Edith Cowan University
School of Medical and Health Sciences

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Does Direct Helicopter Retrieval Improve Survival for Severely Injured Trauma Patients from Rural Locations?

David Ford
PhD Candidate

Presentation overview

- Background
  - Trauma – WA perspective
  - Emergency Rescue Helicopter Service (ERHS)
- Research methodology
- Results
- Discussion
- Conclusion

Background – major trauma in rural WA

- Mortality from trauma up to 4x higher in rural & remote WA compared to Perth
- All major tertiary hospitals located in Perth and transfer to Perth required for all major trauma
- WA Ambulance Service – run by St John Ambulance
  - 720 paramedics (30 metro and 15 country stations)
  - 3000 volunteers (162 country locations)
- Emergency Rescue Helicopter Service
  - 2 helicopters - Perth (Jandakot) and Bunbury bases
- Royal Flying Doctor Service
  - 17 fixed wing aircraft across five bases

Emergency Rescue Helicopter Service (EHRS)

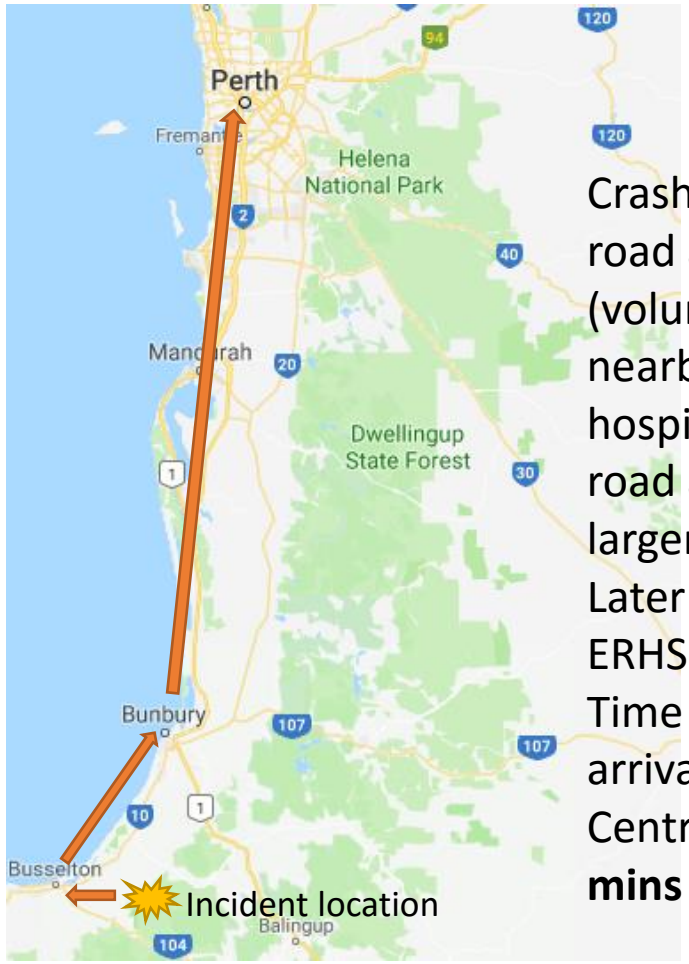
- From July 2003 – February 2016 - single ERHS in WA
  (second Bunbury based ERHS commenced 2015)
- Based at Jandakot airport (15km south Perth)
- ERHS staffed 24/7 by pilot, aircrew person, critical care paramedic & RFDS doctor on selected retrievals.
- ERHS performs 3 types of missions:
  - primary retrievals
  - secondary retrievals
  - rescues
- St John Ambulance WA is tasking agency

ERHS (Jandakot) operating zone

- Primary retrievals predominantly located in zone 50 – 250 km radius of Perth
- 42 outer metropolitan, rural & regional hospitals located within the ERHS (Jandakot) operating zone

