National Clinical Guideline Centre

DRAFT FOR CONSULTATION

Trauma: Service delivery

Major trauma services: service delivery for major trauma

Service delivery guidance

Appendices G – J

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Draft for consultation

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Disclaimer

Those responsible and accountable for commissioning trauma services should take this guideline fully into account. However, this guideline does not override the need for, and importance of, using professional judgement to make decisions appropriate to the circumstances.

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Appendices

Appendix G: Clinical evidence tables

G.1 Pre hospital triage to the appropriate destination

Table 1: Cheung 2013 [44]

Study	**Cheung 2013 [44]**
Study type	Retrospective diagnostic cohort study (Trauma Registry)
Number of studies (number of participants	701
Countries and Settings	TARN registered hospitals; UK
Funding	None reported
Duration of study	5 years
Age, gender, ethnicity	(M:F) 2:1; Age: Not reported; Ethnicity: Not reported
Patient characteristics	People aged below 16 sustaining injury or trauma and admitted to a receiving unit direct from the scene of the incident.
Index test	UK Trauma Tools: East Midlands, London, North West, Northern, South West London, Wessex, Pediatric Trauma Score
Reference standard	Later clinical confirmation of Major Trauma: ISS >15
Results: TP:223, 221, 214, 209, 202, 177, 90 FP:391, 339, 377, 363, 75, 250, 33 FN:7, 9, 16, 21, 28, 53, 140 TN: 80,132, 94, 108, 396, 221, 438 Sensitivity: 0.97, 0.96, 0.93, 0.91, 0.88, 0.77, 0.39	

Study	Cheung 2013 [44]
Specificity: 0.17, 0.28,0.20, 0.23, 0.41, 0.47, 0.93 PPV: 0.36, 0.39, 0.36, 0.37, 0.42, 0.42, 0.74 NPV: 0.91, 0.93, 0.86, 0.85, 0.87, 0.81, 0.76	

Table 2: Dinh 2012[86]

Study	Dinh 2012 [86]
Study type	Retrospective observational study (Trauma Registry)
Number of studies (number of participants	2664
Countries and Settings	Sydney (urban city) Australia, Pre-hospital (Major Trauma Centre)
Funding	None reported
Duration of study	1 year
Age, gender, ethnicity	Non Major Trauma (non-MT): (M:F) 1:1; (Mean Age, SD) 57 (24); Gender: Not reported Major Trauma (MT): (M:F) 3:1; (Mean Age, SD) 42 (19); Gender: Not reported
Patient characteristics	All adult (>15) years old patients who were transported directly by the Ambulance Service of New South Wales(ASNSW) because of injury
Index test	ACS-SCOT: 2006 Triage rule
Reference standard	Later clinical confirmation of Major Trauma: Death, ISS>15
Results: TP: 180 FP: 587 FN: 105 TN: 1792	

Study	Dinh 2012 [86]
Sensitivity: 0.63 Specificity: 0.75 PPV: 0.23 NPV 0.94	

Table 3: Do 2014 [87]

Study	Do 2014 [87]
Study type	Retrospective observational study (Trauma Registry)
Number of studies (number of participants	1934
Countries and Settings	Denmark ; Trauma Network - Tertiary hospitals and level 1 trauma centres
Funding	TrygFonden (Private Philantropy)
Duration of study	1 and 5 months
Age, gender, ethnicity	Adult Population: (M:F) 2:1; (Mean Age, Range) 36 (22-51); Ethnicity: Not reported Paediatric Population: (M:F) 1:1; (Mean Age, Range) 10 (6-13); Ethnicity: Not reported
Patient characteristics	All trauma patients aged 79 or less, with a minimum driving distance of 30 minutes to the regional TC, including self-attendees.
Index test	ACS-SCOT: 2006 Triage rule (derivative)
Reference standard	Later clinical confirmation of Major Trauma: ISS>15
Results: TP: 139 FP: 45 FN: 43 TN: 1469 Sensitivity: 0.76	

Study	Do 2014 [87]
Specificity: 0.97 PPV: 0.76 NPV: 0.97	

Table 4: Ocak 2009 [180]

Study	Ocak 2009[180]
Study type	Retrospective observational study (Trauma Registry)
Number of studies (number of participants	302
Countries and Settings	10 trauma centres (3 Level 1 centres) - Holland
Funding	None reported.
Duration of study	1 year
Age, gender, ethnicity	Non Major Trauma (non-MT): (M:F) 1:1; (Mean Age, SD) 59.7 (23.3); Gender: Not reported Major Trauma (MT): (M:F) 2:1; (Mean Age, SD) 48.4 (23.7); Gender: Not reported
Patient characteristics	Adult trauma patients who were transported by ambulance from the accident scene
Index test	ACS-SCOT: 2006 Triage rule
Reference standard	Later clinical confirmation of Major Trauma: ISS>15.
Results: TP: 127 FP:34 FN: 24 TN: 117 Sensitivity: 0.84 Specificity: 0.77 PPV: 0.78	

Study	Ocak 2009[180]
NPV: 0.82	

G.2 Receiving trauma teams

Table 5: Eastes 2001[91]

Study	Eastes 2001[91]
Study type	Before and after study
Number of studies (number of participants)	1 (Total n=4073; POST (2-tiered team) n=2333; PRE (non-tiered team) n=1740)
Countries and setting	Conducted in USA; Setting: Oregon Health Services University (OHSU) a regional Level I trauma centre located in a three-county metropolitan region.
Line of therapy	Not applicable
Duration of study	Intervention time: four years (24 months POST 2-tiered team implementation, 24 months PRE 2-tiered team implementation)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	People treated at a major trauma centre
Subgroup analysis within study	Case-control group of under-triaged and inappropriately activated as MOD instead of FULL.
Inclusion criteria	Trauma patients entered by EMS personnel in the field and transported directly to OHSU
Exclusion criteria	Trauma patients transferred in from other facilities or who arrived in ED by private vehicle
Age, gender and ethnicity	Age - Mean (SD): Only reported for those admitted to hospital – POST (2-tiered team): 35 (19); PRE (non-tiered team): 33 (18). Gender (M:F): Total: 2883/1190; POST (2-tiered team): 1622/711; PRE (2-tiered team): 1261/479. Ethnicity: Not reported
Further population details	
Indirectness of population	No indirectness
Interventions	(n=2333) Intervention 1: Two-tiered system. Post-implementation period (POST): In September 1994 a tiered response protocol was implemented. An emergency medicine physician, using information provided in the radio

Study	Eastes 2001[91]
	report activated whether the FULL or MOD response. • FULL response included staff trauma surgeon, chief trauma resident, staff ED physician, ED resident, staff anaesthesiologist, anaesthesiologist resident, respiratory care practitioner, three ED nurses, ED specialist, radiology technician and transport aid. • MOD response omitted the anaesthesiologist, anaesthesiologist resident, respiratory therapist, one nurse and the transportation aid. Duration 24 months (January 1, 1996 through December 31, 1997). Concurrent medication/care: None reported Further details: Triaging tool 2 (Two-tiered system): • FULL trauma protocol triage criteria: airway problems (intubated or attempted intubation), breathing difficulties (respiratory rate <10 or >29 breaths/minute), systolic BP <90mmHg, GCS score <11, penetrating injury to the head, neck or torso, flail chest, paralysis, pelvic instability, amputation proximal to the wrist or ankle, major crush injury to torso or upper thigh (45% of patients in the POST population received triggered this response). • MOD trauma protocol triage criteria: GCS score >11 and <13, two or more long bone fractures, fall >20 feet, ejection from vehicle, death in same passenger compartment, extrication time >20 minutes, rollover motor vehicle crash, high-speed motor vehicle crash, auto vs. pedestrian <5mph, special consideration age <5 or >65 years, paramedic discretion (motorcycle crash, all-terrain vehicle, bike crash, significant intrusion/impact, hostile environment, pre-existing medical illness, presence of intoxicants, pregnancy) (55% of patients in the POST population received triggered this response). (n=1740) Intervention 2: Non-tiered system. Pre-system period (PRE): Before September 1994 all patients received FULL trauma team activation. • FULL response included staff trauma surgeon, chief trauma resident, staff ED physician, ED resident, staff anaesthesiologist, anaesthesiologist resident, respiratory care practitioner, three ED nurses, ED specialist, radiology technician and transport aid. Duration 24 months (September 1, 1992 through August 31, 1994). Concurrent medication/care: None reported Further details: Triaging tool 1 (non-tiered system): • FULL trauma protocol triage criteria only: airway problems (intubated or attempted intubation), breathing difficulties (respiratory rate <10 or >29 breaths/minute), systolic BP <90mmHg, GCS score <11, penetrating injury to the head, neck or torso, flail chest, paralysis, pelvic instability, amputation proximal to the wrist or ankle, major crush injury to torso or upper thigh.

Study	Eastes 2001[91]
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: TWO-TIERED versus NON-TIERED Protocol outcome 1: Mortality @ any time point during study - Actual outcome for people treated at a major trauma centre: Combination of those who died in ED and those who died after being admitted to hospital during 2 years; POST (2-tiered teams): 103/2333, PRE (non-tiered teams): 109/1740; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 2: Time in hospital @ any time point during study - Actual outcome for people treated at a major trauma centre: Hospital length of stay at 2 years; POST (2-tiered teams): mean 5.6 days (SD 6.9); n=1937, PRE (non-tiered teams): mean 6.2 days (SD 8.8); n=1670; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 3: Time in ED @ any time point during study - Actual outcome for people treated at a major trauma centre: Length of stay in ED for sub-set of those who were admitted to hospital: POST (2-tiered teams) 1937/2333 (83%); PRE (non-tiered teams) 1670/1740 (96%) during 2 years; Other: Reported as median: POST (2-tiered teams) 1.5 hours; PRE (non-tiered teams) 0.7 hours (p=0.000); Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 4: Time to definitive care @ any time point during study - Actual outcome for people treated at a major trauma centre: Time to OR for sub-set of those who were admitted to hospital: POST (2-tiered teams) 1937/2333 (83%); PRE (non-tiered teams) 1670/1740 (96%) during 2 years; Other: Reported as median: POST (2-tiered teams) 1.3 hours; PRE (non-tiered teams) 1.0 hours (p = 0.000); Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome for people treated at a major trauma centre: Time to ICU for sub-set of those who were admitted to hospital: POST (2-tiered teams) 1937/2333 (83%); PRE (non-tiered teams) 1670/1740 (96%) during 2 years; Other: Reported as median: POST (2-tiered teams) 1.5 hours; PRE (non-tiered teams) 1.4 hours (p = 0.000); Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life; Delays to transfer; Time to CT; Missed/delayed diagnosis of injury; Trauma team member time; Complication rates

Table 6: Kaplan 1997[140]

Study	Kaplan 1997[140]
Study type	Retrospective cohort study

Study	Kaplan 1997[140]
Number of studies (number of participants)	1 (n=437)
Countries and setting	Conducted in USA
Line of therapy	First-line
Duration of study	Intervention + follow-up: In hospital
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Adults 18 years or older
Subgroup analysis within study	Not applicable
Inclusion criteria	None stated
Exclusion criteria	None stated
Age, gender and ethnicity	Age - Range of means: 43 to 42 years. Gender (M:F): 67.5 to 70% male. Ethnicity: Not reported
Further population details	
Extra comments	All trauma patients admitted to a level 1 trauma facility during two sequential 3 month time periods (1 Jan to 30 June 1995).
Indirectness of population	No indirectness
Interventions	(n=240) Intervention 1: Three-tier system (POST) implementation. The initial top tier (see PRE details in intervention 2 below) was split into two immediate trauma team response categories: category I and II. • The responders for each category differ in that the full trauma team (see details in intervention 2 below) responds to category I while the trauma attending and anaesthesia attending are not required to be immediately present for category II patients. Duration 3 months (from 1 April to 30 June 1995). Concurrent medication/care: None stated Further details: 1. By triaging tool: Triaging tool 2. The criteria for inclusion in category I were based on purely physiological derangements, while those for category II were based on mechanism of injury. • Category I triage criteria: Penetrating trauma to head, neck, chest, abdomen, groin and proximal extremities, haemodynamic instability: SBP < 90mmHg, HR > 120 bpm, airway trauma or respiratory distress, GCS < 13, confusion, violence, altered sensorium, paralysis, focal neurological deficit, major amputation. Any patients/situation deemed appropriate by the responsible attending in emergency medicine or trauma (that is, multiple victims). • Category II triage criteria: Distal extremity, penetrating injury without vascular compromise, haemodynamic stability with significance mechanism of injury, helicopter transports that do not meet category I criteria, major burns

Study	Kaplan 1997[140]
	without airway involvement. Any patient/situation deemed appropriate by the responsible emergency medicine or trauma attending (that is, EMS requests a trauma alert but provides no other information). • Consultation patients stayed as those not captured by the criteria for the top two tiers. (n=197) Intervention 2: Two tiered system. Pre-implementation period (PRE). • Trauma alert: The physician component of the trauma service consists of an American College of Surgeons Board certified attending surgeon, a PGY-4 or PGY-5 general surgery resident (who serves as the chief resident on the trauma service) and a PGY-3 and PGy-1 general surgery resident. During the day, a trauma nurse coordinator also attends trauma resuscitations. At night this role is filled by the nurse shift supervisor. Also attending: anaesthetist, operating room charge nurse, respiratory therapist, radiology technician/CT scan technologist, social worker and orderly. • Trauma consultation: The EM team initially evaluating the trauma patient is composed of an American College of Emergency Physicians Board attending EM physician, a post-graduate year three EM resident, and/or a post-graduate year one EM intern as well as an ED registered nurse Duration 3 months (from 1 Jan to 31 March 1995). Concurrent medication/care: None stated Further details: 1. By triaging tool: Triaging tool 1 (Two-tiered system): • Patients triaged to immediate evaluation by the trauma team as trauma alerts with criteria based on physiological derangement and/or mechanism of injury: Results from emergency medical services based on mechanisms or vital signs, initial trauma score ≤ 12, request of emergency medicine attending, multiple simultaneous victims. • Routine consultation after preliminary emergency medicine staff evaluation if trauma patient does not meet alert criteria.
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: THREE-TIERED versus TWO-TIERED

Protocol outcome 1: Mortality
- Actual outcome for Adults 18 years or older: Mortality (surviving to discharge) at In hospital; POST (3-tiered): 229/240, PRE (2-tiered): 187/197; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome for Adults 18 years or older: Mortality (dead at any time after presenting to the ED) at In hospital; POST (3-tiered): 13/240, PRE (2-tiered): 11/197; Risk of bias: High; Indirectness of outcome: No indirectness
- Actual outcome for Adults 18 years or older: Mortality (dead following admission to the hospital) at In hospital; POST (3-tiered): 5/240, PRE (2-tiered): 9/197; Risk of bias: High; Indirectness of outcome: No indirectness

Study	Kaplan 1997[140]
Protocol outcome 2: Complication rates - Actual outcome for Adults 18 years or older: Complications (overall) at ED; POST (3-tiered): 17/240, PRE (2-tiered): 22/197; Risk of bias: High; Indirectness of outcome: No indirectness - Actual outcome for Adults 18 years or older: Complication rate per person at ED; POST (3-tiered): mean 0.12 (SD 0.48); n=240, PRE (2-tiered): mean 0.17 (SD 0.52); n=197; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 3: Time in ED - Actual outcome for Adults 18 years or older: Overall ED time (hours) at ED; POST (3-tiered): mean 3.53 (SD 2.14); n=240, PRE (2-tiered): mean 3.98 (SD 2.81); n=197; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life; Time to CT; Missed/delayed diagnosis of injury; Trauma team member time; Delays to transfer

Table 7: Tinkoff 1996[251]

Study	Tinkoff 1996[251]
Study type	Before and after study
Number of studies (number of participants)	1 (n=Total: 1123; POST (2-tiered team): 542; PRE (non-tiered team): 581)
Countries and setting	Conducted in USA; Setting: State-designated Level I Trauma Centre serving a regional suburban/urban population of approximately one million.
Line of therapy	Not applicable
Duration of study	Intervention time: One year (POST tiered team implementation six months, PRE tiered team implementation six months)
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	People treated at a major trauma centre
Subgroup analysis within study	Not applicable
Inclusion criteria	All consecutive Trauma Service admissions (trauma patients requiring hospitalisation)
Exclusion criteria	ED deaths, ED discharges, and patients leaving against medical advice were excluded as they did not represent Trauma Service admissions. Inter-hospital transfers were also excluded as a major portion of the initial evaluation of these patients was performed at another facility.
Age, gender and ethnicity	Age - Mean (SD): POST: 34.4 (no SD reported); PRE: 35.7 (no SD reported). Gender (M:F): Not reported. Ethnicity: Not

Study	Tinkoff 1996[251]
	reported
Further population details	
Indirectness of population	No indirectness
Interventions	(n=581) Intervention 1: Trauma teams - Advanced. PRE-tiered trauma response. All patients received what later became the higher-level trauma response. Trauma Code defined as response to patients with recognised life-threatening or limb-threatening injury. Trauma code response team includes eleven people: emergency medicine attending, 2-3 emergency medicine residents or trauma service residents, two ED nurses (one procedure, one documentation), respiratory therapist, trauma chief resident, anaesthesia, trauma attending x-ray technician or runner ED technician, trauma service nurse. . Duration January 1, 1992 to June 30, 1992 (6 months). Concurrent medication/care: The operating room, CT technologist and ICU all prepare to receive the patient immediately. The blood bank prepares universal donor blood. Further details: 1. By triaging tool: Triaging tool 1 (Non-tiered trauma response: Vital signs and level of consciousness: witnessed arrest, BP <90 despite ALS, obvious ventilatory compromise, GCS <8. Anatomy of injury: obvious major vascular injury/external haemorrhage, sever maxillofacial injury with potential airway compromise, large wounds, multiple open fractures, major amputation proximal to elbow or knee, suspected head injury (GCS <12) with major torso or extremity injury suspected or present. Mechanism of injury: GSW, major impaling. Logistical: haemodynamic deterioration, simultaneous arrival of 3 or more multitrauma patients.). (n=542) Intervention 2: Trauma teams - Standard. Introduction of two-tiered trauma response - the higher-level trauma code used pre-tiered trauma response stayed the same but a lower level response, or trauma alert, was defined for those with potentially life-threatening or limb-threatening injury. This team included eight people: an emergency medicine attending, 3 emergency medicine residents or one EMR and 2 trauma service residents, two ED nurses (one procedure, one documentation), respiratory therapist, trauma chief resident, trauma attending x-ray technician or runner ED technician, trauma service nurse. . Duration January 1, 1994 to June 30, 1994 (six months). Concurrent medication/care: The operating room, CT technologist, ICU and blood bank are alerted. Further details: 1. By triaging tool: Triaging tool 2 (Introduction of new trauma alert triage criteria: Vital signs and level of consciousness: BP <90, respiratory rate <10 or >30, GCS <12. Anatomy of injury: all penetrating injuries, flail chest, combination of trauma with burns of 10% or inhalation injuries, two or more proximal long bone fractures, pelvic fractures, limb paralysis, amputation proximal to wrist or ankle. Mechanism of injury: ejection from vehicle, death in same passenger compartment, extrication time >20 minutes, falls >20 feet, roll-over, high-speed MVC, auto-pedestrian injury, motorcycle crash. Comorbid factors: Extremes of age <12 or >60, hostile environment, medical illnesses, presence of intoxicants, pregnancy.).

Study	Tinkoff 1996[251]
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: TWO-TIERED versus NON-TIERED Protocol outcome 1: Time in ED at Define - Actual outcome for people treated at a major trauma centre: Emergency department length of stay (all patients) at Six months; POST (2-tiered): mean 241 minutes (SD 137); n=512, PRE (non-tiered): mean 289 minutes (SD 149); n=532; Risk of bias: High; Indirectness of outcome: No indirectness - Actual outcome for people treated at a major trauma centre: Emergency department length of stay (higher-level code patients only) at Six months; POST (2-tiered): mean 167 minutes (SD 108); n=77, PRE (non-tiered): mean 195 minutes (SD 122); n=142; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life at Define; Complication rates at Define; Delays to transfer at Define; Time to CT at Define; Missed/delayed diagnosis of injury at Define; Trauma team member time at Define; Mortality at Define

G.3 A trauma service providing continuity of care

Table 8: Davenport 2010[69]

Study	Davenport 2010[69]
Study type	Retrospective cohort study
Number of studies (number of participants)	(n=75325)
Countries and setting	Conducted in United Kingdom
Line of therapy	First-line
Duration of study	Intervention time: Audit of data 2000-2005
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Major trauma patients as recorded by TARN
Stratum	Overall
Subgroup analysis within study	Patients in shock (SBP < 100 mmHg), critically injured patients (ISS > 24), major head injury (>2 on AIS), and patients transferred indirectly. Post-hoc subgroup analyses to compare multidisciplinary ward care in 2000/2004 and multidisciplinary ward care + trauma unit, and to examine unexpected survival in multidisciplinary ward care in 2003 and

	2004.
Inclusion criteria	Patients' data as reported in the Trauma Audit and Research Network (TARN) for England and Wales and the Royal London Hospital (RLH) trauma registries.
Exclusion criteria	Patients discharged <3 days of admission, patients with fragility fractures or single uncomplicated limb injuries
Recruitment/selection of patients	Patient data recorded between 2000-2005
Age, gender and ethnicity	Age - Median (IQR): 48 years (31-67). Gender (M:F): 43529/31796. Ethnicity: Not reported
Further population details	
Indirectness of population	No indirectness
Interventions	(n=unclear) Intervention 1: Multidisciplinary trauma ward - Multidisciplinary trauma ward (trauma consultant). Multidisciplinary trauma service at the Royal Hospital of London in the years 2003-2004. The multidisciplinary formed in 2003 with overall responsibility for all trauma patients. A formal performance improvement programme was introduced to review all deaths and serious morbidities, and to quality assure the development and implementation of management guidelines. Local acute hospitals were given a single contact point for secondary transfers, the unit adopted a policy of automatic acceptance, and the ethos for duty of care was transferred to the receiving trauma centre. UNCLEAR IF CARE WAS SUPERVISED BY A TRAUMA CONSULTANT OR A SUB-SPECIALTY CONSULTANT. Number of patients is unclear, as patient information only provided for patients entering the service in 2000, 2005, and between 2000-2005. Duration 2 years. Concurrent medication/care: Not described. (n=380) Intervention 2: Multidisciplinary trauma ward - Multidisciplinary trauma ward (trauma consultant). Multidisciplinary trauma service + Trauma unit at the Royal Hospital of London in 2005. This was the first year of the trauma ward, which was an addition to a multidisciplinary ward formed in 2003. The multidisciplinary unit assumed overall responsibility for all trauma patients. A formal performance improvement programme was introduced to review all deaths and serious morbidities, and to quality assure the development and implementation of management guidelines. Local acute hospitals were given a single contact point for secondary transfers, the unit adopted a policy of automatic acceptance, and the ethos for duty of care was transferred to the receiving trauma centre. UNCLEAR IF CARE WAS SUPERVISED BY A TRAUMA CONSULTANT OR A SUB-SPECIALTY CONSULTANT. Duration 1 year. Concurrent medication/care: Usual care (n=17113) Intervention 3: Speciality ward. Multi-speciality trauma care (13 hospitals). Duration 5 years. Concurrent medication/care: Not described (n=55729) Intervention 4: Non-speciality/general ward. Acute hospitals (92 hospitals). Duration 5 years. Concurrent

	medication/care: Not described
Funding	No funding

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: MULTIDISCIPLINARY TRAUMA WARD + TRAUMA UNIT versus SPECIALITY WARD

