

A REVIEW OF ALL CHILD CAR OCCUPANT FATALITIES IN SWEDEN OVER THE PAST THREE DECADES

Katarina Bohman
Isabelle Stockman
Lotta Jakobsson

Anna Carlsson

Maria Klingegård

Rikard Fredriksson

V O L V O

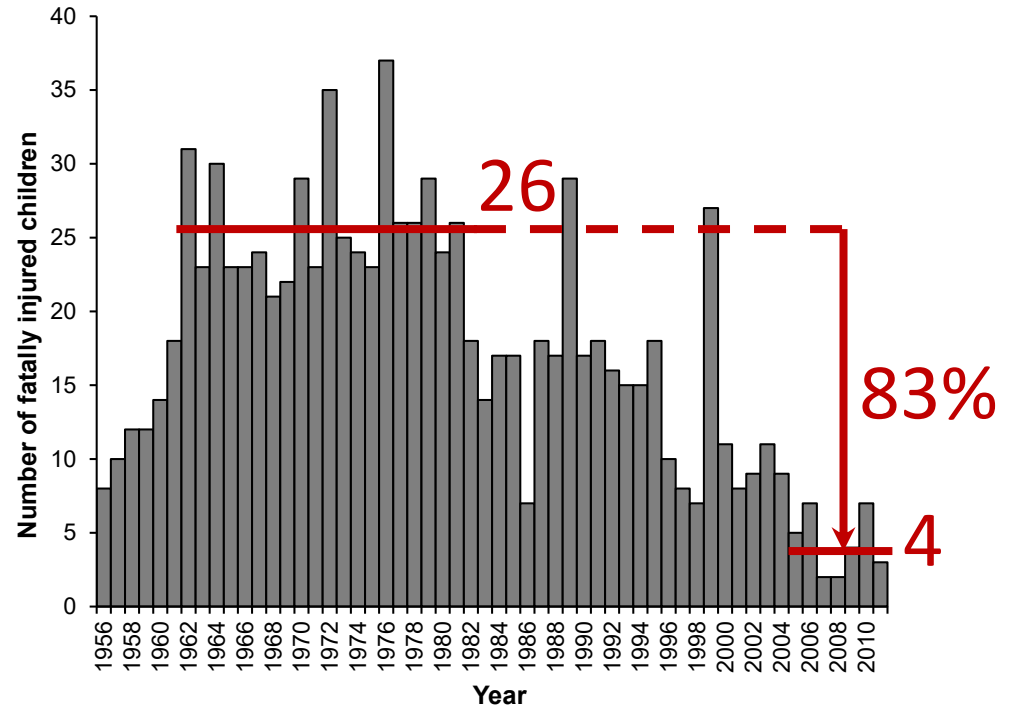


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Background

- Studied Swedish child fatalities from 1956-2011
- 83% reduction in later years compared to 1960s/1970s



Source: Carlsson A, Strandroth J, Bohman K, Stockman I, Svensson M, Wenäll J, Gummesson M, Turbell T, Jakobsson L. Review of Child Car Occupant Fatalities in Sweden During Six Decades, IRCOBI, 2013

Aim

This study aims to provide a current overview of child fatalities in passenger cars in Sweden over the past three decades, to observe

- Overall evolution
- Identify situations and contributing factors behind the remaining fatalities

Method

Swedish Transport Administration's national database on all fatally injured road users in Sweden

- Selection criteria
 - Children 0-15 years
 - Accident years: 1992-2024

Information collected

- Age, sex, child weight and height, seating position, fatal injury, seat belt use, CRS use
- Vehicle model and model year
- Crash description, collision counterpart, crash event, impact direction, and posted speed limit.