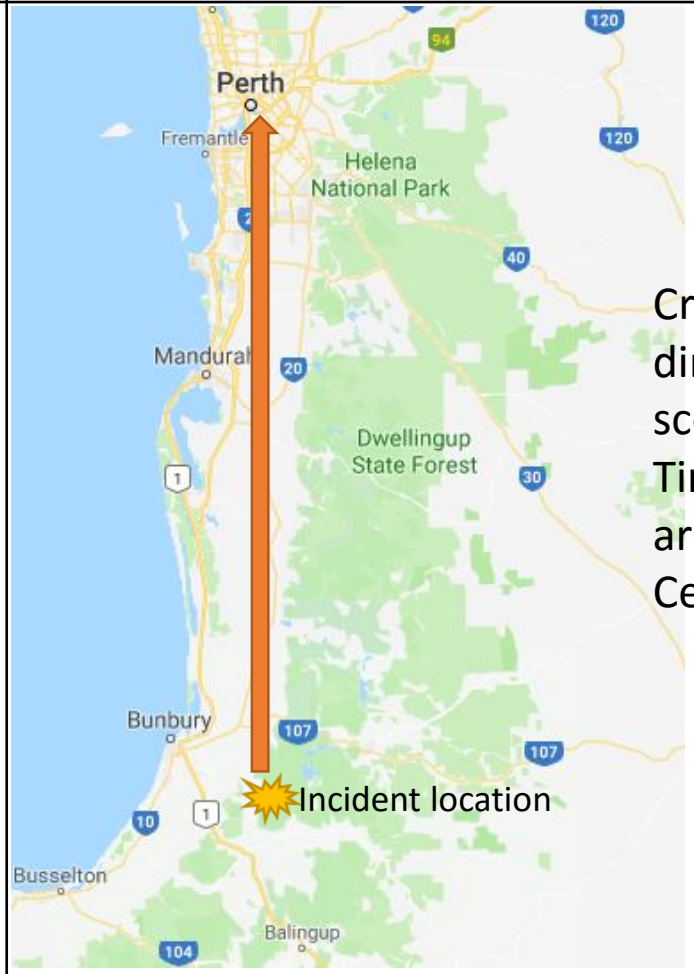
Compare and Contrast of a Direct and Indirect case

Indirect Transfer to Trauma Centre



Crash victim taken by road ambulance (volunteer) to nearby country hospital. Transferred by road ambulance to larger country hospital. Later transferred by ERHS to Perth.
Time from incident to arrival at Trauma Centre = **10 hrs 49 mins**

