

Protection of Children in the Rear Seat in Real World Crashes



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Overview

- **How Much Children Are Traveling**
- **How Often They Are Injured**
- **Crash Characteristics**
- **Who is in the Rear Seat**
- **How are They Restrained**
- **Children in the Rear Seat in SI Crashes**
 - Injury trends
 - Injury mechanisms



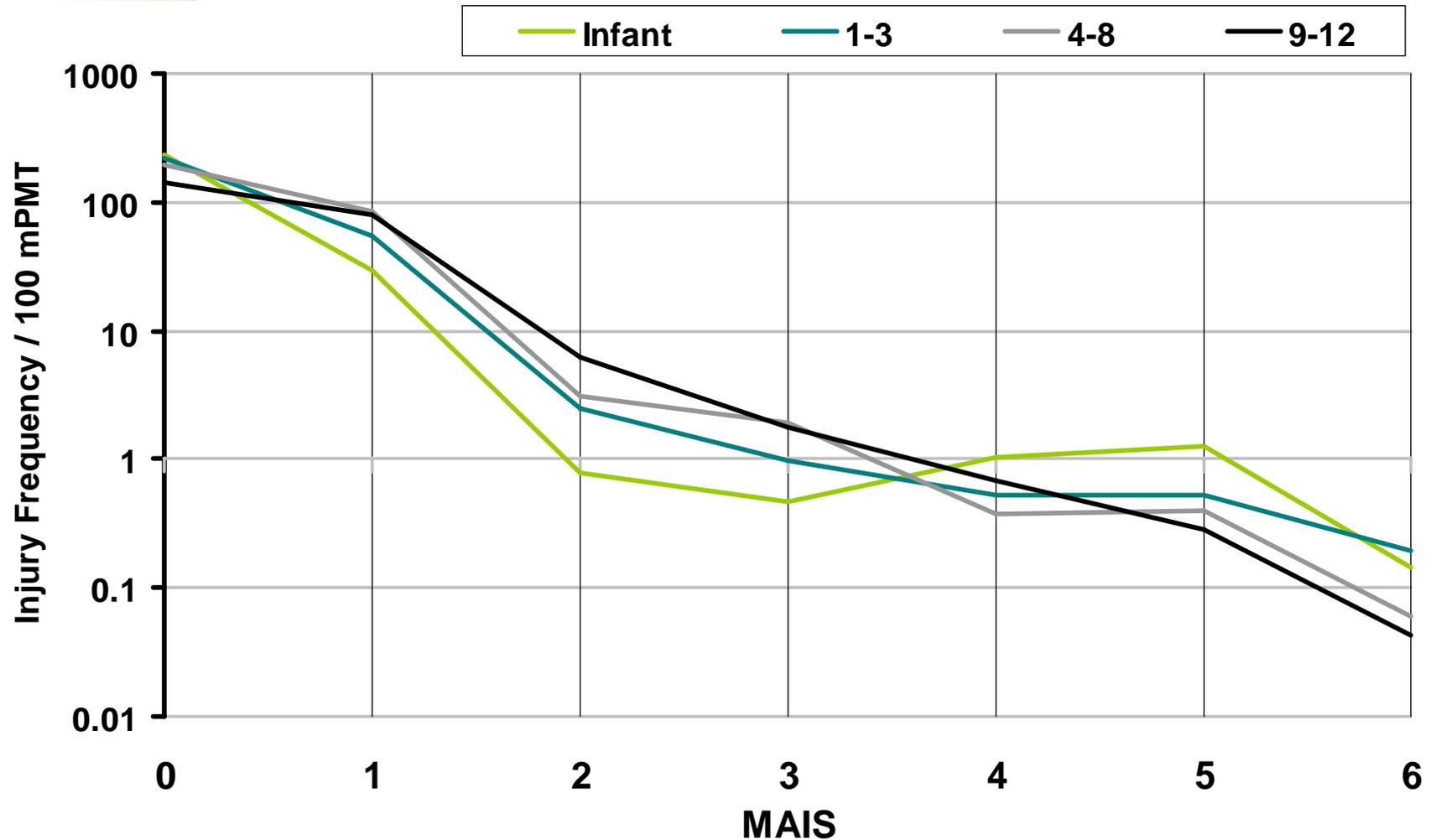
Exposure – Passenger Miles Traveled

- **Exposure estimates were qualitatively examined for children 0-15 Years Old.**
 - Infants have a relatively low exposure to crashes.
 - Exposure increases for toddlers/preschoolers.
 - Exposure level begins to drop for school-aged children.
 - The exposure increases as children enter their early teen years.
 - While this may be a remnant of the estimation method and higher propensity of early teens to ride with inexperienced drivers, it does sensibly reflect their more frequent crash involvement