Data

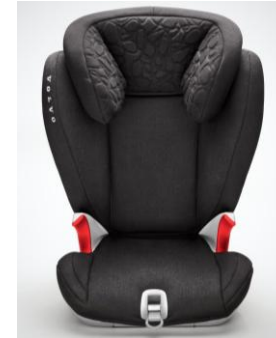
- 221 fatalities in 181 crashes

Method - Analyze

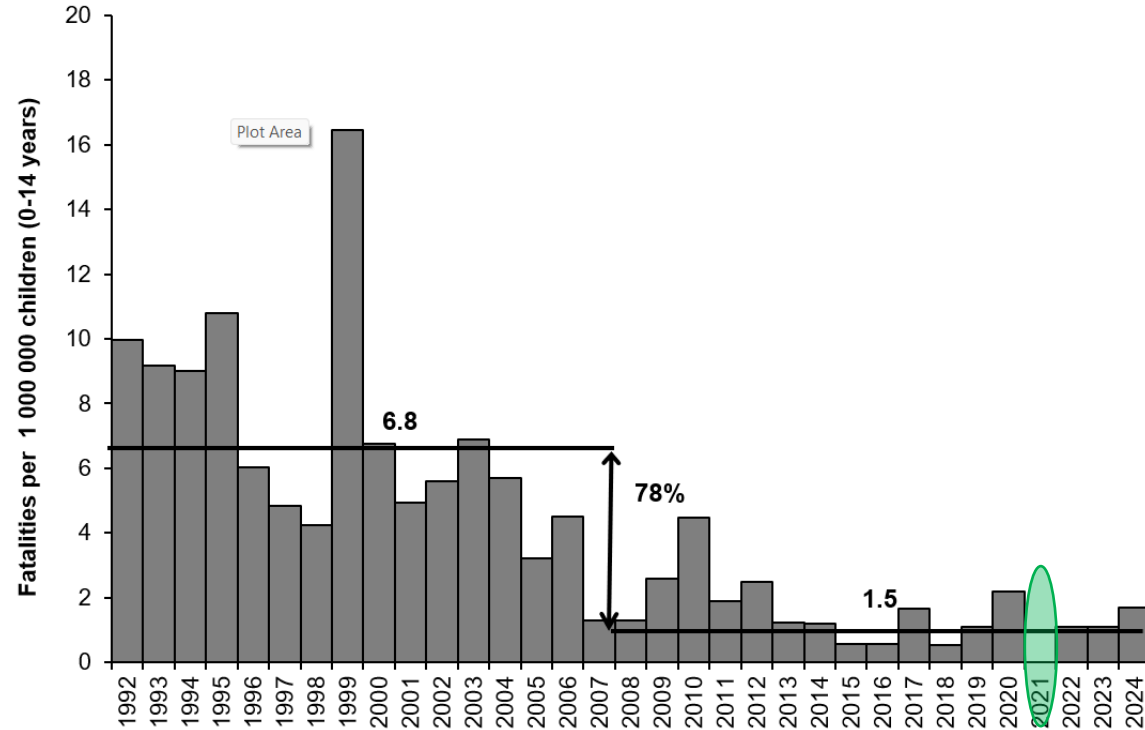
- Three age groups: 0-3yo, 4-9yo, 10-14yo
- Two time periods: 1992-2007 and 2008-2024

Restraint definition

- Appropriate restraint use
 - 0-3yo or shorter than 105cm: rearward facing CRS
 - 105-140cm: booster seat/cushion
 - 4-6yo restrained on CRS with internal harness
 - 140cm+ restrained by seat belt only
- Inappropriate restraint use
 - Child was restrained but not appropriate for the age or size
 - Misuse

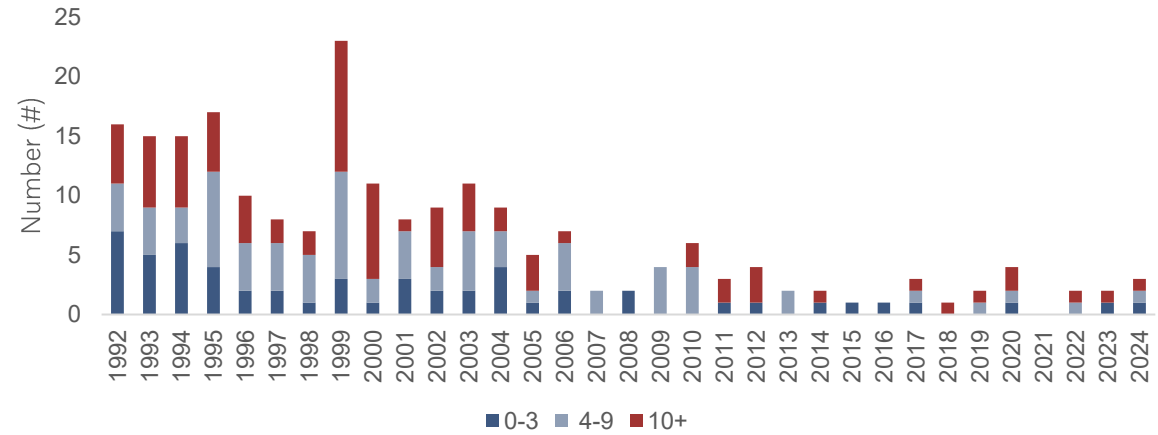
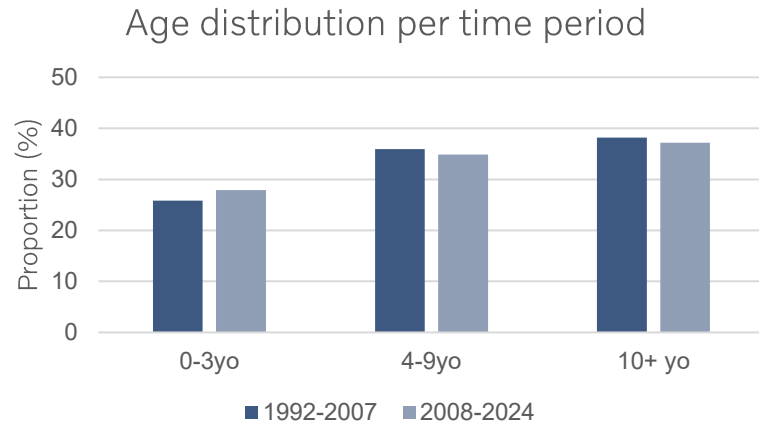