Direct Transfer to Trauma Centre



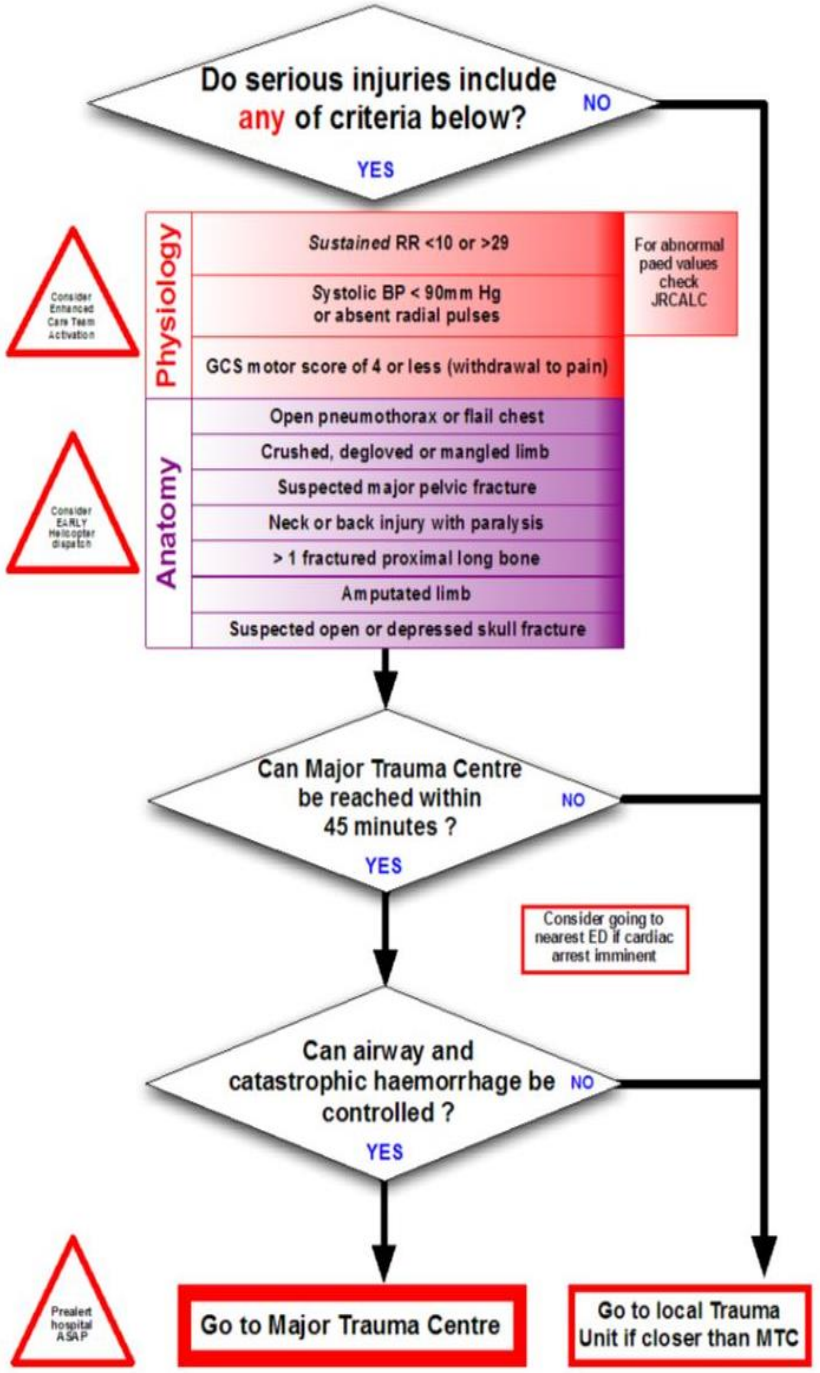
Crash victim retrieved directly from incident scene by ERHS.
Time from incident to arrival at Trauma Centre = 2 hrs 2 mins

Trauma Bypass

- Ambulance Services have a trauma bypass guideline that advises Paramedics to bypass peripheral hospitals and transport major trauma patients directly to a Trauma Centre

- Evidence for the routine direct transport of severely injured rural trauma patients from the accident scene to a Level 1 Trauma Centre appears inconclusive

- This PhD research aims to bolster the body of evidence concerning the efficacy of trauma bypass by direct helicopter retrieval

