

Seatbelts and Child Restraints: Injuries, Deaths and the Law

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Leditschke F⁶, Dilley A⁷, Elliott EJ^{1,2}
and all clinicians who report to the APSU

1. Australian Paediatric Surveillance Unit
2. The University of Sydney
3. The Children's Hospital at Westmead
4. Prince of Wales Medical Research Institute
5. University of New South Wales
6. Royal Children's Hospital, Brisbane
7. Sydney Children's Hospital



3 Studies

1. APSU surveillance for injuries
 2. National Coroners Database review of child passenger deaths
 3. Review of International law and parental knowledge and attitudes
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- **Rate of seatbelt use ~92%**
- **~ 1000 children injured each year in crashes**
- **~40 die each year**
- **20% of all passenger deaths are children**

➤ *(Australian Transport Safety Bureau, 2006)*

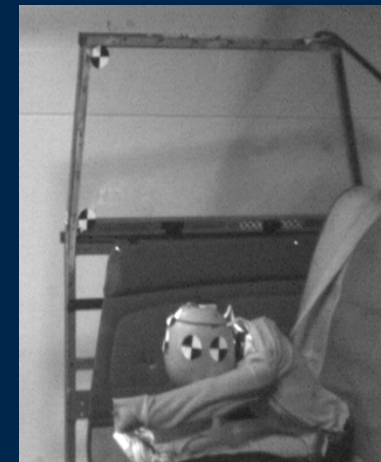
Injuries associated with seatbelt use

- **“Lap-belt syndrome”:**
 - **Lumbar spine - up to 25% paraplegia reported** (Canadian Paediatric Surveillance Unit)
 - **Abdominal**
- **Head**
- **Cervical spine**
- **Thorax**

Early graduation to an adult seatbelt



Misuse



Correct Use



Photographs courtesy of A/Prof Bilston
POWMRI

Current Australian Recommendations (NOT LAWS)

Size	Age	Best Choice Restraint
Birth to 8kg	0 to ~ 6-9 mo	Rear-facing infant capsule
8-18kg	6 mo to ~5 yrs	Forward facing child seat
18kg + or eye level above back of child restraint	~5 yrs +	Booster seat with high back and wings
>145cm	~11 yrs	Adult seat belt

Rear seating position recommended for < 12 yrs

Injuries and Restraints: What we know

- Children aged 2-5 years wearing an adult seatbelt 4x more likely to sustain a significant head injury than those using dedicated child restraints

Winston FK et al. Paediatrics 2000

- Child safety seats and booster seats significantly reduce the risk of serious injury

Winston FK et al. Pediatrics 2000

Durbin D et al. JAMA 2003

Elliott M et al. Arch Pediatr Adolesc Med 2006

Brown J et al. J Paediatr Child Health 2006

- Few Australian Data

APSU Study

- Conducted during 2006 – 2007
- Monthly report cards sent to 1250 child health specialists, key informants in ED

APSU Study - Case definition:

- Age \leq 12 yrs admitted to hospital
- Injured while restrained in a car crash
- presenting with serious injuries
 - abdominal
 - Spinal: lumbar, cervical
 - head
 - thoracic