Results - Overview



- 78% reduction comparing earlier and recent time period
- On average, 1.5 children per year have died as car passenger in recent years
- 2021 – first year with zero fatalities

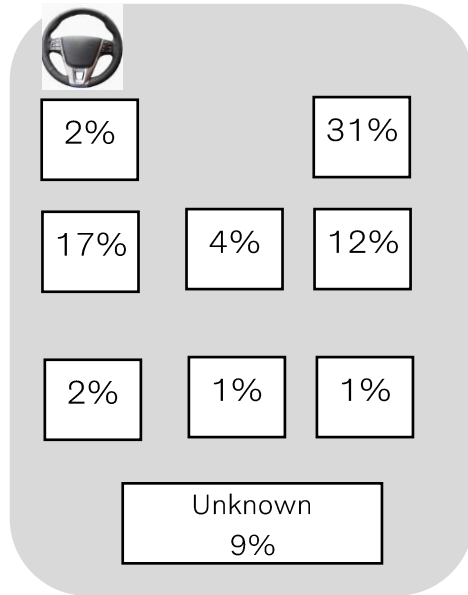
Age distribution



- Similar age distribution per age group per time period

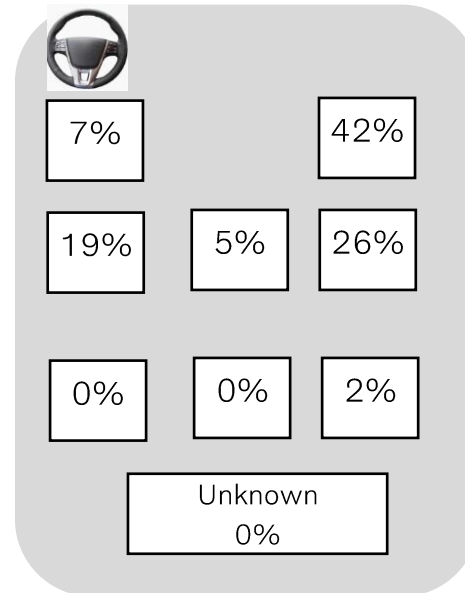
Seat position

1992-2007



Second row unspec.
23%

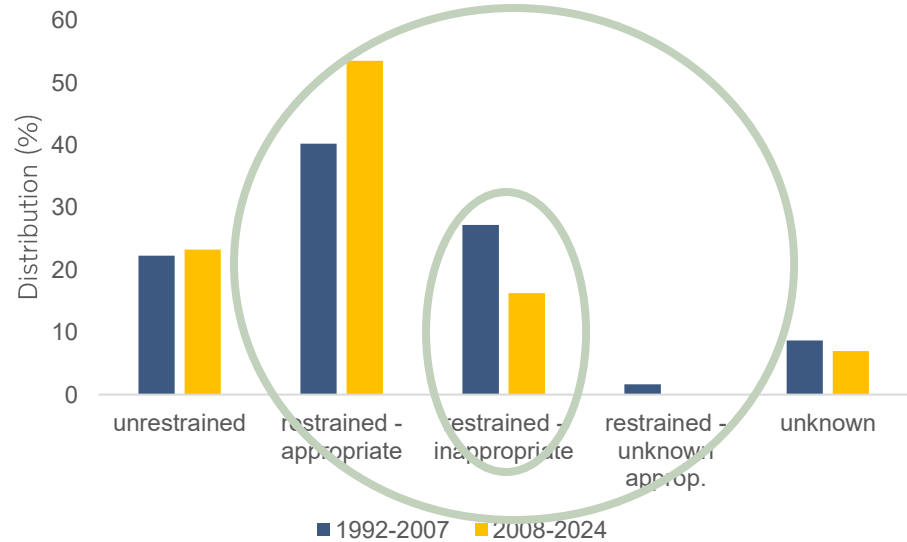
2008-2024



Second row unspec.
0%

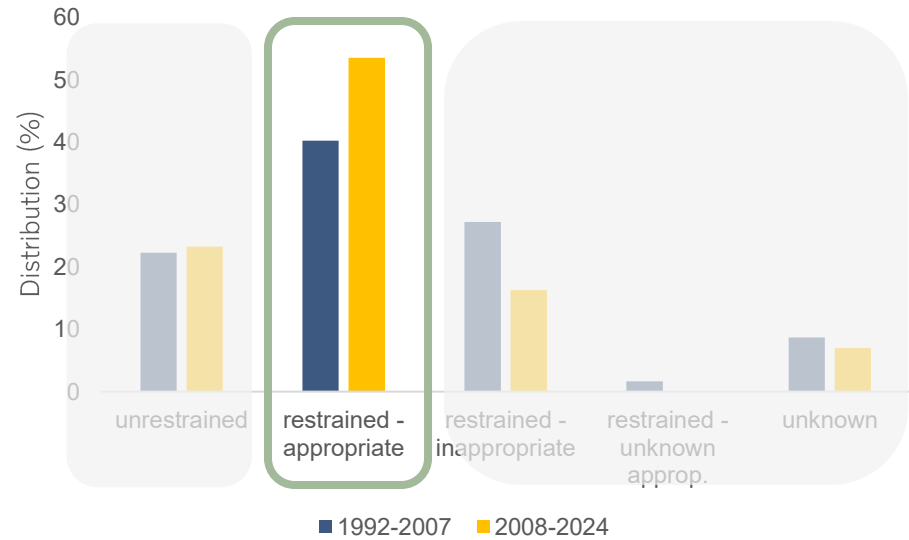
Restraint use

- Inappropriate use:
 - 0-3yo on boosters
 - 4-9yo belt-only
- Few cases of misuse detected
 - Belt under arm
 - Four children in second row: restrained two by two, by the same 3point belt