Injury Rate

[Estimated Injuries per 100 million PMT]

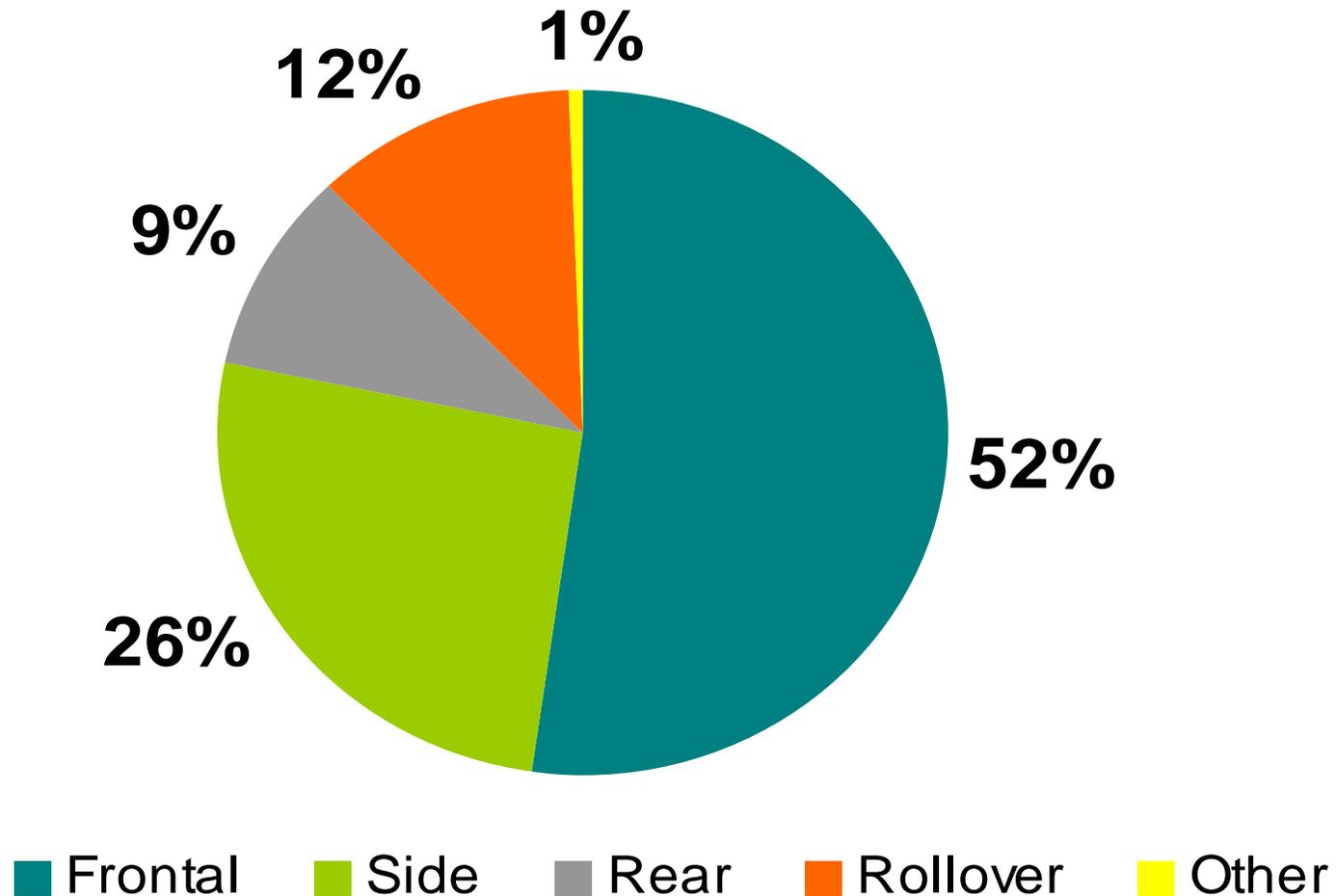


Injuries: CDS 1994-2003 (weighted); VMT: BTS

Note: MAIS 0 refers to rear occupants involved in a crash and yet uninjured.