APSU Study- Results

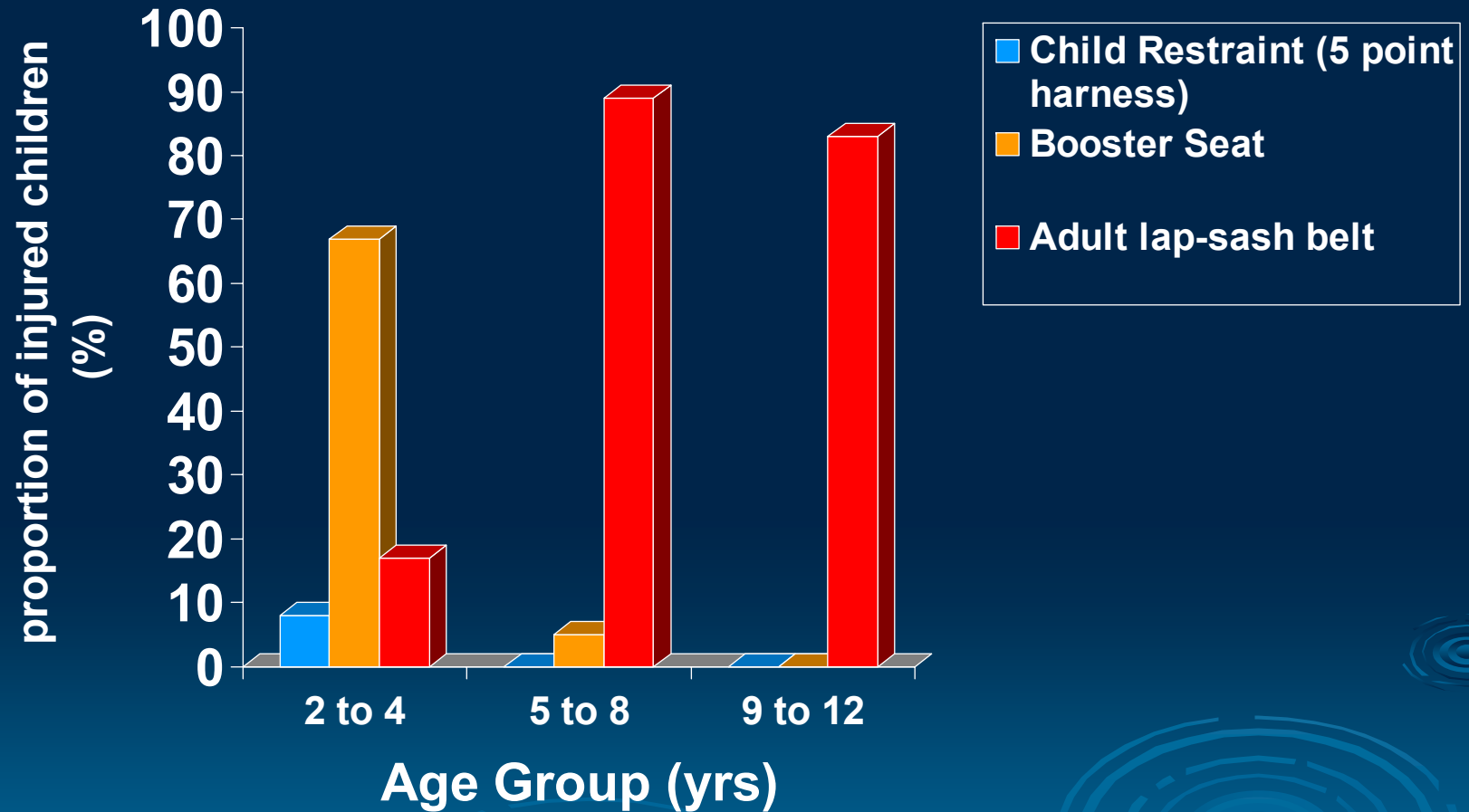
- 85 notifications; clinical data received for 77 (90%)
- Of the 77 notifications 48 met the case definition criteria
- **Sex: 28 M; 19 F; (1 missing)**
- **Median Age: 7.8 years; range: 2 to 12 yrs**