Protocol outcome 1: Mortality
- Actual outcome: Mortality (unadjusted) at discharge or 30 days after admission to hospital; Group 1: 32/380, Group 2: 1371/17113; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome: Mortality (unadjusted) ISS >15 at discharge or 30 days after admission to hospital; Group 1: 31/173, Group 2: 1145/5025; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome: Mortality (unadjusted) ISS >24 at discharge or 30 days after admission to hospital; Group 1: 30/118, Group 2: 970/2803; Risk of bias: Very high; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: MULTIDISCIPLINARY TRAUMA WARD + TRAUMA UNIT versus NON-SPECIALITY/GENERAL WARD

Protocol outcome 1: Mortality
- Actual outcome: Mortality (unadjusted) at discharge or 30 days after admission to hospital; Group 1: 32/380, Group 2: 2360/55729; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome: Mortality (unadjusted) ISS >15 at discharge or 30 days after admission to hospital; Group 1: 31/173, Group 2: 1572/5776; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome: Mortality (unadjusted) ISS >24 at discharge or 30 days after admission to hospital; Group 1: 30/118, Group 2: 1210/2607; Risk of bias: Very high; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SPECIALITY WARD versus NON-SPECIALITY/GENERAL WARD

Protocol outcome 1: Mortality
- Actual outcome: Mortality (unadjusted) at discharge or 30 days after admission to hospital; Group 1: 1371/17113, Group 2: 2360/55729; Risk of bias: Very high; Indirectness of outcome: No indirectness
- Actual outcome: Mortality (unadjusted) ISS >15 at discharge or 30 days after admission to hospital; Group 1: 1145/5025, Group 2: 1572/5776; Risk of bias: Very high; Indirectness of outcome: No indirectness

- Actual outcome: Mortality (unadjusted) ISS >24 at discharge or 30 days after admission to hospital; Group 1: 970/2803, Group 2: 1210/2607; Risk of bias: Very high; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SPECIALIST WARD (SAME HOSPITAL; 2000) versus MULTIDISCIPLINARY TRAUMA WARD + TRAUMA UNIT Protocol outcome 1: Mortality - Actual outcome: Mortality (unadjusted) at discharge or 30 days after admission to hospital; Group 1: 56/484, Group 2: 32/380; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Mortality (unadjusted) ISS >15 at discharge or 30 days after admission to hospital; Group 1: 55/161, Group 2: 31/173; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Mortality (unadjusted) ISS >24 at discharge or 30 days after admission to hospital; Group 1: 47/99, Group 2: 30/118; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Mortality (adjusted) at discharge or 30 days after admission to hospital; Other: Specialist W = 2.6 CI = 3 - 7.6; MDM + TU W= 11.2 CI = 6.2 - 16.4 (estimated from graph); Risk of bias: High; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: SPECIALIST WARD (SAME HOSPITAL; 2004) versus MULTIDISCIPLINARY TRAUMA WARD + TRAUMA UNIT Protocol outcome 1: Length of stay - Actual outcome: Hospital length of stay (ISS >15; 1000 patients before compared with first 1000 patients after introduction of dedicated trauma service) at unclear; Group 1: mean 20 days (SD 47.5); n=1000, Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Hospital length of stay (ISS >24; 1000 patients before compared with first 1000 patients after introduction of dedicated trauma service) at unclear; Group 1: mean 25 days (SD 74.64); n=1000, Group 2: mean 14 days (SD 74.64); n=1000; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Critical care length of stay (ISS >15; 1000 patients before compared with first 1000 patients after introduction of dedicated trauma service) at unclear; Group 1: mean 3 days (SD 7.23); n=1000, Group 2: mean 2 days (SD 7.23); n=1000; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Critical care length of stay (ISS >24; 1000 patients before compared with first 1000 patients after introduction of dedicated trauma service) at unclear; Group 1: mean 5 days (SD 20.84); n=1000, Group 2: mean 3 days (SD 20.84); n=1000; Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life; Readmission (ICU and hospital); Unscheduled reoperation; Patient and carer experience

Table 9: Groven 2011[114]

Study	**Groven 2011[114]**

Study type	Historical controlled study
Number of studies (number of participants)	(n=7247)
Countries and setting	Conducted in Norway; Setting: Level 1 trauma centre
Line of therapy	Adjunctive to current care
Duration of study	Intervention time: 7 years
Method of assessment of guideline condition	Adequate method of assessment/diagnosis: Patients admitted through trauma team activation, patients with penetrating injuries proximal to the elbow or knee, or patients with ISS > 8
Stratum	Overall
Subgroup analysis within study	Not stratified but pre-specified: Population; severe injury (ISS > 15) and critical injury (ISS > 24)
Inclusion criteria	Patients admitted through trauma team activation, patients with penetrating injuries proximal to the elbow or knee, or patients with ISS > 8 admitted to the trauma centre directly or via a local hospital < 24 hours from injury, or admitted > 24 hours from injury when the trauma team were activated.
Exclusion criteria	Patients dead on arrival or who died in the ED within 30 minutes after admission.
Recruitment/selection of patients	Retrospective review of patients' records
Age, gender and ethnicity	Age - Other: Median = 34. Gender (M:F): 5237 male, 2010 female. Ethnicity: Not reported
Further population details	
Indirectness of population	No indirectness
Interventions	(n=4665) Intervention 1: Multidisciplinary trauma ward - Multidisciplinary trauma ward (trauma consultant). Multidisciplinary trauma team led by a surgical trauma team leader in cooperation with a consultant anaesthesiologist. A trauma medical director and a trauma coordinator were appointed. The introduction of the service led to the development of a clinical governance structure, a performance improvement framework, and specific educational programs for physicians and nurses, and well as the initiation of regional networking. In 2005, the educational program was improved, which included compulsory ATLS video coaching and an extensive and systematic trauma surgical training program. From 2007, the trauma team leader assumed a 'hands-off' position. Duration 4 years (January 2005 - December2008). Concurrent medication/care: Other infrastructure remained unchanged following implementation of multidisciplinary trauma service; the same anaesthetic personnel, emergency department and operating room nurses, blood bank, laboratory, and radiology and intensive care unit staff.

	(n=2582) Intervention 2: Non-speciality/general ward. Hospital provided the full spectrum of trauma care. Criteria for trauma team activation and an institutional trauma manual. The authors report that clinicians faced increasing surgical subspecialisation and non-operative management of blunt trauma cases, the surgeons filling the roles as trauma team leaders had decreasing general and trauma surgical experience, and the consultant subspecialists became more elective in their approach. A review of the operative experience of the trauma team leaders revealed limitations to operative training. An internal audit in 2003 showed multiple deviations from standards of care. Duration 3 years (January 2002 - December 2004). Concurrent medication/care: Other infrastructure was unchanged prior to the implementation of the multidisciplinary trauma service; the same anaesthetic personnel, emergency department and operating room nurses, blood bank, laboratory, and radiology and intensive care unit staff.
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: MULTIDISCIPLINARY TRAUMA WARD (TRAUMA CONSULTANT) versus NON-SPECIALITY/GENERAL WARD Protocol outcome 1: Mortality - Actual outcome: Unadjusted mortality at 30 days; Group 1: 261/4665, Group 2: 218/2582; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Unadjusted mortality (ISS>15) at 30 days; Group 1: 237/1947, Group 2: 206/1081; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Unadjusted mortality (ISS>24) at 30 days; Group 1: 196/994, Group 2: 184/614; Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: Adjusted mortality (TRISS) at 30 days; Other: Multidisciplinary team W = 1.44 CI = .90 - 1.99 (n=4659); General ward W = 0.06 CI = -.70 - .82 (n=2582); Risk of bias: High; Indirectness of outcome: No indirectness - Actual outcome: Adjusted mortality (TRISS) ISS>15 at 30 days; Other: Multidisciplinary care W = 3.40 CI = 2.18 - 4.62 (n=1947); General ward W = -.01 CI = -1.71 - 1.69 (n=1081); Risk of bias: High; Indirectness of outcome: No indirectness - Actual outcome: Adjusted mortality (TRISS) ISS>24 at 30 days; Other: Multidisciplinary care W = 6.08 CI = 4.00 - 8.17 (n=994); General ward W = 0.11 CI = -2.59 - 2.81 (n=614); Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life; Length of stay; Time to definitive treatment; Readmission (ICU and hospital); Unscheduled reoperation; Patient and carer experience

G.4 Continuity of care: the trauma coordinator role

Table 10: Curtis 2002[65]

Study	Curtis 2002[65]
Study type	Retrospective cohort study
Number of studies (number of participants)	2 (n=486)
Countries and setting	Conducted in Australia; Setting: St Georges Hospital is a 600 bed teaching hospital of the University of New South Wales. Designated Trauma Centre
Line of therapy	--Please Select--
Duration of study	Intervention time:
Method of assessment of guideline condition	Partially adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	data collected from hospital trauma database on patients who met the following criteria: 1) were in the trauma database entry for pre-specified conditions 2) ISS<16 and 3) Age: 15-69 years
Exclusion criteria	Inter-hospital transfer and ICU patients
Recruitment/selection of patients	Trauma database
Age, gender and ethnicity	Age - Range: 15-69 years. Gender (M:F): Not Reported. Ethnicity:
Further population details	1. Injury severity: Overall/mixed (ISS <8 and ISS 8-15).
Indirectness of population	Serious indirectness: Study population with ISS<16. All population not necessarily Major Trauma
Interventions	(n=148) Intervention 1: Trauma coordinator - Clinical. Full time TCM Positions via two Trauma nurses. Case managers were on duty between 9am to 5 pm Mon-Fri and 11 am-5pmInterventions provided by the TCM nurses were: 1) Daily ward round and review of patient notes2) Identifying and addressing any conflict in medical orders or lack of management plan3) Collaborating between multiple caregivers and fostering communication between teams and paramedical and nursing staff4) Identifying barriers to discharge and contacting relevant personnel to overcome these5) Organising pathologic or radiologic examination and subsequent review in priority cases6) Documentation in medical notes of any intervention or alteration in patient care7) Encouraging regular patient review and documentation of the management plan by the admitting team8) Informing the multiple teams, nursing, and allied health staff (physiotherapy, occupational therapy, and social work) and patient of a new development9) Building a rapport by providing continuity of care with patients and acting as their advocate10) Reassuring patients by ensuring

Study	Curtis 2002[65]
	they and their families are kept well informed. Duration August 2000-Jan 2001(5 month). Concurrent medication/care: NA Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Not applicable/Not stated/Unclear 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=338) Intervention 2: No trauma coordinator. 12 months prior to the implementation of TCM (August 2000). Duration July 1999-July 2000(12 months). Concurrent medication/care: NA Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Not applicable/Not stated/Unclear 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: TCM versus CONTROL Protocol outcome 1: On-going consequential morbidity at Define - Actual outcome: Missed Injury Detection at 5 month; Group 1: 8/149, Group 2: 2/327; Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Overall Complication Rate at 5 month; Group 1: 9/149, Group 2: 21/327; Risk of bias: Very high; Indirectness of outcome: Serious indirectness - Actual outcome: Days to Allied Health Intervention at 5 month; Other: Median Days to Allied Health Intervention was 2.71 in the TCM group and 3.25 in the control group; Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Patients receiving Allied Health Intervention (%) at 5 month; Group 1: 80/149, Group 2: 87/327; Risk of bias: High; Indirectness of outcome: Serious indirectness Protocol outcome 2: Total hospital length of stay at Define - Actual outcome: Median Overall LOS at August 2000 to Jan 2001 (5 month); Other: Median LOS is 3 in TCM group and 4 in control group (p value is 0.606); Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Median LOS ISS 8-15 at August 2000 to Jan 2001 (5 month); Other: Median LOS in TCM=3 and Control=5 (p value is 0.712); Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Median LOS Age >50 years at August 2000 to Jan 2001 (5 month); Other: Median LOS was 4 in the TCM group and 6 in the control group (p value is 0.084); Risk of bias: High; Indirectness of outcome: Serious indirectness	
Protocol outcomes not reported by the study	Mortality at Define; Quality of life at Define; Adverse incident report severity at Define; Time in acute setting at Define; Number of procedures at Define; Time to rehab prescription at Define; ICU length of stay at Define; Impact of traumatic event on concurrent comorbidities at Define; Patient and carer satisfaction at Define; Healthcare staff satisfaction at Define

Table 11: Curtis 2006[67]

Study	Curtis 2006[67]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=1541)
Countries and setting	Conducted in Australia; Setting: Study hospital is a 600 bed teaching hospital of a major university. Level One Trauma Centre
Line of therapy	--Please Select--
Duration of study	Intervention time:
Method of assessment of guideline condition	Partially adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	All patients who fulfilled pre-existing trauma database entry criteria during the study period 1st of March 2002 to 8th May 2003
Exclusion criteria	None
Recruitment/selection of patients	TCM group: Consecutive patients admitted to the trauma centre during the first 14 months after implementation of the TCM program control group: Consecutive patients admitted to the trauma centre during the first 14 months prior to implementation of the TCM program
Age, gender and ethnicity	Age - Median (range): TCM: 36 and Control: 32. Gender (M:F): 528:531. Ethnicity: Not Reported
Further population details	1. Injury severity: Overall/mixed (Overall mean (?) ISS for both groups was 9 each.).
Indirectness of population	Serious indirectness: Population included patients with ISS <9, ISS 9-15 and ISS>15. Cannot determine if all data/outcomes can be attributed to Major Trauma
Interventions	(n=755) Intervention 1: Trauma coordinator - Clinical. TCM was provided 7 days a week to all trauma patient admissions and after hours to 11pm on Wednesdays, Thursday and Friday to an average of 15-20 inpatients per day. Interventions commonly performed by the TCM were: a) attending initial patient resuscitation and assisting clinically in the Emergency Department, b) communicating the patient plan with all parties involved including the clinicians, the patient and the family, c) ensuring documentation of the patient management plan and , d) identifying barriers to discharge. A checklist of standard TCM interventions was kept and updated daily for each patient over the course of the admission. Duration 14 months. Concurrent medication/care: None Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Not applicable/Not stated/Unclear 3. Service set-up: Not applicable/Not stated/Unclear 4. Stage of trauma network development: Not applicable/Not stated/Unclear

Study	Curtis 2006[67]
	(n=786) Intervention 2: No trauma coordinator. Prior to implementation of the TCM group. Duration 14 months. Concurrent medication/care: NA Further details: 1. Concurrent care delivery: 2. Healthcare system: 3. Service set-up: 4. Stage of trauma network development:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: TRAUMA CASE MANAGEMENT (TCM) versus CONTROL

Protocol outcome 1: Mortality at Define
- Actual outcome: Number of Deaths at 14 Months; Group 1: 37/755, Group 2: 38/786; Risk of bias: High; Indirectness of outcome: Serious indirectness

Protocol outcome 2: On-going consequential morbidity at Define
- Actual outcome: Number of occurrences of Respiratory Failure at 14 Months; Group 1: 15/755, Group 2: 26/786; Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome: Number of occurrences of Coagulopathy at 14 Months; Group 1: 17/755, Group 2: 23/786; Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome: Number of occurrences of Missed Injuries Detect at 14 Months; Group 1: 31/755, Group 2: 35/786; Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome: Number of occurrences of Deep Vein Thrombosis (DVT) at 14 Months; Group 1: 1/755, Group 2: 7/786; Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome: Number of Operations at 14 Months; Group 1: 396/755, Group 2: 479/786; Risk of bias: High; Indirectness of outcome: Serious indirectness

Protocol outcome 3: Total hospital length of stay at Define
- Actual outcome: Median LOS in days in Paediatric population at 14 Months; Other: LOS in TCM and control group is 2 days. Authors report this as a significant result of 0.05 with LOS decreasing. There could possibly have been a typo in the results (p value 0.05); Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome: Median LOS (in days) in Age 45-64 population at 14 Months; Other: Median LOS for patients aged 45-64 years was 5 days in TCM group and 7 in control group (p value 0.353); Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome: Total Hospital LOS at 14 Months; Other: 7655 days in TCM group and 8464 in control group (p value 0.499); Risk of bias: High; Indirectness of outcome: Serious indirectness
- Actual outcome: Median LOS in days in moderately/severely injured patient groups at 14 Months; Other: No data reported for outcome. The authors report that reductions in LOS were most evident in the moderately (ISS 9-15) and severely (ISS>15) patient groups (Not Reported Not Reported); Risk of bias: High; Indirectness of outcome: No indirectness

Study	Curtis 2006[67]
	- Actual outcome: Median LOS (in days) in Age 15-44 population at 14 Months; Other: Median LOS in both TCM and control groups was 4 (p value 0.753); Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Median LOS (in days) in Age >64 population at 14 Months; Other: Median LOS was 10 in TCM group and 9 in control group (p value 0.243); Risk of bias: High; Indirectness of outcome: Serious indirectness Protocol outcome 4: Time in acute setting at Define - Actual outcome: Number of occurrences of unplanned ICU visits at 14 Months; Group 1: 6/755, Group 2: 14/786; Risk of bias: High; Indirectness of outcome: Very serious indirectness Protocol outcome 5: Number of procedures at Define - Actual outcome: Number of people receiving Allied Health Intervention (Occupational Therapy) at 14 Months; Group 1: 249/755, Group 2: 212/786; Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Number of people receiving Allied Health intervention (Physiotherapy) at 14 Months; Group 1: 415/755, Group 2: 354/786; Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Number of people receiving Allied Health intervention (Social Work) at 14 Months; Group 1: 279/755, Group 2: 252/786; Risk of bias: ; Indirectness of outcome: Very serious indirectness Protocol outcome 6: Time to rehab prescription at Define - Actual outcome: Median days to Physiotherapy intervention at 14 Months; Other: median days in TCM=1.5 and Control=1.9 (p value=0.036); Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Median days to Occupational Therapy intervention at 14 Months; Other: Median days on TCM group=3.5 and control group=5 (p value is 0.004); Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Median days to Social Work assessment at 14 Months; Other: Median days in TCM group=3 and control=3 (p value=0.445); Risk of bias: High; Indirectness of outcome: Serious indirectness
Protocol outcomes not reported by the study	Quality of life at Define; Adverse incident report severity at Define; ICU length of stay at Define; Impact of traumatic event on concurrent comorbidities at Define; Patient and carer satisfaction at Define; Healthcare staff satisfaction at Define

Table 12: Fanta 2006[100](Shebesta 2006[233])

Study (subsidiary papers)	Fanta 2006[100](Shebesta 2006[233])
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	(n=76)

Study (subsidiary papers)	Fanta 2006[100](Shebesta 2006[233])
Countries and setting	Conducted in USA; Setting: Cincinnati Children's Hospital Medical Centre (CCHMC)-LEVEL 1 Paediatrics Trauma Centre
Line of therapy	--Please Select--
Duration of study	Intervention time:
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Define
Exclusion criteria	Children who were admitted to the ICU, taken to the operating room for any chest, abdominal, or head injury; sustained injury caused by suspected child abuse; or with long-standing medical condition
Recruitment/selection of patients	All families with a child between the ages of 2 months and 17 years admitted to the trauma service between April-Nov 2003
Age, gender and ethnicity	Age - Median (range): 2 months-17 years. Gender (M:F): PNP group M:17 F: 14 RES group M:31 f:14. Ethnicity:
Further population details	1. Injury severity: Low injury severity (ISS, GCS, RTS) (average in PNP group=4.39 and RES group=6.60).
Extra comments	PNP group and RES groups did not differ in age or ethnicity. There were no statistical differences in the ISS or cost of patient care between the two groups either
Indirectness of population	Very serious indirectness: Only in the Paediatric population. PNP ISS=4.39 and RES ISS 6.60.Enrollment limited to non-ICU and non-operative patients
Interventions	(n=31) Intervention 1: Trauma coordinator - Clinical. Paediatric Trauma Nurse Practitioner (PNP) - PNP's work only on weekdays. Timings not specified. MTC employed two trauma PNP's, both with over 4 years' experience, one of whom was responsible for inpatient service every weekday. Role of the PNP was re-engineered in January 2002 to a joint practise model (physician and trauma PNP) Trauma PNP assumes primary care of mild to moderately acutely injured children admitted to hospital and carries out the following tasks:1) Makes daily morning rounds with the surgical team during which a basic care plan for each patient is developed and discussed, thereby enhancing the communication process and providing direction for the trauma PNP.2) Performs a comprehensive patient/family assessment which included a complete history and physical examination of the child as well as the determination of the family's psychosocial needs and concerns3) Communicates to specialist services 4) Collects and interprets diagnostic data 5) Orders writing for therapeutic interventions6) Discharges patients. Duration April-November 2003 (8 months). Concurrent medication/care: If patient assigned to PNP group, the PNP took full responsibility for the patients care until discharge. Patients admitted on Monday, Tuesday, Wednesday or Thursday were prospectively randomised to PNP group Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Not applicable/Not stated/Unclear 3.

