London Ambulance Service NHS Trust

Major Trauma Annual Report 2015

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1. Introduction

The London Ambulance Service NHS Trust (LAS) assesses, treats and transports seriously injured patients to one of four specialist major trauma centres (MTCs) in the Capital. Evidence from around the world shows that rapidly conveying these patients to centres with the necessary expertise and equipment helps reduce morbidity and mortality[1-5]. Major trauma has a relatively low incidence[6], and constitutes less than 0.5% of the LAS workload.

LAS clinicians aim to identify the most seriously injured patients quickly using the London Major Trauma Decision Tool (see Appendix 1); a flowchart that allows them to use the information they have available in the pre-hospital environment to triage patients likely to benefit from care at a MTC. The accepted definition of major trauma is an Injury Severity Score (ISS) greater than 15. The score can only be determined after a detailed assessment in hospital, and with the knowledge of the interventions undertaken and the outcome of the patient. As such it is recognised that the number of patients identified as potential major trauma by LAS clinicians will be higher than those subsequently assessed with an ISS of more than 15. However, the clear criteria in the decision tool should prevent patients who can be treated at a local ED travelling potentially longer distances to an MTC and negatively affecting the MTCs' capacity to treat those needing their services. For the purposes of this report, major trauma is defined as patients who meet the criteria of the London Major Trauma Decision Tool.

This inaugural annual report on major trauma care by the LAS should be considered a baseline summary that will allow for comparison in future years. It presents key information on 5,108 major trauma patients identified as requiring care at an MTC from January to December 2015 following a 999 call. This patient cohort includes those correctly conveyed directly to an MTC as well as those who were not directly transported to one but were instead taken to a local Trauma Unit (TU).

In addition to the 5,108 major trauma patients, a further 355 patients were transported to an MTC who did not trigger the tool and were therefore deemed to be over-triaged. Further details regarding these patients is presented in Appendix 5.

More detailed information can be found in the appendices, which includes a breakdown of information by area of London, mechanism of injury, under-triage, utilisation of the tool and extended journey times.

Data were gathered from the LAS Major Trauma Registry. The registry captures information from a number of different sources including: the electronic call records generated by the Emergency Operations Centre (EOC), the clinical records written by attending LAS clinicians, and London's Air Ambulance clinical logs. Response times were drawn from the information recorded by EOC systems and vehicle Mobile Data Terminals (MDTs).

Patients that suffered a traumatic cardiac arrest are not included within this report but are reported instead in the LAS Cardiac Arrest Annual Report.

2. Findings

2.1. Patient characteristics

2.1.1. Gender and Age

Gender	n	%
Male	3,884	76.0%
Female	1,213	23.8%
Not documented	11	0.2%

Age	Median (years)	Range
Overall	33	0-100
Male	31	0-100
Female	43	0-100

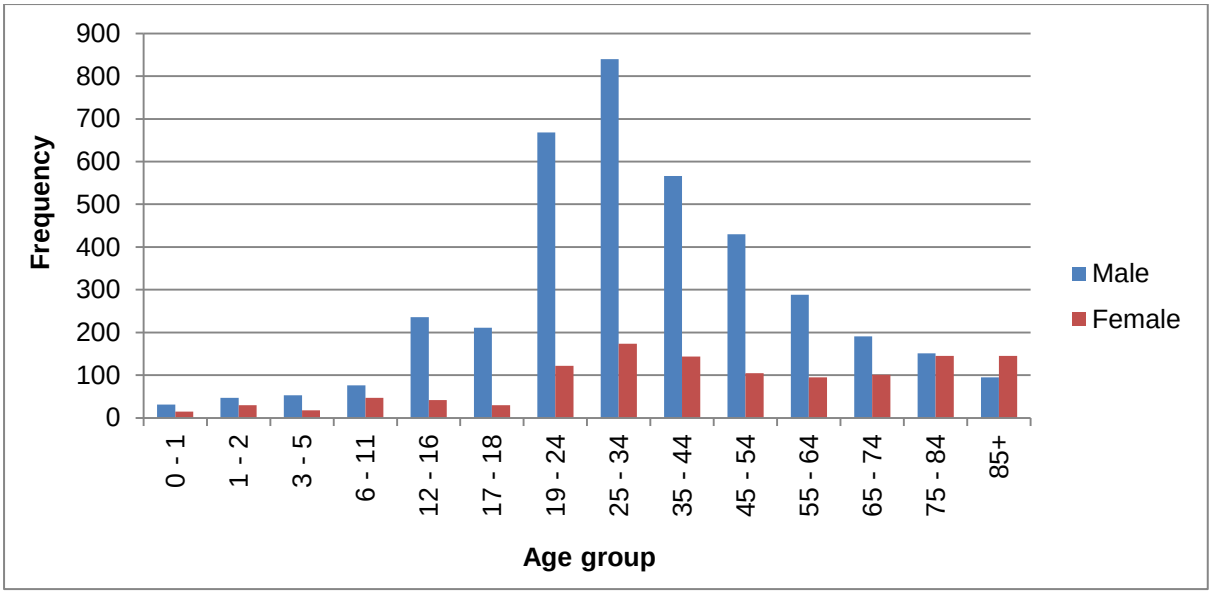

Figure 1 – Age group by gender

- Three-quarters of patients were male.
- The average age was 33 years. Figure 1 shows that patients in the 25-34 year age group were most likely to experience major trauma.
- Males were on average 12 years younger than females. The number of males suffering major trauma exceeded the number of females in almost every age group. Females only exceed males in the 85 and over group, which is probably related to a greater life expectancy for women.

2.1.2. Race

Race	n	%	Median age
White	2,662	52.1%	39
Black / British Black	462	9.0%	22
Other race group	227	4.4%	29
Asian / British Asian	223	4.4%	32
Mixed	36	0.7%	27
Refused / Unable	1,021	20.0%	30
Not documented	477	9.3%	30

^The total percentages do not equal 100% due to rounding

- Over half of patients attended were of a white race origin.
- Patients of a white origin were older than patients in other race groups.

2.2. **Mechanism of injury**

Mechanism type	n	%
Blunt	3,670	71.8%
Penetrating	1,318	25.8%
Other	107	2.1%
Multiple	13	0.3%

- The primary mechanism was blunt trauma for 72% of patients.
- Penetrating trauma injuries presented as the primary mechanism for just over a quarter of patients. It should be noted that this is partially due to the triage tool including all patients with penetrating injuries below the head and above the knee as potential major trauma patients.
- Other traumatic injuries, such as burns and lacerations, accounted for 2% of major trauma.
- Further details regarding the incidence of blunt and penetrating trauma can be found in Appendix 3.

