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# Risk factors for serious injury to child occupants 0-3 years in motor vehicle crashes

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# Background

# Children in car crashes

- Significant cause of morbidity and mortality
- NSW - 1130 injured and 17 killed each year[1]
- Restraint usage over 99%[2]

[1]5 year average from 2005-2009 obtained from NSW Centre for Road Safety
[2]Brown et al., Accident Analysis & Prevention 2010, 42(6):2144-2148

# Child occupants

- Not a homogenous group
- Require different restraints
- Variations in anatomy and biology

Need to look specifically at children aged 0-3 years!

# Crash factors

- Rear seat offers protective effect[3,4]
- Increased risk of serious injury in side-impact[5,6]

[3]Berg et al., Pediatrics 2000, 105(4):831-835
[4]Smith & Cummings, Injury Prevention 2006, 12(2):83-86
[5]Arbogast et al., The Journal of Trauma 2001, 51(3):469-477
[6]Orzechowski et al., The Journal of Trauma 2003, 54(6):1094-1101

# The Henderson study[7]

- Correctly restraint usage = high level of protection
- Premature graduation
- Did not look at 0-3 years as population subset
- No other crash factors analysed

[7]Henderson et al., 38th Annual Proceedings, Association for the Advancement of Automotive Medicine 1994, 75-87

What risk factors are associated with serious injury following a motor vehicle crash in children aged 0-3 years?

# Methods

# Data collection

- Retrospective medical record review
- Children's Hospital at Westmead (80)
- Department of Forensic Medicine (10)

# Variables

- Age
- Restraint status
- Estimated vehicle speed
- Impact direction
- Crash location
- Seating position
- Occupant ejection
- Injury Severity Score (ISS)

# Data analysis

LOGISTIC REGRESSION

Models 1 & 2

- Age, restraint, speed, crash location/impact direction

Models 3 & 4 (excl. unspecified restraint status)