Study (subsidiary papers)	Fanta 2006[100](Shebesta 2006[233])
	Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=45) Intervention 2: No trauma coordinator. Full care managed by Resident Clinicians (RES) from admission to discharge. Duration April-November 2003 (8 months). Concurrent medication/care: Patients admitted on Friday, Saturday or Sunday were prospectively randomised to RES group Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Not applicable/Not stated/Unclear 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PNP versus RES Protocol outcome 1: Total hospital length of stay at Define - Actual outcome: Hospital LOS at 8 months; Group 1: mean 1.03 Days (SD 0.18); n=31, Group 2: mean 1.31 Days (SD 0.73); n=45; Risk of bias: High; Indirectness of outcome: Very serious indirectness Protocol outcome 2: Patient and carer satisfaction at Define - Actual outcome: Parent satisfaction of care at 8 months; Other: ; Risk of bias: Very high; Indirectness of outcome: Very serious indirectness - Actual outcome: Nurse satisfaction regarding care of trauma provider at 8 months; Other: 65 nurses completed the surveys. PNP: 31 and RES: 34; Risk of bias: Very high; Indirectness of outcome: Very serious indirectness	
Protocol outcomes not reported by the study	Mortality at Define; Quality of life at Define; On-going consequential morbidity at Define; Adverse incident report severity at Define; Time in acute setting at Define; Number of procedures at Define; Time to rehab prescription at Define; ICU length of stay at Define; Impact of traumatic event on concurrent comorbidities at Define; Healthcare staff satisfaction at Define

Table 13: Haan 2007[117]

Study	Haan 2007[117]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=41702)
Countries and setting	Conducted in USA; Setting: R Adams Cowley Shock and Trauma Centre, Baltimore, Maryland, USA
Line of therapy	--Please Select--

Study	Haan 2007[117]
Duration of study	Intervention time:
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Define
Exclusion criteria	Define
Recruitment/selection of patients	Trauma registry and trauma management database were used to determine total admissions, number of patients who stayed longer than 24 hours, LOS and the number of hours the centre was in bypass mode Quality management database (created from a nursing quality database and Weekly trauma morbidity mortality conference in which all cases are reviewed) Rates of calls to the Outpatients department and evening call centre after discharge and unplanned walk ins for visits
Age, gender and ethnicity	Age - Other: . Gender (M:F): Not stated. Ethnicity:
Further population details	1. Injury severity: Overall/mixed (Average ISS was roughly >14 and increased over the years, with the average ISS being 16.7 in the final year of study).
Indirectness of population	Serious indirectness: Average ISS in the population was >14 and increased over the years
Interventions	(n=41702) Intervention 1: Trauma coordinator - Clinical. Certified Registered Nurse Practitioners attend discharge rounds which are timed to coincide with the end of work rounds, early enough in the day to facilitate implementation of any discharge plans needed. At each patient's room/bedside a brief history, problem list and treatment plan is presented by the CRNP (which originally used to be presented by the trauma fellow (clinician). Allied Health Services then add their perspective and subspecialists likewise clarify operative planned and discharge needs. The Case Manager (separate entity) then summarizes the discharge plan, considering patient and family wishes. Duration June 2002 to May 2004 (2 years). Concurrent medication/care: Two CRNP's were added to each Trauma Team with each working 5 days per week and maintaining real continuity of care on each service Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Not applicable/Not stated/Unclear 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=41702) Intervention 2: No trauma coordinator. Fellows and senior residents staffed discharge rounds. Duration June 1999 to May 2001 (2 years). Concurrent medication/care: None Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Not applicable/Not stated/Unclear 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear

Study	Haan 2007[117]
Funding	Academic or government funding
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CERTIFIED NURSE PRACTICTIONER (CRNP) versus CONTROL Protocol outcome 1: Mortality at Define - Actual outcome: Deaths Per 100 Admissions at Control Period: June 99-May 01; CRNP Period: June 02- May 04; Group 1: 590/14040, Group 2: 654/13919; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 2: Total hospital length of stay at Define - Actual outcome: Total Hospital LOS at Control Period: June 99-May 01; CRNP Period: June 02- May 04; Mean CRNP group: 8.2 and control group: 7.5; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 3: Time in acute setting at Define - Actual outcome: Number of hours MTC could not accept new admissions at Control Period: June 99-May 01; CRNP Period: June 02- May 04; Mean CRNP group: 3.5 hours and control group : 10 hours; Risk of bias: High; Indirectness of outcome: No indirectness Protocol outcome 4: Number of procedures at Define - Actual outcome: Unexpected Readmissions to ICU per 100 ICU discharges at Control Period: June 99-May 01; CRNP Period: June 02- May 04; Group 1: 463/14040, Group 2: 1072/13919; Risk of bias: High; Indirectness of outcome: No indirectness - Actual outcome: Unexpected Readmissions per 100 live discharges at Control Period: June 99-May 01; CRNP Period: June 02- May 04; Group 1: 154/14040, Group 2: 445/13919; Risk of bias: High; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life at Define; On-going consequential morbidity at Define; Adverse incident report severity at Define; Time to rehab prescription at Define; ICU length of stay at Define; Impact of traumatic event on concurrent comorbidities at Define; Patient and carer satisfaction at Define; Healthcare staff satisfaction at Define

Table 14: Jarrett 2009[131]

Study	Jarrett 2009[131]
Study type	Retrospective cohort study
Number of studies (number of participants)	Not Reported (n=Not reported)
Countries and setting	Conducted in USA; Setting: Charleston Area Medical Centre, West Virginia, USA
Line of therapy	--Please Select--

Study	Jarrett 2009[131]
Duration of study	Not clear:
Method of assessment of guideline condition	Method of assessment /diagnosis not stated
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Not stated
Exclusion criteria	Not stated
Recruitment/selection of patients	No clear mention of where data was taken from; possibly trauma registry. Data from MTC of interest (CAMC) is compared against the National Trauma Data Bank (NTDB)-national trauma databank from trauma in the US and Puerto Rico
Age, gender and ethnicity	Age - --: Gender (M:F): Not reported. Ethnicity:
Further population details	1. Injury severity: Overall/mixed (Comparison of LOS by ISS scores).
Extra comments	The population consists of an overall mix of ISS scores ranging from 1-75 and have been divided into groups corresponding to a particular ISS range.
Indirectness of population	No indirectness: No mention of the actual population being compared in the study
Interventions	(n=1) Intervention 1: Trauma coordinator - Clinical. Charleston Area Medical Centre (CAMC) measure of LOS in the year 2004 with increased advancement of responsibility of the role of the NP with time. Duration 2 years. Concurrent medication/care: Primary focus of the NP is to decrease length of hospital stay. NP's are consistent members of a multidisciplinary team where clinicians rotate weekly or bi-weekly. Some overlap with the case coordinator role; the difference being that the NP drives the discharge plan in collaboration with the senior clinicians while the case coordinator determines the feasibility and financial plans for discharge options. Main role includes: 1) working with consultants to develop their plan of care and determining/establishing a payor source if needed. 2) Trauma patients are followed by the NP along the continuum from ICU to discharge3)NP works with all disciplines of the team (for example, occupational therapists, social workers, case co-ordinators to determine appropriate discharge destination of the patient and work toward that goal on a daily basis4) NP contributes to trauma registry by completing pre-and post-discharge Functional Independence Measures to evaluate outcomes in the trauma population5) contributes to the expanse and dissemination of knowledge through research. On a daily basis, the NP act as an educational resource to the nursing staff and also provide formal education as well Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Private healthcare system 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=1) Intervention 2: No trauma coordinator. Benchmark utilised by the CAMC to measure LOS is the 'National

Study	Jarrett 2009[131]
	Trauma Data Bank (NTDB)'. It is not clear if the data held in the NTDB database is representative of data for LOS in MTC functioning without TC's. Duration 5 years. Concurrent medication/care: NA Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Private healthcare system 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=1) Intervention 3: Trauma coordinator - Clinical. First NP was hired in 1999. However, from 2003-2006, then various steps have been implemented to decrease the LOS and to grow the NP role . Duration 1 year. Concurrent medication/care: Primary focus of the NP is to decrease length of hospital stay. NP's are consistent members of a multidisciplinary team where clinicians rotate weekly or bi-weekly. Some overlap with the case coordinator role; the difference being that the NP drives the discharge plan in collaboration with the senior clinicians while the case coordinator determines the feasibility and financial plans for discharge options. Main role includes: 1) working with consultants to develop their plan of care and determining/establishing a payor source if needed. 2) Trauma patients are followed by the NP along the continuum from ICU to discharge3)NP works with all disciplines of the team (for example, occupational therapists, social workers, case co-ordinators to determine appropriate discharge destination of the patient and work toward that goal on a daily basis4) NP contributes to trauma registry by completing pre-and post-discharge Functional Independence Measures to evaluate outcomes in the trauma population5) contributes to the expanse and dissemination of knowledge through research. On a daily basis, the NP act as an educational resource to the nursing staff and also provide formal education as well Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Private healthcare system 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=1) Intervention 4: Trauma coordinator - Clinical. CAMC LOS for 2006 with further steps taken to reduce LOS within the NP role. Duration 5 years. Concurrent medication/care: Primary focus of the NP is to decrease length of hospital stay. NP's are consistent members of a multidisciplinary team where clinicians rotate weekly or bi-weekly. Some overlap with the case coordinator role; the difference being that the NP drives the discharge plan in collaboration with the senior clinicians while the case coordinator determines the feasibility and financial plans for discharge options. Main role includes: 1) working with consultants to develop their plan of care and determining/establishing a payor source if needed. 2) Trauma patients are followed by the NP along the continuum from ICU to discharge3)NP works with all disciplines of the team (for example, occupational therapists, social workers, case co-ordinators to determine appropriate discharge destination of the patient and work toward that goal on a daily basis4) NP contributes to trauma registry by completing pre-and post-discharge Functional Independence Measures to evaluate outcomes in the trauma population5) contributes to the expanse and dissemination of knowledge through research. On a daily basis, the NP act as an educational resource to the nursing staff and also provide formal education as well Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Private healthcare system 3. Service set-

Study	Jarrett 2009[131]
	up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=1) Intervention 5: Trauma coordinator - Clinical. CAMC LOS for 2001 with further steps taken to reduce LOS within the NP role. Duration 1 year. Concurrent medication/care: Primary focus of the NP is to decrease length of hospital stay. NP's are consistent members of a multidisciplinary team where clinicians rotate weekly or bi-weekly. Some overlap with the case coordinator role; the difference being that the NP drives the discharge plan in collaboration with the senior clinicians while the case coordinator determines the feasibility and financial plans for discharge options. Main role includes: 1) working with consultants to develop their plan of care and determining/establishing a payor source if needed. 2) Trauma patients are followed by the NP along the continuum from ICU to discharge3)NP works with all disciplines of the team (for example, occupational therapists, social workers, case co-ordinators to determine appropriate discharge destination of the patient and work toward that goal on a daily basis4) NP contributes to trauma registry by completing pre-and post-discharge Functional Independence Measures to evaluate outcomes in the trauma population5) contributes to the expanse and dissemination of knowledge through research. On a daily basis, the NP act as an educational resource to the nursing staff and also provide formal education as well Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Private healthcare system 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=1) Intervention 6: Trauma coordinator - Clinical. More advancement in the role of the NP role which were thought to have a positive effect on LOS. Duration 2 years. Concurrent medication/care: Primary focus of the NP is to decrease length of hospital stay. NP's are consistent members of a multidisciplinary team where clinicians rotate weekly or bi-weekly. Some overlap with the case coordinator role; the difference being that the NP drives the discharge plan in collaboration with the senior clinicians while the case coordinator determines the feasibility and financial plans for discharge options. Main role includes: 1) working with consultants to develop their plan of care and determining/establishing a payor source if needed. 2) Trauma patients are followed by the NP along the continuum from ICU to discharge3)NP works with all disciplines of the team (for example, occupational therapists, social workers, case co-ordinators to determine appropriate discharge destination of the patient and work toward that goal on a daily basis4) NP contributes to trauma registry by completing pre-and post-discharge Functional Independence Measures to evaluate outcomes in the trauma population5) contributes to the expanse and dissemination of knowledge through research. On a daily basis, the NP act as an educational resource to the nursing staff and also provide formal education as well Further details: 1. Concurrent care delivery: 2. Healthcare system: 3. Service set-up: 4. Stage of trauma network development: (n=1) Intervention 7: Trauma coordinator - Clinical. More steps taken to implement measures to reduce LOS within

Study	Jarrett 2009[131]
	the NP role. Duration 5 years. Concurrent medication/care: Primary focus of the NP is to decrease length of hospital stay. NP's are consistent members of a multidisciplinary team where clinicians rotate weekly or bi-weekly. Some overlap with the case coordinator role; the difference being that the NP drives the discharge plan in collaboration with the senior clinicians while the case coordinator determines the feasibility and financial plans for discharge options. Main role includes: 1) working with consultants to develop their plan of care and determining/establishing a payor source if needed. 2) Trauma patients are followed by the NP along the continuum from ICU to discharge3)NP works with all disciplines of the team (for example, occupational therapists, social workers, case co-ordinators to determine appropriate discharge destination of the patient and work toward that goal on a daily basis4) NP contributes to trauma registry by completing pre-and post-discharge Functional Independence Measures to evaluate outcomes in the trauma population5) contributes to the expanse and dissemination of knowledge through research. On a daily basis, the NP act as an educational resource to the nursing staff and also provide formal education as well Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Private healthcare system 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=1) Intervention 8: Trauma coordinator - Clinical. Average CAMC LOS data from 2001-2006. Duration 5 years. Concurrent medication/care: ISS 16-24 Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Not applicable/Not stated/Unclear 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=1) Intervention 9: Trauma coordinator - Clinical. Average CAMC LOS data from 2001-2006. Duration 5 years. Concurrent medication/care: ISS 25-74 Further details: 1. Concurrent care delivery: 2. Healthcare system: 3. Service set-up: 4. Stage of trauma network development:
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CAMC 2004 (ISS 16-24) versus CAMC 2006 (ISS 16-24)

Protocol outcome 1: Total hospital length of stay at Define
- Actual outcome: Effect on LOS off greater advancement of NP role with time in ISS 16-24 group at 5 years; Mean CAMC 2004: 8.7, CAMC 2006: 7.1; Risk of bias: Very high; Indirectness of outcome: No indirectness

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CAMC 2001 (ISS 16-24) versus CAMC 2004 (ISS 16-24)

Study	Jarrett 2009[131]
Protocol outcome 1: Total hospital length of stay at Define - Actual outcome: Effect on LOS off greater advancement of NP role with time in ISS 16-24 group at 5 years; Mean CAMC 2001: 8.7 , CAMC 2004: 8.7; Risk of bias: Very high; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CAMC 2001 (ISS 25-74) versus CAMC 2004 (ISS 25-74) Protocol outcome 1: Total hospital length of stay at Define - Actual outcome: Effect on LOS off greater advancement of NP role with time in ISS 25-74 group at 5 years; Mean CAMC 2001: 14.7, CAMC 2004 : 11.6; Risk of bias: Very high; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: CAMC 2004 (ISS 25-74) versus CAMC 2006(ISS 25-74) Protocol outcome 1: Total hospital length of stay at Define - Actual outcome: Effect on LOS off greater advancement of NP role with time in ISS 25-74 group at 5 years; Mean CAMC 2004: 11.6. CAMC 2006: 13.8; Risk of bias: Very high; Indirectness of outcome: No indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: AVERAGE CAMC LOS (2001-2006) FOR ISS 16-24 versus NTDB 2001-2006 Protocol outcome 1: Total hospital length of stay at Define - Actual outcome: Comparison of LOS by ISS (16-24) at 5 years (2001-2006); Mean CAMC : 8.2, NTDB: 8.5; Risk of bias: Very high; Indirectness of outcome: Serious indirectness RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: AVERAGE CAMC LOS (2001-2006) FOR ISS 25-74 versus NTDB 2001-2006 Protocol outcome 1: Total hospital length of stay at Define - Actual outcome: Comparison of LOS by ISS (25-74) at 5 years (2001-2006); Mean CAMC: 13.4 , NTDB: 13.3; Risk of bias: Very high; Indirectness of outcome: Serious indirectness	
Protocol outcomes not reported by the study	Mortality at Define; Quality of life at Define; On-going consequential morbidity at Define; Adverse incident report severity at Define; Time in acute setting at Define; Number of procedures at Define; Time to rehab prescription at Define; ICU length of stay at Define; Impact of traumatic event on concurrent comorbidities at Define; Patient and carer satisfaction at Define; Healthcare staff satisfaction at Define

Table 15: Spisso 1990[242]

Study	Spisso 1990[242]
Study type	Retrospective cohort study
Number of studies (number of participants)	1 (n=1528+1087=2615)
Countries and setting	Conducted in USA; Setting: University of California, Davis Medical Centre, USA
Line of therapy	--Please Select--
Duration of study	Other:
Method of assessment of guideline condition	Partially adequate method of assessment/diagnosis: Analysis of cost-benefit ratio of the NP's role, an assessment of the documentation of quality of care for both inpatients and outpatients, and an evaluation of the impact of the NP's on the healthcare team
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	Patients with International Classification Of Disease Diagnosis Codes from 800-904.9 and ISS scores of 13 or greater data for the year 1985-186 (pre-NP) compared with 1986-87 (post NP)
Exclusion criteria	Major trauma patients who died in the emergency department or operating room within 24 hours were excluded from the LOS analysis
Recruitment/selection of patients	Data sources used included salary and billing statistics provided from the hospital finance department, fiscal year average inpatient LOS reports, trauma patient medical record data, patient assistance department data, a time benefit survey tool and a NP evaluation tool. Data was then analysed pre- and post- implementation of NP roles
Age, gender and ethnicity	Age - --: Age not given. Gender (M:F): No stated. Ethnicity:
Further population details	1. Injury severity: Overall/mixed (13 or greater).
Indirectness of population	No indirectness
Interventions	(n=1087) Intervention 1: Trauma coordinator - Clinical. Data from the year 1986-87 (Post implementation of NP) NP's are licensed Registered Nurses who have completed additional training through an educational curriculum meeting standards set by the Board of RN and Board of QA. (Educational programs vary from an 18 month certification to a postgraduate Master's degree NP's with previous critical care background carry out following responsibilities: Clinical case management of Inpatients:1)attending morning rounds with trauma team2) helping to evaluate patient progression through the hospital course, co-ordinating follow-up of care and describing the plan of care to the families3)transcribing verbal orders and clarifying nursing staff questions during morning rounds to facilitate implementation of the team plan4)recommending appropriate treatment modalities per standardised procedures and review complex cases with the physician team and with consultation services to promote multidisciplinary

Study	Spisso 1990[242]
	communication5)performing procedures such as chest tube removals, minor suturing, simple incisions and drainage, foreign body removals and removal of drains and invasive catheters6) monitoring and evaluating patients readiness for discharge based on a pre-set criteria7)performing pre-discharge physical examinations, writing discharge orders, dictating hospital course summaries and making recommendations for follow-up consult referrals Clinical case management of Outpatients8)staffing the outpatient clinic where follow-up examinations would be performed, monitor on-going patient problems and perform preoperative histories and physical examinations for trauma patients requiring additional elective procedures9) facilitate access to ancillary services for the patients and assure follow-up and support for social and economic needs of the patients10)available to provide resource information and respond to telephone inquiries from ancillary personnel, families and patients . Duration 1 year. Concurrent medication/care: NA Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Private healthcare system 3. Service set-up: MTC (Regional Trauma Centre). 4. Stage of trauma network development: Not applicable/Not stated/Unclear (n=1528) Intervention 2: No trauma coordinator. 1985-86 was the year pre implementation of NP . Duration 1 year. Concurrent medication/care: NA Further details: 1. Concurrent care delivery: MDT care 2. Healthcare system: Private healthcare system 3. Service set-up: MTC 4. Stage of trauma network development: Not applicable/Not stated/Unclear
Funding	Funding not stated

RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: POST-NP versus PRE-NP

Protocol outcome 1: On-going consequential morbidity at Define
- Actual outcome: Compliance with Interdisciplinary consultations via Inpatient Records at 30-day; Group 1: 149/210, Group 2: 198/210; Risk of bias: Very high; Indirectness of outcome: Serious indirectness
- Actual outcome: Description of injuries in discharge summaries at 30-day; Group 1: 163/210, Group 2: 204/210; Risk of bias: Very high; Indirectness of outcome: Serious indirectness
- Actual outcome: Discharge Teaching in discharge summaries at 30-day; Group 1: 144/210, Group 2: 204/210; Risk of bias: Very high; Indirectness of outcome: Serious indirectness
- Actual outcome: Plan for follow-up care in discharge summaries at 30-day; Group 1: 146/210, Group 2: 206/210; Risk of bias: Very high; Indirectness of outcome: Serious indirectness

Protocol outcome 2: Total hospital length of stay at Define
- Actual outcome: Hospital LOS at 1 year; Risk of bias: High; Indirectness of outcome: No indirectness

Study	Spisso 1990[242]
	Protocol outcome 3: Number of procedures at Define - Actual outcome: Description of procedures in discharge summaries at 30-day; Group 1: 155/210, Group 2: 202/210; Risk of bias: Very high; Indirectness of outcome: Serious indirectness - Actual outcome: Events of hospitalisation in discharge summaries at 30-day; Group 1: 157/210, Group 2: 198/210; Risk of bias: High; Indirectness of outcome: Serious indirectness Protocol outcome 4: Patient and carer satisfaction at Define - Actual outcome: Comparison of outpatients waiting times in minutes at 1 year; Other: Pre- NP: 41 minutes , Post-NP: 19 minutes; Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Comparison of written patients complaints at 1 year; Other: Pre-NP: 16 , Post-NP: 7; Risk of bias: Very high; Indirectness of outcome: Serious indirectness Protocol outcome 5: Healthcare staff satisfaction at Define - Actual outcome: Clinician time saving via implementation of NP role in minutes at 1 day; Mean 352 ; Risk of bias: High; Indirectness of outcome: Serious indirectness - Actual outcome: Percentage of nursing staff rating NP's interacting with RN staff and providing liaison with physicians as 'very' effective at 1 year; Other: 29/30; Risk of bias: Very high; Indirectness of outcome: Serious indirectness - Actual outcome: Percentage of nursing staff rating NP's interacting with patients and family on plan of care as 'very' effective at 1 year; Other: 29/30; Risk of bias: Very high; Indirectness of outcome: Serious indirectness - Actual outcome: Percentage of nursing staff rating NP's discharging patients as 'very' effective at 1 year; Other: 28/30; Risk of bias: Very high; Indirectness of outcome: Serious indirectness - Actual outcome: Percentage of nursing staff rating NP's performing extended role procedures as 'very' effective at 1 year; Other: 18/30; Risk of bias: Very high; Indirectness of outcome: Serious indirectness
Protocol outcomes not reported by the study	Mortality at Define; Quality of life at Define; Adverse incident report severity at Define; Time in acute setting at Define; Time to rehab prescription at Define; ICU length of stay at Define; Impact of traumatic event on concurrent comorbidities at Define

G.5 Documentation and transfer of information

Table 16: McFetridge 2007[156]

Study (ref id)	McFetridge 2007[156]

Study (ref id)	McFetridge 2007[156]
Aim	To explore the communication between ED and ICU nursing staff during transfer of critically ill patients from the ED to the ICU.
Population	Twelve nurses were selected for individual interview (three from ED and ICU, respectively, from each of the acute hospitals. Two focus group interviews were also carried out, each consisting of two ED and two ICU nurses. So each focus group consisted of four nurses. In total, 20 nurses took part in the study. Managers of the ED and ICU departments were asked to identify nurses who had experience of being directly involved in the patient handover between the ED and ICU which was the essential inclusion criteria for this study.
Setting	Nurses were recruited from ED and adult general ICU in two major acute hospitals in Northern Ireland.
Study design and methodology	Multi-method design combining documentation review, semi-structured individual and focus group interviews. The study was both descriptive and exploratory, thus aiming to enhance the validity of the findings. The research team developed the frameworks for individual and focus group interviews based on available literature and professional experience. In the interviews and focus groups discussion was not limited to the issues within the interview schedule, as through the use of prompts, all participants were encouraged to discuss in detail any aspect of patient handover. A review of hospital-based documentation would elicit any intra- or inter-departmental protocols or documents applicable to patient handover, and opinions put forward by nurses in individual an d focus group interviews would ascertain to what extend nurses were aware of and applied such protocols.
Analysis methods	Recorded data from interviews and focus groups was transcribed and manual content analysis was used to identify categories and themes, using a constant comparative approach. As issues emerged from the data, they were compared with previously identified issues, and eventually combined into themes. Authors employed a narrative presentation format in order to ensure that the richness of data was preserved. Three members of the research team independently analysed the data to achieve internal verification, following which common issues and themes were identified and agreed. Managers from the four departments involved in the study were asked to provide documents and protocols relating to the patient handover and related communication practices. These documents were searched for any relevant content pertaining to the practice of patient handover.
Themes with findings	**Theme 1: The pre-transfer period.** ED and ICU nurses had different perceptions as to when the actual handover began. The majority of ED nurses felt that the patient handover did not begin until they communicated directly with the ICU staff nurse within the actual ICU, whilst the ICU nurses felt that the process began when a phone call was made to the ICU alerting them of a pending transfer from the ED. Despite the different perceptions, ED and ICU nurses were of the general opinion that it should begin from within the ED department as often there is little or no contact with ICU staff prior to arriving with the patient to the ICU. Blurring of roles can occur during the handover process as ICU nurses often liaise directly with the on-call anaesthetist to receive information on the patient. Therefore, ICU nurses may not feel the need to communicate with any other individuals prior to the actual transfer. Generally there is some form of telephone communication between the two departments before transfer but a lack of consistency in those individuals involved in the communication was highlighted. Experienced ICU nurses may use informal

Study (ref id)	McFetridge 2007[156]
	phone calls as an opportunity to ask appropriate questions about the pending transfer.
	Theme 2: Arrival of the patient to the intensive care unit. Arrival at the ICU with a critically ill patient is an extremely busy period. The ICU nurses immediately focused on the critical physical needs of the patient and attaching him/her to the monitoring equipment, ventilator and intravenous devices; information exchange with the ED nurse was secondary, although ICU nurses were clearly aware of its importance. ED nurses found it difficult to identify whom to actually handover the patient information to. At this stage ED nurses felt a loss of control in the management of the patient. In order to gain as much information as possible the ICU nurse would listen to doctor-to-doctor handover first before they took handover from the ED nurse, thus, giving the ED nurse the feeling of being overlooked and detached from the handover process. The experienced ICU nurse would be aware of the importance of ensuring the ED nurse is made feel welcome and is engaged in all stages of the patient handover process. It was suggested that another member of the ICU nursing team could settle the patient into the unit, while the patient's ICU nurse could spend uninterrupted time receiving handover.
	Theme 3: Information giving and receiving. No standardised framework to structure or guide the patient handover process was used (let alone existed at either hospital); there was lack of consistency and structure to the process. Generally the ED flimsy or other patient documentation was used as an aid memoir. Prioritising and recognising the importance of information - respondents identified a vast amount of information that should be shared between ED and ICU nurses. ED staff felt they had much detail to share regarding the patient but were uncertain how much the ICU nurse had already received from the medical staff. Lack of communication by the ICU staff as to what information they require from ED staff at the time of handover. Nursing staff from both clinical areas recognised that they lacked clarity and awareness of each other's roles.
	Theme 4: Influence of experience and attitude of nurses. Besides the detrimental effect of a lack of consistency and structure to the handover, respondents also mentioned that experience and attitude of nurses had an effect on handover quality. Experienced ED nurses had a greater ability to prioritise the information that should be provided to the ICU staff. Likewise new ICU nurses may not know what information has been missed at handover and what questions should be asked. The sense of being 'sidelined' that some ED nurses felt may have a detrimental effect too, but ICU nurses justified their behaviour as they wanted to focus upon the medical handover first and settling the patient into the bed space.
	Theme 5: Patient handover: a critical event. The importance of the patient handover was emphasised; it is recognised as an integral process in the continuity of care for the critically ill patient. Respondents expressed that effective and accurate handover would reduce the amount of time spent searching for information at a later stage, has the potential to reduce the risk of critical incidents and would positively influence the care delivered (patient safety). No specific policy pertaining to patient handover existed in these units. The main document associated with the patient handover process was the ED flimsy and associated medical records. The respondents provided their views of what documentation should be available at handover: ED Flimsy, medical notes, nursing notes, observation chart, CT scan report, arterial blood gas results, blood results, fluid balance chart, x-rays, Medicine Kardex, Electrocardiogram, property form. Reliance on memory alone has the potential to lead to omissions of detail being shared. A structured framework could include a list of mandatory and supplementary documentation for patient handover. Organisational considerations to be given as to how both ED and ICU nurses can have uninterrupted time to complete the handover when the patient arrives at ICU.