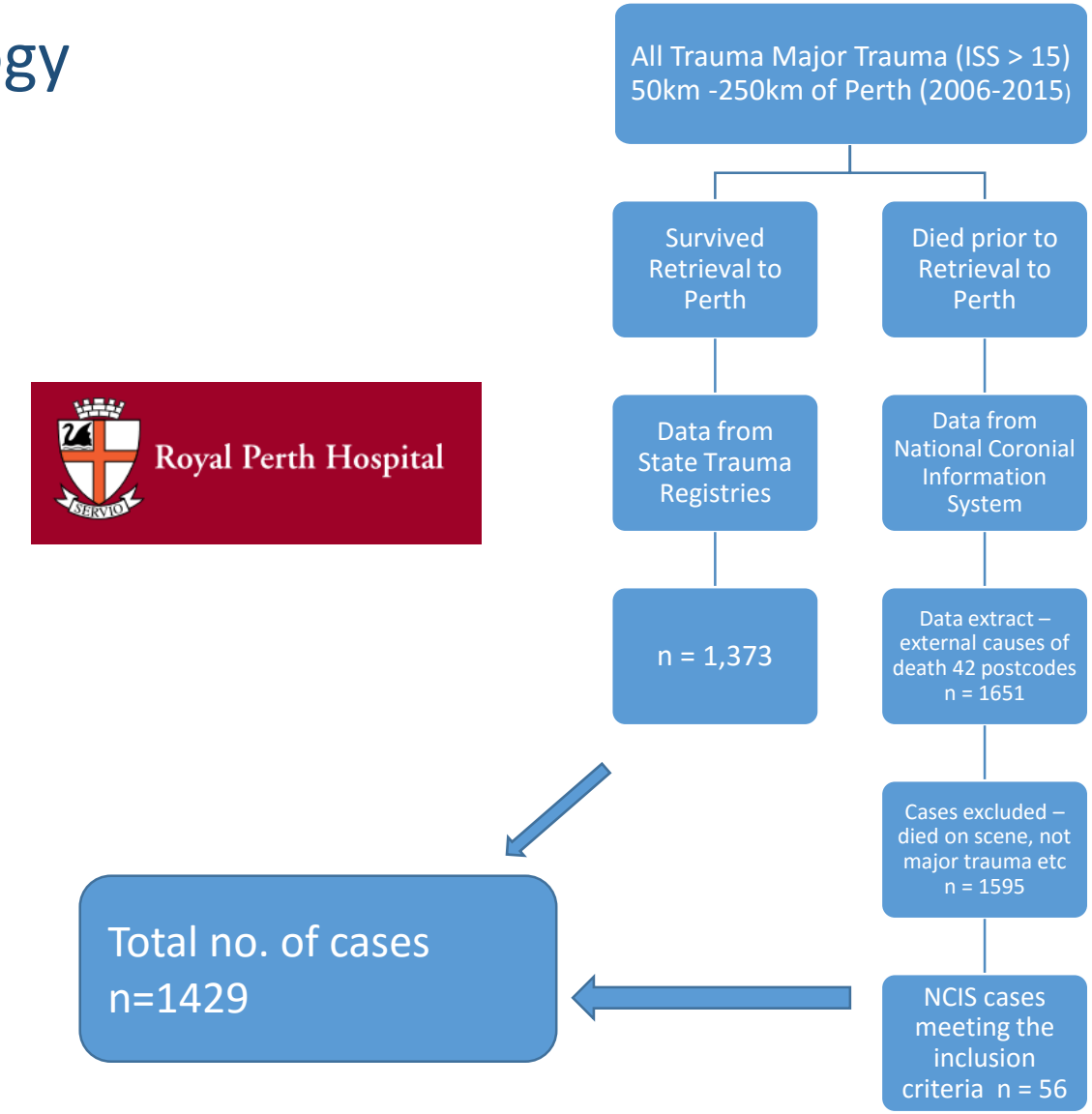


Research Objectives

To determine whether direct helicopter retrieval from an incident scene to a tertiary hospital improves survival for severely injured trauma patients in rural locations in the zone 50-250 km of Perth, compared to indirect retrieval

No research to date investigating the mortality for severely injured trauma patients in WA who are treated in rural or regional hospitals but die prior to being transferred to a tertiary hospital in Perth