Accident location: 43% rural

Seating position

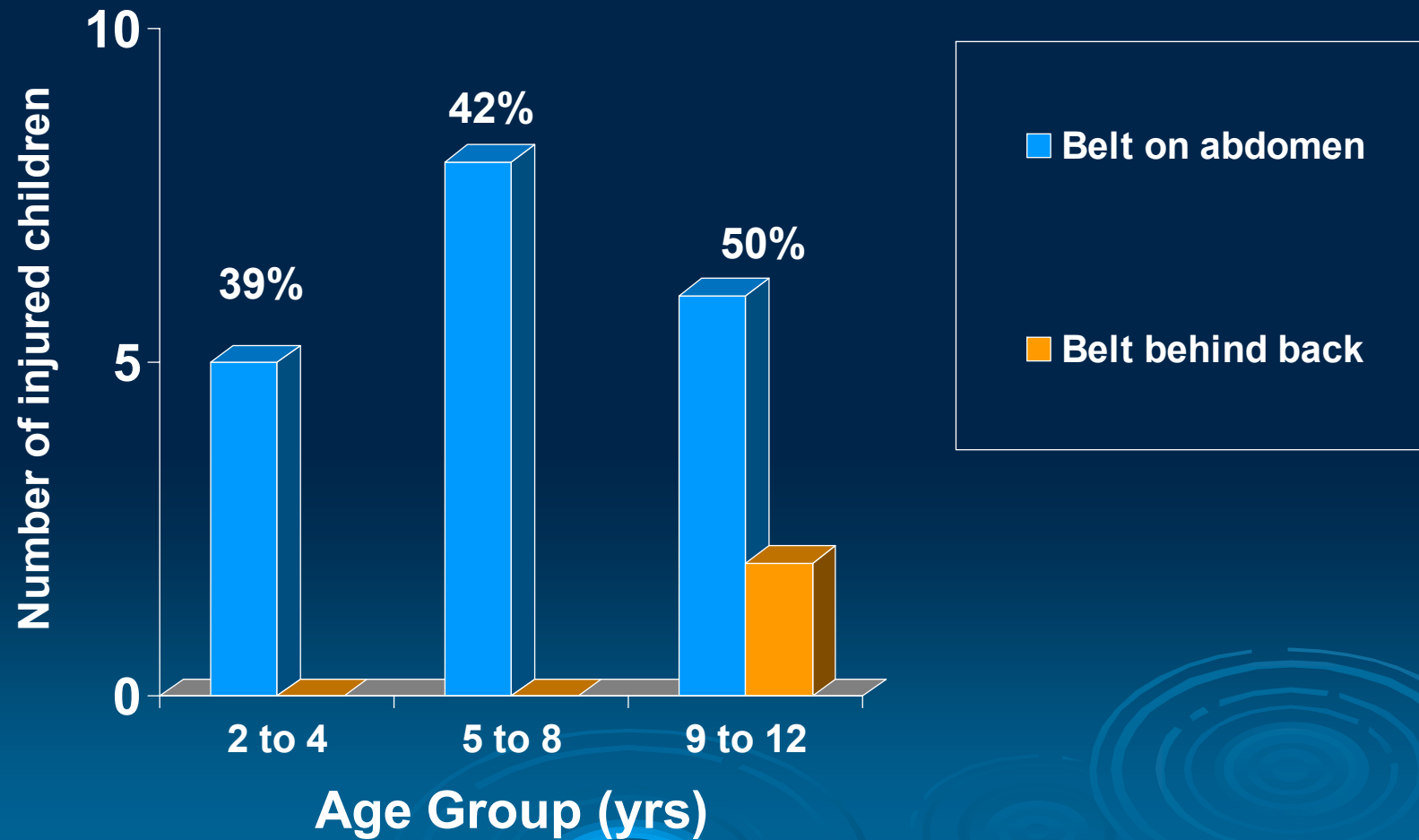
Front:	20%
Rear Side:	50%
Rear Centre:	20%
Unknown:	10%

Use of restraints by age group



Misuse of restraints by age group

N=48; 46% were misusing seatbelts



Injuries

Abdominal	37 (77%)
Intestinal	13 (27%)
Hepatic	12 (25%)
Splenic	9 (19%)
Duodenal	8 (17%)
Renal	5 (10%)

Spinal	16 (33%)
Spinal cord	4 (8%)
Thoracic	19 (40%)
Facial	17 (35%)
Head and Neck	17 (35%)
Extremities	11 (23%)