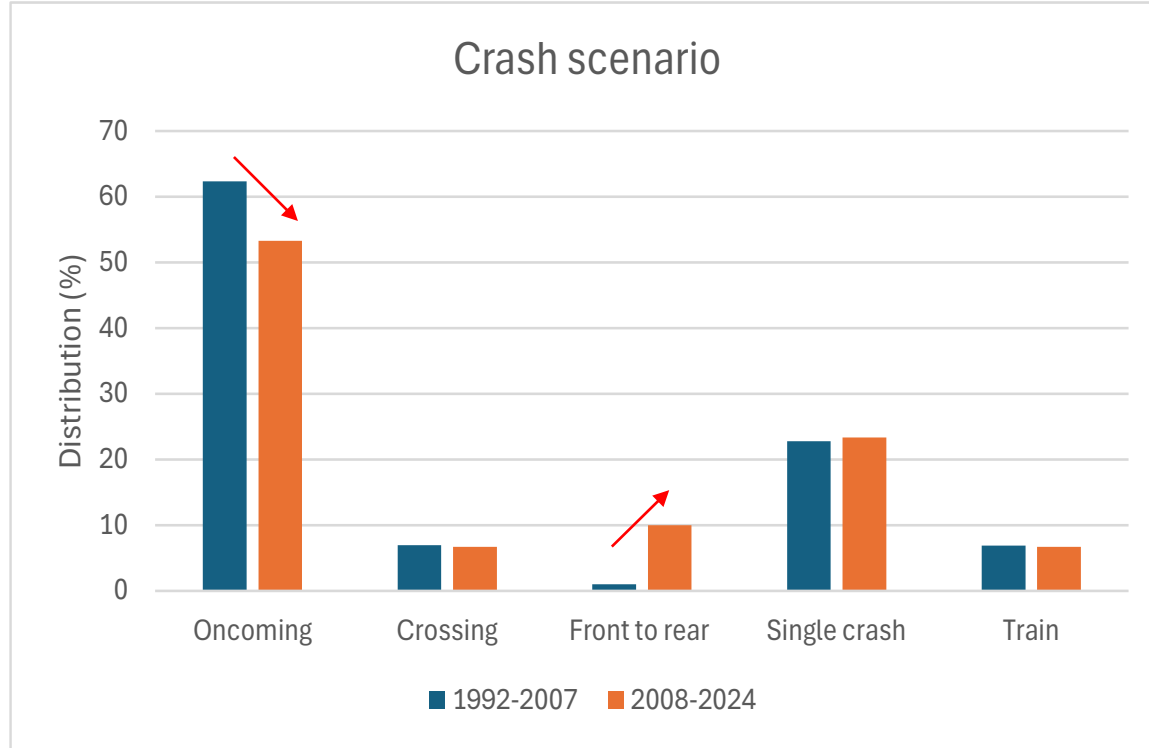


Restraint use

- 5% drowning
- 11% fire

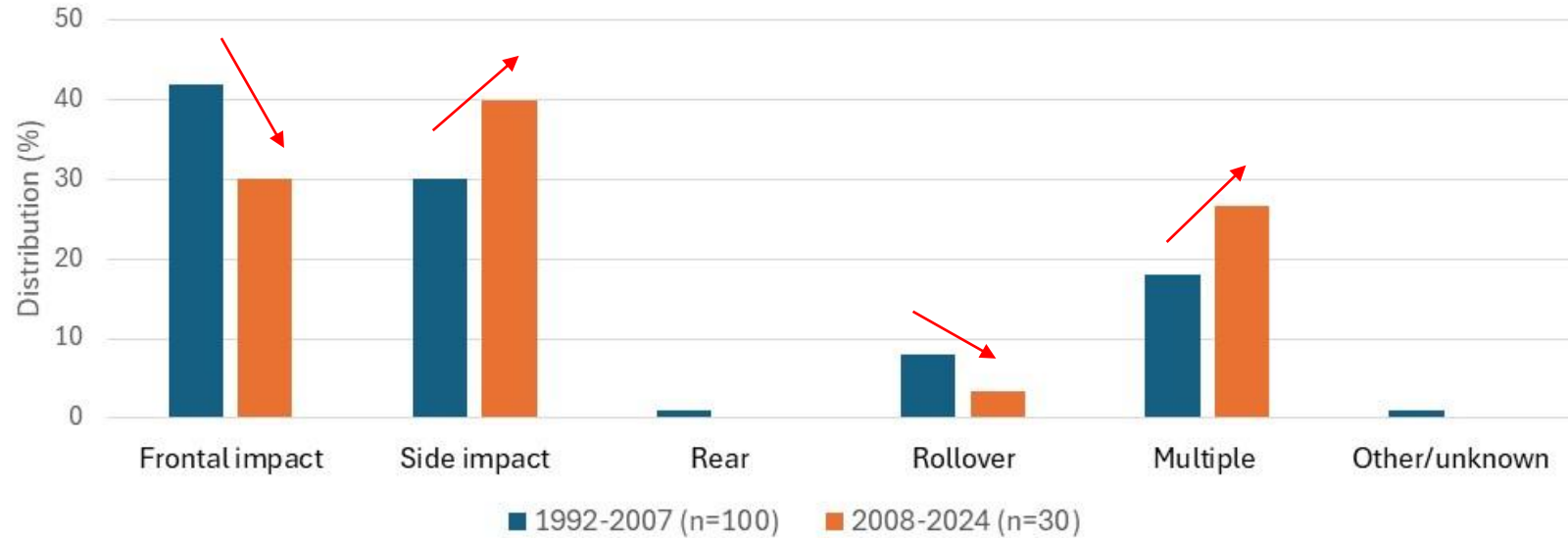


Restrained cases – crash scenario