2.3. **Event information**

Peak occurrence		n	%
Time of day	16:00-19:59	1,203	23.6%
Day	Saturday	836	16.4%
Month	June	482	9.4%

- The most common time that major trauma occurred was during the late afternoon, and was more likely to happen on a Saturday than any other day of the week.

2.3.1. Time of day by mechanism

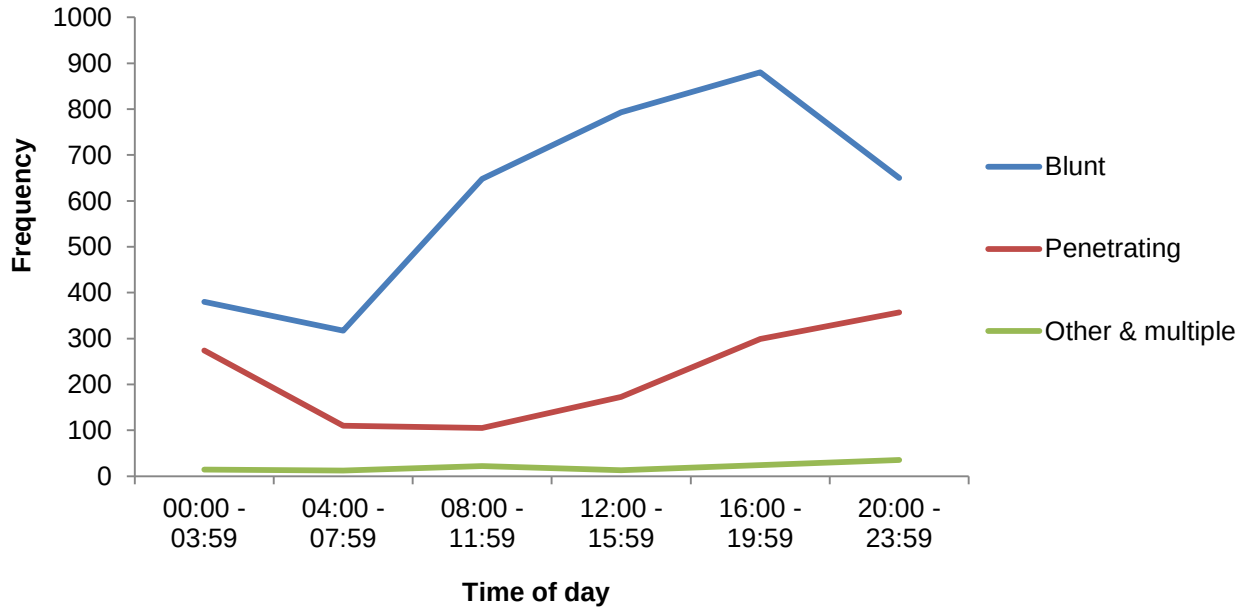

Figure 4 – Time of day by mechanism

- The peak times of occurrence for blunt trauma (16:00-19:59) is in line with the overall figures. The two hours with the highest incidence of blunt major trauma are from 17:00 to 18:59.
- Penetrating trauma injuries are most likely to be seen in the late evening and very early morning, with the peak occurrence in the last hour of the day.

2.4. **Location of incident**

Top 5 Locations	All mechanisms	Blunt mechanisms	Penetrating mechanisms	Other & multiple mechanisms
Street	2,596	1,903	657	36
Private address	1,591	1,067	456	68
Work	163	135	25	3
Tube/Rail/Bus	93	82	11	0
Parkland/Woodland/River	93	75	18	0

- 89% of all incidents occurred in one of the 5 locations reported in the table above.
- The most common type of location where both blunt and penetrating major trauma occurred was in the street.
- The highest incidence of other traumatic injuries, such as burns, occurred at a private address.

2.5. **Response and on-scene information**

2.5.1. Chief Complaint

Top 5 Chief Complaints	n
Falls	1,330
Traffic/transportation accident	1,323
Stab/gunshot/penetrating trauma	770
Traumatic injuries (specific)	246
Unconscious/fainting (near)	166

- 75% of all incidents were categorised at the point of the 999 call as one of the 5 chief complaints reported in the table above.
- The most frequent chief complaint was falls, closely followed by traffic/transportation incidents.

2.5.2. Response categories

Response categories	N	%
R1	316	6.2%
R2	2,962	58.0%
C1	465	9.1%
C2	1,142	22.4%
C3	190	3.7%
C4	31	0.6%

^ Two further calls were triaged by clinicians as Red 3.

- 64% (n=3,280) of patients were allocated a Red response, with 36% (n=1,828) assigned a Category C response.
- Over half of major trauma calls received a Red 2 response category.
- For patients allocated a Red 1 response (n=316), 162 (51%) of patients received a response within 8 minutes.

2.5.3. Response time by mechanism

Median call to scene time in mins (range)	Call Connect	ORCON
All patients	11 (0-235)	9 (0-232)
Blunt	11 (0-235)	9 (0-232)
Penetrating	9 (0-156)	8 (0-154)
Other & Multiple	10 (0–84)	8 (0–82)

- The average response time to major trauma patients from the point of the 999 call being connected was 11 minutes, and 9 minutes when using ORCON definitions (which allow an initial period of time prior to the clock starting in an attempt to establish the chief complaint).
- Patients with penetrating trauma received the quickest average response at 9 minutes from the 999 call being connected.

2.5.4. On-scene times

Overall median on-scene times	From first attending resource	From first transporting ambulance
All patients	38:04	33:11
Blunt	43:55	39:00
Penetrating	21:11	17:37
Other & Multiple	35:11	27:13

- The average on-scene time for all major trauma patients was 38 minutes from arrival of the first resource (i.e. a solo vehicle such as a car, motorbike or cycle). When examining times from the point of arrival of a transporting ambulance, the on-scene time was 33 minutes. Thus, on average, a first responder spent 5 minutes on-scene assessing and treating the patient whilst awaiting the arrival of an ambulance.
- The LAS has set itself aspirational on-scene times for blunt trauma of 20 minutes and 5 minutes for penetrating trauma. This reflects the additional time needed to assess and manage blunt trauma prior to transportation (such as the potential need for analgesia and immobilisation) compared to the minimal time required for penetrating trauma. Although on-scene times were shorter for patients with penetrating injuries at 21 minutes versus just under 44 minutes for blunt trauma, they are considerably longer than the aspirational aim.

