J. (2005) Dedicated Trauma Care Unit: An Outcome Based Model, *Journal of Trauma Nursing*, 12 (1), 21-23. (USA)
- <sup>120</sup> The report of the National Confidential Enquiry into Perioperative Deaths 1990. NCEPOD. London 1992
- <sup>121</sup> National Confidential Enquiry into Perioperative Deaths: Who Operates When? II. NCEPOD, London 2003
- <sup>122</sup> That is to say, with laminar flow, special operating tables, image intensifier, microscope, full range of instruments and implants etc
- <sup>123</sup> Sikand M, White C, Moran CG (2005) The financial cost of polytrauma: implications for tertiary referral centres in the United Kingdom, *Injury*, 36(6): 733-737
- <sup>124</sup> Preoperative Assessment and Patient Preparation. The role of the anaesthetist (2) AAGBI, London 2010
- <sup>125</sup> Recommendations for Standards of Monitoring during anaesthesia and recovery. AAGBI. London 2000
- <sup>126</sup> Recommendations for Standards of Monitoring during anaesthesia and recovery. AAGBI. London 2000; NHS Quality Improvement Scotland, Anaesthesia Project Group. Anaesthesia – Care before, during and after Anaesthesia. NHS QIS, Edinburgh July 2003
- <sup>127</sup> Intensive Care National Audit and Research Centre <http://www.icnarc.org>
- <sup>128</sup> Intensive Care Society and Intercollegiate Board for Training in Intensive Care Medicine. *Standards for Consultant Staffing in Intensive Care Units*. ICS (2007)
- <sup>129</sup> Intensive Care Society Standards Committee. *Allied Health Professions and Healthcare Scientists Critical Care Staffing Guidance*. Modernisation Agency, DH (2002)
- <sup>130</sup> Intensive Care Society (2009) *Levels of Critical Care for Adult Patients*, ICS
- <sup>131</sup> Intensive Care Society (2002) Guidelines for the transfer of the critically ill adult, ICS
- <sup>132</sup> Further detail regarding rehabilitation following traumatic injury, including that provided during the acute phase of care, can be found in the rehabilitation chapter.
- <sup>133</sup> Bradley LJ, Kirker SGB, Corteen E, Seeley HM, Pickard JD, Hutchinson PJ (2006) Inappropriate acute neurosurgical bed occupancy and short falls in rehabilitation: Implications for the National Service Framework, *British Journal of Neurosurgery*, 20(1): 36-39
- <sup>134</sup> Greenwood RJ, Strens LHA, Watkin J, Losseff N, Brown MM (2004) A study of acute rehabilitation after head injury, *British Journal of Neurosurgery*, 18(5): 462-466
- <sup>135</sup> N, Hall K. (1982) Head injury rehabilitation: benefits of early intervention. *Archives of Physical Medicine and Rehabilitation*, 63:433-437
- <sup>136</sup> Mackay LE, Bernstein BA, Chapman PE, Morgan AS, Milazzo LS. (1992) Early intervention in severe head injury: long-term benefits of a formalized program, *Archives of Physical Medicine and Rehabilitation*, 73(7):635-641
- <sup>137</sup> Wheeler L, Ansari S, Turner-Stokes L (1995) Proceedings of the Society for Research in Rehabilitation, *Clinical Rehabilitation*

- <sup>138</sup> Shiel A, Burn JPS, Henry D, Clark J, Wilson BA, Burnett ME, McLellan DL (2001) The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial, *Clinical Rehabilitation*, 15(5):501–514
- <sup>139</sup> Schweickert W, Pohlman M, Pohlman A et al (2009). Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised control trial, *Lancet*, 373:1874-82
- <sup>140</sup> Turner-Stokes L (2008) Evidence for the effectiveness of multi-disciplinary rehabilitation for acquired brain injury: a synthesis of two systematic approaches, *Journal of rehabilitation medicine*. 40(9): 691-701.
- <sup>141</sup> National Institute of Health and Clinical Excellence 2009, Rehabilitation after critical illness, NICE available at <http://guidance.nice.org.uk/CG83> (accessed 24/11/09); British Society of Rehabilitation Medicine (2009) BSRM Standards for Rehabilitation Services Mapped on to the National Service Framework for Long-Term Conditions, BSRM, London
- <sup>142</sup> British Society of Rehabilitation Medicine (2009) BSRM Standards for Rehabilitation Services Mapped on to the National Service Framework for Long-Term Conditions, BSRM, London
- <sup>143</sup> National Institute for Health and Clinical Excellence. The early management of head injuries: Understanding NICE guidance – information for patients, carers and families, and the public. London: NICE (2003)
- <sup>144</sup> National Institute for Health and Clinical Excellence. Head injury: Triage, assessment, investigation and early management of head injury in infants, children and adults. London: NICE (2004)
- <sup>145</sup> Snyder, P.J. & Nussbaum, P.D., (2005). *Clinical Neuropsychology: A pocket handbook for assessment* (2nd Edition). Washington: APA.