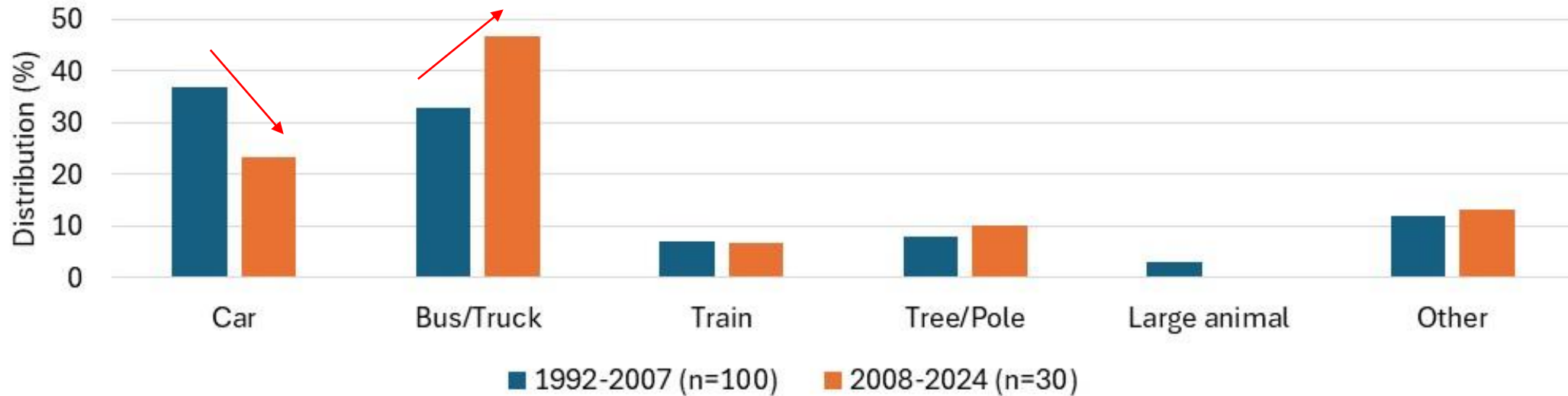
- Majority are oncoming
- Single crashes – second most common
- In later period:
 - Trend with fewer oncoming and some more front to rear