Median on-scene times excluding entrapments and doctor attendances	From first attending resource	From first transporting ambulance
All patients	38:06	33:13
Blunt	43:28	38:23
Penetrating	20:58	17:27
Other & Multiple	34:59	27:08

- Average on-scene times were not significantly delayed when excluding patients who are trapped or inaccessible and require specialist extrication and/or where doctors are in attendance performing advanced interventions.

2.6. **Major Trauma Decision Tool use**

The London Major Trauma Decision Tool is divided into two sections for adult and paediatric (under 12) patients and consists of five steps or branches. Within each step are up to twelve individual triggers or reasons why the patient has been assessed by LAS clinicians as major trauma. The tool is used in a systematic fashion; a patient may well fit into multiple triggers but the trigger that falls within the highest step will be the primary trigger for activation of the major trauma pathway. Once a patient has triggered on the tool, and is therefore deemed to have suffered major trauma, LAS clinicians should convey the patient to a MTC. However, in certain instances where the patient's condition is unstable (e.g. an unmanageable airway), it will be appropriate for the patient to be conveyed to an Emergency Department at a TU (as designated by the London Major Trauma Network). The decision tool is presented in full in Appendix 1.

2.6.1. Tool and pathway compliance

Pathway compliance~		n	%^
Compliant	Conveyed to MTC appropriately+	5,038	98.6%
	Conveyed to TU appropriately	16	0.3%
Non-compliant	Initially conveyed to TU (under-triage)	52	1.0%

~2 patients refused conveyance.
^The total percentages do not equal 100% due to rounding
+1 patient did not trigger the tool but was deemed appropriate on clinical review.

- 99% of major trauma patients were conveyed to the correct destination, with 98.6% taken directly to a MTC and 0.3% taken to a TU.
- Of the 16 patients conveyed to a TU appropriately, Queens Romford received 11 patients with isolated head injuries as it is a designated neurosurgical facility within the major trauma network. For the remaining 5 patients, a TU was an appropriate destination due to the patient presenting with a compromised airway.
- 1% of patients were not transported to a MTC when they should have been but were under-triaged to a TU. Under-triaged patients are usually only discovered by the LAS when we are called upon to subsequently transfer them from the TU to a MTC. It is likely that the under-triage rate is higher as there will be instances where the patient is not transferred or where we are unaware of subsequent transfers.
- Appendix 4 shows the breakdown of the decision tool triggers for the under-triaged group. It is noted that patients over 55 make up the majority of the under-triage group (n=36, 69%).

2.6.2. Adult tool use – steps and triggers (n= 4,628)

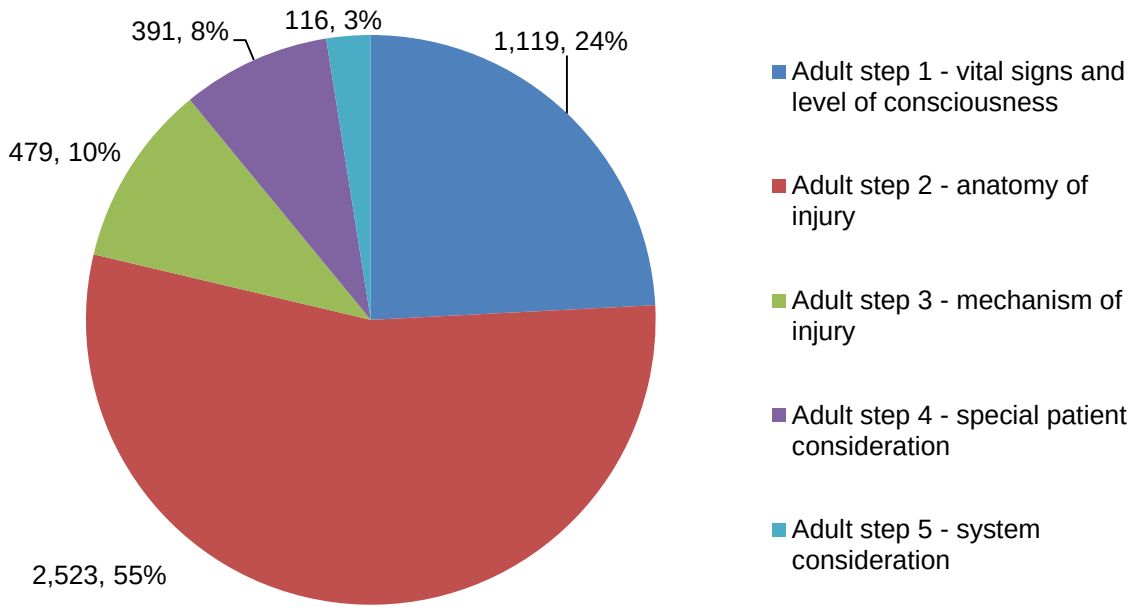

Figure 2 - Adult trauma tool step usage

- 4,628 patients triggered on the adult section of the London Major Trauma Decision Tool.
- Figure 2 shows that over half of patients meet step 2 of the adult tool, which focuses on anatomy of the injury.
- Nearly a quarter of patients are identified at step 1 based on their vital signs of level of consciousness.

Top ten primary adult tool triggers	Step	n
Penetrating trauma below the head & above the knees (not arms)	2	1,131
Glasgow coma score of 13 or below	1	926
Suspected pelvic fracture	2	527
Older patients (>55years)	4	338
Spinal trauma suggested by abnormal neurology	2	290
Bullseye to the windscreen and/or damage to the 'A' post of the vehicle caused by impact of individual outside of the vehicle	3	291
Suspected open and/or depressed skull fracture	2	227
Open fracture of the lower limb proximal to the ankle	2	184
Falls >20 ft. (equivalent to two storeys)	3	161
Respiratory rate less than 10 or greater than 29 breaths per minute	1	134

- When examining the individual triggers on the tool, it can be seen that the most frequent primary trigger for patients is penetrating trauma below the head and above the knee.
- Older patients above the age of 55 years of age form part of the special patient consideration step and this trigger is used when the patient does not meet any within steps 1 to 3.
- A full list of all primary triggers for the adult tool is contained in Appendix 6.