Distribution of Children 0-12 Years Old Involved in Real World Crashes



NASS CDS DATA 1995-1996, 1998-2003
ALL WEIGHTED CRASHES by CRASH MODE

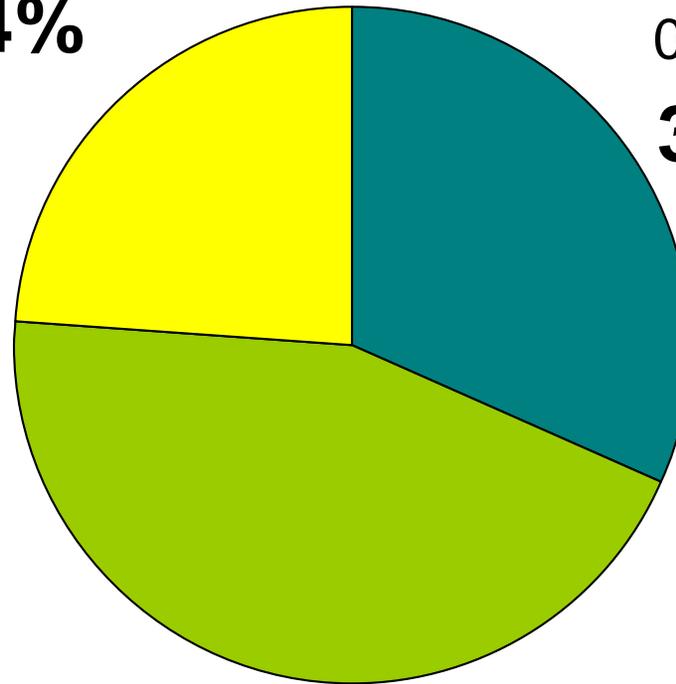


Distribution of Children 0-12 Years Old Involved in Frontal Crashes

Frontal Crashes

NASS CDS 1995-1996, 1998-2003
WEIGHTED N = 1,189,642

9-12YO
24%



0-3YO
32%

4-8YO
44%



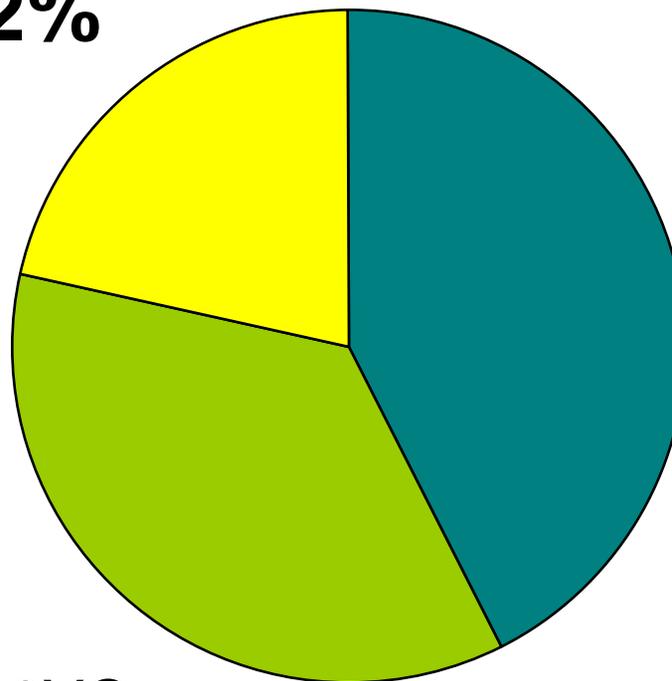
Distribution of Children 0-12 Years Old Involved in Side Impact Crashes

Side Crashes

NASS CDS 1995-1996, 1998-2003
WEIGHTED N = 1,189,642

9-12YO

22%



0-3YO

42%

4-8YO

36%



Distribution of Children 0-12 Years Old Involved in All Crashes

All Crashes

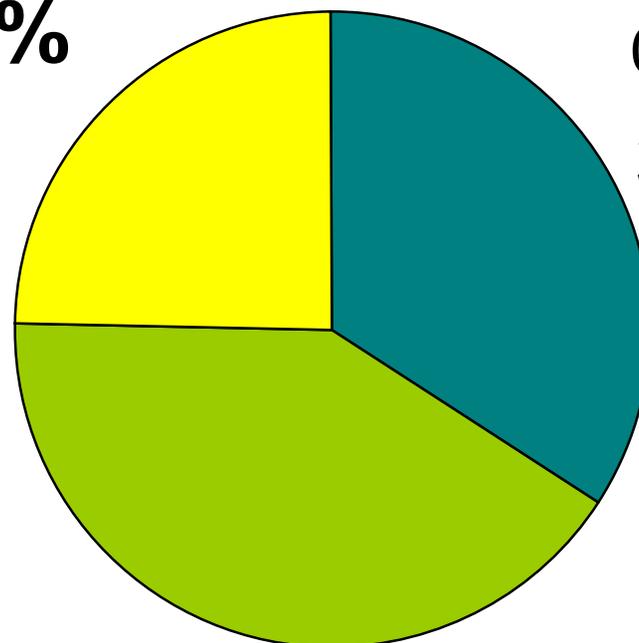
NASS CDS 1995-1996, 1998-2003
WEIGHTED N = 2,273,878

9-12YO

25%

0-3YO

34%



4-8YO

41%



Who is in the Rear Seat? How are they Restrained?