Methodology



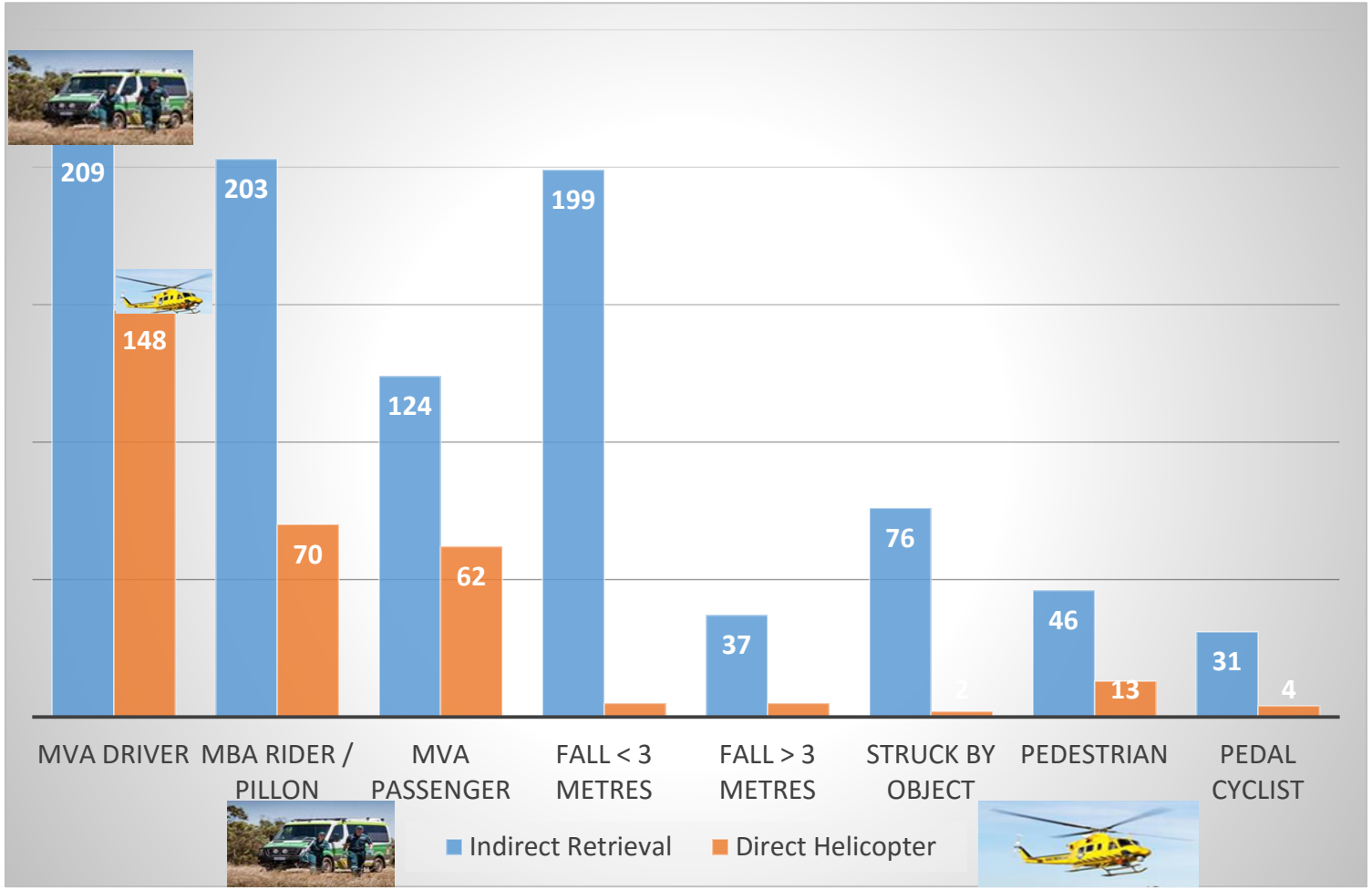
Royal Perth Hospital

NCIS National Coronial Information System

Results – Demographic data

Item	Indirect Retrieval 	Direct Helicopter 
Number of Patients	1086	343
Age in years (mean)	42	40
Males	829 (77%)	242 (71%)

Results – Mechanism of Injury



MVA (Motor Vehicle Accident) Most common mechanism for both Indirect and Direct groups followed by MBA (Motor bike Accident)

Results – Injury data

Item	Indirect Retrieval 	Direct Helicopter 
Number of Patients	1086	343
Blunt trauma	1048 (96%)	340 (99%)
ISS (mean)	24.3 (SD=8.8)	28.0 (SD=10.9)
NISS (mean)	31.7 (SD=13.0)	34.1 (SD=13.7)
TRISS - initial (mean)	0.90 (SD=0.19)	0.87 (SD=0.22)
TRISS – final (mean)	0.96 (SD=0.08)	0.91(SD=0.17)

Results – Vital Signs at Definitive Care Hospital

Item	Indirect Retrieval 	Direct Helicopter 
Haemoglobin (g/L)	133	131
International Normalised Ratio (INR)	1.29	1.35
Platelets	233	251
Glasgow Coma Score	14.3	13.9
Arterial pH	7.3	7.25
Arterial PCo2	43.4	45.9
Mean Systolic Blood Pressure (mmHg)	130	121
Mean Pulse Rate (bpm)	91	95