2.6.3. Paediatric tool use – steps and triggers (n=277 under 12 years)

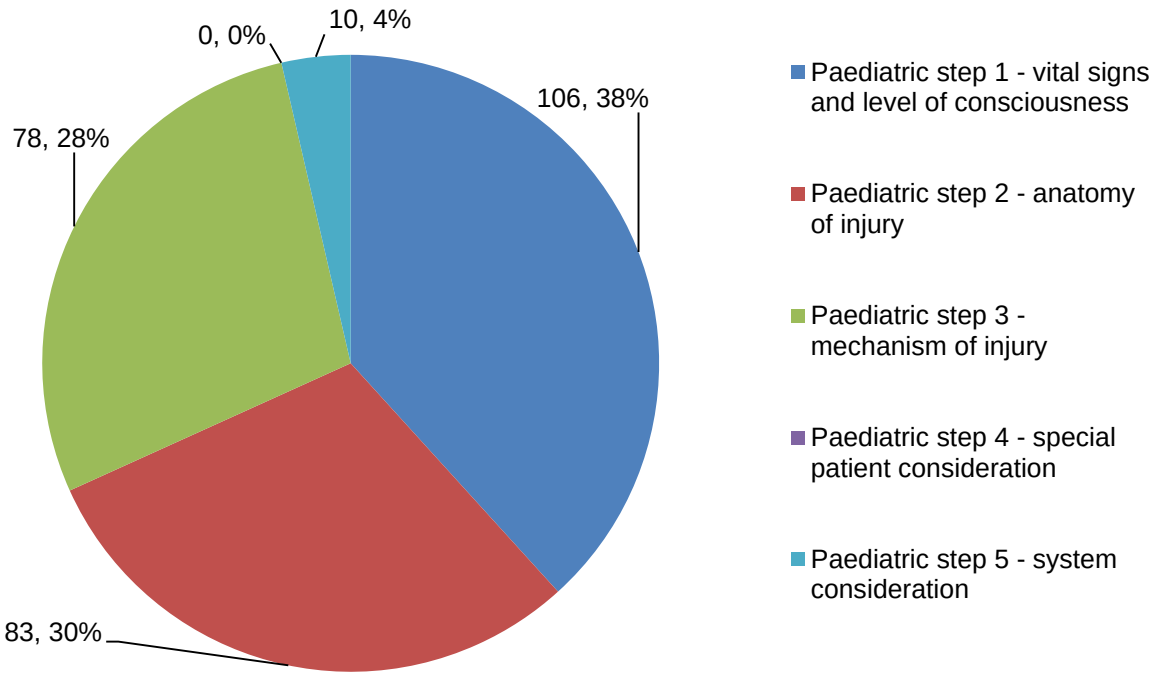

Figure 3 - Paediatric tool step usage

- 277 patients triggered on the paediatric section of the London Major Trauma Decision Tool.
- Over one-third of paediatric patients met step 1 in the paediatric tool, which focuses on abnormal vital signs and reduced level of consciousness.
- This was closely followed by step 2's assessment of the anatomy of the injury and step 3's focus on the mechanism.
- No patients met step 4's special patient consideration regarding history of bleeding disorders or known anti-coagulation therapy use.
- 10 patients triggered on step 5 where a senior clinician at EOC approved transportation to a MTC following LAS clinician's on-scene concern regarding the patient's condition.

Top 10 primary paediatric tool triggers	Step	n
Uninterrupted fall over twice the patient's height	3	65
Glasgow coma score less than 14	1	50
Burns/scald greater than 20 per cent	2	16
Abnormal vital signs not explained by other cause for example crying, pain responses	1	15
Suspected pelvic fracture	2	15
Open long bone fracture (with significant soft tissue injury)	2	13
Bullseye to the windscreen and/or damage to the 'A' post of the vehicle by impact of individual outside of the vehicle	3	10
Significant crew concern only when discussed with a senior clinician	5	10
Penetrating trauma below the head above the knees (not arms)	2	9

- When examining the individual triggers on the tool, it can be seen that the most frequent primary trigger for paediatric patients was the uninterrupted fall from height.
- A full list of all primary triggers for the paediatric tool is contained in Appendix 6.

2.6.4. Appropriate triage to a MTC without the decision tool

Patients may be conveyed to a MTC on the instruction of a doctor on-scene. A Helicopter Emergency Medical Service or an Advanced Paramedic Practitioner (APP) at the scene of the incident decided 128 patients would benefit from being taken to a major trauma centre despite not triggering the decision tool. For a further 15 patients, crews were advised by a senior clinician in EOC or on-call clinical advisor that their patient should go to a MTC. Of these 143 patients, the majority (n=132, 92.3%) were adults.

Non-tool mechanisms	n	%
RTC	81	56.6%
Fall	34	23.8%
Burns	7	4.9%
Assault	5	3.5%
Stabbing	4	2.8%
Other	3	2.1%
Shooting	3	2.1%
Other penetrating injury	3	2,1%
Animal bite	1	0.7%
Glass injury	1	0.7%
Hanging	1	0.7%

- Over half of patients that were conveyed to a MTC - on the advice of HEMS, APP or a senior LAS clinician - had been involved in a road traffic collision.
- Nearly a quarter of patients experienced a fall as the mechanism of injury but did not meet the criteria of the decision tool (i.e. for adults it was <20 feet and for paediatrics it was either an interrupted fall or one that was not twice the patients' height).

2.7. MTC utilisation and journey times

2.7.1. MTC utilisation

MTC utilisation	n	%
St Mary's	1,639	32.5%
Royal London	1,615	32.1%
King's College	949	18.8%
St George's	835	16.6%

- Of the 5,038 patients conveyed to a MTC, nearly two-thirds were conveyed to St. Mary's and Royal London MTC's.

2.7.2. Journey times

The national major trauma network was designed by NHS England to keep the length of journeys to within an acceptable limit which is currently no more than 60 minutes.

Journey times	Median	25th percentile	75th percentile
All destinations	16:52	10:39	22:65
King's College	13:32	06:68	19:97
St George's	15:22	10:44	20:00
Royal London	17:49	11:73	23:25
St Mary's	18:25	11:71	24:79

- The median journey time was consistently less than 20 minutes, which was well within the 60 minute acceptable limit.
- Only 12 cases exceeded the 60 minute journey time target. Further detail on these cases are reported in Appendix 7.

3. Discussion

This report of the incidence of major trauma in London demonstrates the excellent use of the London Major Trauma Decision Tool by LAS clinicians.

The steps of the tool are organised with the most serious presentations first. For adults, step 2 - injury anatomy - is the most frequently selected element of the tool (55%), with a very high number of patients conveyed to a MTC due to central penetrating trauma (n=1,131, 22%). As it is impossible to assess the extent of the damage that has been caused by a penetrating injury in the pre-hospital environment, the tool ensures that all those patients with potentially hidden serious internal injuries are triaged to a MTC to receive the care they require.

Step 1 of the paediatric tool - vital signs and levels of consciousness - is the most commonly used (38%). The most common reason that children were conveyed to a MTC was following a fall greater than twice their height (23%). With very young children the distance fallen may appear insignificant and might not necessitate transport to an MTC in an older patient, but has the potential to cause serious injuries in children and infants.