Height and Age Distribution Rear Seat Occupants

Weighted

Height

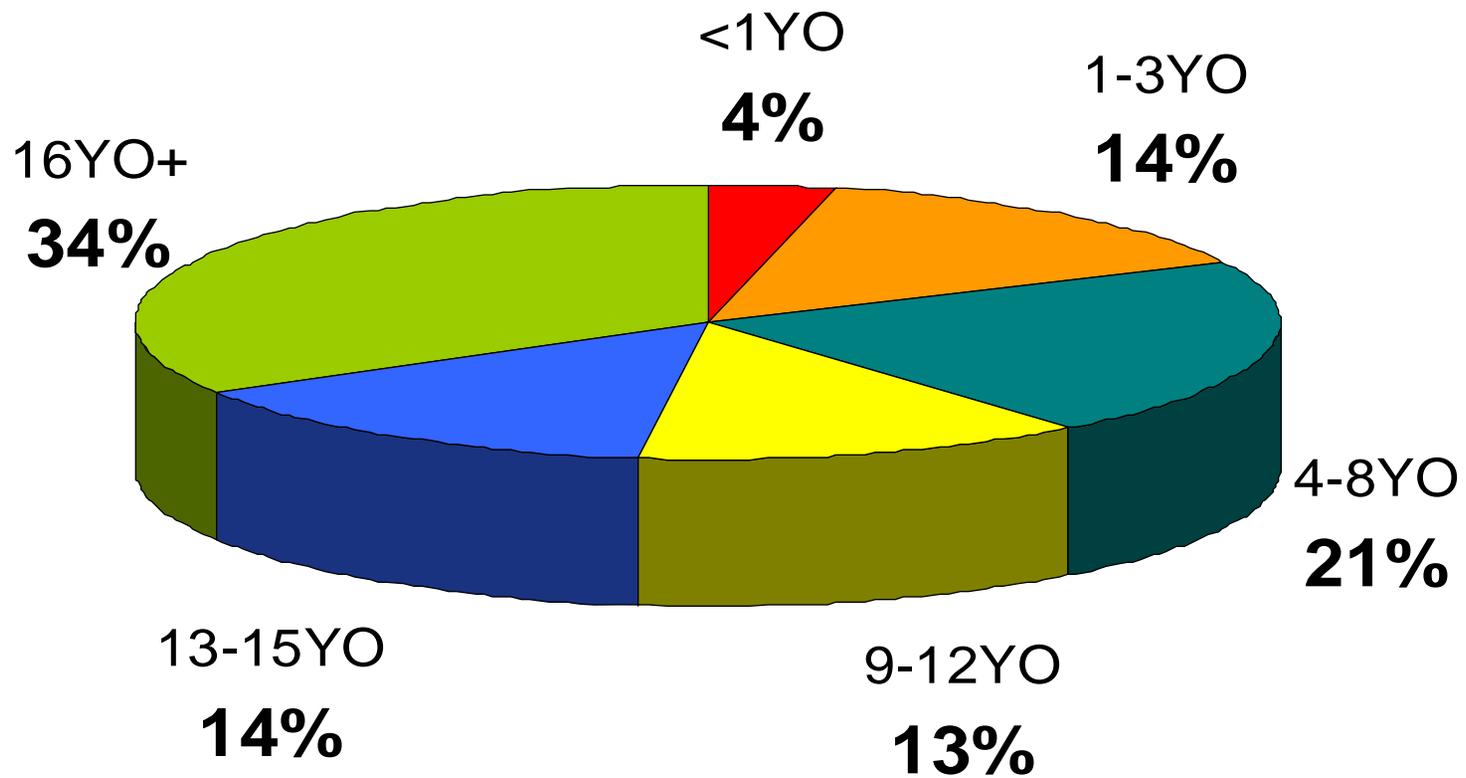
AGE	<35"	35"-45"	45"-55"	55"-65"	65"-75"	75"+	Total
0	3.6%	0.0%	0.0%	0.0%	0.0%	0.0%	3.6%
1-3	8.7%	5.2%	0.4%	0.0%	0.0%	0.0%	14.3%
4-8	0.7%	9.1%	10.5%	1.0%	0.0%	0.0%	21.3%
9-12	0.0%	0.2%	3.5%	8.7%	0.5%	0.0%	12.9%
13-15	0.0%	0.0%	0.1%	4.2%	9.9%	0.0%	14.3%
16+	0.0%	0.0%	0.1%	10.6%	22.2%	0.8%	33.7%
Total	13.0%	14.5%	14.6%	24.6%	32.6%	0.8%	100.0%

NASS CDS Data - 1995, 1996, 1998-2004
ALL CRASHES - ALL MODES (MAIS 0-6)