Impact and Outcome

Had surgery N=22 (46%)

Admitted to ICU N=22 (46%)

ICU stay (days): Range: 1-47
Median: 5

Hospital stay (days): Range 2-103;
Median: 6

Paraplegia 2

Death: 4

Most severe injuries were associated with **front or rear centre seating** position and **use of adult seatbelts without boosters** and **age under 9 years**

An example



- 6 year old male, 120 cm tall
- Front seat passenger
- Adult lap-sash belt – no booster
- Sash under arm
- Closed head injury (GCS 12)
- Abdominal injuries
- Surgical interventions including hepatectomy; cholecystectomy
- 11 days in ICU
- 31 days in hospital
- Ongoing problems with learning and behaviour

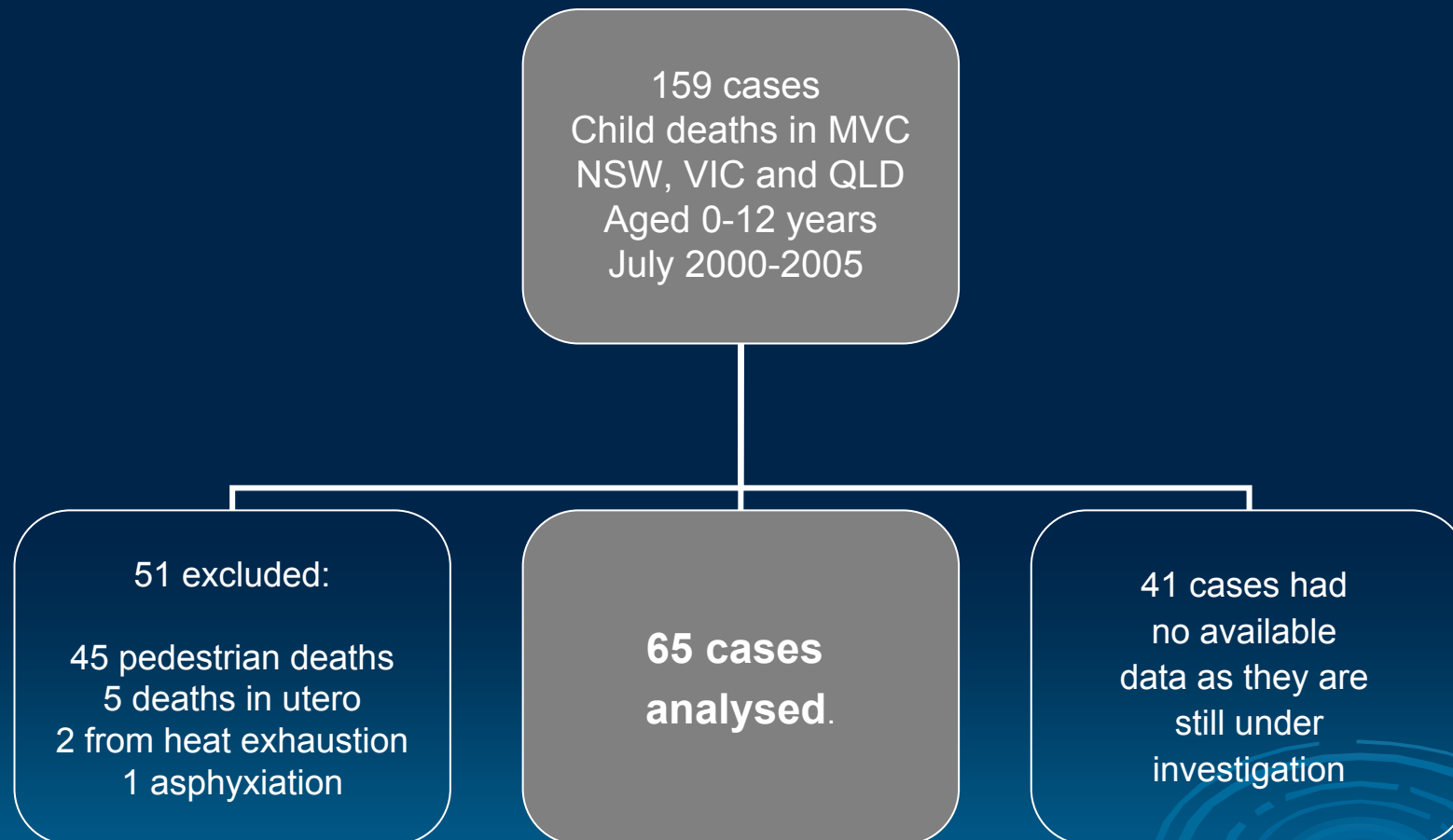
Photo- curtesy Fiona Fahy, Trauma Nurse Co-ordinator, CHW