- Age, restraint, speed, crash location/impact direction

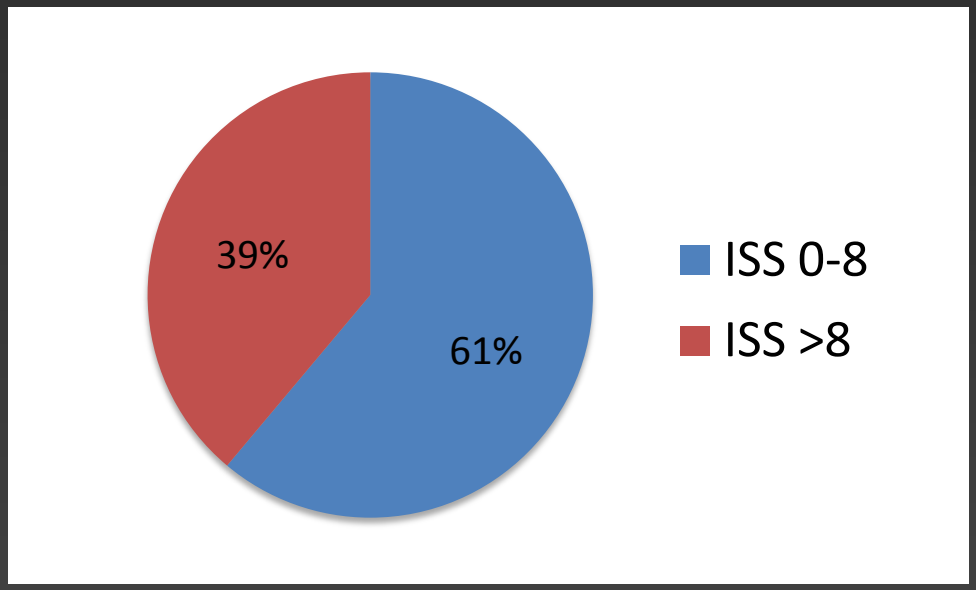
# Results

# Study population

- Age: mean 15 months, range 1-35 months
- 14.4% fatally injured

# Injury Severity Score

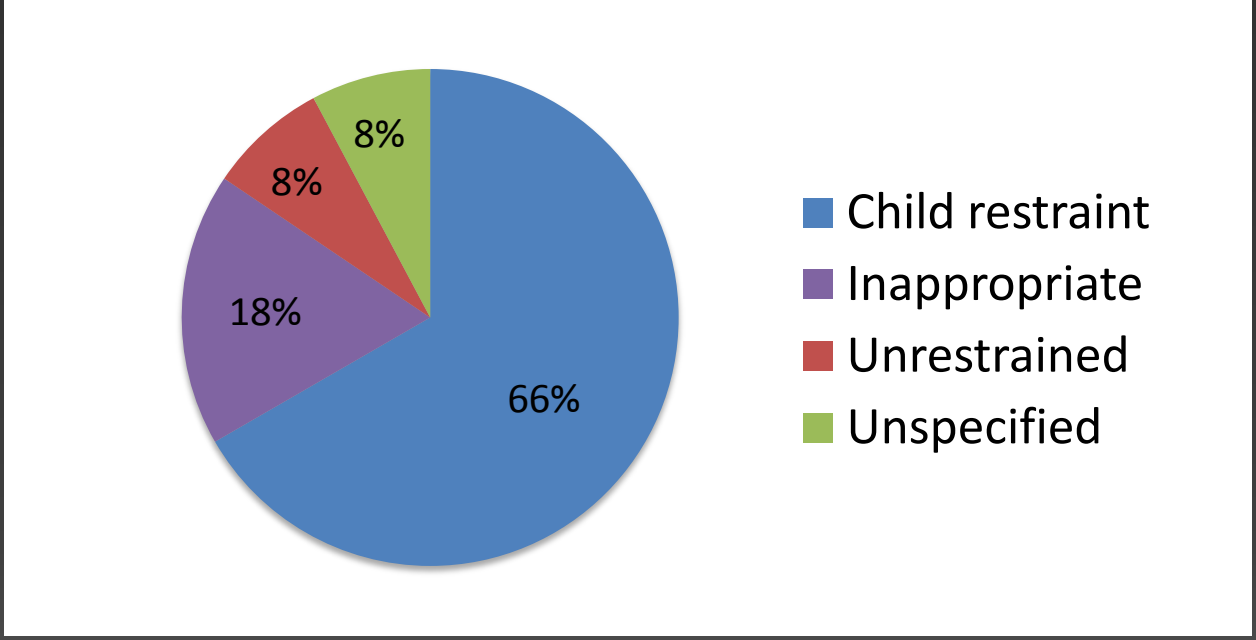
- Mean 8.3
- Range 0-75