The patient demographics we present support those reported widely with major trauma generally considered to affect young men[1]. However, patients over the age of 55 account for 20% of the major trauma patients and are more likely to be under-triaged, which reflects emerging information about major trauma in the UK[7]. Not every patient over 55 who suffers a traumatic injury needs to be conveyed to a major trauma centre; however the effect of age should always be considered when assessing the seriousness of a patient's injuries. For example, older patients present with serious injuries following low level mechanisms, such as falling down the stairs (53%) or a fall from standing (33%), which in younger patients would not necessarily result in major trauma. This is a difficult group of patients to assess as they often have a number of chronic conditions and on medication which will change their normal physiology, meaning that they may not present in the same way to serious injuries as a younger patient. The LAS will continue to educate staff on the importance of patient age and medication history.

Over-triage to a MTC is of concern as MTCs have to focus their resources on more seriously injured patients and do not have the additional capacity for patients who can receive suitable care at a local TU. During 2015-16, 355 patients were conveyed to a MTC when they did not present with any triggers from the decision tool (see Appendix 5). It is not possible to capture the reasons patients are over-triaged from clinical documentation however potential explanations may include misinterpretation of the decision tool or not referring to the tool when making a decision. The LAS monitors the number of over-triaged patients identified and the Clinical Audit and Research Unit report cases to local management teams who provide feedback to staff.

The major trauma networks have been set up so that patients should be within 60 minutes of a MTC when an ambulance is running on blue lights. Our median journey times to MTC's are within 20 minutes, with only 12 (0.2%) patient journeys exceeding the 60 minute national target. A key focus for the LAS, however, is that the time spent at the scene of an incident should be minimised as far as possible. The LAS has worked to better understand and

reduce the on-scene time over the last 5 years but we must continue to decrease the times closer to our aspirational targets of 20 minutes for blunt and 5 minutes for penetrating trauma. There will always be reasons that can extend the time spent on scene that will be beyond the control of the LAS clinicians, including where advanced or time critical interventions are performed by HEMS doctors and extrication of trapped or inaccessible patients. However, even when these factors are accounted for, the median on-scene time was 38 minutes for blunt trauma and 17 minutes for penetrating trauma suggesting that there is room for improvement. The Clinical Audit and Research Unit will continue to report cases of extended on-scene times to local management teams for investigation and feedback to staff. Furthermore, cases of short penetrating trauma on-scene times will be highlighted for positive feedback to staff.

3.1. Limitations

The figures reported are considered to be representative of major trauma patients attended by the LAS but may not be complete due to the methods used to identify cases. If a destination code for a MTC is not documented or selected on an MDT, the patient will not be included in the data sources used for this report. Furthermore, under-triaged patients are usually identified when they are transferred by the LAS from a local TU to a MTC. However, it is not always possible to identify these patients and match them to the original incident and not all under-triaged patients will be transferred once they are admitted to a TU.

Furthermore, the information presented reflects patients identified by the London Major Trauma Decision Tool rather than those determined at hospital to have an ISS of greater than 15. A challenge for the LAS is to gather outcome data from MTC's to continue to improve the network, develop the tool and to provide feedback to our staff to help compliance with the tool. It is expected that the LAS will work with the network and MTC's to pilot the exchange of outcomes data going forward.

3.2. Conclusion

The LAS has embedded the major trauma specialist pathway into clinical practice and we can be assured that our patients receive a good service with rapid transportation to specialist facility for ongoing care and treatment.

References

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Glossary

‘A’ post – The front pillars of a vehicle that hold the windscreen in place.

Abnormal neurology – Changes to the nerves and nervous system, e.g. pins and needles or loss of sensation.

Advanced interventions – Specialist treatments that are provided by more skilled clinicians, e.g. Rapid Sequence Intubation and thoracotomies.

Advanced Paramedic Practitioner (APP) – a Paramedic with a greater range of assessment and interventional skills.

Altered physiology – Changes in organs and their functions, e.g. an increase in heart rate, respiratory rate.

Anti-coagulation therapy – A type of drug therapy that reduces the body’s ability to form clots in the blood.

Blunt trauma – Injuries where a patient is struck by an object that does not penetrate the body, e.g. falls from height, road traffic collisions and crushing injuries.

Bullseye windscreen – A distinctive pattern of concentric cracks to the front windscreen of a vehicle caused by impact.

Clinical Commissioning Group (CCG) - CCGs are NHS bodies that are responsible for the planning, agreeing and monitoring health services within their local area.

Central penetrating wound – Penetrating trauma between the neck and knees, excluding the arms.

Depressed skull fracture –A break in the skull resulting in dents or indentations.

Emergency Department – Department of a hospital that specialises in emergency medicine.

Emergency Operations Centre (EOC) – The control centre of the London Ambulance Service which handles calls, dispatches vehicles and supports clinicians in their care.

Glasgow Coma Score (GCS) – A measurement that assesses the level of consciousness a person has through observing and scoring eye, verbal and motor responses.

HEMS – Helicopter Emergency Medical Services. An emergency service which brings a team to the scene of an incident, usually by helicopter and can transport a patient to hospital in the aircraft. The team can give more advanced interventions in a pre-hospital setting than a regular ambulance crew would be able to. In London, all HEMS teams are led by a doctor.

Injury Severity Score (ISS) – An anatomical scoring system that is used to assess trauma severity in hospitals. A score above 15 is considered major trauma.

Journey time – The time taken for the ambulance to leave the incident scene to arriving at hospital.

London's Air Ambulance – The charity that provides the HEMS service in London to deliver an advanced trauma team to trauma patients in London via helicopter or response car.

London Major Trauma Decision Tool – Tool developed by London Ambulance Service to determine if a patient needs a Major Trauma Centre or not. It assesses vital signs and consciousness, anatomy of injury, mechanism of injury and special patient considerations.

Major Trauma Centre (MTC) – A hospital that can provide specialist services and expertise to the most severely injured patients. In London the major trauma centres are: King's College Hospital, Royal London Hospital, St. George's Hospital and St. Mary's Hospital.

Major Trauma – Serious injuries that could result in death or serious disability.

Mechanism of Injury – The method of injury.

Median – The mid-point in a range of values.

Mobile Data Terminal (MDT) – A computerised device which allows ambulance crews to communicate with EOC.

Morbidity – The frequency which a disease appears in the population.

Mortality – The frequency of death within the population.

On-scene times – The time ambulance clinicians spend at the incident location assessing and caring for the patient prior to transportation.

Other Trauma – Injuries that are not blunt or penetrating but are still major trauma injuries, e.g. burns and massive lacerations (non-penetrating).