- <sup>146</sup> Kay, J. B. & Warschawsky, S.(1999). WISC-III index growth curve characteristics following traumatic brain injury. *Journal of Clinical and Experimental Neuropsychology*, 21(2), 186-189.
- <sup>147</sup> Snyder, P.J. & Nussbaum, P.D., (2005). *Clinical Neuropsychology: A pocket handbook for assessment* (2nd Edition). Washington: APA
- <sup>148</sup> Brown, A.W., Malec, J.F., McClland, R.L., Diehl, N.N., Englander, J., Cifu, D.X, (2005). Clinical Elements that Predict Outcome after Traumatic Brain Injury: A Prospective Multicenter Recursive Partitioning (Decision-Tree) Analysis. *Journal of Neurotrauma*, 22(10): 1040-1051.
- <sup>149</sup> Division of Neuropsychology (2004). *Clinical Neuropsychology and Rehabilitation Services for Adults with Acquired Brain Injury*. Leicester: BPS
- <sup>150</sup> Division of Neuropsychology (2006). *Clinical neuropsychology and services for children with acquired brain injury*. Leicester: BPS.
- <sup>151</sup> Snyder, P.J. & Nussbaum, P.D., (2005). *Clinical Neuropsychology: A pocket handbook for assessment* (2nd Edition). Washington: APA.
- <sup>152</sup> Snyder, P.J. & Nussbaum, P.D., (2005). *Clinical Neuropsychology: A pocket handbook for assessment* (2nd Edition). Washington: APA
- <sup>153</sup> Brown, A.W., Malec, J.F., McClland, R.L., Diehl, N.N., Englander, J., Cifu, D.X, (2005). Clinical Elements that Predict Outcome after Traumatic Brain Injury: A Prospective Multicenter Recursive Partitioning (Decision-Tree) Analysis. *Journal of Neurotrauma*, 22(10): 1040-1051.
- <sup>154</sup> Carvell JE, Grundy DJ, 1994. Complications of spinal surgery in acute spinal cord injury. *Paraplegia* 32: 389-395
- <sup>155</sup> British Orthopaedic Association Standards for Trauma (BOAST) December 2008, BOAST 3: Pelvic and Acetabular Management.
- <sup>156</sup> Standards for the Management of Open Fractures of the Lower Limb. British Association of Plastic, Reconstructive and Aesthetic Surgeons and the British Orthopaedic Association, September 2009;;
- <sup>157</sup> Nanchahal J, Nayagam S, Khan U, Moran C, Barrett S, Sanderson F, Pallister I. Standards for the Management of Open Fractures of the Lower Limb. RSM Press 2009
- <sup>158</sup> A report by the British Orthopaedic Association/ British Association of Plastic Surgeons Working Party on the management of open tibial fractures. Sep 1997. *Brit J.Plast. Surg.* 1997;50:570-583
- <sup>159</sup> A report by the British Orthopaedic Association/ British Association of Plastic Surgeons Working Party on the management of open tibial fractures. Sep 1997. *Brit J.Plast. Surg.* 1997;50:570-583
- <sup>160</sup> Standards for the Management of Open Fractures of the Lower Limb. Nanchahal J, Nayagam S, Khan U, Moran C, Barrett S, Sanderson F, Pallister I RSM Press 2009
- <sup>161</sup> British Orthopaedic Association (2006) The initial care and transfer of patients with spinal cord injuries, BOA.

- <sup>162</sup> Carvell JE, Grundy DJ, 1994. Complications of spinal surgery in acute spinal cord injury. *Paraplegia* 32: pages 389-395
- <sup>163</sup> Smith M, 2002, -"Efficacy of specialist versus non-specialist management of spinal cord injury within the UK". *Spinal Cord*. 40: pages 10-16
- <sup>164</sup> National Burn Care Review (2001) Standards and Strategy for Burn Care: A Review of care in the British Isles, British Burn Association, London
- <sup>165</sup> Schaller P, Geldmacher J. Hand injury in poly trauma a retrospective study of 782 cases. *Handchir Mikrochir Plast Clin* 1994; 26: 307-312;
- <sup>166</sup> Chan RNW, Ainscow D, Sikorski JM. Diagnostic Failures in the Multiple Injured. *J Trauma*. 1980;20:684-687.