Study (ref id)	McFetridge 2007[156]
Limitations and applicability of evidence	The authors note that it was a small scale study undertaken at two acute hospitals in NI so may lack applicability to the wider UK setting. They suggest that the study would have benefitted from observational data collection of the actual handover process. Reflexivity is not specifically mentioned. The researchers all have a nursing background but they do not provide insight into how this may have influenced the interview and analysis process. Unfortunately no depiction of the semi-structured interview schedule is provided. Also, mixing the focus groups to contain both ED and ICU nurses from the same hospital, that is, colleagues may have hindered some respondents to express their views freely. It is unlikely that the 'critically ill' patients were specifically or solely presenting with major trauma. Nonetheless the evidence shines a light on the process of patient handover, highlights potential communication barriers between ED and ICU staff which may be relevant to the trauma situation and makes useful recommendations how these may be overcome.

Table 17: Owen 2009[185]

Study (ref id)	Owen 2009[185]
Aim	To investigate perceptions by paramedics and hospital receiving staff about what enables and constrains handover in ED.
Population	Nineteen paramedics (including ambulance officers, paramedics and intensive care paramedics with experience ranging from 2-15 years), fifteen nurses (registered nurses working permanently in ED with experience ranging from 3-25 years), and sixteen doctors (combination of ED consultants with a range of 6-18 years' experience, ED registrars and junior doctors rotating through ED) from ambulance services, and ED Selection opportunistic based on participants first-hand experiences with the phenomenon of interest and willingness to participate in the study.
Setting	Two hospitals and two ambulance services across two states in Australia. The ED selected were an urban/district and a major referral department.
Study design and methodology	Three experienced qualitative researchers conducted interviews, using open-ended probing questions to elicit participants' perceptions of handover. Semi-structured script was utilised based on issues around handover identified in the literature. Interviews were transcribed verbatim.
Analysis methods	Thematic analysis based on grounded theory: Two researchers independently assessed the transcripts before reaching a shared agreement about themes. Early themes were revised and refined through a process of constant comparison of instances from the data and confirmed the direction of future interviews. Data analysis was inductive and guided by a grounded theory approach, which results in an organising system of data that are further refined to concepts or themes. Interviewing continued until there was no new information found and the researchers believed saturation was achieved. The researcher considered the importance of reliability and validity as conceptualised as rigour with the goal of accurately representing those whose experiences they were studying. Within the context of this study, the researchers attempted to adhere as closely as possible to the techniques of credibility, dependability, confirmability and transferability to support the rigour of the work.

Study (ref id)	Owen 2009[185]
Themes with findings	**Theme 1. Difficulties in creating a shared cognitive picture.** Paramedics in particular expressed frustration at how to report their perception of the patient in the pre-hospital context in such a way that it would be understood by receiving staff at the hospital ("*the difficulty of using language to paint a picture for people when they weren't at the scene*"). Receiving staff also spoke of difficulty they had in trying to translate the information they hear from paramedics during handover. Verbal report was just one of the ways they gathered information. The lack of a shared language ('common tongue') contributed to the difficulty in reaching a shared view of the patient during handover between pre-hospital and hospital staff. The interdependent nature of handover in the ED requires that there is a high level of shared understanding among the members of the team about their respective roles, tasks and objectives throughout the handover process (pre-hospital and hospital staff largely operate in different environments, coming together only momentarily – lack of awareness of each other's duties, responsibilities and problems).
	Theme 2. Tensions between 'doing' and 'listening'. A frequent source of tension for paramedics was their experience of receiving staff physically attending to the patient during the handover rather than listening (not being overly attentive to the actual handover). Some paramedics described tactics such as keeping the patient on 'their stretcher' to ensure that the receiving staff stop and listen. There was acknowledgment by receiving staff that they did not always listen attentively during handover, due to the multiple tasks they had to attend to (distractions and competing demands). Need to find a balance between getting involved with the patient and listening to the paramedic. Agreement that handover formed an important part of overall decision-making process – details, nuances and vital clues are contained in the handover. ED staff suggested paramedics ensure their message is heard by being assertive, speaking loudly and ensuring that there was a clear leader in the process.
	Theme 3. Fragmented communication. Colloquial term 'Chinese whispers' used unprompted in over 20 of the interviews to describe how information changed during the handover process. Most participants felt that the lack of a structured process for presenting information contributed to the problem. Lack of consistency. Handover needs to be "*to the point*" but also cover all the necessary information. The multiple times that handover could be repeated for the same patient (scene > triage > ED nursing staff > doctor) contributed to the problem of information being lost or changed during the process. Distortion in verbal information as it is transmitted to other health-care members. There needs to be a predetermined format and structure to ensure adequate information exchange. Perhaps some kind of minimum amount of information required at handover which both pre-hospital and hospital staff are aware of and have training to support this shared knowledge.
Limitations and applicability of evidence	Possible limitations according to the researchers were that participants were professionals being asked questions concerning their peers who they work with on a daily basis, which may have influenced their responses. The researchers did address this by assuring participants that their responses would be confidential and any reported data anonymised. There is no explicit mention of reflexivity. The researchers do not detail their professional backgrounds or provide insight into how this may have influenced the interview and analysis process. Unfortunately no description is provided of the semi-structured interview transcript. While this study may not be directly application to our review question due to the population being not specifically major trauma related, the evidence does shine a light on the processes and communication barriers between pre-hospital and hospital staff which may be relevant to the trauma situation (if not exacerbated by the need for definitive diagnosis as early as possible and need for information about mechanism of injury and details of the scene to assess possible 'hidden' symptoms).

Table 18: Suserud 2003[245]

Study (ref id)	Suserud 2003[245]
Aim	To investigate the experiences of ambulance nurses reporting on and handing over patients to staff of emergency receiving units.
Population	Six ambulance nurses with between three and fourteen years' experience of pre-hospital emergency care. Each nurse had to have undertaken a one-year specialist course in emergency care and have at least three years' hospital experience within the specialty. Three nurses also had between three and eight years' experience in causality and emergency departments.
Setting	Set in the everyday lives of ambulance nurses and from their perspective that the phenomenon must be understood. Three ambulance stations in western Sweden.
Study design and methodology	Qualitative description derived from phenomenological life world portrayal to evaluate the experiences as they have been lived. Qualitative interviews used to do justice to human experience and describe their significance. Each participant was invited for interview based on their written description of a case in which they had assessed and cared for a seriously ill, priority one patient. All the chosen cases were designated fatal and needed both clinical and surgical treatment. Participants were encouraged to describe how the reporting and handing over of patients was carried out, starting from when they first contacted the receiving hospital and ending when responsibility for the patients was taken on by the emergency unit personnel. The written case descriptions constituted the common starting point for the interviews, but other situations were also reported to illustrate thoughts and experiences.
Analysis methods	Interviews were taped and transcribed. Analysis of transcriptions consisted of three sections: totality, parts and back to totality. Totality aimed at understanding the collected interview data. Then processing this text into smaller parts, to gain deeper understanding of the text. It was then described in the form of meaning bearing units. During this phase, questions were put in relation to the text and produced as concordant units. This then constituted answers to how the nurses experienced reporting on and handing over of patients. Several themes were identified and described.
Themes with findings	**Theme 1. Preparation during transportation.** Ambulance nurses usually contact the hospital emergency nurse in charge during transportation. This allows hospital staff to prepare for patients' care needs. This can include reshuffling patients, assembling enough staff competencies, preparing medication, alerting x-ray units, checking equipment and obtaining any available records (links with theme 7 below).
	Theme 2. Initial assessment – collecting evidence. Ambulance nurses make initial assessment of the patient and obtain an overall picture. They also monitor patients during transportation so hospital staff has full reports on the patient situation. These reports provide emergency staff with a basis for making medical diagnoses (collecting diagnostic parameters). Recording the entire process of care until handover ought to constitute the basis for the quality of nursing care. It should contain 'on the spot' accounts that form part of the whole chain of care provision, from falling ill until discharge. What should verbal and written reports consist of to illustrate the first appearance of illness or describe an accident site so that the hospital personnel can use this information?

Study (ref id)	Suserud 2003[245]
	Theme 3. Explicit care needs. Patients with clear care needs are often easy to hand over. They are quickly identified and made top priority from the moment of alert until hand over at hospital. In some situations these patients are handed over directly to intensive care units (by-passing the emergency section).
	Theme 4. Implicit care needs. If care needs are less evident it is more difficult to assess and prioritise patients who have diffuse complaints but who are in great need of care. Despite patient conditions being vague, sometimes the receiving hospital staff demand 'preliminary diagnoses' reports to facilitate placing and prioritising of patients. This can be agitating for the ambulance nurses
	Theme 5. Wrong diagnoses can be enduring. Fear of 'forcing' a diagnosis report and when these may turn out to be wrong. Once expressed, wrong diagnoses can be difficult to rectify, they can hang on to patients and delay appropriate care. Risk that the preliminary diagnoses will follow the patient without updated, proper evaluation being made. This can waste time, and important care needs information might be lost if continuity of care is reduced. Ambulance nurses can feel anxiety over feeling pressed to provide working diagnoses in the preparatory conversations with hospital emergency units.
	Theme 6. Positive handover – a matter of teamwork. Positive handover is best when patients are smoothly and confidently shuttled into hospital care facilities. In this scenario the trust and confidence that has emerged between patients and ambulance staff during the pre-hospital phase can be transferred to hospital settings. Highlights the importance of maintaining the sequence of the care provision chain.
	Theme 7. Communicating with receiving staff. Hand-over of responsibility for the patient aided when whole 'troupes' of emergency care staff are available and detailed handover reports are made. An unbroken link between ambulance and hospital emergency ward increased trust for patients and their families in the process. Services viewed as a whole, rather than separate parts.
	Theme 8. Negative handover – difficulties in communicating. Sometimes difficult to describe complete sequences of illness to receiving staff. Experience-based assessment and clinical knowledge sometimes difficult to verbalise so receiving staff and fully understand. Ambulance nurses can face difficulties having to report complex patient conditions verbally to confused/distracted emergency unit staff in stressful situations (link to theme 9 below).
	Theme 9. Lack of resources complicates reception. Difficulties arise when receiving units have too little control over the situation due to resource deficiencies including personal competencies, stress-related situations and space capacity. Reduces trust in the safe hand over of patients.
Limitations and applicability of evidence	Very limited description of analysis method with little information provided with which to assess rigor of analysis process. The themes identified seem more descriptive of the actual process of handover rather than evaluation/perspectives on their experiences. There is no explicit mention of reflexivity. The researchers do not detail their professional backgrounds or provide insight into how this may have influenced the interview and analysis process. For instance, if they came across as health professionals or connected to the hospital, then perhaps participants may have felt slightly like their processes were being audited or their behaviour being monitored and this may have affected how they described their experiences.

Study (ref id)	Suserud 2003[245]
	This study may not be directly application to our review question due to the population being not specifically major trauma related.

G.6 Trauma audit

Table 19: Cornish 2011[55]

Aim	Population	Method
The National Bowel Cancer Audit Project (NBOCAP) collects data from hospitals in the UK and aims to improve surgical outcomes and quality of care for patients. The aims of this study were to understand why trusts were/were not participating in the NBOCAP and how to improve the quality of data collected and feedback.	Of the 171 trusts contacted by email, 66% of trusts (n=117) had at least 1 consultant respond. Of the 117 trusts that responded, 60 (51.2%) had submitted data to the NBOCAP. A total of 549 consultants received the questionnaire, and 159 (29.0%) consultants responded. Fifty-one per cent (n=60) of the trusts had submitted data to the NBOCAP.	This was a prospective e-survey on colorectal surgeons' attitudes towards and opinions of the NBOCAP, within trusts in the UK. A questionnaire was emailed to members of the Association of Coloproctology of Great Britain and Ireland (ACPGBI).
Findings Reasons for data submission included the following: comparison of a units' data with national data (56.8%), a national audit improves outcomes (45.9%) and generation of information for use at a local level (42.6%). Factors rated likely to influence future data submissions (% agreement): Health Care Commission mandating audit (57.9%), credit in annual health check (42.8%), pressure from patients/patient groups (38.3%), pressure from professional bodies (57.9%), peers becoming involved (56.6%), fully integrated online data submission (62.9%) and online reporting to allow up to date feedback for individual units (72.3%) The main reasons for non-submission were as follows: lack of technical support (23.6%), lack of funding (19.6%) and lack of dedicated audit time (18.9%). Ninety-six (60.4%) consultants felt that the audit report should identify individual trust results. Fifty-three per cent of consultants (n=87) rated their trusts' resources for audit as being very poor or poor.		

Table 20: Racy 2014[209]

Aim	Population	Method
To identify how data was collected at a local level, what software and methods were used and what resources were allocated to collect and upload trauma data to the TARN.	Major trauma units in the UK	A telephone survey was carried out to collect data from all 26 MTCs in England. The questionnaire was designed to identify what systems and resources were in place at each major trauma centre (MTC) for collecting trauma data and uploading it to TARN, with the questions geared towards assessing the capabilities of the local electronic systems

Aim	Population	Method
		used and whether these would be compatible with an automatic link to the TARN registry.
The majority of hospitals used Microsoft Excel (n=11) as a local database. Seven used dedicated commercial software. Only three responders were able to state whether the software they used was high level architecture compatible (whether it can interact with other systems irrespective of platform). The mean number of TARN data collectors was two per centre, ranging from one to five. Data had been collected and uploaded to the TARN registry for a mean of five years, ranging from one to twelve. When uploading data to TARN, the data for each patient is entered manually into an online form. Data already input into existing databases has to be entered again, requiring time and a dedicated member of staff, as well as resulting in the duplication of data. Creating an automatic upload to TARN would require the data into the local database to be correctly entered and coded. Failure to do so would result in inaccurate and misleading data or an administrator would have to check the data for accuracy. Some data may be left out and may have to be added later. Data not meeting the inclusion criteria for TARN would have to be filtered out.		

Table 21: Rudd 2001[220]

Aim	**Population**	**Method**
To describe the standards of care for stroke patients in England, Wales and Northern Ireland and to determine the power of national audit, coupled with an active dissemination strategy to effect change.	157 trusts (64% of eligible trusts in England, Wales, and Northern Ireland) participated in both rounds. Participants—5589 consecutive patients admitted with stroke between 1 January 1998 and 31 March 1998 (up to 40 per trust) and 5375 patients admitted between 1 August 1999 and 31 October 1999 (up to 40 per trust).	A national audit of organisational structure and retrospective case note audit, repeated within 18 months. Separate postal questionnaires were used to identify the types of change made between the first and second round and to compare the representativeness of the samples. Audit tool—Royal College of Physicians Intercollegiate Working Party stroke audit.
Findings The proportion of patients managed on stroke units rose between the two audits from 19% to 26% with the proportion managed on general wards falling from 60% to 55% and those managed on general rehabilitation wards falling from 14% to 11%. Standards of assessment, rehabilitation, and discharge planning improved equally on stroke units and general wards, but in many aspects remained poor (41% formal cognitive assessment, 46% weighed once during admission, 67% physiotherapy assessment within 72 hours, 24% plan documented for mood disturbance, 36% carers' needs assessed separately). Changes that occurred between audit 1 and 2 (N=257 Trusts completing both audits) – Top five improvement listed: Stroke team 21 (10) 135 1, Consultant stroke physician 30 (10) 127, Specialist nurse for stroke 24 (10) 131 2, Interdisciplinary care pathways 56 (30) 101 0, Multidisciplinary documentation 68 (39) 89 0, Better social worker involvement 21 (15) 128 8, Information for patients and relatives 86 (52) 71 0 Feedback of audit results: Trusts indicated that the confidential report detailing their performance against the national benchmark was valuable. Similarly, feedback		

Aim	Population	Method
from the 17 regional workshops between the audit rounds suggested that they were a stimulating arena for sharing ideas on good practice at a local level. We cannot prove that change would not have occurred with feedback of results alone, but we believe that regional workshops were an important additional factor in giving local clinicians new ideas for change and the confidence to promote those ideas.		

G.7 Paediatric trauma training

Table 22: Baker 2009[15]

Study	Baker 2009[15]
Study type	Non-randomised comparative study
Number of studies (number of participants)	1 (n=183)
Countries and setting	Conducted in USA; Setting: Regional paediatric trauma referral centre for a 20 county area in South-western Ohio
Line of therapy	First-line
Duration of study	Not clear
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	paediatric patients requiring acute resuscitation and activation of the critical care and trauma response teams upon arrival to ED; all resuscitations initiated by Emergency medical services (EMS) personnel
Exclusion criteria	None reported
Recruitment/selection of patients	Retrospective review of eligible patient records from July 20030 June 2006
Age, gender and ethnicity	Age - Mean (SD): 5.4(5). Gender (M:F): 35:68. Ethnicity: not reported
Further population details	
Extra comments	Used a multivariable analysis
Indirectness of population	Serious indirectness: Not all had trauma (only 45%)

Interventions	(n=65) Intervention 1: Paediatric training - PALS. PALS- trained EMS caregivers with PALs certification. Duration NA. Concurrent medication/care: Verified by the caregiver via telephone call. PALS trained care providers tended to perform EMS runs in the rural areas (n=118) Intervention 2: Paediatric training - standard care. None. Duration NA. Concurrent medication/care: Non-PALS trained providers performed a majority of EMS runs within the urban areas around the hospital.
Funding	Funding not stated
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: PALS versus STANDARD CARE Protocol outcome 1: Mortality - Actual outcome: Mortality; OR 0.7 (95%CI 0.3 to 1.6); Risk of bias: Very high; Indirectness of outcome: No indirectness Protocol outcome 2: skill delivery - Actual outcome: successful intubation in patients requiring intubation; OR 4.4 (95%CI 1.2 to 25.9); Risk of bias: Very high; Indirectness of outcome: No indirectness - Actual outcome: successful IV/IO access in patients in whom this was attempted; OR 17.4 (95%CI 2.5 to 1000); Risk of bias: Very high; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life ; Hospitalisation ; Time to diagnosis ; Time to intervention ; Time to transfer ; skill retention ; Other clinical outcomes ; Length of stay

G.8 Access to services

G.8.1 Airway

Table 23: Bernard 2010[22]

Study (ref. id)	**Bernard 2010[22]**
Study type	RCT (Patient randomised; Parallel)
Number of studies (number of participants)	1 (n=312)

Countries and setting	Conducted in Australia; Setting: Pre-hospital and hospital, major trauma unit
Line of therapy	First-line
Duration of study	--:
Method of assessment of guideline condition	Adequate method of assessment/diagnosis
Stratum	Overall
Subgroup analysis within study	Not applicable
Inclusion criteria	See above
Exclusion criteria	Exclusions: Within 10 minutes of a designated trauma hospital, no intravenous access, allergy to any rapid sequence induction drugs or transport planned by medical helicopter
Age, gender and ethnicity	Age - Mean (range): 40-41.4. Gender (M:F): Define. Ethnicity: Not stated
Further population details	1. Age: Not applicable/Not stated/Unclear
Extra comments	Patients assessed by paramedics as having: evidence of head trauma, Glasgow Coma Score ≤ 9, age ≥15 years and intact airway reflexes.
Indirectness of population	--
Interventions	(n=160) Intervention 1: Intubation/surgical airway - Immediate. Was applied to all patients. After intubation patients received a single dose of pancuronium and intravenous infusion of morphine and midazolam. If intubation was not achieved at first attempt one further attempt was allowed.. Duration Time at scene 35 (SD12) minutes. Concurrent medication/care: Not stated apart from intervention (n=152) Intervention 2: Intubation/surgical airway - Delayed. Hospital intervention: High flow supplemental oxygen by mask and assisted bag/mask ventilation if required. An oropharyngeal or nasopharyngeal airway was inserted if airway suctioning was required. A small dose of morphine was permitted. Patients underwent rapid sequence induction. . Duration Time at scene 25 (SD10) minutes. Concurrent medication/care: See intervention
Funding	Academic or government funding (The National Health and Medical Research Council)
RESULTS (NUMBERS ANALYSED) AND RISK OF BIAS FOR COMPARISON: IMMEDIATE versus DELAYED	