**Children 0-12YO
represent 52% of rear
seat occupants**



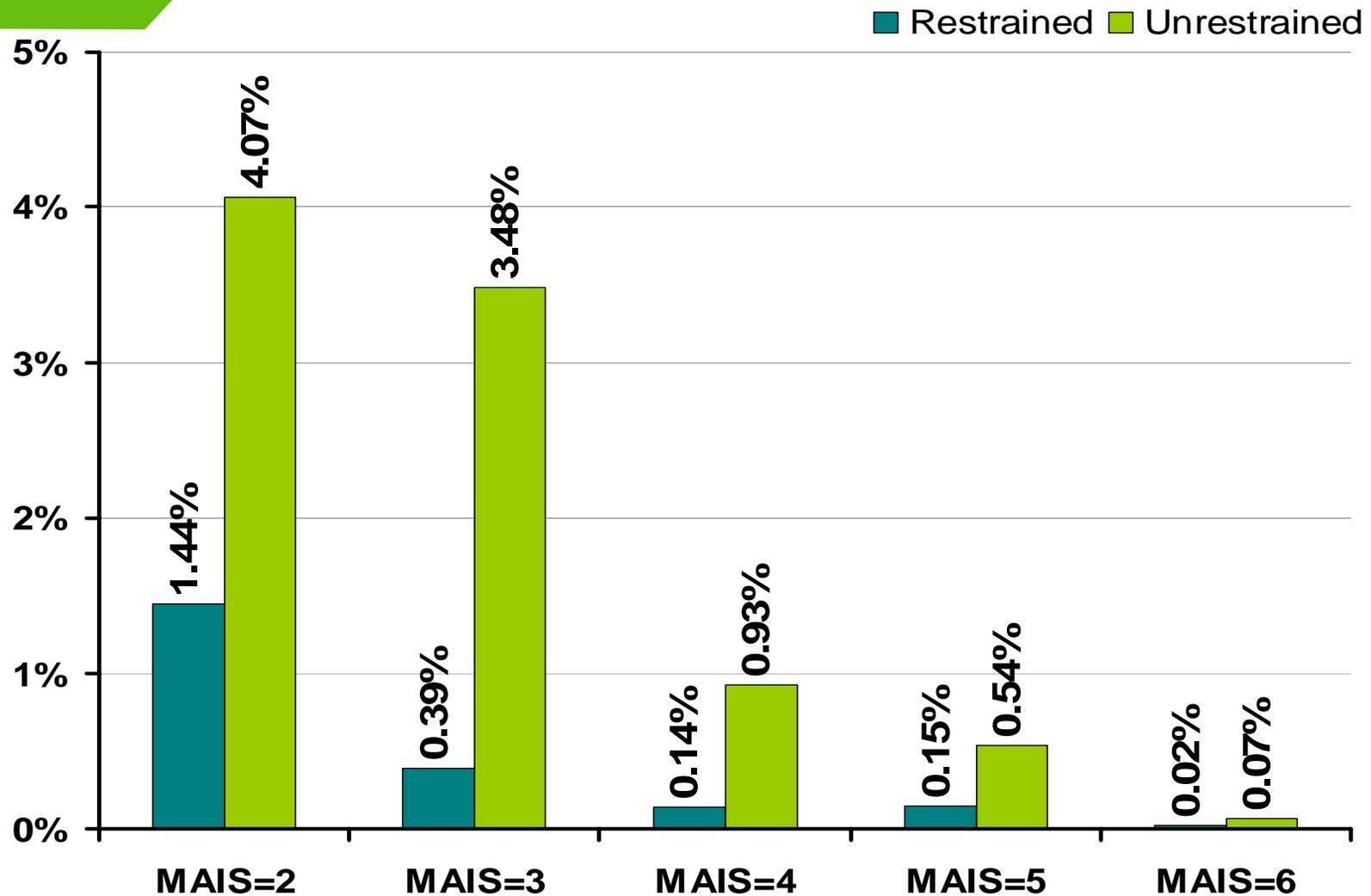
Rear Seat Occupant Distribution



NASS CDS Data - 1995, 1996, 1998-2004
ALL CRASHES - ALL MODES (MAIS 0-6)