Over-triage – When a patient is transported to a major trauma centre when they have not triggered the Major Trauma Decision tool.

Paediatric – In terms of major trauma in London, Children under 12 years old.

Penetrating trauma – Injuries where an object pierces the skin, e.g. stabbings, gunshot wounds and impalements.

Pre-alert – An alert made to the hospital that a patient is incoming, allowing the hospital to prepare the right services for the patient. It often includes age, sex, description of events, the patient's injuries and their current condition.

Pre-hospital – The environment or care given by ambulance staff prior to the patients arrival at hospital.

Proximal – A term to refer to the distance of a limb from the body. The closer to the centre the more proximal the limb is.

Respiratory rate – The number of breaths per minute.

Response Categories – Nationally-agreed categories on the type of response patient's should get depending on the severity and priority of the incident.

Response times – The time it takes an emergency service vehicle to arrive on-scene after the call have been received in the Emergency Operations Centre.

Road Traffic Collision (RTC) – A incident that occurs when a vehicle collides with another vehicle, person or object.

Solo responder – A fast-response vehicle that does not have transporting capabilities, often with only one ambulance crew member.

Thorax – The area between the neck and the abdomen, the chest.

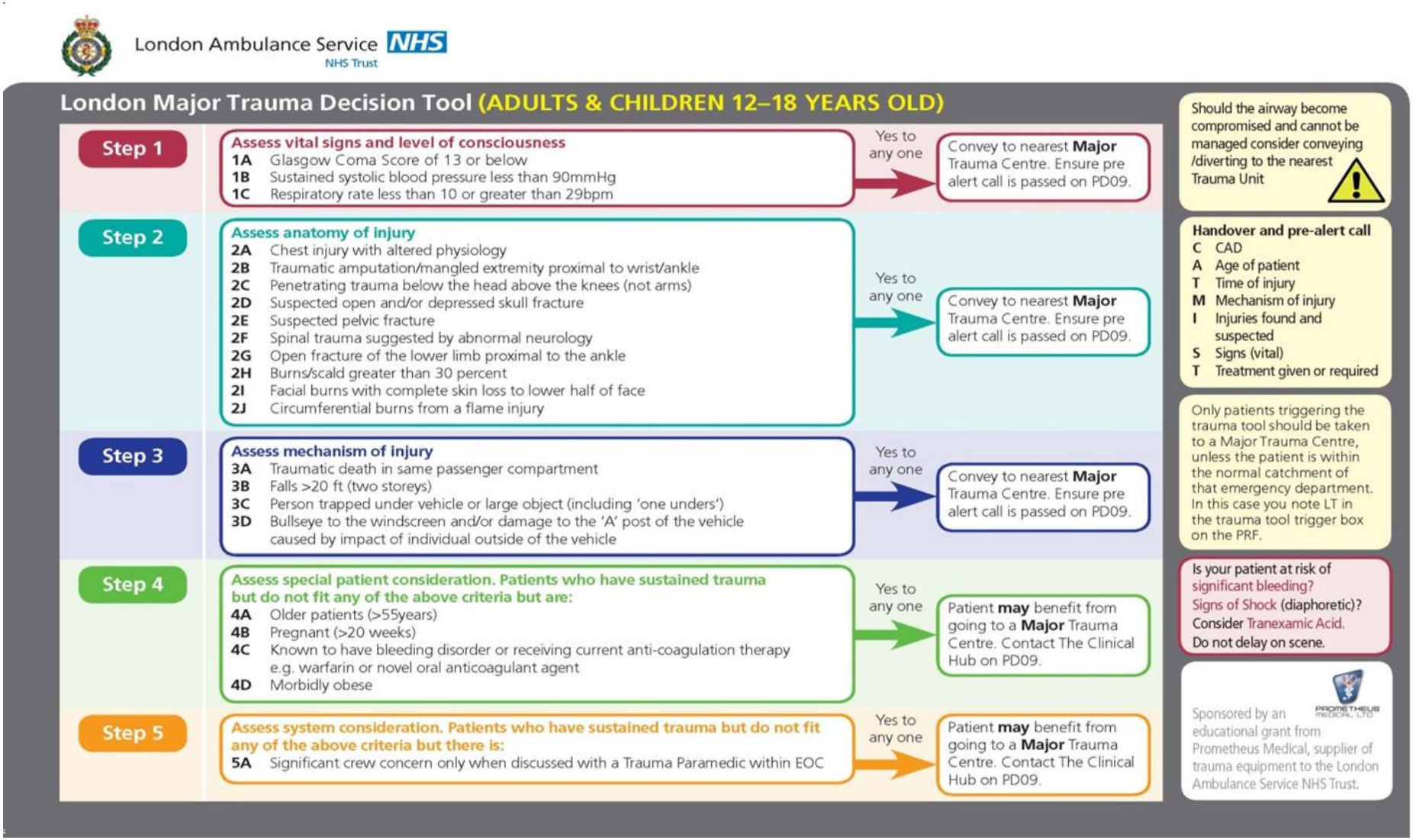
Trauma Unit (TU) – An emergency department that is connected to the Trauma Network but does not hold the same specialist skills as a major trauma centre.

Triage – The process of determining when, how and where a patient should be treated.

Under-triage – When a patient is transported to a Trauma Unit or Emergency Department instead of a major trauma centre despite triggering the Major Trauma Decision Tool.

Vital signs – Measurements that assess the state of a patient's body functions, e.g. pulse rate, respiratory rate, blood pressure.

Appendix 1: London Major Trauma Decision Tool



London Major Trauma Decision Tool (CHILDREN UNDER 12 YEARS OLD)

Step 1

Assess vital signs and level of consciousness

- **6A** Glasgow Coma Score of 13 or below
- **6B** Inappropriate behaviour post injury (too quiet or inconsolable)
- **6C** Abnormal vital signs not explained by other cause for example crying, pain responses

Yes to any one → Convey to nearest **Major** Trauma Centre. Ensure pre alert call is passed on PD09.

Step 2

Assess anatomy of injury

- **7A** Significant bruising to chest or abdomen
- **7B** Traumatic amputation/mangled extremity proximal to wrist/ankle
- **7C** Penetrating trauma below the head above the knees (not arms)
- **7D** Suspected open and/or depressed skull fracture
- **7E** Suspected pelvic fracture
- **7F** Significant degloving (soft tissue) injury
- **7G** Spinal trauma suggested by abnormal neurology
- **7H** Open long bone fracture (with significant soft tissue injury)
- **7I** Multiple fractures (long bone)
- **7J** Burns/scald greater than 20 percent
- **7K** Facial burns with complete skin loss to lower half of face
- **7L** Circumferential burns from a flame injury

Yes to any one → Convey to nearest **Major** Trauma Centre. Ensure pre alert call is passed on PD09.