Results – Mortality data

Status	Indirect Retrieval 	Direct Helicopter 
Total no. of patients	1086	343
Died (survived initial incident and arrived alive at hospital)	157 (14.5%)	35 (10.2%)
Time (minutes) from trauma time to death time (mean)	487.2	299.9

$X^2 = 4.053$; $p=0.044$

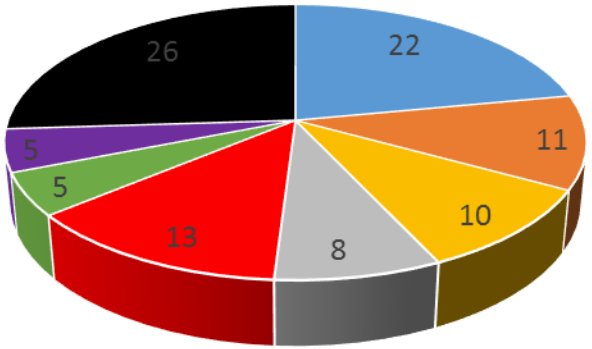
Results – Demographic and Injury Data for **Deceased Patients**

Item	Indirect Retrieval 	Direct Helicopter 
No. of patients who died	157	35
Males (% of total)	72	74
Mean age (years)	49	45.5
ISS	29.3 (SD=13.7)	35.6 (SD=11.2)
NISS	40.0 (SD=18.9)	50.8 (SD=17.8)
TRISS - initial	0.55 (SD=0.35)	0.49 (SD=0.36)
TRISS - final	0.84* (SD=0.19)	0.35* (SD=0.41)

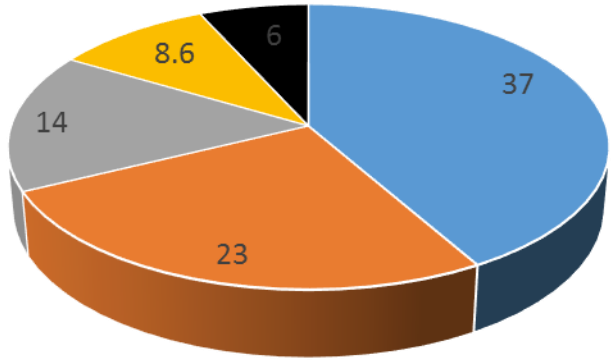
* Small patient numbers

Results – Mechanism of Injury (**Deceased Patients**)

Cause of death
Indirect Retrieval



Cause of death
Direct Helicopter



Discussion

- **Previous systematic reviews** of the benefits of direct retrieval and/or helicopter retrieval **inconclusive** because of high heterogeneity in studies
- This study demonstrated that **mortality from major trauma in rural trauma patients was lower when retrieved direct by helicopter** from the incident scene and transported to a tertiary hospital compared to indirect retrieval
  - Benefit of helicopter retrieval is likely to result from a combination of crew expertise, timely critical care interventions (i.e definitive airway management, blood products, finger thoracostomy etc), speed of transport and trauma centre access
  - Uncontrolled haemorrhage remains the single largest contributor to preventable mortality and tertiary hospitals may be better at responding to patients requiring massive transfusion

Limitations

- National Coronial Information System (NCIS) data sourced from autopsy, coroners and police reports – limited compared to Trauma Registry data

Conclusion

- **Direct helicopter retrieval** (from the incident scene to a tertiary hospital) **improved survival of severely injured patients in the zone 50 – 250km of Perth compared to indirect retrieval** (transfer to a secondary hospital prior to transfer to a tertiary hospital).