Distribution of Real World Crashes Restraint Status vs MAIS 2+



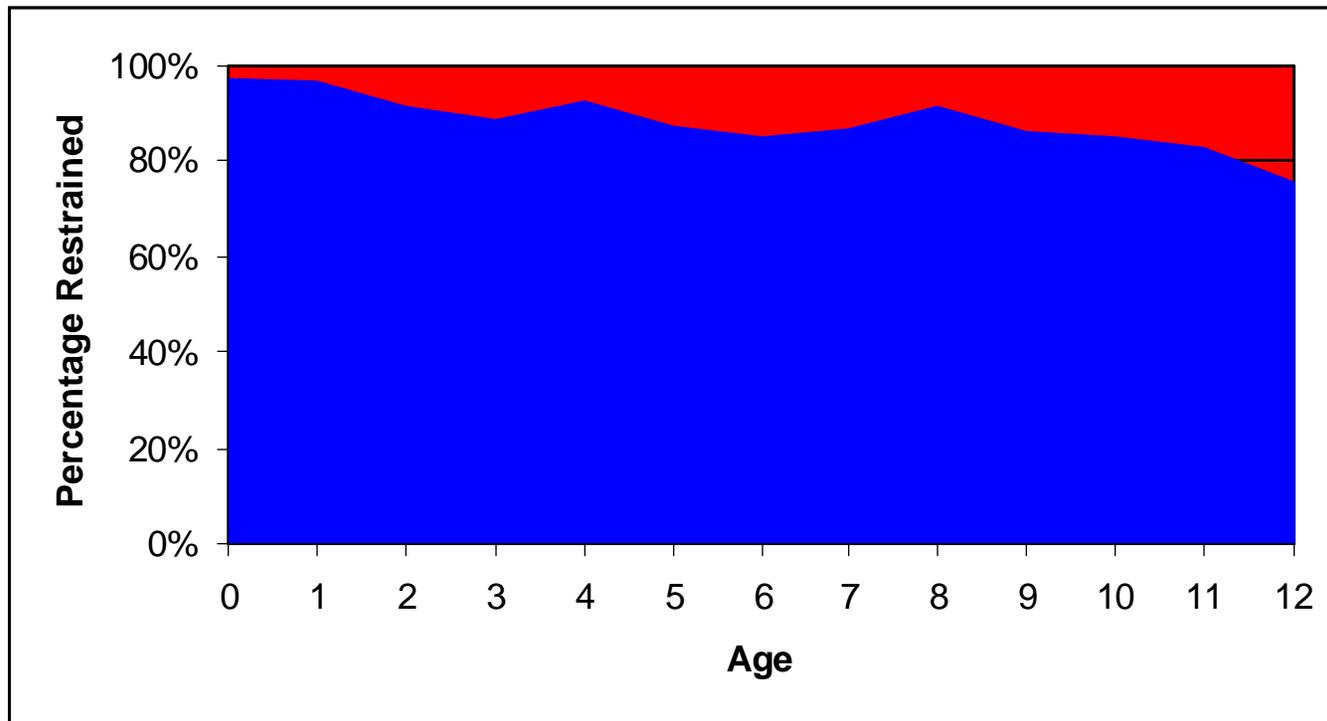
Note: 71% of Restrained Passengers are Uninjured.