- <sup>167</sup> Juhl M, Moller-Madsen B, Jensen J. Missed Injuries in an Orthopaedic Department. *Injury*. 1990;21:110-112;
- <sup>168</sup> Hand Surgery in the UK. Manpower, Resources, Standards, Training. Report by the working party BSSH 2007
- <sup>169</sup> Juhl M, Moller-Madsen B, Jensen J. Missed Injuries in an Orthopaedic Department. *Injury*. 1990;21:110-112;
- <sup>170</sup> Hand Surgery in the UK. Manpower, Resources, Standards, Training. Report by the working party BSSH 2007
- <sup>171</sup> British Association of Oral and Maxillofacial Surgeons website <http://www.baoms.org.uk/>
- <sup>172</sup> H.Cannel et al (1996) Maxillofacial Injuries in multiply injured patients, *British Journal of Oral and Maxillofacial Surgery*, 34, 303-308
- <sup>173</sup> Champy M, Lodde JP, Jaeger JH, Wilk A (1976) Biomechanical basis of mandibular osteosynthesis according to the F.X. Michelet method, *Rev Stomatol Chir Maxillofac* 77(1):248-51 (French)
- <sup>174</sup> Bullock MR, Chestnut R, Ghajar A, et al (2006) Guidelines for the Surgical Management of Traumatic Brain Injury, *Neurosurgery*, 58:S2-1 - S2-3;
- <sup>175</sup> Brain Trauma Foundation (2007) Guidelines for the Management of Severe Traumatic Brain Injury (3<sup>rd</sup> Edition), *Journal of Neurotrauma*, 24 (supplement 1).
- <sup>176</sup> Maas AI, Dearden M, Teasdale GM et al,(1997) EBIC- guidelines for management of severe head injury in adults, *Acta Neurochirurgica*, 139:4 (286-94)
- <sup>177</sup> Gosselink. R, Bott. J, Johnson. M, Dean.E, Nava.S et al. (2008), Physiotherapy for adult patients with critical illness: recommendations of the European Respiratory Society of Intensive Care Medicine Task Force on Physiotherapy for Critically Ill Patients, *Intensive Care Medicine*, 34(7): 1188-99
- <sup>178</sup> Henry M, Arnold T, Harvey J (2003) BTS guidelines for the management of spontaneous pneumothorax, *Thorax*, 58 (suppl ii): ii30-ii52; Laws D, Neville E, Duffy J (2003) BTS guidelines for the management of spontaneous pneumothorax, *Thorax*, 58 (suppl ii): ii53-ii59
- <sup>179</sup> Intensive Care Society (2008) Standards for the care of adult patients with a temporary tracheostomy, ICS, London [http://www.ics.ac.uk/intensive\\_care\\_professional/standards\\_safety\\_and\\_quality](http://www.ics.ac.uk/intensive_care_professional/standards_safety_and_quality)
- <sup>180</sup> Children's Orthopaedics and Fracture Care, British Orthopaedic Association, July 2006
- <sup>181</sup> British Orthopaedic Association Standards for Trauma (BOAST) September 2008, BOAST 1: Hip Fracture In The Older Person; The Care Of Patients With Fragility Fracture. Published by the British Orthopaedic Association, September 2007
- <sup>182</sup> Practice Management Guidelines For Geriatric Trauma. The EAST Practice Management Guidelines Work Group 2001.
- <sup>183</sup> For more information on the rehabilitation prescription, please see Chapter 5
- <sup>184</sup> Sirois MJ, Lavoie A, Dionne CE (2004) Impact of Transfer Delays to Rehabilitation in Patients with Severe Trauma, *Arch Phys Med Rehabil*, 85:184-191.
- <sup>185</sup> Bradley LJ, Kirker SGB, Corteen E, Seeley HM, Pickard JD, Hutchinson PJ (2006). Inappropriate acute neurosurgical bed occupancy and short falls in rehabilitation: Implications for the National Service Framework, *British Journal of Neurosurgery* 2006, 20(1): 36-39
- <sup>186</sup> Cope N, Hall K. (1982) Head injury rehabilitation: benefits of early intervention, *Archives of Physical Medicine and Rehabilitation*, 63:433-437.