Protocol outcome 1: Length of stay at Define - Actual outcome: Length of stay at ICU; Other: Median (IQR) immediately 107 (32-240) vs. delayed 103 (36 to 261) hours p=0.74; Risk of bias: Low; Indirectness of outcome: No indirectness - Actual outcome: Length of stay at Hospital stay; Other: Median (IQR) immediately 11 (5-19) delayed 11 (3.5-21) days p=0.75; Risk of bias: Low; Indirectness of outcome: No indirectness Protocol outcome 2: No. of procedures at Define - Actual outcome: Craniotomy at Within 6 hours of ED arrival; Group 1: 41/160, Group 2: 32/152; Risk of bias: Low; Indirectness of outcome: No indirectness Protocol outcome 3: Glasgow Outcomes Scale at Define - Actual outcome: GOS 5-8 at 6 months; Group 1: 80/157, Group 2: 56/142; Risk of bias: Low; Indirectness of outcome: No indirectness - Actual outcome: Initial GCS 5-9 and GOS 5-8 at 6 months; Group 1: 45/81, Group 2: 34/73; Risk of bias: Low; Indirectness of outcome: No indirectness Protocol outcome 4: Mortality at Define - Actual outcome: Mortality at ED; Group 1: 17/160, Group 2: 14/152; Risk of bias: Low; Indirectness of outcome: No indirectness - Actual outcome: Mortality at In hospital; Group 1: 53/160, Group 2: 55/152; Risk of bias: Low; Indirectness of outcome: No indirectness - Actual outcome: Mortality at 6 months; Group 1: 53/157, Group 2: 55/142; Risk of bias: Low; Indirectness of outcome: No indirectness	
Protocol outcomes not reported by the study	Quality of life at Define; Adverse events at Define

G.8.2 Interventional radiology

Table 24: Howell 2010[127]

Reference	Study type	No. of patients	Patient characteristics	Intervention	Comparison	Length of follow-up	Outcome measures	Effect sizes	Source of funding	Comments
Howell 2010[127]	Retrospective cohort	n=635 (rapid interventional radiology n=379; Delayed interventional radiology n=256)	Patients identified through the National Trauma Data Bank (version 7.1) between 2002-2006.	Rapid IR=<1 hour of arrival	Delayed IR=1-3 hours after arrival.	Duration of hospital admission	**Full regression model (rapid vs. delayed, + all covariates)**		Government/ academic funding	Due to the availability of data in patients' records, the timing of the procedure is based on the time since admission, and therefore does
							OR (95% CI)	2.0 (1.2-3.4); p=0.009		
							Full regression model in patients treated in blunt			

Reference	Study type	No. of patients	Patient characteristics	Intervention	Comparison	Length of follow-up	Outcome measures	Effect sizes	Source of funding	Comments
			Median ISS score=17 (IQR 9-29), overall in-hospital mortality rate of 23.2%. Mean age=39 years (SD=18). 53.9% penetrating injury. IR vascular occlusion was abdominal in 31%, in an extremity in 26%, head and neck in 21%, thoracic in 10%, aortic in 8%, and other in 4%. The majority of patients that died did so within the first 48 hours after injury (80%). Population was intended to represent adult hypotensive patients who undergo early, therapeutic IR vascular occlusive procedures, as indicated by; age > 15 years,					**trauma patients (n=293)**			not account for time spent pre-hospital. Multivariate analysis is used to control for key confounding factors and differences at baseline; however, as a non-randomised, retrospective study, it is not possible to control for all potential confounding factors that may have influenced the allocation of patients or the outcome of their care.
							OR (95% CI)	2.6 (1.2-5.7); p=0.012		
							Full regression model in patients treated in penetrating trauma patients (n=342)			
							OR (95% CI)	2.9 (1.2-7.3); p=0.023		
							Full regression model in patients treated in Level I Trauma Centre (n=335)			
							OR (95% CI)	2.4 (1.1-5.5); p=0.038		
							Full regression model in patients treated in Level II Trauma Centre (n=300)			
							OR (95% CI)	2.3 (0.98-5.2); p=0.056		
							Full regression model in all patients where time to procedure entered as a continuous variable			
							Narrative	47% increased risk of mortality for every hour of delay		
							Time to death			

Reference	Study type	No. of patients	Patient characteristics	Intervention	Comparison	Length of follow-up	Outcome measures	Effect sizes	Source of funding	Comments
			systolic BP <90mm Hg on arrival, and who underwent procedures for arterial vessel occlusion (ICD-9-CM 38.80, 38.82-86 and 38.88) <3 hours of trauma admission. Only patients who were directly transferred to a level I or II trauma centre were included. Patients who underwent vascular occlusive procedures > 3 hours from admission or who underwent early intracranial or venous occlusion procedures (ICD-9-CM 38.81, 38.87 and 38.89) were excluded. Also, patients who underwent any laparotomy or				Median time to death for each group -1	Rapid median=0.1; Delayed median=0.1; p=.308		

Reference	Study type	No. of patients	Patient characteristics	Intervention	Comparison	Length of follow-up	Outcome measures	Effect sizes	Source of funding	Comments
			abdominal/pelvis operation, thoracic operative procedures, open vascular or endovascular repair procedures, or intracranial procedures at any time during hospital stay were excluded. Patients were not excluded for peritoneal lavage, percutaneous gastrostomy, tube thoracostomy, tracheostomy, vena cava interruption, haemodialysis, and endoscopic surgery.							

Table 25: Schwartz 2014[228]

Reference	Study type	No. of patients	Patient characteristics	Intervention	Comparison	Length of follow-up	Outcome measures	Effect sizes	Source of funding	Comments
Schwartz 2014[228]	Retrospective cohort	n=88 (work hours interventional radiology n=32; out of hours interventional	Adult trauma patients identified through the institution's	Interventional radiology in working hours (Mon-Fri 7.30 am-5.30 pm);	Interventional radiology out of normal working hours (Mon-Fri	30-days	**Full regression model (work day vs. out of hours + covariates)**		No funding stated	Due to the availability of data in patients' records, the timing of the procedure is
							OR (95%	1.94 (CI		

Reference	Study type	No. of patients	Patient characteristics	Intervention	Comparison	Length of follow-up	Outcome measures	Effect sizes	Source of funding	Comments
		radiology n=56)	Trauma Registry of the American College of Surgeons database admitted between 2008-2011 with a severe pelvic injury (pelvis AIS score ≥3) who received at least 1 unit of blood product, and had documentation of haemorrhagic shock (defined as base deficit >5, transfusion of RBCs in the ED, and faculty documentation of shock in patient notes). Median ISS work hours group=29 (IQR=22 – 43); median ISS out of hours group=27 (19 – 41). Patients with blunt trauma=98%.	median time to interventional radiology=193 minutes (IQR=137-275)	5.30pm – 7.30 am and anytime on weekends and holidays); median time to interventional radiology=301 minutes (IQR=211-389)		CI)	reported in paper=1.05 1–4.967); p=.017		based on the time since admission, and therefore does not account for time spent pre-hospital. Multivariate analysis is used to control for key confounding factors; these covariates were selected from a larger pool of potential covariates using stepwise logistic regression. Covariates included in the final model were age, injury severity score, shock (base value), and arrival heart rate. 191 patients were identified as being eligible for the study; however 103 patients died within 24-hours without undergoing IR and were excluded (29% of patients admitted during working hours; 62% of patients admitted out of hours)

Appendix H: GRADE tables

H.1 Receiving trauma teams

Table 26: Clinical evidence profile: Two-tiered response team versus non-tiered response team in a Level 1 trauma centre

Quality assessment							No. of patients		Effect			
No. of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other	2-tiered	non-tiered strategies	Relative (95% CI)	Absolute	Quality	Importance
Mortality (follow-up 2 years)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	103/2333 (4.4%)	6.3%	RR 0.7 (0.54 to 0.92)	19 fewer per 1000 (from 5 fewer to 29 fewer)	VERY LOW	CRITICAL
Hospital length of stay (days) (follow-up 2 years; Better indicated by lower values)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	1937	1670	-	MD 0.6 lower (1.12 to 0.08 lower)	VERY LOW	CRITICAL
ED length of stay (minutes) - All patients (code, alert or consultation) (follow-up 6 months; Better indicated by lower values)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	512	532	-	MD 48 lower (65.35 to 30.65 lower)	VERY LOW	CRITICAL
ED length of stay (minutes) - Code patients only (follow-up 6 months; Better indicated by lower values)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	77	142	-	MD 28 lower (59.38 lower to 3.38 higher)	VERY LOW	CRITICAL
Health related quality of life												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Complication rate												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Delays to transfer												

0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Time to CT												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Missed/delayed diagnosis												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Trauma team member time												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL

(a) Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias.
(b) Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

Table 27: Clinical evidence profile: Three-tiered response team versus two-tiered response team in a Level 1 trauma centre

Quality assessment							No. of patients		Effect		Quality	Importance
No. Of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**3-tiered**	**2-tiered strategies**	**Relative (95% CI)**	**Absolute**		
Mortality (post ED presentation) (follow-up 3 months)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	Very serious[b]	None	13/240 (5.4%)	5.6%	RR 0.97 (0.44 to 2.12)	2 fewer per 1000 (from 31 fewer to 63 more)	VERY LOW	CRITICAL
Mortality (post hospital admission) (follow-up 3 months)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	Very serious[b]	None	5/240 (2.1%)	4.6%	RR 0.46 (0.16 to 1.34)	25 fewer per 1000 (from 39 fewer to 16 more)	VERY LOW	CRITICAL
Survival to discharge (follow-up 3 months)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	229/240 (95.4%)	94.9%	RR 1.01 (0.96 to 1.05)	9 more per 1000 (from 38 fewer to 47 more)	VERY LOW	CRITICAL
Complications (follow-up 3 months)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	17/240 (7.1%)	11.2%	RR 0.63 (0.35 to	41 fewer per 1000 (from 73 fewer to 18	VERY LOW	CRITICAL

									1.16)	more)		
Complication rate per person (follow-up 3 months; Better indicated by lower values)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	240	197	-	MD 0.05 lower (0.14 lower to 0.04 higher)	VERY LOW	CRITICAL
ED length of stay (hours) (follow-up 3 months; Better indicated by lower values)												
1	Observational studies	Serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	240	197	-	MD 0.45 lower (0.93 lower to 0.03 higher)	VERY LOW	CRITICAL
Health related quality of life												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Delays to transfer												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Time to CT												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Missed/delayed diagnosis												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL
Trauma team member time												
0	-	-	-	-	-	-	-	-	-	-	-	CRITICAL

(a) Downgraded by 1 increment if the majority of the evidence was at high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias
(b) Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MIDs.

H.2 A trauma service providing continuity of care

Table 28: Clinical evidence profile: Multidisciplinary ward versus general ward care

Quality assessment							No. of patients		Effect		Quality	Importance
No. of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other	Multidisciplinary ward	General ward	Relative (95% CI)	Absolute		
Mortality - ISS > 8 (follow-up 30 days)												

1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	261/4665 (5.6%)	8.4%	RR 0.66 (0.56 to 0.79)	29 fewer per 1000 (from 18 fewer to 37 fewer)	VERY LOW	CRITICAL
Mortality - ISS > 15 (follow-up 30 days)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	237/1947 (12.2%)	19.1%	RR 0.64 (0.54 to 0.76)	69 fewer per 1000 (from 46 fewer to 88 fewer)	VERY LOW	CRITICAL
Mortality - ISS > 24 (follow-up 30 days)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	196/994 (19.7%)	30%	RR 0.66 (0.55 to 0.78)	102 fewer per 1000 (from 66 fewer to 135 fewer)	VERY LOW	CRITICAL

(a) Downgraded twice as the evidence was at very high risk of bias
(b) Downgraded once as the confidence interval crossed one MID

Table 29: Clinical evidence profile: Multidisciplinary ward plus trauma unit versus general ward care

Quality assessment							No. of patients		Effect			
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**Multidisciplinary ward care + trauma unit**	**General ward care**	**Relative (95% CI)**	**Absolute**	**Quality**	**Importance**
Unadjusted mortality - All patients (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	32/380 (8.4%)	4.2%	RR 1.99 (1.42 to 2.78)	42 more per 1000 (from 18 more to 75 more)	VERY LOW	CRITICAL
Unadjusted mortality - ISS >15 (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	31/173 (17.9%)	27.2%	RR 0.66 (0.48 to 0.91)	92 fewer per 1000 (from 24 fewer to 141 fewer)	VERY LOW	CRITICAL
Unadjusted mortality - ISS >24 (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	30/118 (25.4%)	46.4%	RR 0.55 (0.4 to 0.75)	209 fewer per 1000 (from 116 fewer to 278 fewer)	VERY LOW	CRITICAL

(a) Downgraded twice as the evidence was at very high risk of bias
(b) Downgraded once as the confidence interval crossed one MID

Table 30: Clinical evidence profile: Multidisciplinary ward plus trauma unit versus specialist ward care

Quality assessment							No. of patients		Effect			
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**Multidisciplinary ward care + trauma unit**	**Specialist ward care**	**Relative (95% CI)**	**Absolute**	**Quality**	**Importance**
Unadjusted mortality - All patients (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	32/380 (8.4%)	8%	RR 1.05 (0.75 to 1.47)	4 more per 1000 (from 20 fewer to 38 more)	VERY LOW	CRITICAL
Unadjusted mortality - ISS >15 (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	31/173 (17.9%)	22.8%	RR 0.79 (0.57 to 1.09)	48 fewer per 1000 (from 98 fewer to 21 more)	VERY LOW	CRITICAL
Unadjusted mortality - ISS >24 (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	30/118 (25.4%)	34.6%	RR 0.73 (0.54 to 1)	93 fewer per 1000 (from 159 fewer to 0 more)	VERY LOW	CRITICAL

(a) Downgraded twice as the evidence was at very high risk of bias
(b) Downgraded once as the confidence interval crossed one MID

Table 31: Clinical evidence profile: Multidisciplinary ward plus trauma unit versus specialist ward care (same hospital; 2000)

Quality assessment							No. of patients		Effect			
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**Multidisciplinary ward care + Trauma unit**	**Specialist ward care**	**Relative (95% CI)**	**Absolute**	**Quality**	**Importance**
Unadjusted mortality - All patients (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	32/380 (8.4%)	11.6%	RR 0.73 (0.48 to	31 fewer per 1000 (from 60 fewer to 12	VERY LOW	CRITICAL

									1.1)	more)		
Unadjusted mortality - ISS >15 (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	31/173 (17.9%)	34.2%	RR 0.52 (0.36 to 0.77)	164 fewer per 1000 (from 79 fewer to 219 fewer)	VERY LOW	CRITICAL
Unadjusted mortality - ISS >24 (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	30/118 (25.4%)	47.5%	RR 0.54 (0.37 to 0.78)	218 fewer per 1000 (from 105 fewer to 299 fewer)	VERY LOW	CRITICAL

(a) Downgraded twice as the evidence was at very high risk of bias
(b) 2 Downgraded once as the confidence interval crossed one MID

Table 32: Multidisciplinary ward care (2004) versus multidisciplinary ward care plus trauma unit

Quality assessment							No. of patients		Effect			
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**Multidisciplinary ward care**	**Multidisciplinary ward care + trauma unit**	**Relative (95% CI)**	**Absolute**	**Quality**	**Importance**
Critical care length of stay - ISS >15 (measured with: a comparison of the 1000 patients admitted immediately before and 1000 patients admitted immediately after the introduction of the trauma ward; better indicated by lower values)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	1000	1000	-	MD 1 higher (0.37 to 1.63 higher)	VERY LOW	CRITICAL
Critical care length of stay - ISS >24 (measured with: a comparison of the 1000 patients admitted immediately before and 1000 patients admitted immediately after the introduction of the trauma ward; better indicated by lower values)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	1000	1000	-	MD 2 higher (0.17 to 3.83 higher)	VERY LOW	CRITICAL
Hospital length of stay - ISS >15 (measured with: a comparison of the 1000 patients admitted immediately before and 1000 patients admitted immediately after the introduction of the trauma ward; better indicated by lower values)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	1000	1000	-	MD 7 higher (2.84 to 11.16 higher)	VERY LOW	CRITICAL
Hospital length of stay - ISS >24 (measured with: a comparison of the 1000 patients admitted immediately before and 1000 patients admitted immediately after the introduction of the trauma ward; better indicated by lower values)												

1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	1000	1000	-	MD 11 higher (4.46 to 17.54 higher)	VERY LOW	CRITICAL

(a) Downgraded twice as the evidence was at very high risk of bias
(b) Downgraded once as the confidence interval crossed one MID

Table 33: Specialist ward care versus general ward care

Quality assessment							No. of patients		Effect		Quality	Importance
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**Speciality ward care**	**General ward care**	**Relative (95% CI)**	**Absolute**		
Unadjusted mortality - All patients (assessed with: mortality at discharge or 30 days after admission)												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	1371/17113 (8%)	4.2%	RR 1.89 (1.77 to 2.02)	37 more per 1000 (from 32 more to 43 more)	VERY LOW	CRITICAL
Unadjusted mortality - ISS >15												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	No serious imprecision	None	1145/5025 (22.8%)	27.2%	RR 0.84 (0.78 to 0.89)	44 fewer per 1000 (from 30 fewer to 60 fewer)	VERY LOW	
Unadjusted mortality - ISS >24												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious[b]	None	970/2803 (34.6%)	46.4%	RR 0.75 (0.7 to 0.8)	116 fewer per 1000 (from 93 fewer to 139 fewer)	VERY LOW	CRITICAL

(a) Downgraded twice as the evidence was at very high risk of bias
(b) Downgraded once as the confidence interval crossed one MID

H.3 Continuity of care: the trauma coordinator role

Table 34: Clinical evidence profile: Trauma Coordinator versus no Trauma Coordinator

Quality assessment							No. of	Effect		Quality	Importance

							patients					
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**TC**	**No TC**	**Relative (95% CI)**	**Absolute**		
Mortality (follow-up 14 months; assessed with: Number of deaths)												
1	Observational studies	Serious	No serious inconsistency	Serious[a]	Very serious[b]	None	37/755 (4.9%)	4.8%	RR 1.01 (0.65 to 1.58)	0 more per 1000 (from 17 fewer to 28 more)	VERY LOW	CRITICAL
Number of people receiving Allied Health Intervention - Occupational Therapy (follow-up 14 months; assessed with: Case-mix database)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	249/755 (33%)	27%	RR 1.22 (1.05 to 1.43)	59 more per 1000 (from 13 more to 116 more)	VERY LOW	CRITICAL
Number of people receiving Allied Health Intervention - Physiotherapy (follow-up 14 months; assessed with: Case-mix data)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	415/755 (55%)	45%	RR 1.22 (1.1 to 1.35)	99 more per 1000 (from 45 more to 158 more)	VERY LOW	CRITICAL
Number of people receiving Allied Health Intervention - Social Work (follow-up 14 months; assessed with: Case-mix data)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	279/755 (37%)	32.1%	RR 1.15 (1 to 1.32)	48 more per 1000 (from 0 more to 103 more)	VERY LOW	CRITICAL
Patients receiving Allied Health Intervention (follow-up 5 months; assessed with: Case-Mix Data)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	No serious imprecision	None	87/149 (58.4%)	22%	RR 2.65 (2.08 to 3.39)	363 more per 1000 (from 238 more to 526 more)	VERY LOW	CRITICAL
Number of Unplanned ICU visits (follow-up 14 months; assessed with: Case-mix data)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	6/755 (0.79%)	1.8%	RR 0.45 (0.17 to 1.15)	10 fewer per 1000 (from 15 fewer to 3 more)	VERY LOW	CRITICAL
Documentation in patient records - Completeness of description of procedures in discharge summaries (follow-up 30 days)												
1	Observational studies	Very serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	202/210 (96.2%)	73.8%	RR 1.3 (1.2 to 1.42)	221 more per 1000 (from 148 more to 310 more)	VERY LOW	CRITICAL
Documentation in patient records - Completeness of events of hospitalisation in discharge summaries (follow-up 30 days)												
1	Observational studies	Very serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	198/210	74.8%	RR 1.26 (1.16 to 1.37)	194 more per 1000 (from 120 more to 277 more)	VERY LOW	CRITICAL

							(94.3%)					
Documentation in patient records - Completeness of description of injuries in discharge summaries (follow-up 30 days)												
1	Observational studies	Very serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	204/210 (97.1%)	77.6%	RR 1.25 (1.16 to 1.35)	194 more per 1000 (from 124 more to 272 more)	VERY LOW	CRITICAL
Documentation in patient records - Completeness of discharge teaching in discharge summaries (follow-up 30 days)												
1	Observational studies	Very serious[c]	No serious inconsistency	Serious[a]	No serious imprecision	None	204/210 (97.1%)	68.6%	RR 1.42 (1.29 to 1.56)	288 more per 1000 (from 199 more to 384 more)	VERY LOW	CRITICAL
Documentation in patient records - Completeness of plan for follow-up care in discharge summaries (follow-up 30 days)												
1	Observational studies	Very serious[c]	No serious inconsistency	Serious[a]	No serious imprecision	None	206/210 (98.1%)	69.5%	RR 1.41 (1.29 to 1.55)	285 more per 1000 (from 202 more to 382 more)	VERY LOW	CRITICAL
Documentation in patient records - Compliance with obtaining interdisciplinary consultations when indicated in inpatient records (follow-up 30 days)												
1	Observational studies	Very serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	198/210 (94.3%)	71%	RR 1.33 (1.21 to 1.46)	234 more per 1000 (from 149 more to 327 more)	VERY LOW	CRITICAL
Number of occurrences of complications - Overall Complication Rate @ August 2000 to Jan 2001 (5 months) (follow-up 5 months; assessed with: Databases)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Very serious[b]	None	21/327 (6.4%)	6%	RR 1.06 (0.5 to 2.27)	4 more per 1000 (from 30 fewer to 76 more)	VERY LOW	CRITICAL
Number of occurrences of complications - Number of occurrences of Respiratory Failure (14 Months) (follow-up 14 months; assessed with: Databases)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	15/755 (2%)	3.3%	RR 0.6 (0.32 to 1.13)	13 fewer per 1000 (from 22 fewer to 4 more)	VERY LOW	
Number of occurrences of complications - Number of occurrences of Coagulopathy (14 Months) (follow-up 14 months; assessed with: Databases)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Very serious[b]	None	17/755 (2.3%)	2.9%	RR 0.77 (0.41 to 1.43)	7 fewer per 1000 (from 17 fewer to 12 more)	VERY LOW	CRITICAL
Number of occurrences of complications - Number of occurrences of Deep Vein Thrombosis (DVT) (14 Months) (follow-up 14 months; assessed with: Databases)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Serious[b]	None	1/755 (0.13%)	0.9%	RR 0.15 (0.02 to 1.21)	8 fewer per 1000 (from 9 fewer to 2 more)	VERY LOW	
Number of procedures (follow-up 14 months; assessed with: Databases)												
1	Observational	Serious[c]	No serious	Serious[a]	No serious	None	396/75	60.9%	RR 0.86 (0.79	85 fewer per 1000 (from	VERY LOW	CRITICAL

	studies		inconsistency		imprecision		5 (52.5%)		to 0.94)	37 fewer to 128 fewer)		
Missed Injury detection (follow-up 5 months; assessed with: Databases)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	No serious imprecision	None	2/327 (0.61%)	5.4%	RR 0.11 (0.02 to 0.53)	48 fewer per 1000 (from 25 fewer to 53 fewer)	VERY LOW	CRITICAL
Number of missed injuries (follow-up 14 months; assessed with: Databases)												
1	Observational studies	Serious[c]	No serious inconsistency	Serious[a]	Very serious[b]	None	31/755 (4.1%)	4.1%	RR 0.92 (0.57 to 1.48)	3 fewer per 1000 (from 18 fewer to 20 more)	VERY LOW	CRITICAL
Hospital LOS (follow-up 8 months; measured with: Prospective Data; Better indicated by lower values)												
1	Observational studies	Serious[c]	No serious inconsistency	Very serious[a]	Serious[b]	None	31	45	-	MD 0.28 lower (0.5 to 0.06 lower)	VERY LOW	CRITICAL
Health related quality of life												
Time to rehabilitation prescription												
Impact of traumatic event on concurrent morbidities.												