Step 3

Assess mechanism of injury

- **8A** Traumatic death in same passenger compartment
- **8B** Uninterrupted fall over twice the patient's height (not bouncing down stairs)
- **8C** Person trapped under vehicle or large object (including 'one unders')
- **8D** Bullseye to the windscreen and/or damage to the 'A' post of the vehicle caused by impact of individual outside of the vehicle
- **8E** Bicycle injury resulting in abdominal and /or groin pain (thrown from or impacted on handle bars)
- **8F** Ejection from inside car, van or lorry
- **8G** Fall from or trampled by large animal

Yes to any one → Convey to nearest **Major** Trauma Centre. Ensure pre alert call is passed on PD09.

Step 4

Assess special patient consideration. Patients who have sustained trauma but do not fit any of the above criteria but are:

- **9A** Known to have bleeding disorder or receiving current anti-coagulation therapy e.g. warfarin or novel oral anticoagulant agent

Yes to any one → Patient **may** benefit from going to a **Major** Trauma Centre. Contact The Clinical Hub on PD09.

Step 5

Assess system consideration. Patients who have sustained trauma but do not fit any of the above criteria but there is:

- **0A** Significant crew concern only when discussed with a Trauma Paramedic within EOC

Yes to any one → Patient **may** benefit from going to a **Major** Trauma Centre. Contact The Clinical Hub on PD09.

Children's Vital Signs

Respiratory rate

Age	Breaths/min
<1 year	30–40
1–2 years	25–30
2–5 years	25–30
5–11 years	20–25

Pulse rate

Age	Beats/min
<1 year	110–160
1–2 years	100–150
2–5 years	95–140
5–11 years	80–120

Glasgow Coma Score

Eye opening

Spontaneous	4
To speech	3
To pain	2
None	1

Verbal response

Orientated	5
Confused	4
Inappropriate words	3
Incomprehensible sounds	2
No verbal response	1

Motor response

Obeys commands	6
Localises pain	5
Withdraws from pain	4
Abnormal flexion	3
Extensor response	2
No response	1

Modified verbal response <4 years old

Appropriate words, social smiles fixes and follows objects	5
Cries but is consolable	4
Persistently irritable	3
Restless, agitated	2
Silent	1

Appendix 2: Incident information by area (as determined by the CCG of the incident)

CCG	n	Male		Blunt		Penetrating		Response time	Journey time to MTC	999 call connection to MTC
		n	%	n	%	n	%			
NHS Barking and Dagenham CCG	110	89	81%	74	67%	33	30%	0:11:51	0:18:51	1:14:21
NHS Barnet CCG	195	138	71%	150	77%	43	22%	0:12:57	0:24:20	1:22:30
NHS Bexley CCG	90	64	71%	75	83%	12	13%	0:11:27	0:25:34	1:28:06
NHS Brent CCG	192	152	79%	136	71%	49	26%	0:11:33	0:16:45	1:29:08
NHS Bromley CCG	147	103	70%	117	80%	25	17%	0:12:07	0:23:33	1:21:34
NHS Camden CCG	169	127	75%	122	72%	43	25%	0:09:30	0:12:55	1:04:26
NHS Central London	177	133	75%	132	75%	44	25%	0:10:15	0:10:04	1:00:38
NHS City and Hackney CCG	172	137	80%	115	67%	54	31%	0:09:17	0:10:53	0:57:39
NHS Croydon CCG	204	153	75%	157	77%	38	19%	0:10:44	0:18:44	1:11:52
NHS Ealing CCG	243	193	79%	172	71%	64	26%	0:11:46	0:20:34	1:15:52
NHS Enfield CCG	187	132	71%	125	67%	51	27%	0:11:19	0:28:19	1:23:02
NHS Greenwich CCG	182	127	70%	126	69%	51	28%	0:09:48	0:20:43	1:15:42
NHS Hammersmith and Fulham CCG	129	106	82%	92	71%	34	26%	0:10:39	0:13:16	1:05:34
NHS Haringey CCG	209	159	76%	125	60%	79	38%	0:10:45	0:20:31	1:07:22
NHS Harrow CCG	81	56	69%	63	78%	18	22%	0:10:48	0:26:50	1:22:48
NHS Havering CCG	88	55	63%	71	81%	17	19%	0:10:45	0:27:10	1:27:41
NHS Hillingdon CCG	169	124	73%	138	82%	28	17%	0:10:43	0:27:09	1:27:33
NHS Hounslow CCG	175	135	77%	144	82%	26	15%	0:11:35	0:28:26	1:30:40
NHS Islington CCG	201	161	80%	128	64%	70	35%	0:09:55	0:14:42	0:59:48

CCG	n	Male		Blunt		Penetrating		Response time	Journey time to MTC	999 call connection to MTC
		n	%	n	%	n	%			
NHS Kingston CCG	96	69	72%	81	84%	12	13%	0:11:09	0:16:48	1:14:19
NHS Lambeth CCG	257	196	76%	184	72%	70	27%	0:09:13	0:08:56	0:53:32
NHS Lewisham CCG	163	121	74%	113	69%	48	29%	0:10:28	0:13:49	1:05:52
NHS Merton CCG	118	93	79%	97	82%	20	17%	0:09:20	0:09:13	0:53:11
NHS Newham CCG	172	144	84%	105	61%	61	35%	0:09:34	0:13:14	1:00:03
NHS Redbridge CCG	135	96	71%	93	69%	41	30%	0:11:25	0:20:16	1:13:52
NHS Richmond CCG	106	78	74%	92	87%	11	10%	0:11:23	0:24:08	1:26:24
NHS Southwark CCG	230	183	80%	153	67%	69	30%	0:09:49	0:08:30	0:52:43
NHS Sutton CCG	107	78	73%	85	79%	20	19%	0:10:25	0:15:15	1:04:53
NHS Tower Hamlets CCG	151	130	86%	85	56%	61	40%	0:08:57	0:07:03	0:46:44
NHS Waltham Forest CCG	147	122	83%	88	60%	55	37%	0:10:07	0:20:22	1:03:45
NHS Wandsworth CCG	161	120	75%	128	80%	33	20%	0:10:18	0:10:54	1:00:04
NHS West London CCG	140	107	76%	101	72%	37	26%	0:10:55	0:10:28	1:02:59

Notes:

- All figures above relate to patients transported in accordance with the major trauma decision tool.
- All times are median averages.
- Response time shown is from the time the 999 call is connected to the first LAS vehicle arriving on-scene.
- Four patients were attended by the LAS at locations in non-London CCG areas and have been excluded from the table (one each from NHS East Surrey CCG, NHS Herts Valleys CCG, NHS Surrey Downs CCG and NHS West Essex CCG).