Summary

- MVA and MBA most common causes of major trauma in WA
- Greater than 70% males for indirect and helicopter direct retrieval
- Higher ISS in the helicopter direct group
- Vital signs similar in both groups
- **Mortality rate higher in the indirect retrieval group (14.7%) compared to helicopter direct (10.2%)**
- Time interval from trauma to death greater in the indirect group

Email:
d.ford@ecu.edu.au

References

1. Gupta R, Rao S. Major Trauma Transfer in Western Australia. ANZ Journal of Surgery. 2003;73:372- 375.
2. Fatovich DM, Jacobs IG. The relationship between remoteness and trauma deaths in Western Australia. Journal of Trauma. 2009;67:910-914.
3. Danne P. Trauma Management in Australia and the Tyranny of Distance. World Journal of Surgery. 2003;27:385-389.
4. Government of Western Australia. Department of Infrastructure and Regional Development. Bureau of Infrastructure, Transport and Regional Economics. Road Trauma Australia Statistical Report. 2014;4.
5. Fatovich DM, Langford SA, Jacobs IG. A comparison of metropolitan vs. rural major trauma in Western Australia. Resuscitation. 2011;82:886-890.
6. Williams T, et al. Outcomes of different health care contexts for direct transport to a trauma centre versus initial secondary centre care: a systematic review and meta-analysis. Journal of Prehospital Emergency Care. 2013;17(4):442-458.
7. Galvagno SM, Thomas S, Haut ER, Hirshon JM, Floccare D, Pronovost P. Helicopter emergency medical services for adults with major trauma. Cochrane Database Syst Rev. The Cochrane Library 2013,Issue 3
8. Department of Health Victoria. Trauma Victoria. *Pre-hospital Triage Guideline Version* 1.0; 2014.
9. Queensland Ambulance Service. *Clinical Practice Guidelines: Trauma / Pre-hospital trauma bypass; 2015*
10. Ambulance Service of New South Wales. Pre-Hospital Management of Major Trauma Protocol T1; 2015

References cont.

11. Remick KN, Schwab CW, Smith BP, Monshizadeh A, Kim PK, Reilly M. Defining the optimal time to the operating room may salvage early trauma deaths. Journal of Acute Care Surgery. 2014;76(5):1251-1258
12. Mutschler M, Nienaber U, Brockamp T, Wafaisade A, Fabian T, Paffrath T, Bouillon B, Maegele M. *Renaissance of base deficit for the initial assessment of trauma patients: a base deficit-based classification for hypovolamic shock*
13. Brown JB, Forsythe RM, Stassen NA, Gestring ML. *The National Trauma Triage Protocol: Can this tool predict which patients with trauma will benefit from helicopter transport*. Journal Trauma Acute Care Surgery. 2012;73(2):319-325.
14. Fatovich DM, Langford SA, Jacobs IG. A comparison of metropolitan vs. rural major trauma in Western Australia. Resuscitation. 2011;82:886-890.
15. Fatovich DM, Phillips M, Jacobs IG, Langford SA. Major Trauma Patients Transferred From Rural and Remote Western Australia by the Royal Flying Doctor Service. The Journal of Trauma. 2011;71(6):1816-1820
16. Fatovich DM, Jacobs IG, Langford SA, Phillips M. The effect of age, severity, and mechanism of injury on risk of death from major trauma in Western Australia. Journal of Trauma Acute Care Surgery. 2012;74(2):647-651
17. Cheng CH, Graham CA, Gabbe BJ, Yeung JH, Kossman T, Judson RT, Rainer TH, Cameron PA. A Comparison of Trauma Care in Victoria, Australia, and Hong Kong, China. Annals of Surgery. 2008;247(2):335-342
18. Svenson J. Trauma systems and timing of patient transfer: are we improving? American Journal of Emergency Medicine. 2008;26:465-468

References cont.

19. Galvagno SM, Thomas S, Haut ER, Hirshon JM, Floccare D, Pronovost P. Helicopter emergency medical services for adults with major trauma. Cochrane Database Syst Rev. The Cochrane Library 2013,Issue 3
20. Brown JB, Forsythe RM, Stassen NA, Gestring ML. The National Trauma Triage Protocol: Can this tool predict which patients with trauma will benefit from helicopter transport. Journal Trauma Acute Care Surgery. 2012;73(2):319-325
21. Thomas SH, Brown KM, Oliver ZJ, Spaite DW, Lawner BJ et al. An Evidence-Based Guideline For The Air Medical Transportation of Prehospital Trauma Patients. Prehospital Emergency Care. January/March 2014;18(1):35-43