(a) The majority of the evidence included an indirect population (downgrade by one increment) or a very indirect population (downgrade by two increments)
(b) Downgraded by 1 increment if the confidence interval crossed one MID or by 2 increments if the confidence interval crossed both MID's.
(c) Downgraded by 1 increment if the majority of the evidence was a high risk of bias, and downgraded by 2 increments if the majority of the evidence was at very high risk of bias

H.4 Paediatric training

Table 35: Clinical evidence profile: PALS versus no PALS

Quality assessment							No. of patients		Effect			
No. Of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**PALS versus standard care**	**Control**	**Relative (95% CI)**	**Absolute**	**Quality**	**Importance**
Mortality												

1	Randomised trials	Very serious[a]	No serious inconsistency	Serious[b]	Very serious[c]	None	24/65 (36.9%)	32.2%	OR 0.7 (0.3 to 1.63)	72 fewer per 1000 (from 197 fewer to 114 more)	VERY LOW	CRITICAL
Successful intubation in those requiring it												
1	Randomised trials	Very serious[a]	No serious inconsistency	Serious[b]	Serious[c]	None	40/47 (85.1%)	47.4%	OR 4.4 (1.2 to 16.13)	325 more per 1000 (from 46 more to 462 more)	VERY LOW	CRITICAL
Successful IV/IO access in those for whom it was attempted												
1	Randomised trials	Very serious[a]	No serious inconsistency	Serious[b]	No serious imprecision	None	57/57 (100%)	68.8%	OR 17.4 (2.5 to 121.11)	287 more per 1000 (from 158 more to 308 more)	VERY LOW	CRITICAL

(a) The non-randomised study did adjust for some confounding variables, but there would have been some residual bias. Attrition bias was serious.
(b) Indirectness was serious as only 47% had trauma
(c) If the CIs crossed one default MID, imprecision was deemed serious, and if they crossed two MIDs imprecision was regarded as very serious.

H.5 Access to services

H.5.1 Airway

Table 36: Clinical evidence profile: pre-hospital versus ER intubation

Quality assessment							No. of patients		Effect			
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**Pre-hospital**	**ED**	**Relative (95% CI)**	**Absolute**	**Quality**	**Importance**
Mortality - ED												
1	Randomised trials	No serious risk of bias	No serious inconsistency	No serious indirectness	Very serious[a]	None	17/160 (10.6%)	14/152 (9.2%)	RR 1.15 (0.59 to 2.26)	14 more per 1000 (from 38 fewer to 116 more)	LOW	CRITICAL

Mortality – in hospital												
1	Randomised trials	No serious risk of bias	No serious inconsistency	No serious indirectness	serious[a]	None	53/160 (33.1%)	55/152 (36.2%)	RR 0.92 (0.67 to 1.124)	29 fewer per 1000 (from 119 fewer to 45 more)	MODERATE	CRITICAL
Mortality – 6 months												
1	Randomised trials	No serious risk of bias	No serious inconsistency	No serious indirectness	Serious[a]	None	53/157 (33.8%)	55/142 (38.7%)	RR 0.87 (0.64 to 1.18)	50 fewer per 1000 (from 139 fewer to 70 more)	MODERATE	CRITICAL
Glasgow Outcome Scale extended 5-8 - All patients												
1	Randomised trials	No serious risk of bias	No serious inconsistency	No serious indirectness	Serious[a]	None	80/157 (51%)	56/142 (39.4%)	RR 1.29 (1 to 1.67)	114 more per 1000 (from 0 more to 264 more)	MODERATE	CRITICAL
Glasgow Outcome Scale extended 5-8 - Initial Glasgow Coma Scale 5-9												
1	Randomised trials	No serious risk of bias	No serious inconsistency	No serious indirectness	Serious[a]	None	45/81 (55.6%)	34/73 (46.6%)	RR 1.19 (0.87 to 1.63)	88 more per 1000 (from 61 fewer to 293 more)	MODERATE	CRITICAL
Craniotomy within 6 hours of ED arrival												
1	Randomised trials	No serious risk of bias	No serious inconsistency	No serious indirectness	Very serious[a]	None	41/160 (25.6%)	32/152 (21.1%)	RR 1.22 (0.81 to 1.83)	46 more per 1000 (from 40 fewer to 175 more)	LOW	CRITICAL

(a) Outcomes were downgraded by one increment if the upper or lower 95% CI crossed the lower MID or the upper or lower 95% CI crossed the upper MID. Outcomes were downgraded by two increments if the upper CI simultaneously crossed the upper MID and the lower CI crossed the lower MID. Default MIDs were set at RRs of 0.75 and 1.25 for dichotomous variables, and at 0.5 of the control group weighted mean standard deviation either side of the null line for continuous variables.

H.5.2 Interventional radiology

Table 37: Clinical evidence profile: Rapid versus delayed interventional radiology

Quality assessment							No. of patients		Effect			
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**Rapid**	**Late**	**Relative (95% CI)**	**Absolute**	**Quality**	**Importance**

In-hospital mortality (Blunt trauma)											
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious	None	Not reported	Not reported	OR 2.4 (1.05 to 5.49)	Not calculated[b]	VERY LOW	CRITICAL
In-hospital mortality (Penetrating trauma)											
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious	None	Not reported	Not reported	OR 2.26 (0.98 to 5.21)	Not calculated[b]	VERY LOW	CRITICAL

(a) Downgraded by two increments as evidence was at very high risk of bias
(b) Absolute values could not be reported as insufficient data reported in the paper

Table 38: Clinical evidence profile: Work hours versus out of hours interventional radiology

Quality assessment							No. of patients		Effect			
No. of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other**	**Work hours**	**Out of hours**	**Relative (95% CI)**	**Absolute**	**Quality**	**Importance**
30-day mortality												
1	Observational studies	Very serious[a]	No serious inconsistency	No serious indirectness	Serious	None	32	56	OR 2.4 (1.05 to 5.49)	Mortality in patients admitted during work hours n=21 Mortality in patients admitted out of work hours n=32	VERY LOW	CRITICAL

(a) Downgraded by two increments as evidence was at very high risk of bias

Appendix I: Forest plots

I.1 Pre-hospital triage to the appropriate destination

Figure 1: Sensitivity and specificity of index test ACS-SCOT in detecting major trauma

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Dinh 2012	180	587	105	1792	0.63 [0.57, 0.69]	0.75 [0.74, 0.77]
Do 2014	139	45	43	1469	0.76 [0.70, 0.82]	0.97 [0.96, 0.98]
Ocak 2009	127	34	24	117	0.84 [0.77, 0.90]	0.77 [0.70, 0.84]

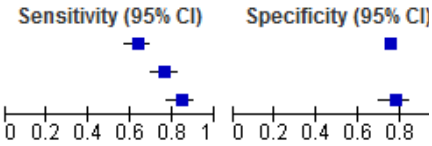


Figure 2: Sensitivity and specificity of index test ACS COT in detecting major trauma in children

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Do 2014	8	10	3	217	0.73 [0.39, 0.94]	0.96 [0.92, 0.98]

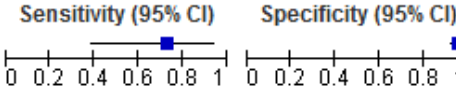


Figure 3: Sensitivity and specificity of index test UK Tools in detecting major trauma in children (London)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheung 2013	221	339	9	132	0.96 [0.93, 0.98]	0.28 [0.24, 0.32]

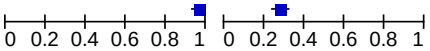


Figure 4: Sensitivity and specificity of index test UK Tools in detecting major trauma in children (East Midlands)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheung 2013	223	391	7	80	0.97 [0.94, 0.99]	0.17 [0.14, 0.21]

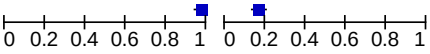


Figure 5: Sensitivity and specificity of index test UK Tools in detecting major trauma in children (North West)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheung 2013	214	377	16	94	0.93 [0.89, 0.96]	0.20 [0.16, 0.24]

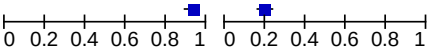


Figure 6: Sensitivity and specificity of index test UK Tools in detecting major trauma in children (Northern)

Study	TP	FP	FN	TN	Sensitivity (95% CI)	Specificity (95% CI)
Cheung 2013	209	363	21	108	0.91 [0.86, 0.94]	0.23 [0.19, 0.27]

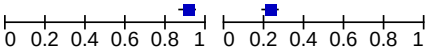


Figure 7: Sensitivity and specificity of index test UK Tools in detecting major trauma in children (South West London)

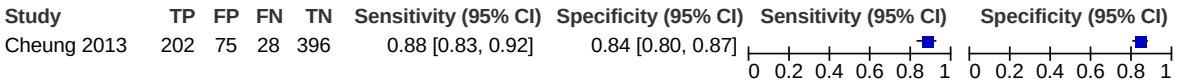
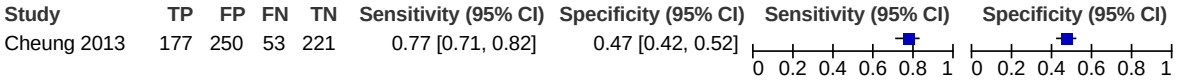


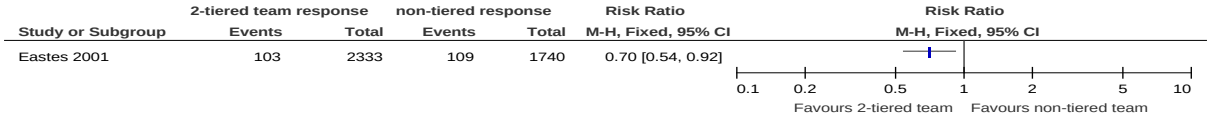
Figure 8: Sensitivity and specificity of index test UK Tools in detecting major trauma in children (Wessex)



I.2 Receiving trauma teams

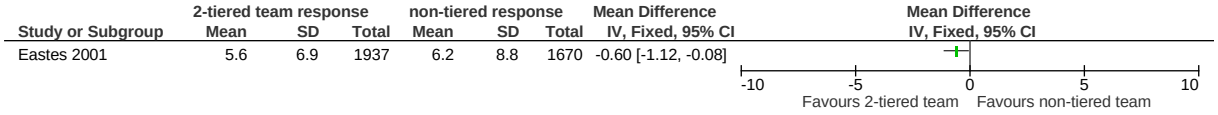
I.2.1 Mortality

Figure 9: Two-tiered response team versus non-tiered response team in a Level 1 trauma centre



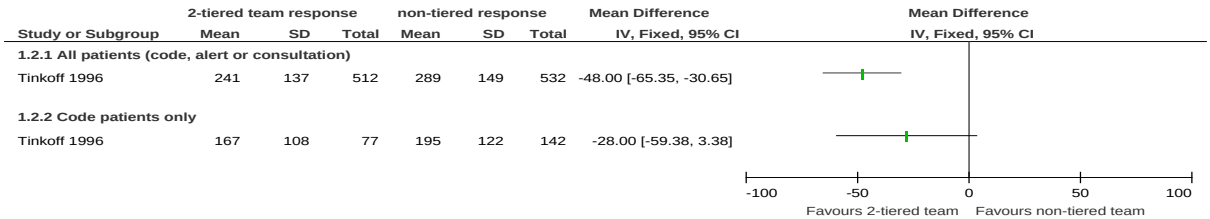
I.2.2 Hospital length of stay

Figure 10: Two-tiered response team versus non-tiered response team in a Level 1 trauma centre: Days



I.2.3 Emergency department length of stay

Figure 11: Two-tiered response team versus non-tiered response team in a Level 1 trauma centre: Minutes



I.2.4 Mortality

Figure 12: Three-tiered response team versus two-tiered response team in a Level 1 trauma centre: Mortality post presenting to ED

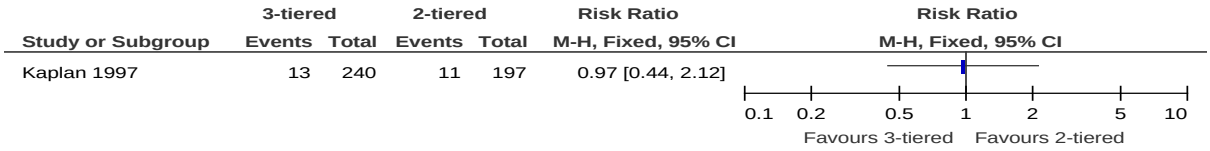
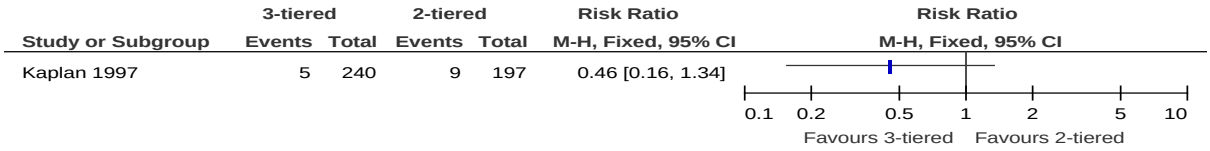
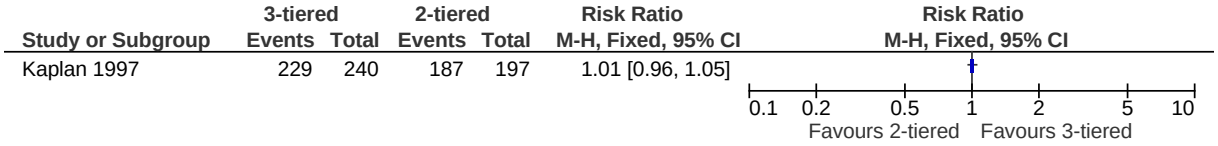


Figure 13: Three-tiered response team versus two-tiered response team in a Level 1 trauma centre: Mortality post admission to hospital



I.2.5 Survival

Figure 14: Three-tiered response team versus two-tiered response team in a Level 1 trauma centre: survival to discharge



I.2.6 Complications

Figure 15: Three-tiered response team versus two-tiered response team in a Level 1 trauma centre: complications overall

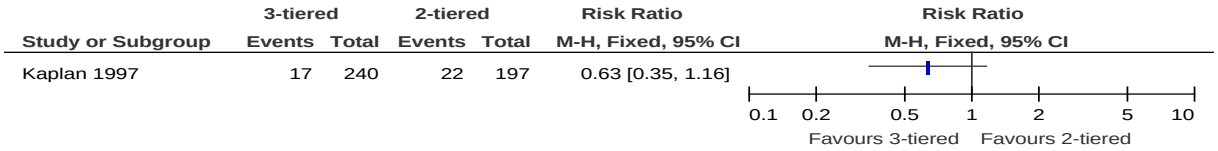


Figure 16: Three-tiered response team versus two-tiered response team in a Level 1 trauma centre: complication rates per person

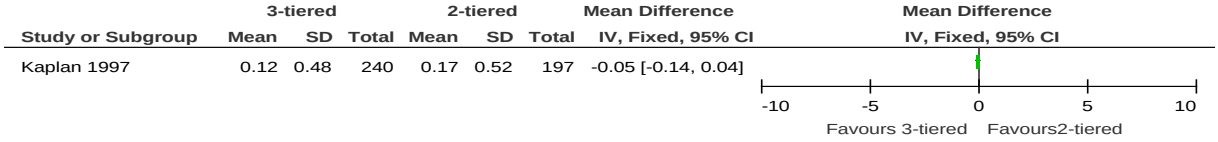
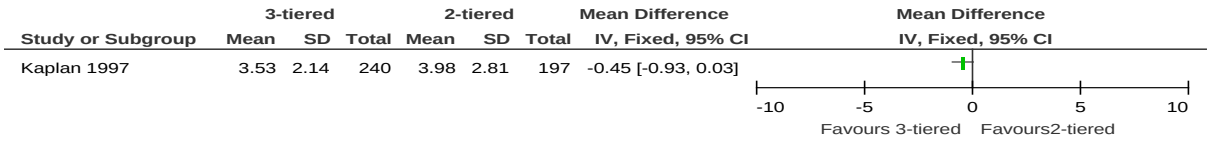


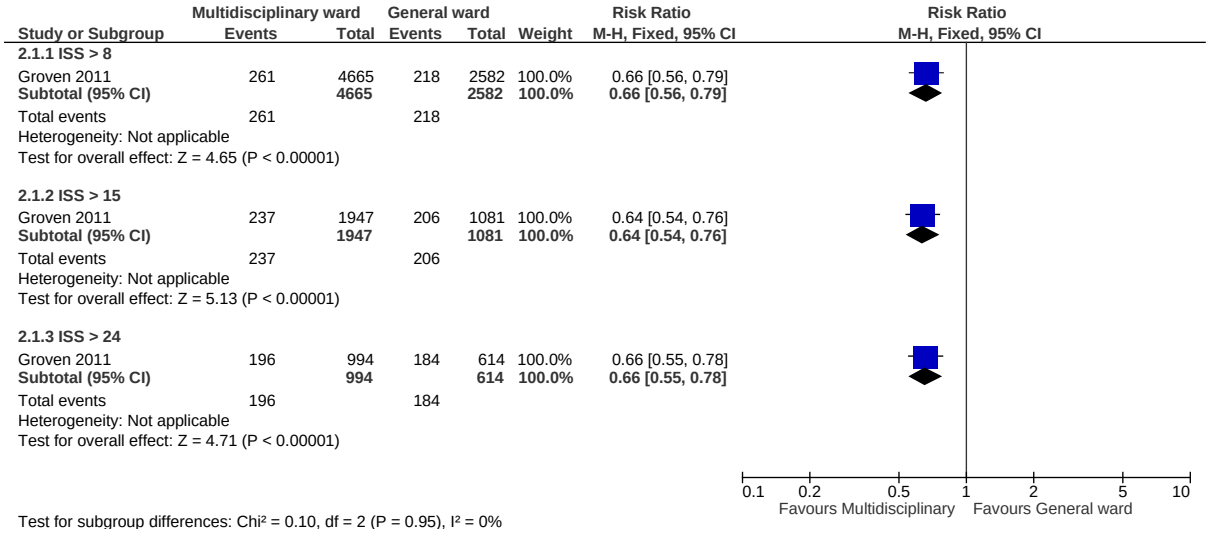
Figure 17: Three-tiered response team versus two-tiered response team in a Level 1 trauma centre: Hours



I.3 A trauma service providing continuity of care

I.3.1 Multidisciplinary ward versus general ward care

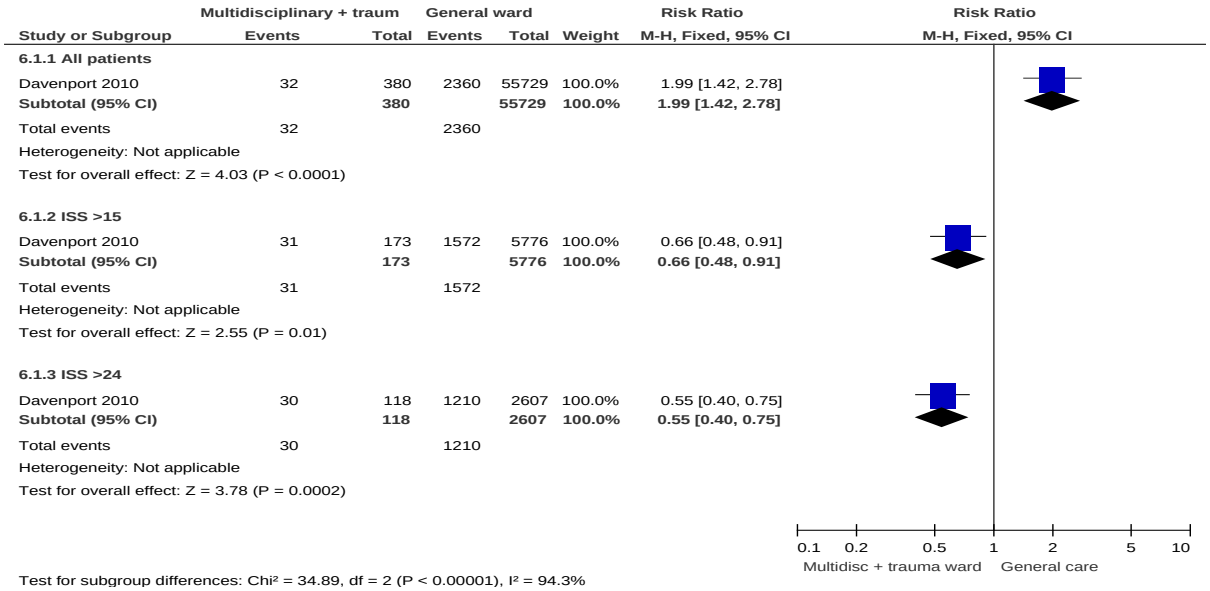
Figure 18: Mortality



Test for subgroup differences: Chi² = 0.10, df = 2 (P = 0.95), I² = 0%

I.3.2 Multidisciplinary ward plus trauma ward versus general ward care

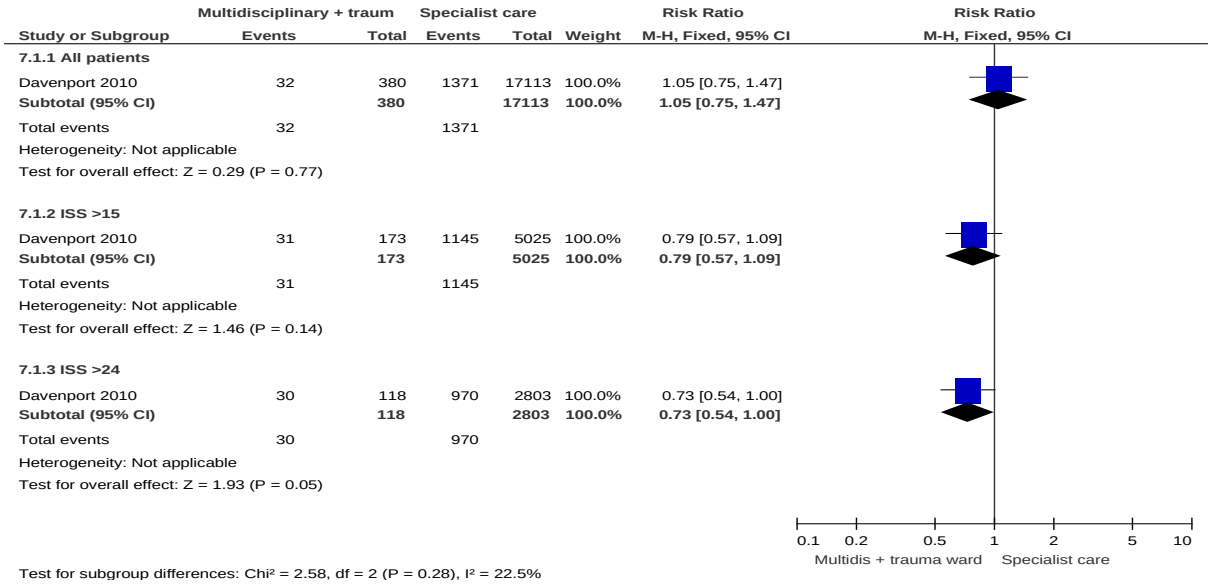
Figure 19: Mortality



Test for subgroup differences: Chi² = 34.89, df = 2 (P < 0.00001), I² = 94.3%

I.3.3 Multidisciplinary ward plus trauma ward versus specialist ward care

Figure 20: Mortality



I.3.4 Multidisciplinary ward care versus multidisciplinary ward care plus trauma ward