Review of child deaths in motor vehicle crashes

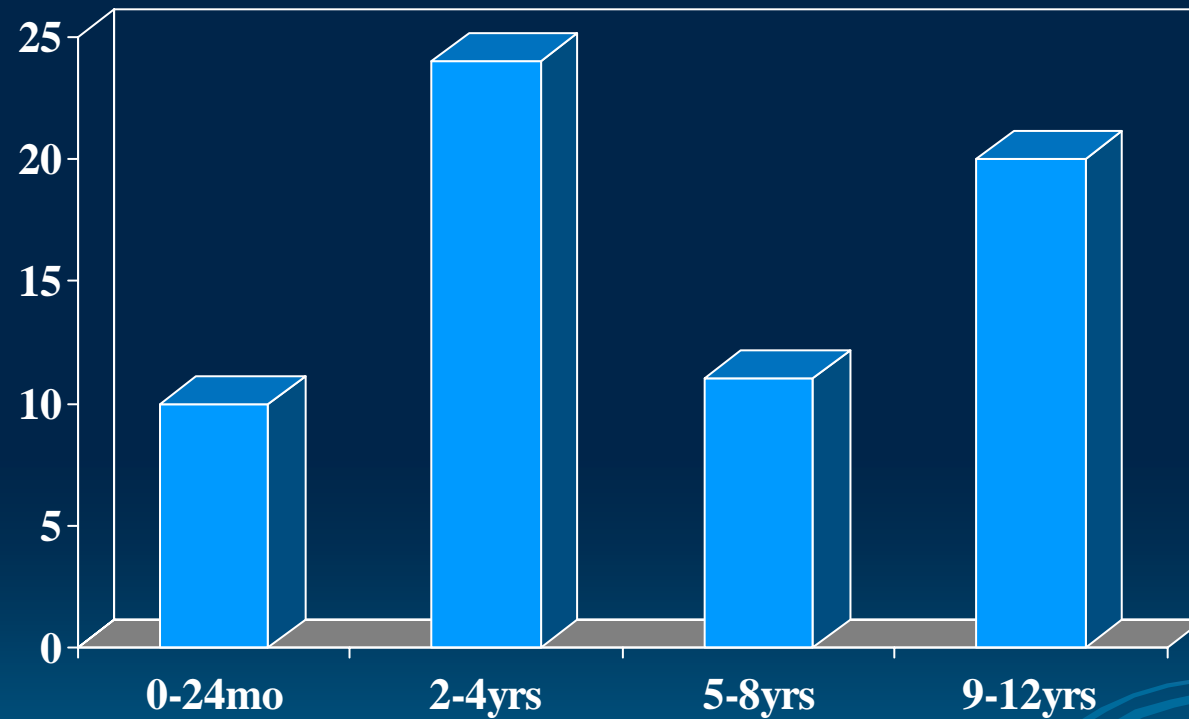
National Coroners Information System



National Coroners Information System (NCIS)