AGES 0-12 Years Old, WEIGHTED NASS-CDS 1995, 1996, 1998-2003



Percentage Restrained by Age

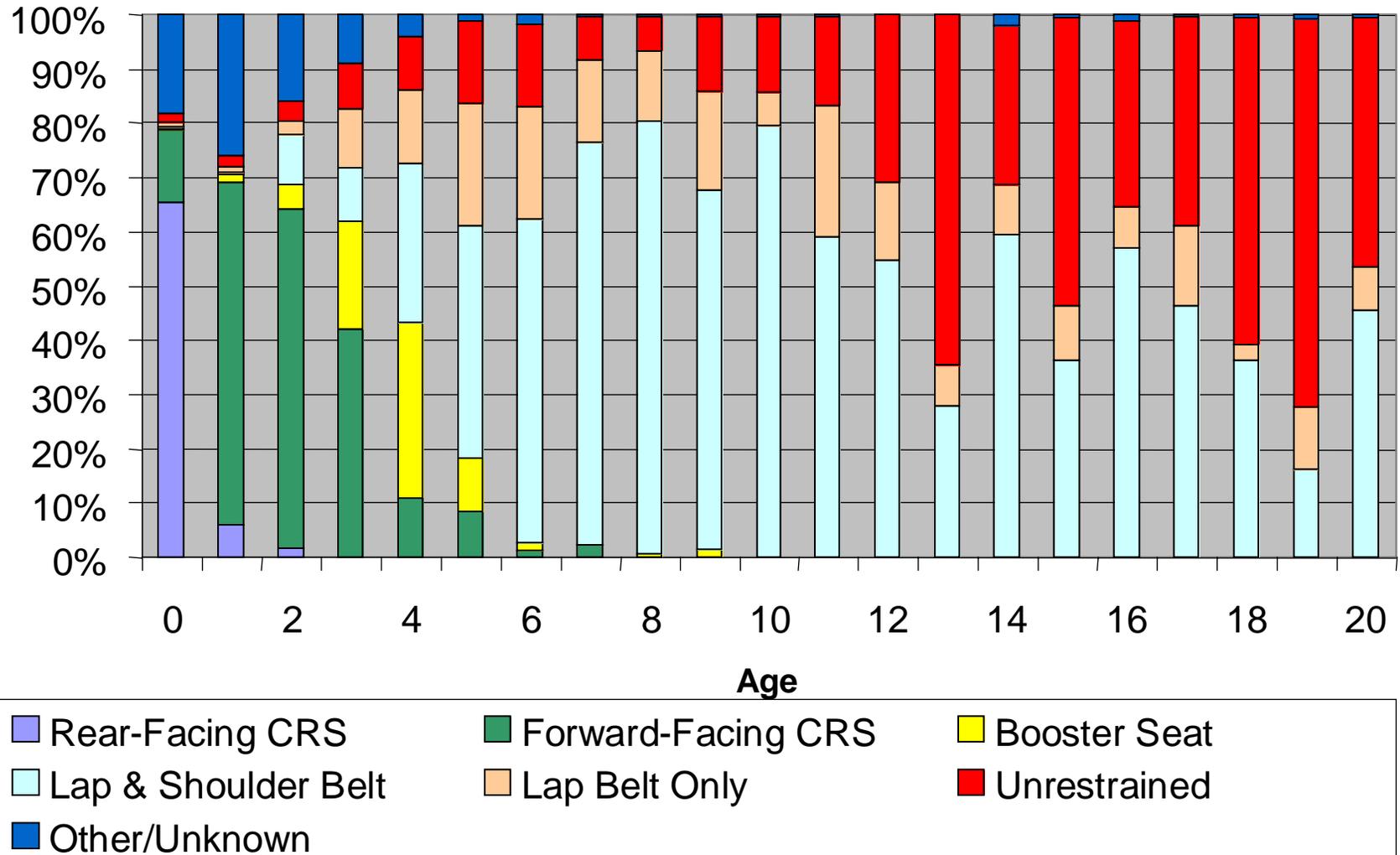
- **Restrained children appear to be under-represented in FARS fatalities.**
- **Unrestrained children appear to be over-represented in FARS fatalities.**
 - Example: unrestrained children make up 8% of the four-year-old population, but 48% of the four-year-old fatalities.



Children 0-12 Years Old
NASS CDS 1995-2004 (weighted)



Restraint Usage Profile By Age in Real World Crashes



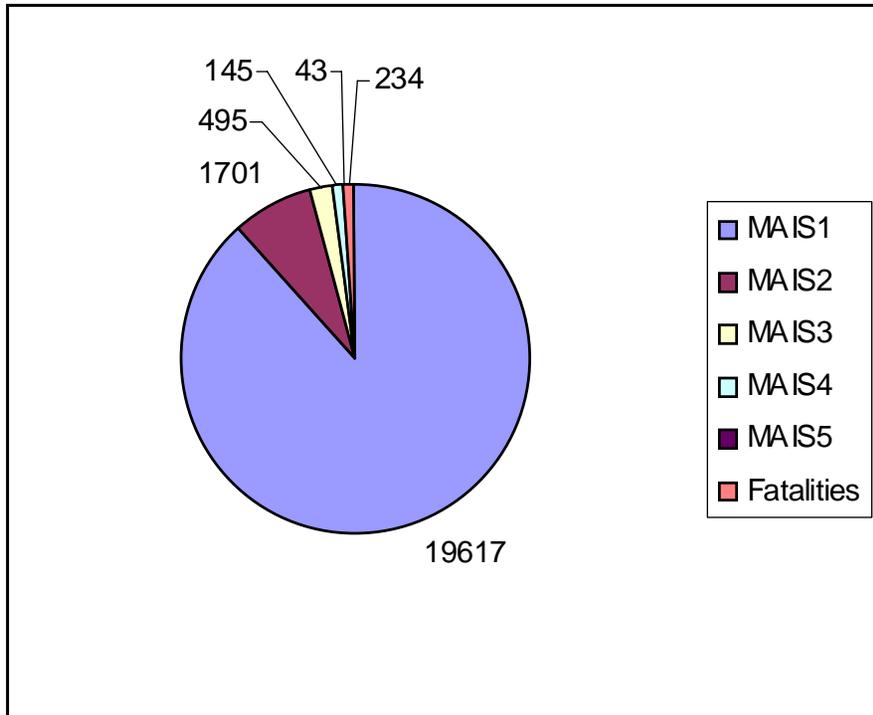
All CDS Crashes (Weighted) – All Crash Modes
Data Years 1995, 1996, 1998-2004