Figure 21: Mortality

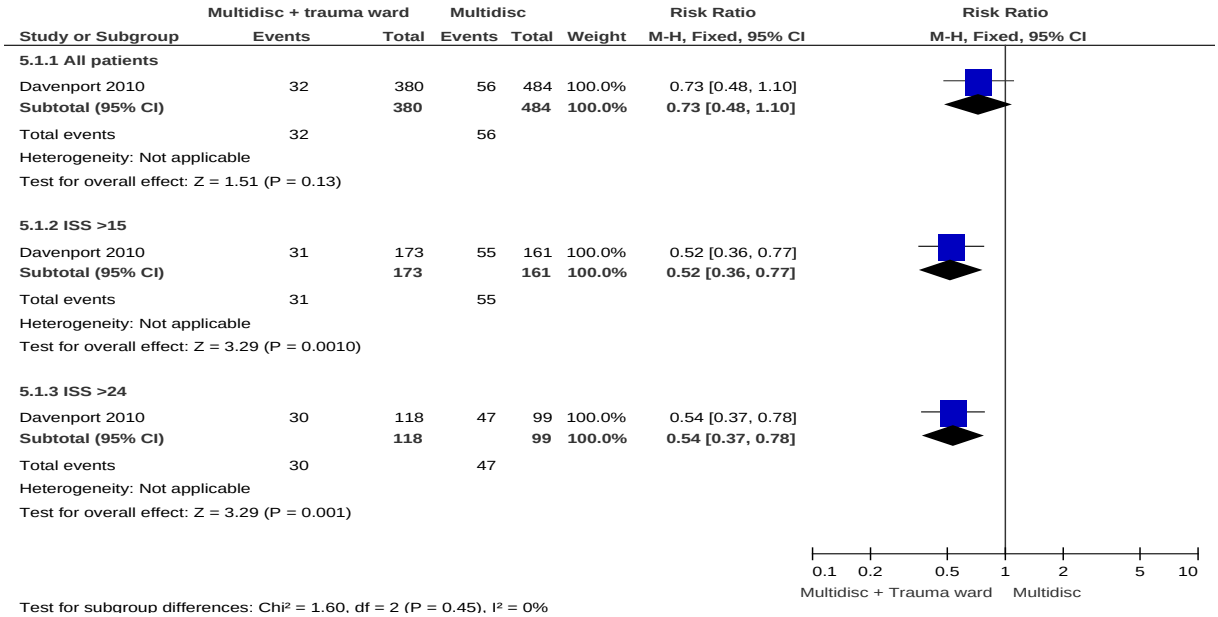
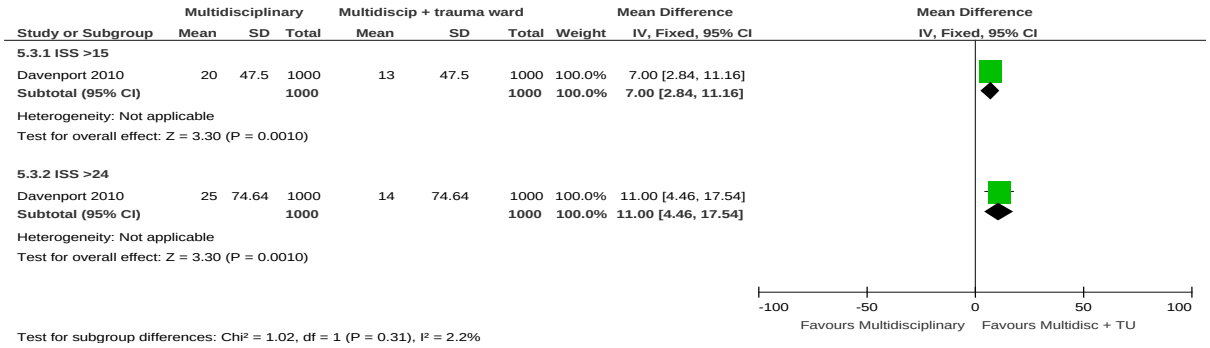
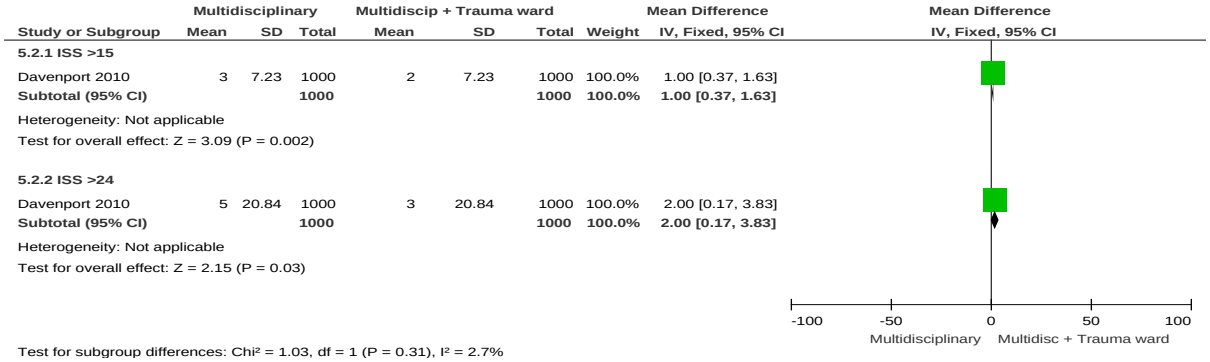


Figure 22: Hospital length of stay



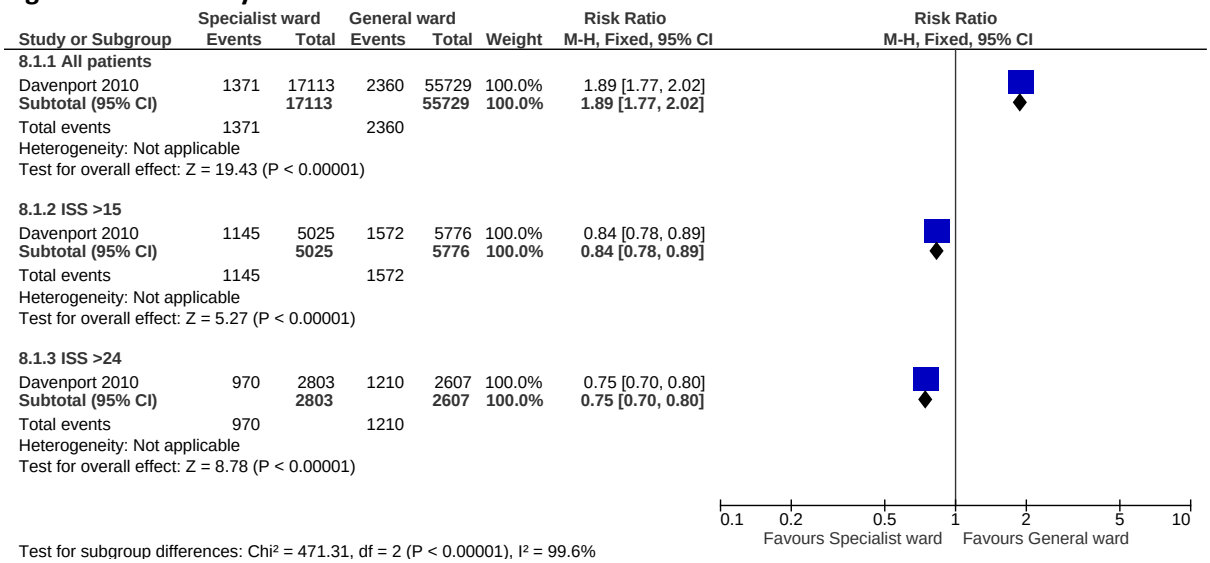
1

Figure 23: Critical care length of stay



2 ## I.3.5 Specialist ward care versus general ward care

Figure 24: Mortality



I.4 Continuity of care: the trauma coordinator role

I.4.1 Trauma coordinators versus no trauma coordinator

Figure 25: Mortality

Study or Subgroup	Trauma Coordinator Events	Total	No Trauma Coordinator Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Curtis 2006	37	755	38	786	100.0%	1.01 [0.65, 1.58]
Total (95% CI)		**755**		**786**	**100.0%**	**1.01 [0.65, 1.58]**
Total events	37		38			

Heterogeneity: Not applicable
Test for overall effect: Z = 0.06 (P = 0.95)

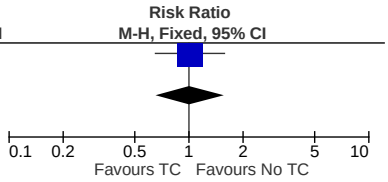


Figure 26: Number of people receiving Allied Health Intervention

Study or Subgroup	Trauma Coordinator Events	Total	No Trauma Coordinator Events	Total	Risk Ratio M-H, Fixed, 95% CI
1.2.1 Occupational Therapy					
Curtis 2006	249	755	212	786	1.22 [1.05, 1.43]
1.2.2 Physiotherapy					
Curtis 2006	415	755	354	786	1.22 [1.10, 1.35]
1.2.3 Social Work					
Curtis 2006	279	755	252	786	1.15 [1.00, 1.32]

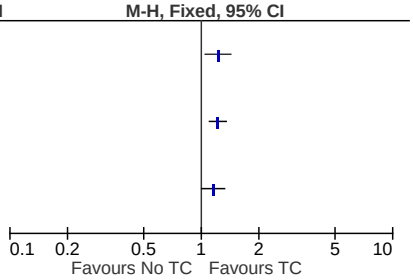


Figure 27: Number of unplanned ICU visits

Study or Subgroup	Trauma Coordinator Events	Total	No Trauma Coordinator Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Curtis 2006	6	755	14	786	100.0%	0.45 [0.17, 1.15]
Total (95% CI)		**755**		**786**	**100.0%**	**0.45 [0.17, 1.15]**
Total events	6		14			

Heterogeneity: Not applicable
Test for overall effect: Z = 1.66 (P = 0.10)

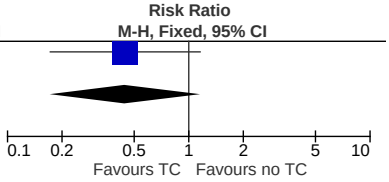


Figure 28: Documentation in patient records

Study or Subgroup	Trauma Coordinator Events	Total	No Trauma Coordinator Events	Total	Risk Ratio M-H, Fixed, 95% CI
1.4.1 Completeness of description of procedures in discharge summaries					
Spisso 1990	202	210	155	210	1.30 [1.20, 1.42]
1.4.2 Completeness of events of hospitalisation in discharge summaries					
Spisso 1990	198	210	157	210	1.26 [1.16, 1.37]
1.4.3 Completeness of description of injuries in discharge summaries					
Spisso 1990	204	210	163	210	1.25 [1.16, 1.35]
1.4.4 Completeness of discharge teaching in discharge summaries					
Spisso 1990	204	210	144	210	1.42 [1.29, 1.56]
1.4.5 Completeness of plan for followup care in discharge summaries					
Spisso 1990	206	210	146	210	1.41 [1.29, 1.55]
1.4.6 Compliance with obtaining interdiscplinary consultations when indicated in inpatient records					
Spisso 1990	198	210	149	210	1.33 [1.21, 1.46]

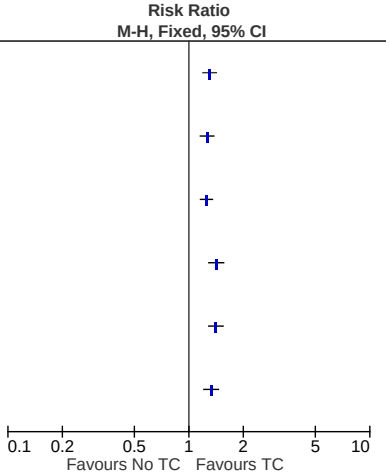
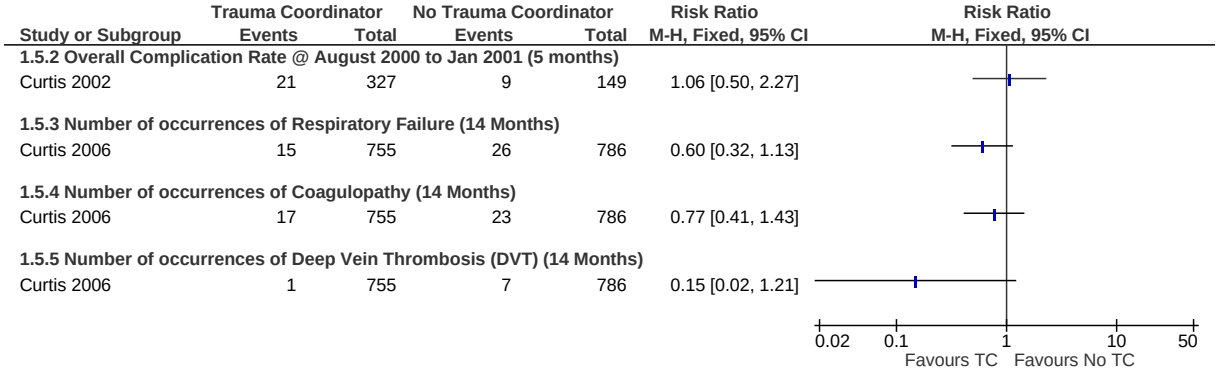
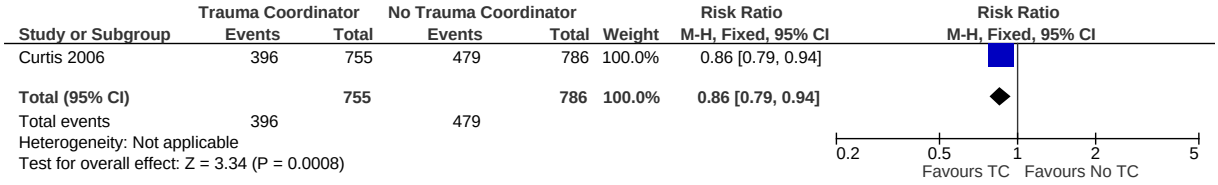


Figure 29: Number of occurrences of complication



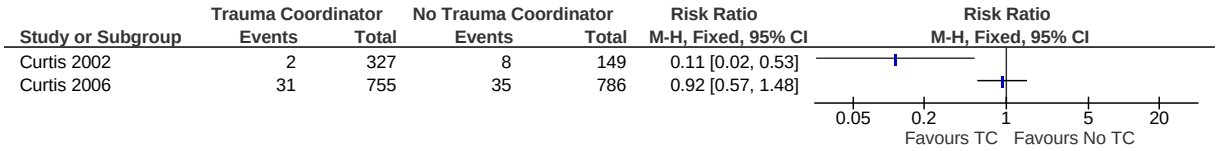
1

Figure 30: Number of procedures



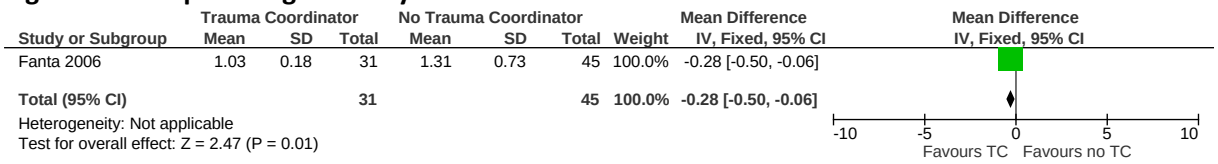
2

Figure 31: Number of missed injuries



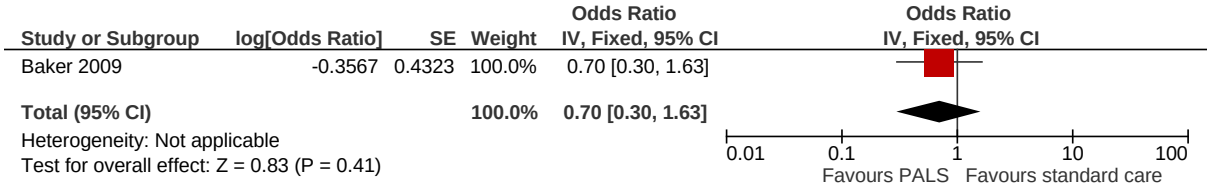
3

Figure 32: Hospital length of stay



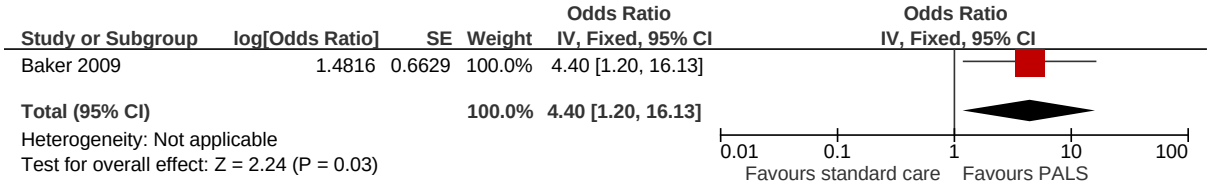
4 # I.5 Paediatric trauma training

Figure 33: PALS training versus no PALS training for mortality



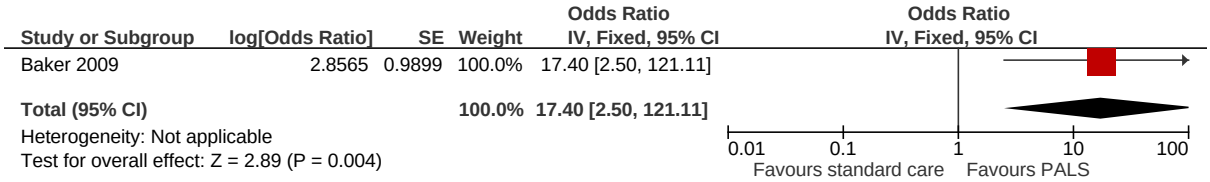
5

Figure 34: PALS training versus no PALS training for successful intubation if required



1

Figure 35: PALS training versus no PALS training for successful IV/IO access if attempted



I.6 Access to services

I.6.1 Airway

I.6.1.1 Pre-hospital versus hospital intubation - RCT

Figure 36: Mortality

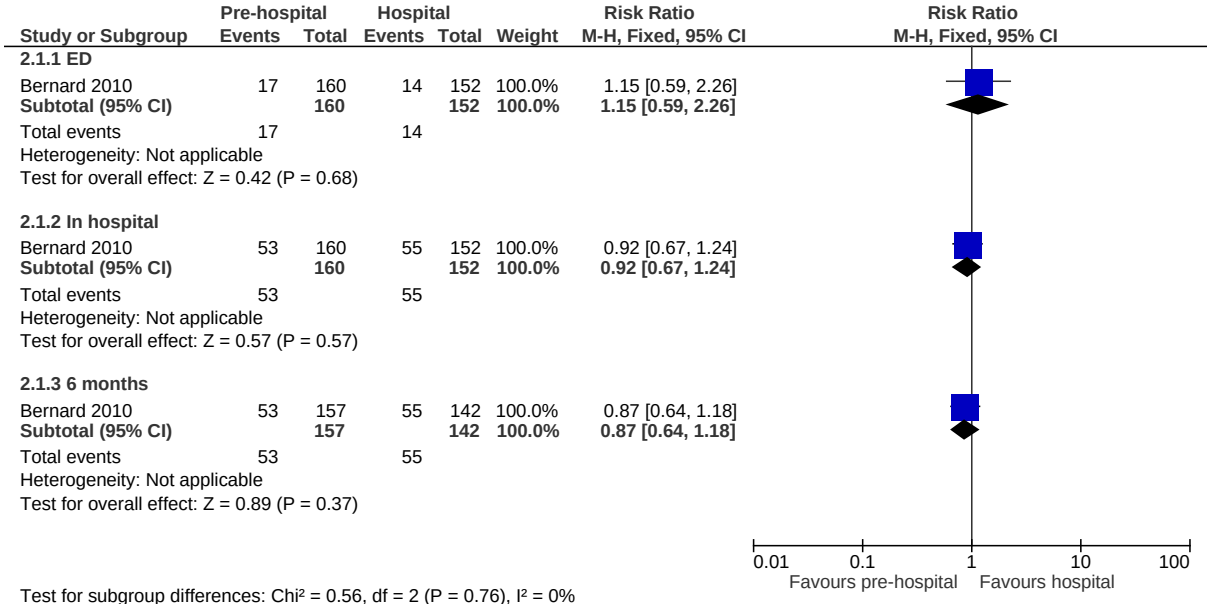


Figure 37: Glasgow Outcomes Scale extended 5-8

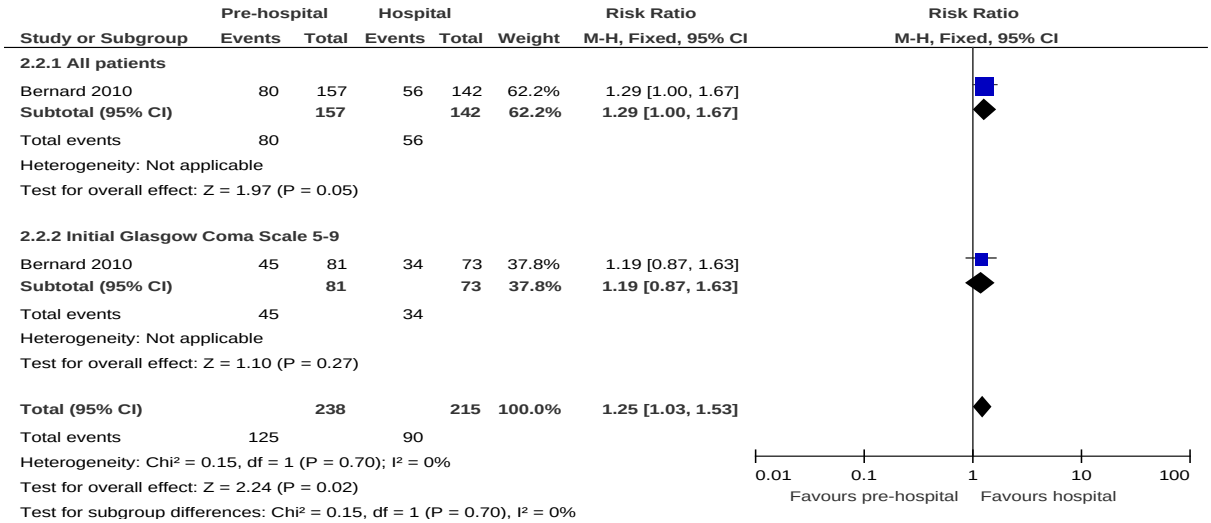
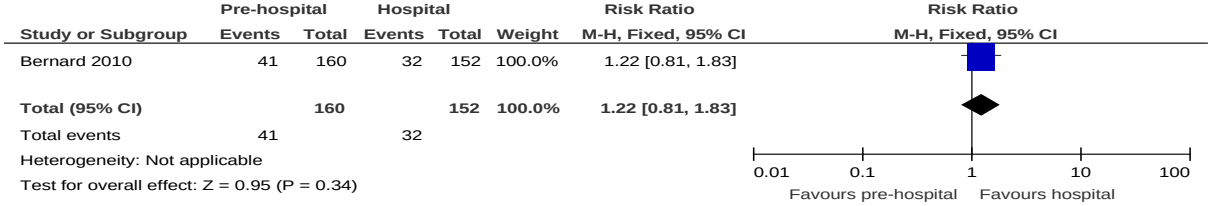