Coroners' database: Age Distribution



N=65

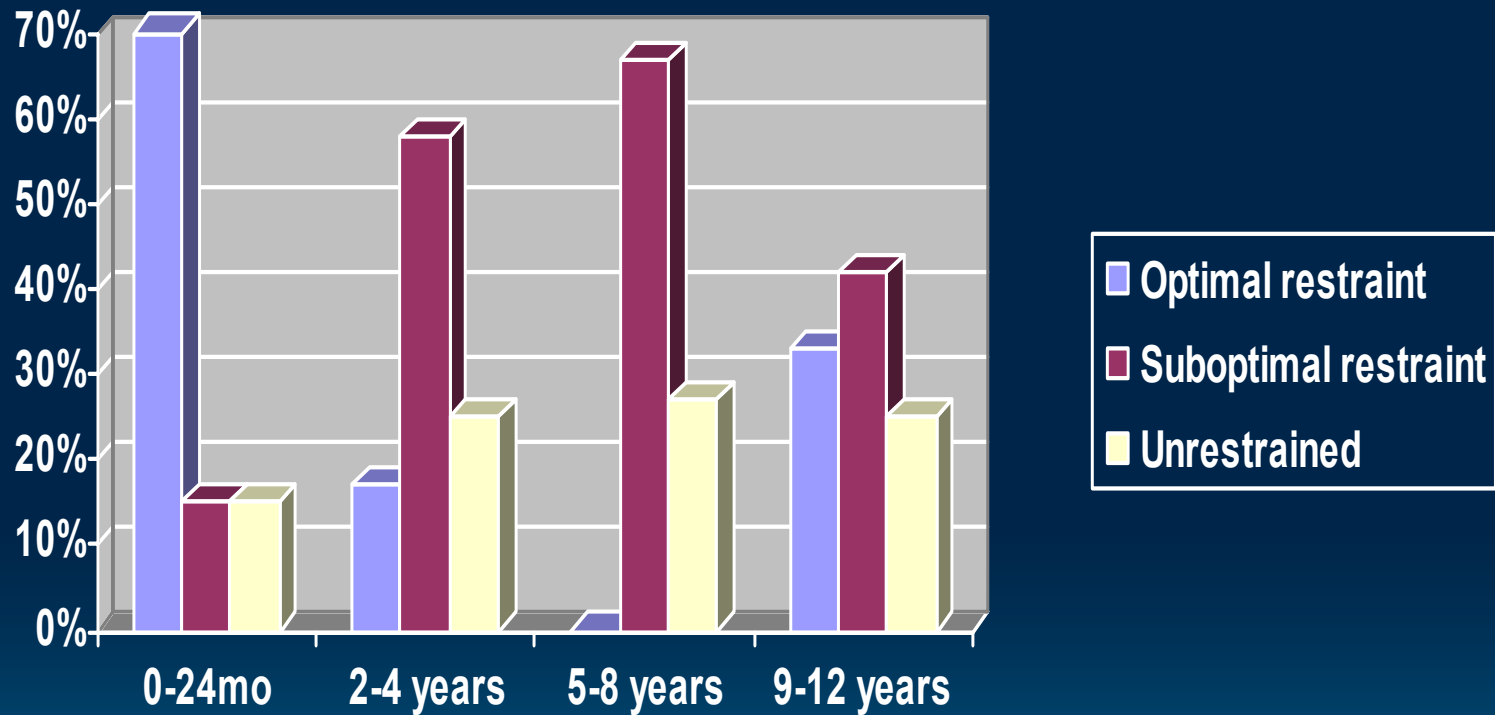
Coroners' Database: Restraint Use

N=65

Information about restraint use available for 52 cases

- 21% (14) Unrestrained
- 58% (38) Used some form of restraint
 - 25% (13) Optimal restraint=age and high appropriate and no recorded misuse or evidence of misuse on autopsy
 - 33% (23) Suboptimal restraint= age inappropriate and/or misuse
 - 5% (2) not enough information