Appendix 3: Mechanism of injury

Top 10 Blunt trauma mechanisms	n	Median age
RTC car/van vs. pedestrian	534	34
Fall down stairs	526	62
Fall from standing on the level	469	70
Fall < 20ft or >6ft	285	37
RTC car/van vs. motorbike (inc scooter)	278	29
Fall from height >20ft	251	30
RTC car/van vs. car	153	33
Fall < 6ft	132	39
RTC single vehicle (car/van)	113	32
Assault – blunt no weapons	110	34

- The majority of the top ten mechanisms recorded are either Road Traffic Collisions (RTCs) involving cars, or falls.
- Overall the median age for blunt was 38 years.
- The median ages for patients suffering falls down stairs (62 years) or on the level (70 years) is much higher than the other mechanisms.

Penetrating trauma mechanism	n	Median age
Stab - thorax /neck	411	24
Stab - abdomen/groin	281	27
Stab - limb	247	22
Stab – multiple (central regions)	217	21
Penetrating injury (other)	76	32
Glass injury	34	32
RTC causing penetrating injury	19	29
Shot - thorax/neck	12	26
Stab - other	10	27
Shot - limb	8	26
Shot - abdomen/groin	6	30
Animal bite	6	41
Shot - multiple	5	28
Shot - other	1	51

- Stab injuries to the central body regions make up the bulk of penetrating major trauma injuries
- The median age of patients sustaining penetrating trauma was 33.
- Penetrating trauma patients are much more likely to be male, with 91% of penetrating trauma victims being men.

Appendix 4: Under-triage patients (n=52)

Primary decision tool trigger	Step	n
Adult decision tool		
Older patients (>55years)	4	18
Glasgow coma score of 13 or below	1	9
Chest injury with altered physiology	2	5
Spinal trauma suggested by abnormal neurology	2	5
Known to have bleeding disorder or receiving current anti-coagulation therapy	4	4
Respiratory rate less than 10 or greater than 29bpm	1	3
Open fracture of the lower limb proximal to the ankle	2	2
Suspected pelvic fracture	2	2
Penetrating trauma below the head above the knees (not arms)	2	1
Paediatric decision tool		
Glasgow coma score of 13 or below	1	1
Inappropriate behaviour post injury (too quiet or inconsolable)	1	1
Uninterrupted fall over twice the patient's height (not bouncing down stairs)	3	1

Of the adult patients (n=49), 36 were over the age of 55 and the mechanisms for these patients are presented:

Under-triaged older patient mechanisms	n	%
Fall down stairs	19	52.8%
Fall from standing on the level	12	33.3%
Fall < 6ft	2	5.6%
RTC car/van vs. car	2	5.6%
Unknown cause	1	2.8%

- Under-triaged older patients have usually suffered falls (91.6%). The mechanisms are lower level either from stairs, from standing or less than 6 feet.
- In addition, 4 of these patients were known to have anti-coagulant medication, thus placing them at a greater risk of a bleed.

Appendix 5: Over-triage to a Major Trauma Centre

Over-triaged patients by MTC	Correctly triaged patients	Over-triaged	Over-triaged as % of MTC total
St Mary's	1639	131	8%
Royal London	1615	112	7%
St George's	835	60	7%
King's College	949	52	5%

- Over-triaged patients can add up to an additional 7% to the major trauma workload of a MTC.

Appendix 6: Trauma tool trigger breakdowns

Adult decision tool triggers	Step	n
Penetrating trauma below the head above the knees (not arms)	2	1,132
Glasgow coma score of 13 or below	1	927
Suspected pelvic fracture	2	527
Older patients (>55years)	4	338
Bullseye to the windscreen and/or damage to the 'A' post of the vehicle caused by impact of individual outside of the vehicle	3	291
Spinal trauma suggested by abnormal neurology	2	290
Suspected open and/or depressed skull fracture	2	227
Open fracture of the lower limb proximal to the ankle	2	184
Falls >20 ft (two storeys)	3	161
Respiratory rate less than 10 or greater than 29bpm	1	134
Significant crew concern only when discussed with a senior clinician	5	116
Chest injury with altered physiology	2	113
Sustained systolic blood pressure less than 90mmHg	1	58
Known to have bleeding disorder or receiving current anti-coagulation therapy e.g. Warfarin or novel oral anticoagulant agent	4	42
Traumatic amputation/mangled extremity proximal to wrist/ankle	2	29
Person trapped under vehicle or large object (including 'one unders')	3	25
Burns/scald greater than 30 per cent	2	15
Morbidly obese	4	7
Circumferential burns from a flame injury	2	5
Pregnant (>20 weeks)	4	4
Traumatic death in same passenger compartment	3	2
Facial burns with complete skin loss to lower half of face	2	1

Paediatric decision tool triggers	Step	n
Uninterrupted fall over twice the patient's height (not bouncing down stairs)	3	65
Glasgow coma score of 13 or below	1	51
Inappropriate behaviour post injury (too quiet or inconsolable)	1	42
Burns/scald greater than 20 per cent	2	16
Abnormal vital signs not explained by other cause for example crying, pain responses	1	15
Suspected pelvic fracture	2	15
Open long bone fracture (with significant soft tissue injury)	2	13
Bullseye to the windscreen and/or damage to the 'A' post of the vehicle by impact of individual outside of the vehicle	3	10
Significant crew concern only when discussed with a senior clinician	5	10
Penetrating trauma below the head above the knees (not arms)	2	9
Spinal trauma suggested by abnormal neurology	2	8
Suspected open and/or depressed skull fracture	2	6
Significant bruising to chest or abdomen	2	6
Multiple fractures (long bone)	2	5
Significant degloving (soft tissue) injury	2	2
Bicycle injury resulting in abdominal and /or groin pain (thrown from or impacted on handle bars)	3	1
Person trapped under vehicle or large object (including 'one unders') crying, pain responses	3	1
Facial burns with complete skin loss to lower half of face	2	1
Fall from or trampled by large animal	3	1

Appendix 7: Journeys to MTCs of 60 minutes or more

Journey delay reasons	n
Delayed by stopping to meet with HEMS en route to hospital	4
Delayed by traffic conditions	3
Delayed due to stopping for interventions by HEMS after patient deterioration	2
Delayed by stopping to provide care after patient deterioration	2
Delayed by distance	1