Restrained cases – Crash type



- Frontal and side most common crash type
- In later period:
 - Fewer frontal impacts and rollovers
 - More side impact and multiple crashes

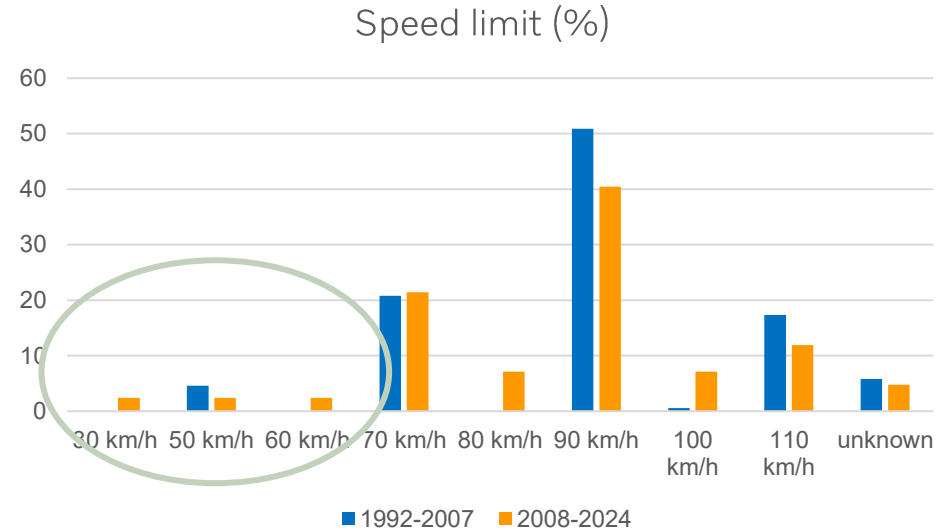
Restrained cases – Crash counterparts



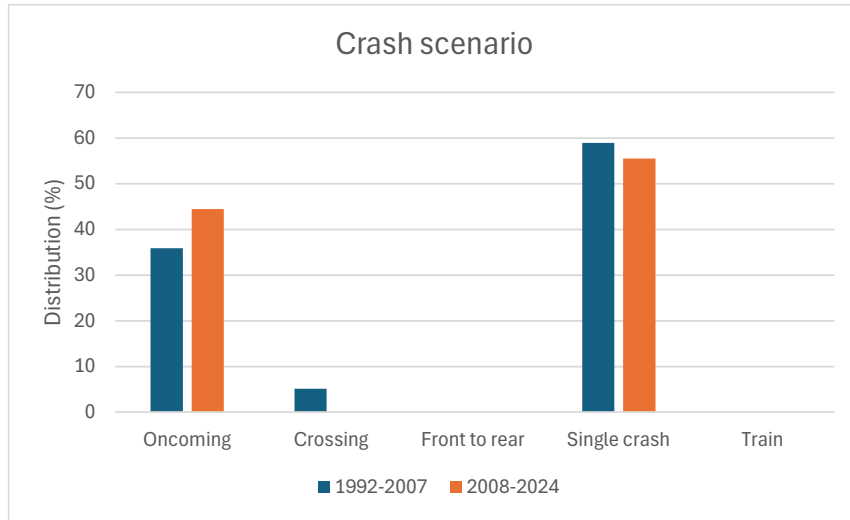
- Cars and trucks most common counterpart
- In later period:
 - More crashes with buss/trucks and fewer impacts with other cars

Speed limit

- Majority of crashes, in both periods occur in roads with higher speed limits (70+ km/h)
- Majority of crashes occurring on road with lower speed limits:
 - Driver was speeding or on-coming vehicle was speeding
 - Train impact
 - Run off road into tree
 - Several of these occupants were unbelted