# Restraint use

Study population

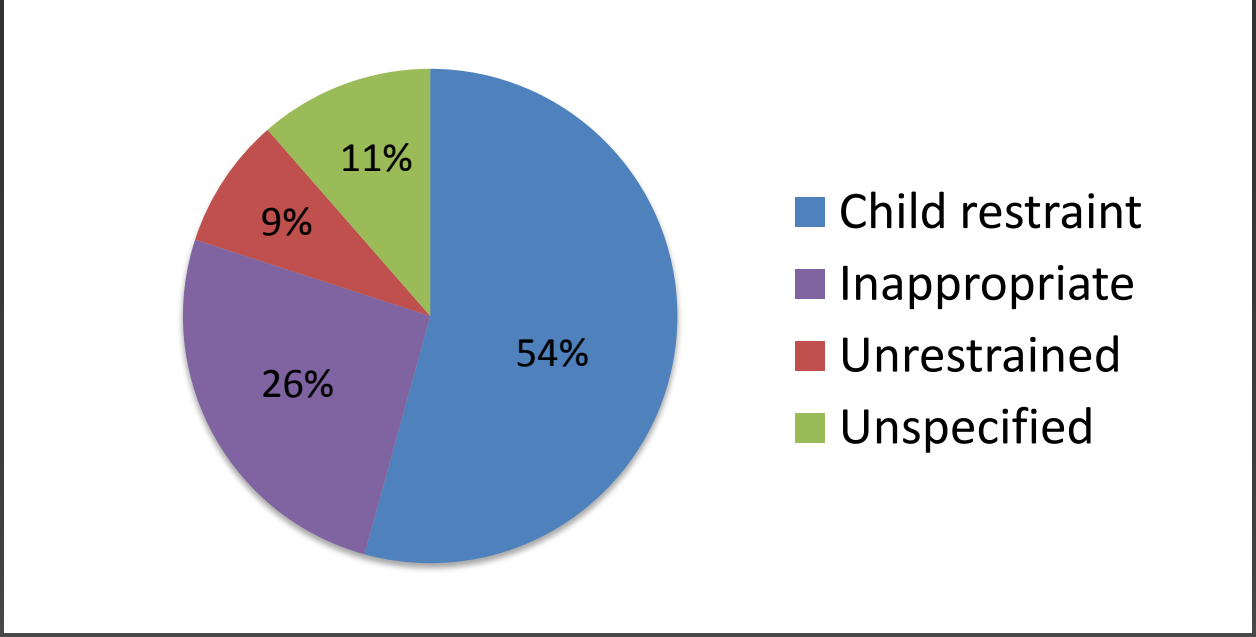
- Restraint use: 85.6%
- Inappropriate restraint use: 17.8%



# Restraint use

Seriously injured cases

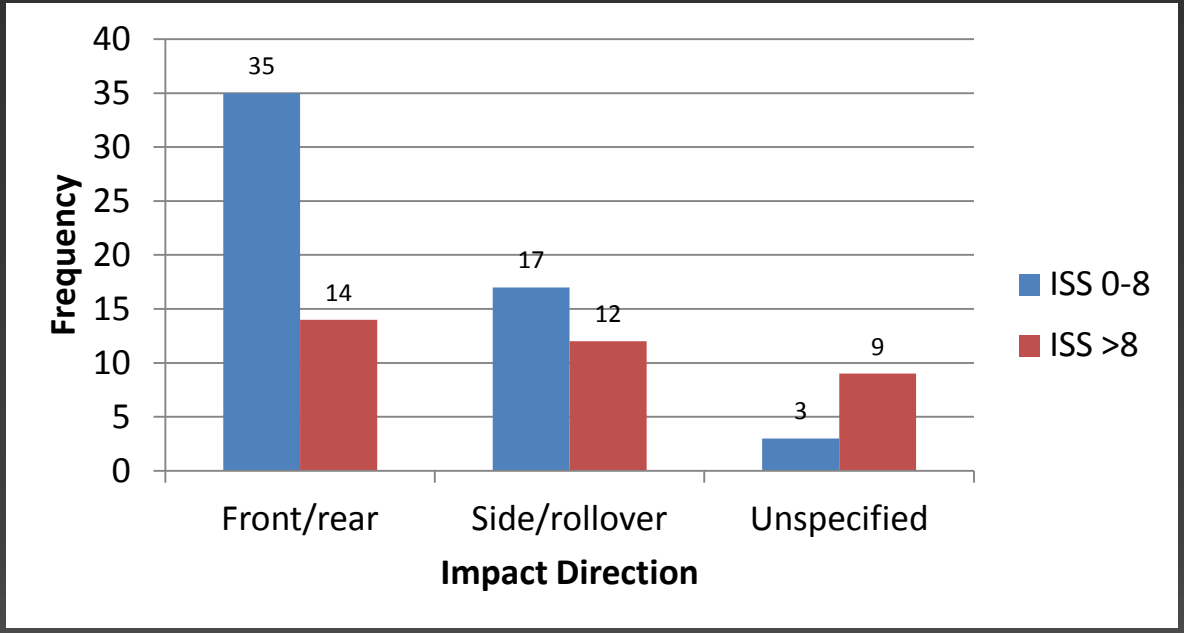
- Restraint use: 80.0%
- Inappropriate restraint use: 25.7%