Coroner's data: Restraint use according to age group



Coroners' Database: Criteria for Preventable Deaths

1. No direct vehicle intrusion into the child's seating compartment^{1,2}

AND

2. Documented survival of another appropriately restrained passenger in the same vehicle³

1. [ANCAP. Version 4.7, issued March 2007, retrieved from www.ancap.com.au/mediapapers/protocolpapers](http://www.ancap.com.au/mediapapers/protocolpapers)
2. [EuroNCAP. Version 4.1, issued March 2004, retrieved from www.euroncap.com/testprocedures.aspx](http://www.euroncap.com/testprocedures.aspx)
3. [Brasel K et al. Journal of Trauma-Injury, Infection and Critical Care, 2005; 59\(5\):1057-1061](#)

Coroners' Database: Example of preventable death

- Two 11 year old children
- Back seat
- Restrained by adult seat belt but sash under arm and both lying down across the back seat (?asleep)
- Head-on into rock wall ~ 100km/h
- No direct intrusion of vehicle body or other objects into vehicle
- Correctly restrained driver – survived, injuries to extremities
- Correctly restrained 8 year old front seat passenger – survived with injuries to the neck, collar-bone, and extremities

Preventable Deaths

	Unrestrained	Suboptimal restrained	Optimal restraint
Potentially Preventable	12	17	1
Unlikely preventable	2	6	12

~ 75% of the unrestrained and sub-optimally restrained children could have survived

Laws and Recommendations



Current Australian Recommendations (NOT LAWS)

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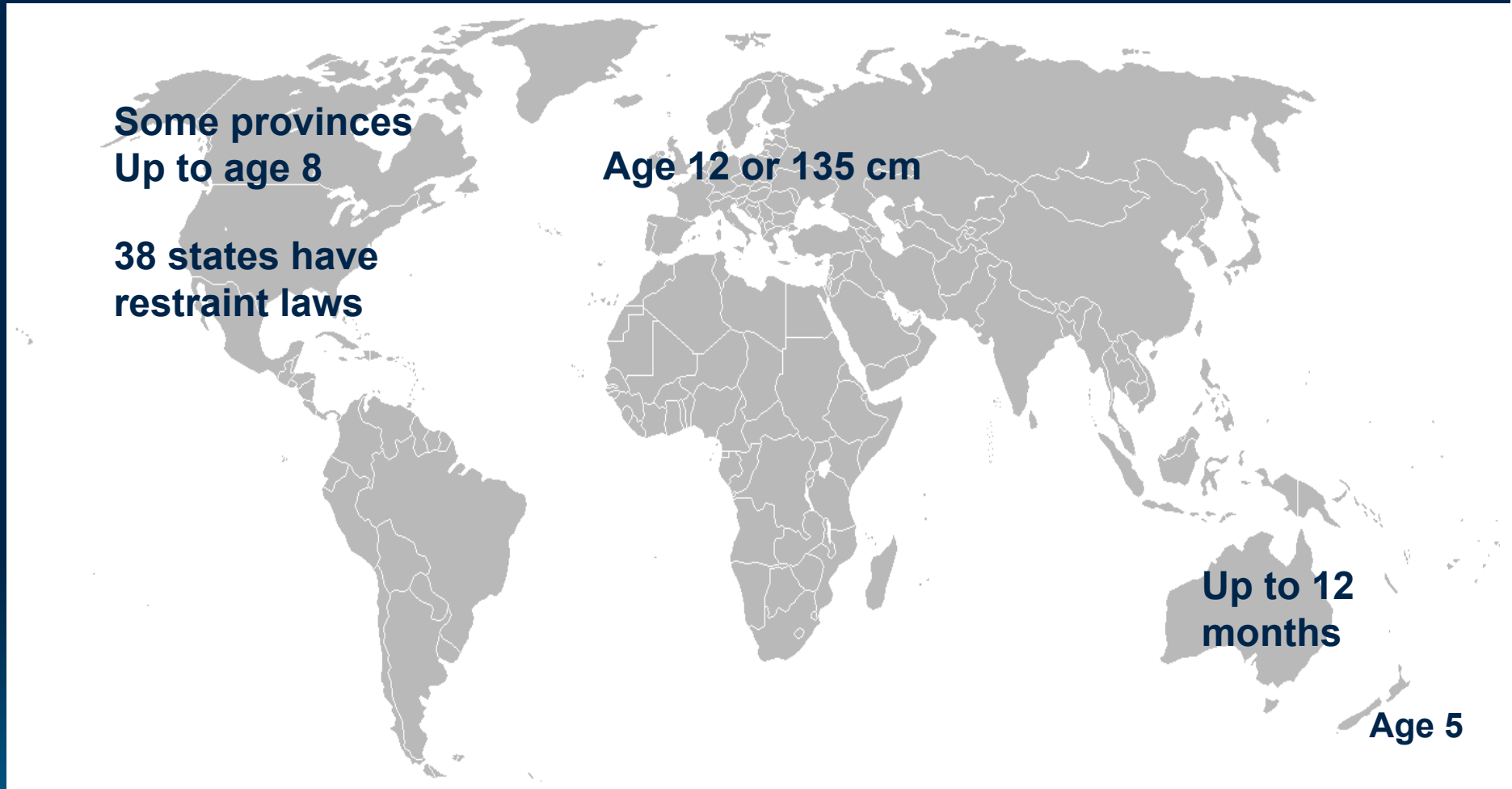
Rear seating position recommended for < 12 yrs