- <sup>187</sup> Wheeler L, Ansari S, Turner-Stokes L (1995) Proceedings of the Society for Research in Rehabilitation, *Clinical Rehabilitation*

- <sup>188</sup> Shiel A, Burn JPS, Henry D, Clark J, Wilson BA, Burnett ME, McLellan DL (2001) The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial, *Clinical Rehabilitation*, 15(5):501–514.
- <sup>189</sup> Sirois MJ, Lavoie A, Dionne CE (2004) Impact of Transfer Delays to Rehabilitation in Patients with Severe Trauma, *Arch Phys Med Rehabil*, 85:184-191
- <sup>190</sup> National Audit Office (2010) Ministry of Defence: Treating Injury and Illness arising on Military Operations, The Stationery Office, London
- <sup>191</sup> Surgeon General's Policy Letter (2010) Defence Medical Rehabilitation Programme v5 (J5DDR03)
- <sup>192</sup> Read, K.M., Kufera, J.A., Dischinger, P.C., et al (2004) Life-altering outcomes after lower extremity injury sustained in motor vehicle crashes. *Journal of Trauma-Injury Infection & Critical Care*, 57 (4): 815-23.
- <sup>193</sup> Morris, S., Lenihan, B., Duddy, L., et al (2000) Outcome after musculoskeletal trauma treated in a regional hospital. *Journal of Trauma-Injury Infection & Critical Care*, 49 (3): 461-9.
- <sup>194</sup> Post, R.B., Van Der Sluis, C.K., Ten Duis, H.J. (2006) Return to work and quality of life in severely injured patients. *Disability and Rehabilitation*, 28 (22): 1399-1404.
- <sup>195</sup> National Institute for Health and Clinical Excellence (2009), *Critical Illness Rehabilitation Guidance*, NICE: <http://guidance.nice.org.uk/CG83> (accessed 25.02.10)
- <sup>196</sup> Department of Health (2005) The National Service Framework for Long-term Conditions, DH, London
- <sup>197</sup> Healthy Working Lives (2010) *What is Vocational Rehabilitation*, <http://www.healthyworkinglives.com/advice/vocational-rehabilitation/definition.aspx> accessed 15.03.10
- <sup>198</sup> American College of Critical Care Medicine Task Force 2004-2005 (2007) Clinical practice guidelines for support of the family in the patient-centred intensive care unit, *Critical Care Medicine*, 35: 605-622
- <sup>199</sup> British Society of Rehabilitation Medicine (2003), *Amputee Rehabilitation: Recommended Standards & Guidelines*, BSRM, London
- <sup>200</sup> British Society of Rehabilitation Medicine (2009) BSRM Standards for Rehabilitation Services Mapped on to the National Service Framework for Long-Term Conditions, BSRM, London
- <sup>201</sup> British Society of Rehabilitation Medicine (2004), Vocational assessment and rehabilitation after acquired brain injury: inter-agency guidelines, BSRM, London
- <sup>202</sup> Royal College of Physicians, British Society of Rehabilitation Medicine, Multidisciplinary Association of Spinal Cord Injury Professionals, Spinal Injuries Association (2008) *Chronic spinal cord injury: management of patients in acute hospital settings: national guidelines*. Concise Guidance to Good Practice series, No 9. RCP, London
- <sup>203</sup> Spinal Injuries Association (2009) *Preserving and developing the national spinal cord injury service: phase 2 seeking the evidence*, SIA, Milton Keynes
- <sup>204</sup> South of England Spinal Cord Injury Board (2010) *Standards for Patients Requiring Spinal Cord Injury Care*, South East Coast Specialised Commissioning Group
- <sup>205</sup> Royal College of Speech and Language Therapists (2006) *Position paper: speech and language therapy in adult critical care*, RCSLT, London
- <sup>206</sup> National Institute for Health and Clinical Excellence (2009), *Critical Illness Rehabilitation Guidance*, NICE: <http://guidance.nice.org.uk/CG83> (accessed 25.02.10)
- <sup>207</sup> National Institute for Health and Clinical Excellence (2009), *Critical Illness Rehabilitation Guidance*, NICE: <http://guidance.nice.org.uk/CG83> (accessed 25.02.10)
- <sup>208</sup> Strasser D C, Uomoto J M, Smits S J (2008). The interdisciplinary team and polytrauma rehabilitation: prescription for partnership, *Archives of Physical Medicine and Rehabilitation*, 89:179-81
- <sup>209</sup> National Institute for Health and Clinical Excellence (2009), *Critical Illness Rehabilitation Guidance*, NICE: <http://guidance.nice.org.uk/CG83> (accessed 25.02.10)
- <sup>210</sup> Department of Health (2009) *Specialised Services National Definition Set No 7: Brain Injury and Complex Rehabilitation*. DH, London.