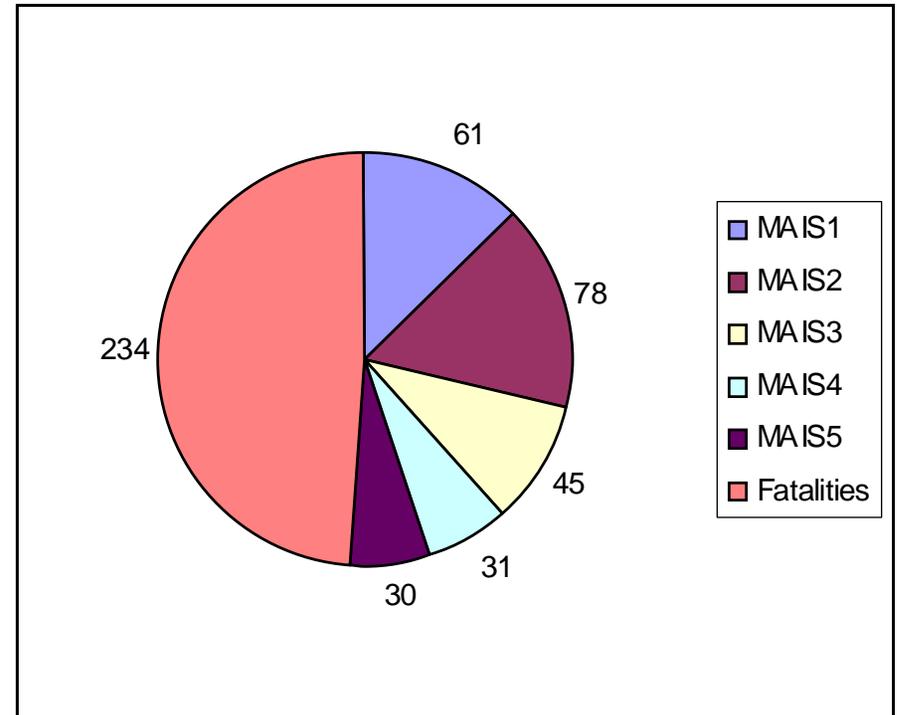
Children in the Rear seat in Side Impact Crashes



Side Impact Crashes Average Annual Injury Count and Fatality Equivalents



Injury Count



Fatality Equivalents

WEIGHTED NASS-CDS DATA YEARS 1995, 1996, 1998-2003

AGES 0-12 Years Old

Note: FARS average fatality count for 1994-2003 was 394.



Side Impact Crash Modes - Fatality Equivalent Estimates from Weighted Annual Averages of Injury by Restraint Type

Injury Level	Child Seat			Seat Belt		Unrestrained	Unknown	Total
	Rear Facing	Forward Facing	Booster Seat	Lap and Shoulder	Lap Only			
MAIS 1-2*	1	21	2	48	25	40	2	139
MAIS 3-6*	0	5	2	17	12	65	6	107
CDS Fatalities	1	5	78	53	26	68	4	234
CDS Total	2	31	82	117	63	174	12	480
FARS Fatalities	66			69	23	187	48	394

NASS-CDS DATA YEARS 1995, 1996, 1998-2003; FARS DATA YEARS 1994-2003

AGES 0-12 Years Old

*Survivors only

Note: Only 3 fatal child seat cases in CDS



Side Impact Trend Analysis

- **Crash parameters and injury characteristics were qualitatively examined for high delta V (>30 kph) side impact crashes.**
 - Very few torso injuries are without associated head injuries, especially for MAIS > 1
 - Unrestrained children tend to have more severe injuries
 - Children on the near side tend to have more severe injuries than those on the far side or in the center.



Side Impact Trend Analysis –Cont'd

Injury Mechanisms

1. Head
injuries (n=280)

Interior surface – left/right
Seat back support
Child seat

2. Torso
injuries (n=99)

Interior surface – left/right
Belt webbing/buckle
Seat back support/ground

3. Upr/Lwr
Extremities
combined (n=139)

Seat back support
Interior surface – left/right
Belt webbing/buckle

High delta V (>30 kph) in side impact crashes



Summary

- 52% of rear seat occupants are children 0-12 Years Old
- Infants have a relatively low exposure to crashes; exposure increases as children enter their early teen years
- 71% of restrained passengers are uninjured
- Unrestrained children tend to have more severe injuries
- For side impact crashes:
 - Very few torso injuries are without associated head injuries, esp. for MAIS > 1
 - Children on the near side tend to be more severely injured than those on the far side or in the center
 - Injury trends are: 1st Head injuries; 2nd Torso injuries; 3rd Upr/Lwr Extremities
 - Injury mechanisms: interior surface, seat back support, belt webbing/buckle



Thank you

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Any questions/comments?