# Impact direction

Serious injury (ISS >8) occurred in:

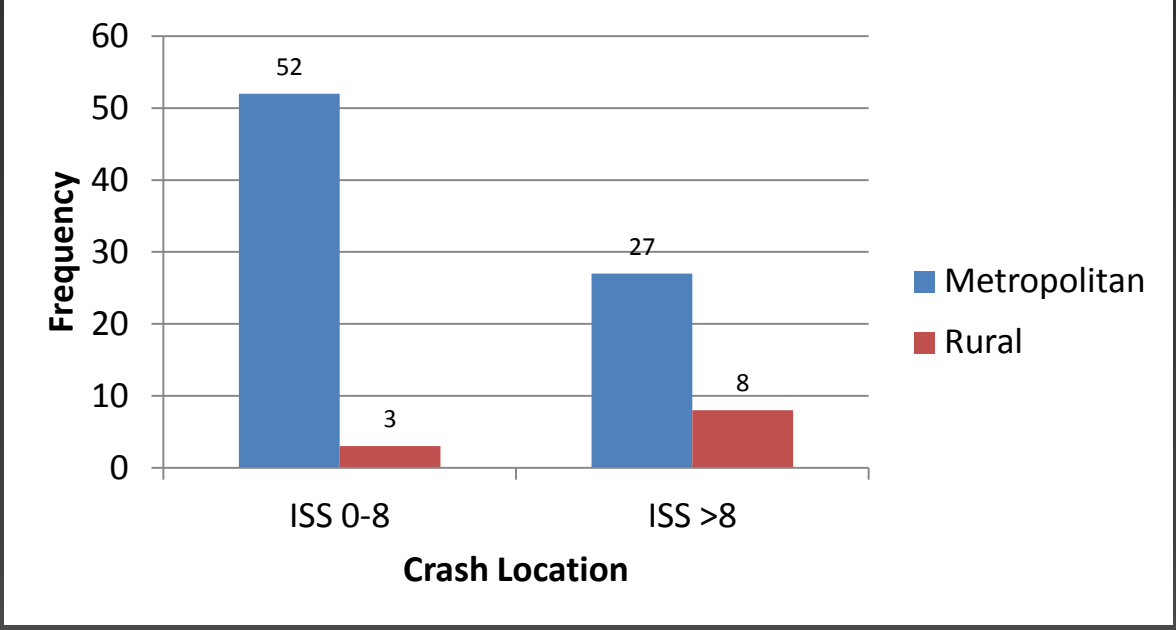
- 41.1% of side/rollover impacts
- 28.6% of front/rear impacts