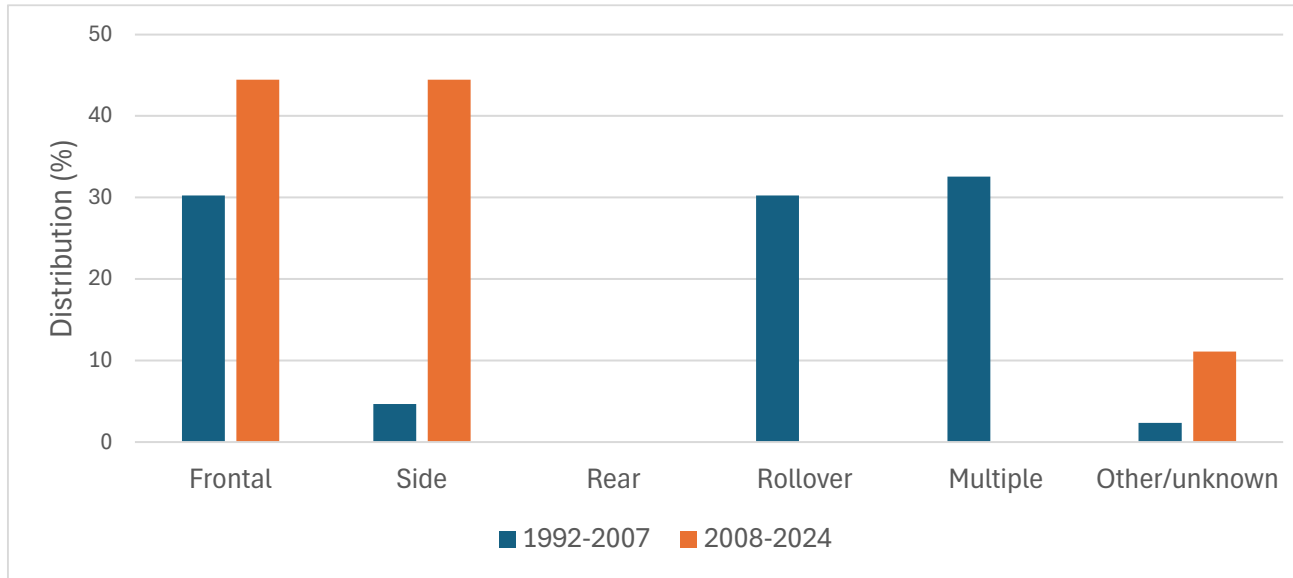


Unrestrained cases – Crash scenario



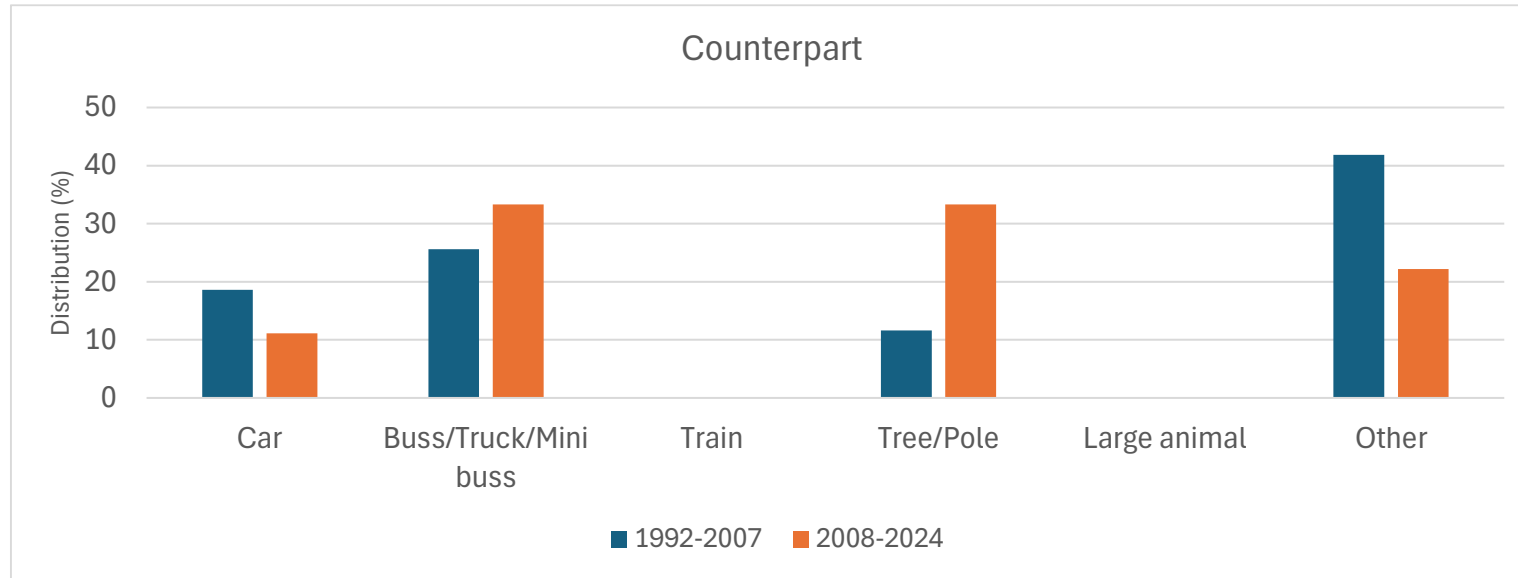
- 42 cases in earlier time period
- 9 cases in recent time period
- Single crashes is the most common crash scenario for the unrestrained cases