Current Australian Laws

- Children aged 0 to 12 months
 - mandatory restraint - in an AS approved child restraint
- Children aged over 12 months:
 - Mandatory restraint by either
adult seatbelt OR child restraint OR booster



Laws overseas – booster/restrains



*Katie N Reeve, Yvonne A Zurynski, Elizabeth J Elliott and Lynne Bilston
Seatbelts and the law: how well do we protect Australian children? MJA 186:635-638, 2007*

7th Amendment to Australian Road Rules 25th January 2008

- up to 6 mo: rear facing baby capsule**
- 6 mo to 4 yrs: forward facing child restraint**
- 4 to 7 yrs: booster seat or**
- ≥ 7 yrs : adult seatbelt**

Rear seat mandatory for < 7 years

58% of children in our study were ≥ 7 years old

? Enactment of this amendment as law by states ?

“I’m 10 and I’m a big girl now!”

**DOB 12-Oct-1997
Height 129cm**



**DOB 15-Oct-1997
Height 158cm**

Restraint laws based on age alone may not cover all kids

Compliance and parental knowledge



Compliance

NSW & Victoria:

- age at graduation to adult seatbelt = 5.6 yrs (range 3-9yrs)

Charlton J, et al. Monash University Accident Research Centre 2006

NZ:

- 40% of children requiring a booster seat were using one
- 5-9yrs – 93% required a booster seat but only 30% were using one

Cameron L et al. JPCH 2006

NSW paediatric ED:

- 18% of children <12yrs presenting injured in car crashes appropriately restrained

Brown J et al. JPCH 2006

Suboptimal use of restraints highest in 2-8 yr olds

What do parents/carers know



Parents confused about car seats

The Age, June 20, 2007

Children in car restraints at risk

The Australian June 17, 2007

- **Uncertainty about which restraint to use once forward facing restraint outgrown**
- **Only 44% had some knowledge about child restraint legislation**
- **Failure to perceive risk associated with early graduation to adult belts**
- **~20% of restraints are incorrectly fitted to vehicles**

Misuse




An example of age-inappropriate restraint and misuse



- Tip of the iceberg
- APSU unlikely to pick up all cases
- Coroners data – incomplete; 2000-2005 only 65 cases had adequate data to analyse

What do we need to better protect child passengers?

- **Clear laws**
 - **Education for parents, carers and children (and all drivers!)**
 - **Awareness campaigns – media**
 - **Advocacy – paediatricians and other health professionals are well placed to advocate for child passenger safety**
 - **Detailed on-going data collection**
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