# Crash location

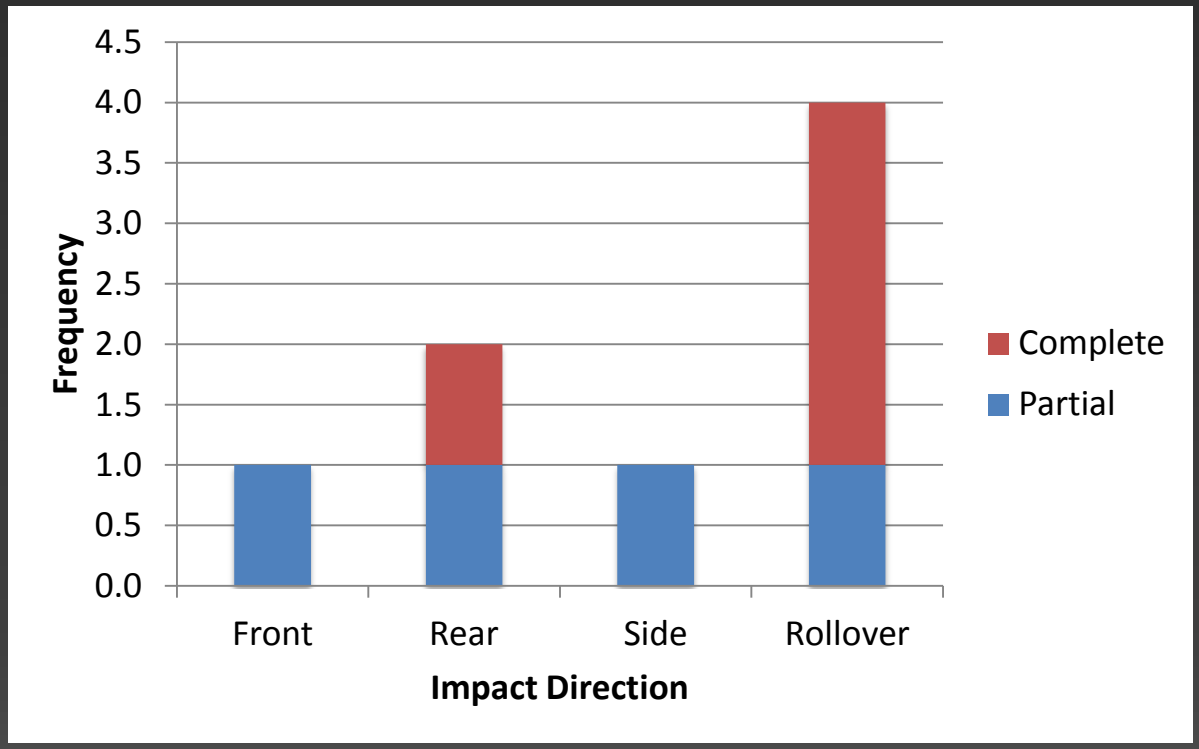
Serious injury (ISS >8) occurred in:

- 72.7% of rural crashes
- 34.2% of metropolitan crashes



# Ejections

- 4 out of 8 ejections were complete
- 75% of complete ejections occurred in rollovers



# Logistic regression 1

Age, restraint status, estimated speed, crash location

- Serious injury 6x as likely in rural crashes
    - OR increased to 9.0 with exclusion of unspecified restraint status
- Serious injury 3x as likely for inappropriately restrained

# Logistic regression 2

Age, restraint status, estimated speed, impact direction

- Serious injury 4x as likely for inappropriately restrained
    - OR increased to 4.7 with exclusion of unspecified restraint status
- Serious injury 3x as likely for side/rollover impacts

# Discussion

# Key findings

- Inappropriate restraint use appears to increase the risk of serious injury
- Side/rollover impacts may pose the greatest injury risk to young children
- Serious injuries appear to be more likely in rural crashes
- There may be an association between rollovers and complete ejections

# Implications

Restraint use

- Premature graduation from child restraints needs to be addressed
- Need to investigate the protection provided by forward- and reward-facing restraint systems
- Role of restraint misuse?

# Implications

Impact direction

- Better understanding of injury mechanisms injury in side & rollover impacts needed

Crash location

- Need to investigate why children are at a significantly greater risk for serious injury in rural crashes

# Implications

Ejections

- May be related to restraint misuse but this needs further investigation
- May also be related to restraint design
- Small numbers means observations need further confirmation

# Limitations

- Sample biased towards seriously injured children
- Retrospective nature
- Use of ISS as a measure of serious outcome

# Acknowledgements

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Co-authors

- Dr Julie Brown, Neuroscience Research Australia
- Prof Lynne Bilston, Neuroscience Research Australia
- Kellie Wilson, Sydney Children's Hospital
- Prof Danny Cass, Children's Hospital Westmead
- Patricia Manglick, Children's Hospital Westmead
- Prof Jo Duflou, Department of Forensic Medicine Glebe

Funding

- Jodie Wheatley was supported by Lorrie Fay Memorial Kidsafe Scholarship
- Lynne Bilston is supported by NHMRC Senior Research Fellowship
- Julie Brown is supported by ACR APDI fellowship

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