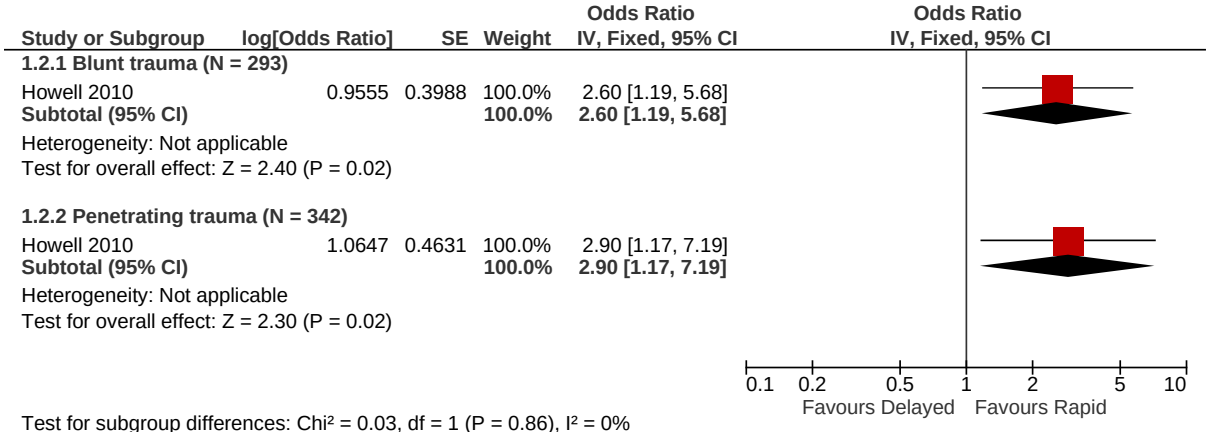
Figure 38: Craniotomy within 6 hours of ED arrival



I.6.2 Interventional radiology

I.6.2.1 Rapid (less than 1 hour) versus later (1-3 hours) interventional radiology

Figure 39: In hospital mortality



Appendix J: Excluded clinical studies

J.1 Pre-hospital triage to the appropriate destination

Table 39: Studies excluded from the clinical review

Reference	Reason for exclusion
Aprahamian 1990 [11]	Study assesses association between paediatric trauma score and injury severity (non-diagnostic).
Ashkenazi 2006 [13]	Major incident triage rule.
Balik 1993[16]	Study reports association between paediatric Trauma Score and Death (non-Diagnostic)
Bamoski 1998 [17]	Non-validated local triage tool - no evidence of validation. Association of Air Medical Services).
Baxt 1989 [19]	Data cannot be extracted.
Baxt 1990 [20]	Study develops triage tool – no validation (Trauma Triage Rule)
Bouillon 1997 [27]	Cut off points selected – study bias.
Brown 2009 [30]	Systematic meta-analysis for ambulance activation.
Brown 2011C [29]	Compares steps along the ACS-SCOT tool.
Buren 2013 [34]	Non-validated local triage tool - no evidence of validation. (Viborg Regional Hospital Tool).
Burstein 1996 [36]	Outdated Rule - Considers 1990 ACS Guideline.
Chan 1989[43]	Outdated Rule - Considers Trauma Score.
Ciesla 2013 [46]	Unclear reporting of trauma triage rule.
Claridge 2010 [48]	Compares tiered trauma teams.
Cross 2012[59]	Major incident triage tool – (Sacco triage criteria)
Cross 2013 [60]	Comparison of major incident triage tools.
Cottington 1988 [57]	Outdated triage tool – Trauma Score.
Cox 2011 [58]	Study data reported in Cox 2012.
Crystal 2004 [62]	Study compares pre-alert mechanisms for the emergency teams (non-diagnostic)
Davidson 2014 [70]	Comparison of individual steps along the ACS-SCOT protocol.
Davis 2012 [73]	Non-validated local triage tool – no evidence of validation. (Florida State Triage Rule).
Deane 1986 [77]	Outdated Rule - Considers Trauma Score.
Delgado 2012 [80]	Abstract only
Demetriades 1998 [82]	Prognostic study assessing variables predictive of mortality/major trauma (non-diagnostic).
Dowd 2000 [88]	In hospital trauma activation protocol.
Eastbridge 2010 [92]	Non-validated triage tool – (Field Triage Tool – Military setting).
Fullerton 2014 [105]	Non-- validated triage tool – (Los Angeles Country Trauma Triage Decision Scheme)
Garwe 2011 [109]	Study compares outcomes between direct and indirect transfer to MTC in pelvic patients (non-diagnostic).
Garwe 2012 [111]	Study compares outcomes between direct and indirect transfer to MTC in pelvic patients (non-diagnostic).
Gawre 2011A [110]	Study compares factors between direct and indirect transfer to MTC in

Reference	Reason for exclusion
	pelvic patients (non-diagnostic).
Henry 1996A [124]	Outdated Rule - Considers 1990 ACS Guideline.
Horne 2012[126]	Major incident triage tool.
Johnson 1996 [136]	Non-validated local triage tool - no evidence of validation. (Paediatric Trauma Triage Checklist).
Jones 1993 [137]	Risk prediction tool for major haemorrhage.
Kann 2007 [139]	Outdated Rule - Considers 1999 ACS Guideline.
Lossius 2000[150]	Non-validated triage tool – unclear explanation. In-hospital triage tool.
Mann 1997 [152]	Before and after study of trauma network (non-diagnostic).
McLellan 1989 [158]	In-hospital validation of early scoring system (estimated injury severity score).
Meisler 2009 [160]	Abstract only
Moen 2008 [163]	Study compares outcome of patients with severe head injury admitted directly to a neurosurgical department with those initially transferred to a local hospital (non-diagnostic).
Mohan 2011 [164]	In hospital triage tool.
Monti 1991 [165]	Outdated Rule - Considers 1990 ACS Guideline.
Morris [167]	Outdated Rule - Considers Trauma Score.
Nakahara 2010A [168]	Non-validated local triage tool – no evidence of validation.
Nakamura 2012 [169]	Comparison of clinical outcomes between age groups using the ACS-SCOT protocol (non-diagnostic study)
Nasr 2007 [170]	Non-validated in hospital trauma activation tool (Sick Kids Paediatric Trauma Rule).
Newgard 2002A [173]	Prognostic study assessing variables predictive of mortality/major trauma (non-diagnostic).
Newgard 2005 [172]	Non-validated triage tool – (Unclear description of clinical decision tool)
Newgard 2010A [175]	Non-validated triage tool – considers only the physiologic criteria of ACSCOT.
Newgard 2013C [171]	Abstract only
Norcross 1995 [176]	Outdated Rule - Considers 1990 ACS Guideline.
Nuss 2001 [177]	Non-validated triage tool – unclear explanation. In-hospital triage tool.
Phillips 1996[194]	Non-validated local triage tool – no evidence of validation. (Florida State Triage Rule).
Phillips 1996A [193]	Non-validated local triage tool – no evidence of validation. (Florida State Triage Rule).
Potoka 2001 [202]	Study develops new tool – comparison with Paediatric trauma score not at cut-offs relating to Major Trauma.
Potter 2013 [203]	Incomplete reporting of data – cannot be extracted.
Purtill 2008 [206]	Incomplete study data – cannot be extracted.
Qazi 1998 [207]	Outdated Rule - Considers 1990 ACS Guideline.
Rehn 2009 [214]	Study uses ASC-SCOT tool for trauma team activation within a hospital. Incorrect report of outcomes.
Rominski 2014 [217]	Non-validated local triage tool - no evidence of validation. (South African Triage Score).
Sacco 2007 [222]	Major incident protocol – Sacco triage method
Samplais 1997C [223]	Study compares outcomes between direct and indirect transfer to MTC for MT patients (Non-diagnostic).

Reference	Reason for exclusion
Sartorius 2010 [224]	Study reports prognostic ability of MGAP to predict death (non-diagnostic).
Scheetz 2003[225]	Outdated Rule - Considers 1999 ACS Guideline.
Scheetz 2007 [226]	Invalidated triage tool – (CART 16 and CART 18 schemes)
Shah 2013 [232]	Reports diagnostic accuracy of biochemical test (lactate test) -non-triage tool.
Shifflette 2010 [234]	Study compares outcomes between different age groups (non-diagnostic).
Sola 1994 [239]	In hospital trauma team activation algorithm.
Talbert 2007 [247]	Abstract only
Ukiyama 2012[255]	In-hospital surgical triage tool – non-trauma population.
Uleberg 2007 [256]	Outdated Rule - Considers 1993 ACS Guideline.
Van laarhoven 2014 [257]	Non-validated triage tool – (The Field Triage Protocol - Netherlands)
Veenema 1995 [258]	Compares prior stabilisation versus direct MTC transfer (non-diagnostic).
Viven 2011[174,260]	Study not in English.
Wallis 2006 [262]	Comparison of major incident triage tools (Paediatric Triage Tape, Jumpstart, Start, Careflight)
Wallis 2006A[263]	Major incident tool (Paediatric Triage Tape)
Wolllaston 2004[270]	Non-validated local triage tool – no evidence of validation. (Toowoomba Adult Trauma Rule).
Wormer 2013 [271]	Study reports the impact of a trauma education on activation air ambulance (non-diagnostic).
Wuerz 1996 [272]	Outdated Rule - Considers 1990 ACS Guideline.

J.2 Pre-alert processes

Table 40: Studies excluded from the clinical review

Reference	Reason for exclusion
Booth 2013[26]	All patients not just trauma
Brown 2001[31]	All patients not just trauma

J.3 Receiving trauma teams

Table 41: Studies excluded from the clinical review

Study	Reason for exclusion
Ahmed 2007[4]	Wrong comparison. Comparing different trauma team leaders
Alberts 1999[6]	Wrong comparison. Before and after reorganisation of a trauma service with no details of trauma teams
Anon-2002[1]	Summary of service implementation
Anon-2011[2]	Abstract
Baker 1985[14]	Multiple interventions implemented at the same time
Bevan 2009[23]	No relevant outcomes - reports over and under triage rates
Bhakta 2013[24]	Wrong comparison. Implementation of a 24/7 open trauma bed protocol
Chittawatanarat 2013[45]	Wrong intervention
Claridge 2010[48]	Wrong intervention

Study	Reason for exclusion
Cole 2013[53]	Wrong comparison. Comparing different trauma team leaders
Cummings 2007[64]	Wrong comparison. Comparing different trauma team leaders
Curtis 2011[66]	Outcomes for over and under triaged patients
Davis 2010[74]	Accuracy of an unvalidated pre-hospital triage tool
Deane 1989[76]	Accuracy of a pre-hospital unvalidated triage tool
Dekeyser 1994[79]	Financial costs of a 2-tiered system
Demarest 1999[81]	Comparison of in house vs. on call attending trauma surgeon. Wrong comparison. Comparing different trauma team leaders
Deo 1997[83]	Comparison of different no of doctors resuscitating
Dutton 2003[90]	Wrong intervention
Fallon 2014[99]	Implementation of an attending vs. on call surgeon. Before and after study with significant differences in injury severity and no reporting of other confounders
Groven 2011[114]	Wrong comparison. Implementation of trauma service
Hartmann 1996[120]	Wrong comparison. Comparing different trauma team leaders
Haut 2006[121]	Comparison of full time vs. part time trauma surgeon
Helling 2003[123]	Wrong comparison. In-house vs. out of hospital attending trauma surgeon
Jenkins 2013[134]	Review cross checked for references
Jenkins 2014[135]	Wrong comparison. Comparing outcome for those treated by each tier rather than a comparison of different tiered or non-tiered systems.
Kouzminova 2009[143]	Wrong comparison
Leeper 2013[146]	Wrong comparison. Comparing different trauma team leaders
Lillebo 2012[148]	Wrong intervention
Mcnicholas 2010[159]	Abstract
Ochsner 1995[181]	Accuracy of a unvalidated pre-hospital triage tool
Ong 2014[183]	Abstract
Plaisier 1998[195]	Not People without traumatic brain injury. Inappropriate comparison
Podnos 1998[196]	Wrong comparison. Comparing different trauma team leaders
Rehn 2012[213]	Reports over and under triage rates
Ryan 1998[221]	Comparison of outcomes for major trauma vs. stable trauma patients
Toulson 2005[252]	No relevant outcomes
Williams 2011[267]	Comparison of stable vs. major trauma patients

J.4 Transfer between emergency departments

Table 42: Studies excluded from the clinical review

Reference	Reason for exclusion
Burrell 1989[35]	Incorrect study design (case series)
Isler 1977[130]	Incorrect study design (abstract only)
Mann 2002[153]	Incorrect interventions (air vs. ground transfer)
McGinn 1996[157]	Incorrect study design (case series)
Porter 2014[201]	Incorrect interventions (introduction of a call centre to arrange transfer and acceptance of trauma patients)
Ramnarayan 2003[210]	Incorrect population (not trauma)

J.5 A trauma service providing continuity of care

Table 43: Studies excluded from the clinical review

Study	Reason for exclusion
Baker 198514	Study did not account for key confounding factors
Bhakta 201324	Study not relevant to the review: implementation of a 24/7 open trauma bed protocol in the surgical intensive care unit
Dutton 200390	Study not relevant to review: implementation of multidisciplinary rounds

J.6 Continuity of care the trauma coordinator role

Table 44: Studies excluded from the clinical review

Study	Reason for exclusion
Anderson 1991[8]	Incorrect study design. Commentary on trauma service delivery
Anderson 1994[9]	Incorrect study design. Commentary on trauma service delivery
Armitage 1997[12]	Conference abstract
Beachley 1988[21]	Incorrect study design. Background information only - delete from paper flow chart
Brackin 2000[28]	Conference abstract
Bull 2006[33]	Conference abstract
Carter 2011[40]	Incorrect study design. Commentary on trauma charge nurse role
Chakravarthy 2008[42]	Incorrect study design. Commentary on the trauma nurse practitioner role
Civil 1995[47]	Incorrect study design. Commentary on introduction of trauma coordinator
Clemow 2006[50]	Incorrect study design. Audit of the impact of new ways of working. Not review population
Crouch 2015[61]	Incorrect study design. Survey.
Dekeyser 1993[78]	Incorrect study design. Commentary on trauma nurse coordinator role
Gunnels 2001[116]	Incorrect study design. Commentary on critical response nurse role
Harrahill 1995[119]	Incorrect study design. Commentary on trauma case management
Harrahill 1999[118]	Incorrect study design. Commentary on role of trauma nurse practitioner
Heinemann 2004[122]	Not review population. Treatment for substance use in patients with substance use issues following treatment for TBI
Hollingsworth-fridlund 2004[125]	Incorrect study design. Commentary on quality assurance of trauma services
Jelinek 2014[132]	Incorrect interventions. Trauma report nurse - triage responsibility only
Jones 2001[138]	Incorrect study design. Commentary on training of critical care nurses
Martin 2011[155]	Incorrect study design. Commentary on the impact of trauma nurses (no data)
Mendis 2012[161]	Indirect Population (lower limb) and not Major Trauma
Morgan 1987[166]	Incorrect study design. Commentary on role of trauma nurse coordinator
Price 1988[205]	Incorrect study design. Commentary on role of trauma coordinator
Revell 2013[215]	Conference abstract
Schweer 2004[229]	two models of care compared: case management vs. trauma co-ordinator

Sesperez 2001[231]	Outcomes are not based on data from case management on its own but combination of implementation of clinical pathways and case management together
Songne 1991[240]	Incorrect study design. Commentary on role of trauma nurse

J.7 Documentation and transfer of information

Table 45: Studies excluded from the clinical review

Reference	Reason for exclusion
Carter 2009[38]	Incorrect study design
Evans 2010[97]	Incorrect study design
Evans 2010[96]	Incorrect study design
Gopwani 2015[112]	No reportable data
Jenkin 2007[133]	Incorrect study design
Knutsen 2013[142]	Incorrect study design
Yong 2008[273]	Incorrect study design

J.8 Trauma audit

Table 46: Studies excluded from the clinical review

Reference	Reason for exclusion
Appelros 2007[10]	Reports on changes in stroke outcome in relation to fluctuation in submitting data to a national stroke audit
Batty 2004[18]	National audits conducted over two time periods to compare evidence – based prescribing in older people. No information provided on how the results were disseminated between audits. Reports changes in performance indicators.
Clark 1992[49]	Investigation of the effectiveness of computer based and manual district and unit information systems for identifying hospital deaths eligible for reporting to the National Confidential Enquiry into Perioperative Deaths
Edwards 2007[93]	Assessed whether it was possible to compared data being collected by a number of trauma services across Europe
Fuller 2011[104]	Reports changes in care using the UK Trauma Audit and Research Network. No details on how the results were disseminated between audits.
Gordon 1989[113]	Audit of trauma deaths occurring in an accident and emergency department. No feedback on the audit findings given to staff
Hysong 2006[129]	Compared how high versus low performers (clinical practice guideline adherence) use clinical audit data for feedback purpose. No trauma population
Lecky 2000[144]	Reports changes in care using the UK Trauma Audit and Research Network. No details on how the results were disseminated between audits.
Olthof 2013[182]	Reports on reliability of data collected for a Danish National Audit on trauma
O'Reilly 2015[179]	Compared different local trauma registries in terms of information recorded.
Owen 1999[186]	Reports consistency of data abstraction, interpretation and entry by two hospitals with an identical trauma database program

Reference	Reason for exclusion
Papadopoulos 1996[187]	Reports autopsy findings of preventable pre-hospital deaths
Pedersen 2012[188]	Reports on reliability of data collected for a Danish National Audit on schizophrenia
Penney 1995[189]	Reports on changes in practice as a result of a National audit project on gynaecologists in Scotland
Peterson 2007[190]	Intervention to improve adherence to guidelines
Petroze 2014[192]	Reports on outcomes associated with hospital infections using a trauma registry in Rwanda
Pohlemann 2011[197]	Reports survival trends and predictors of mortality using a German pelvic registry
Reeves 2008[212]	Reports inter-rater reliability of data elements collected for a National stroke registry
Ringdal (2007)[216]	Feasibility study of using data from existing trauma registries of major hospitals in Scandinavia. Reports on common data points collected
Rostami 2009[218]	Report on non-trauma local audits
Schwamm 2006[227]	Discussion of the challenges of quality improvement programs
Shravat 2006[235]	Reports changes in care as a result of the NICE head injury guideline
Sousa 2006[241]	Literature review checked for references
Tee 2013[249]	Systematic review to assess the current state of spine registries

J.9 Paediatric trauma training

Table 47: Studies excluded from the clinical review

Study	Reason for exclusion
Ablah 20093	Incorrect study design
American academy of pediatrics 20137	Incorrect study design. Inappropriate comparison. Incorrect interventions
Burt 200737	Inappropriate comparison. Incorrect interventions
Carter 201339	Inappropriate comparison
Cooper 199354	Incorrect interventions
D'amelio 199568	Incorrect interventions
Dhingra 201284	Incorrect interventions
Falcone 200898	Incorrect interventions
Foltin 2002102	Incorrect interventions
Kendirli 2011141	Not guideline condition
Lin 2000149	Incorrect interventions
Mansfield 2001154	Incorrect population
Petrosyan 2009191	Incorrect interventions
Popp 2012200	Incorrect interventions
Pracht 2008204	Incorrect interventions
Schweich 1998230	Incorrect interventions
Srivastava 2012243	Incorrect interventions. Not guideline condition
Stone 2010244	Systematic review: literature search not sufficiently rigorous
Svenson 1996246	Incorrect interventions
Thorpe 2013250	Incorrect interventions

Study	Reason for exclusion
Trainor 2000253	Incorrect interventions
Waisman 2002261	No comparator group
Weinstock 2005265	Incorrect interventions
Wolfram 2003269	No comparator group

J.10 Information and support

Table 48: Studies excluded from the clinical review

Reference	Reason for exclusion
Castillo 2013[41]	Cohort study comparing multicomponent intervention (peer support, self-management, information provision and provider training). The only outcome reported in the multivariate analysis is PHQ. A final value score is used and there is no reporting of this score as baseline.
Coco 2012[52]	Staff views on information and support for traumatic brain injury. No data on who should provide the information.
Coco 2013[51]	No information who should provide the information
Gabbe 2013[106]	Patient views on what information should be provided. Included in major trauma guideline
Leith 2004[147]	Patient and carers with traumatic brain injury views on service provision. No data on who should provide the information
O'Brien 2004[178]	Patient experience of trauma resuscitation

J.11 Access to services

J.11.1 Airway

Table 49: Studies excluded from the clinical review

Study	Reason for exclusion
Althani 20145	Groups not matched at baseline and no adjustment
Bochicchio 200325	Specific interventions not directly compared
Bukur 201132	Specific interventions not directly compared
Corral 200756	Case study
Cudnik 201063	Wrong comparison
Davis 2005 71	Specific interventions not directly compared
Davis 2005C 72	Specific interventions not directly compared
Dunham 201489	Delay greater than 24 hours
Evans 201095	Groups not matched at baseline and no adjustment (GCS)
Evans 201194	Factors associated with complication in pre-hospital intubation
Frankel 1997103	Pre-hospital and hospital intubation groups not directly compared (reports deaths compared with TRISS)
Garner 1999108	Comparison of paramedic vs. physician care
Garner 2001107	No relevant outcomes. Results reported for treatment by critical care team but not just airway intervention
Hussmann 2011128	Intubated vs. non-intubated patients

Study	Reason for exclusion
Miraflor 2011162	No details of brain injury or shock
Oswalt 1992184	Not matched on confounders and no adjusted analysis
Ruchholtz 2002219.	Specific interventions not directly compared
Sise 2009237	Wrong comparison
Sloane 2000238	Groups not matched at baseline and no adjustment (ISS)
Trupka 1994254	Groups not matched at baseline and no adjustment (ISS)
Wang 2010264	Outcomes by experience in intubation
Winchell 1997268	Shock not compared/reported between groups and not adjusted for
Zonies 2009274	Abstract

J.11.2 Interventional radiology

Table 50: Studies excluded from the clinical review

Reference	Reason for exclusion
DeBoer 1982[75]	Case series
Dick 2013[85]	Incorrect intervention: fluid resuscitation
Farber 2012[101]	Incorrect intervention: fasciotomy
Gul 2012[115]	Case series
Lee 1984[145]	Incorrect intervention: Laparotomy
Lu 1993[151]	Case series
Pommerening 2014[198]	Incorrect intervention: Laparotomy
Poole 1994[199]	Incorrect intervention: Fasciotomy
Rabin 2014[208]	Incorrect intervention: Aortic repair
Reed 2006[211]	Case series
Simmons 2011[236]	Incorrect intervention: Vascular surgery
Tanizaki 2014[248]	Incorrect intervention: Pelvic embolisation
Velmahos 1997a[259]	Incorrect intervention: Fasciotomy
Williams 1997[266]	Incorrect intervention: Fasciotomy

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