- <sup>211</sup> Department of Health (2009) *Specialised Services National Definition Set No 7: Brain Injury and Complex Rehabilitation*. DH, London.



- <sup>212</sup> Department of Health (2009) *Specialised Services National Definition Set No 7: Brain Injury and Complex Rehabilitation*. DH, London.
- <sup>213</sup> Department of Health (2009) *Specialised Services National Definition Set No 7: Brain Injury and Complex Rehabilitation*. DH, London.
- <sup>214</sup> Anderson ID, Woodford M, de Dombal FT, Irving M. Retrospective study of 1000 deaths from injury in England and Wales. *BMJ (Clin Res Ed)* 1988;296:1305-1308
- <sup>215</sup> Yates DW, Woodford M, Hollis S. Preliminary analysis of the care of injured patients in 33 British hospitals: first report of the United Kingdom Major Trauma outcome study. *BMJ* 1992;305:737-40
- <sup>216</sup> Lecky FE, Woodford M, Boumara O, Yates DW. Lack of change in trauma care in England and Wales since 1994. *Emerg Med J* 2002;19:520–523
- <sup>217</sup> National Audit Office. *Major Trauma care in England*. London: The Stationery Office (2010). p4
- <sup>218</sup> Intercollegiate Group on Trauma Standards. *Regional Trauma Systems. Interim Guidance for Commissioners*, Royal College of Surgeons of England 2009
- <sup>219</sup> The current London SHA criteria can be obtained from the London Trauma Office at London Ambulance Service HQ.
- <sup>220</sup> Analysis undertaken for this report. Abbreviated Injury Score (Head) of 3 or more and GCS less than 9 or intubated on index admission.
- <sup>221</sup> Patel HC et al Trends in head injury outcome from 1989 to 2003 and the effect of neurosurgical care: an observational study. *Lancet* 2006 Mar 11;367(9513):816.
- <sup>222</sup> These are significant adverse events (i.e. complications of medical care), usually resulting from error, which demand a full investigation.
- <sup>223</sup> As of 12 April 2010
- <sup>224</sup> The terms Quality Improvement and Performance Improvement appear in the literature. They are often used interchangeably although some authors argue that Quality Improvement programmes involve a greater emphasis on systems of care rather than individual providers. The term Quality Improvement is used throughout this document, except in reference to other guidelines and publications.
- <sup>225</sup> Performance Improvement Subcommittee of the American College of Surgeons Committee on Trauma. *Trauma Performance Improvement Manual*. American College of Surgeons 2002
- <sup>226</sup> World Health Organization, International Society of Surgery and International Association for Trauma Surgery and Intensive Care. *Guidelines for trauma quality improvement programmes*. World Health Organization 2009
- <sup>227</sup> Davenport RA, Tai N et al. A major trauma centre is a specialty hospital not a hospital of specialties. *Br J Surg*, 2010 Jan;97(1):109-17
- <sup>228</sup> Victoria State Trauma System, *Trauma Towards 2014*, State Government of Victoria 2009
- <sup>229</sup> British Orthopaedic Association and Royal College of Surgeons of England. *Better care for the severely injured*. Royal College of Surgeons of England 2000
- <sup>230</sup> The Utstein TCD expert panel Kjetil G. Ringdal, Timothy J. Coats, Rolf Lefering, Stefano Di Bartolomeo, Petter Andrea s Steen, Olav Roise, Lauri Handolin, Hans Morten Lossius. The Utstein template for uniform reporting of data following major trauma: a joint revision by SCANTEM, TARN, DGU-TR and RITG. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2008, 16:7 doi:10.1186/1757-7241-16-7
- <sup>231</sup> The Intensive Care National Audit and Research Centre
- <sup>232</sup> This issue was outside the scope of work of this subgroup of the DH Clinical Advisory Group. The pre-hospital care subgroup has recommended, on the basis of expert consensus, that it is reasonable to routinely transport severely injured patients directly to an MTC rather than a closer TU if the former is less than 45minutes away. Exceptions would apply where the patient was unstable and the TU had facilities to stabilise the injuries.
- <sup>233</sup> Willis C.D. Gabbe. B. J and Cameron P.C “Measuring Quality in Trauma Care” *Injury* (2007) 38 527 – 537.