Unrestrained cases – Crash type



- In earlier period – rollover, multiple and frontal impacts was the most common crash configurations for unrestrained
- Recent years – only 9 cases – frontal and side impacts are most common

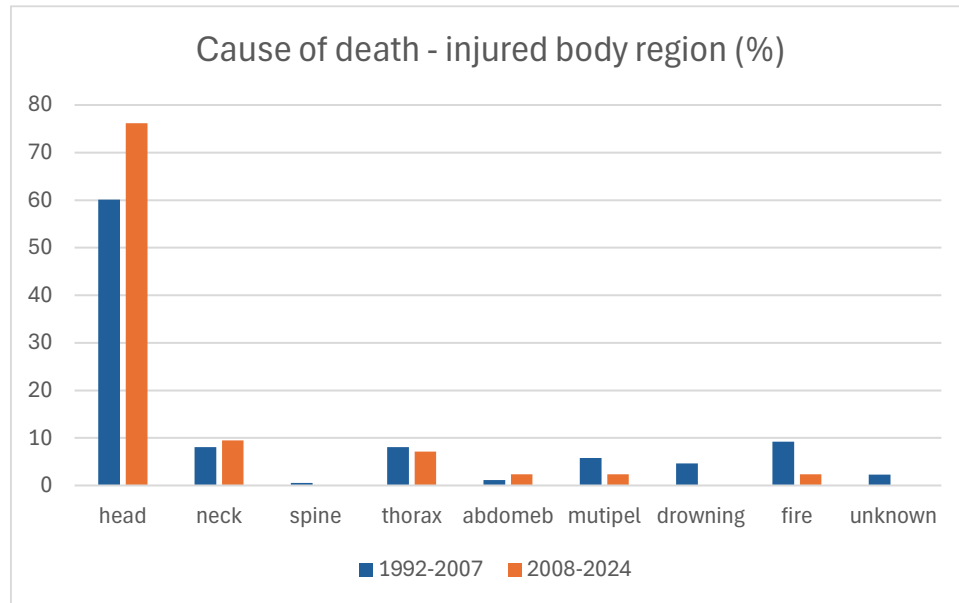
Unrestrained cases - Crash counterparts



- Increase in pole impacts in recent time period
- “Others” includes various run-off road objects – ditches, rocks

Cause of death – injured body region

Restrained + unrestrained children



Conclusions and Moving forward

Fatalities reduced 78%

Ensure Children Are Properly Restrained

- Increase overall restraint use
- Ensure restraint choice matches age and size
- Reduce misuse of child restraint systems

Address complex crash scenarios

- Improve performance in crashes involving skidding or heavy braking prior to impact
- Ensure the child remains properly restrained throughout the entire pre-crash sequence

Mitigate High-severity crashes

- Excessive speeds (disregarding posted speed limits)
- Collision with heavy vehicles
- Underride with heavy trucks



Conclusions

- Addressing Vision Zero require continued, coordinated efforts regarding restraint use, vehicle design, safe speeds and infrastructure

THANK YOU FOR YOUR ATTENTION!

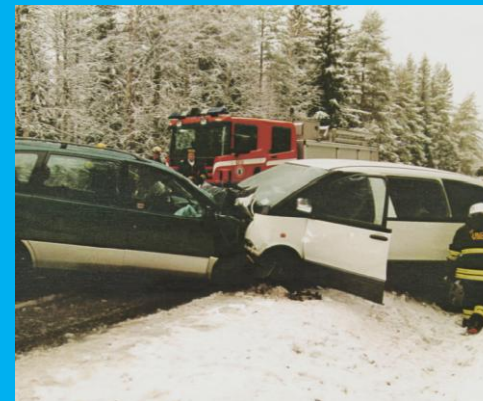
V O L V O



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Saving lives with rear-facing CRS



Real world crashes

Maria Klingegård
Anders Kullgren
Helena Stigson
Anders Ydenius

Anna Carlsson

Katarina Bohman
Isabelle Stockman
Lotta Jakobsson

Rikard Fredriksson

Estimated survivability

Influencing factors

Age
Restraint type
Type of fatal injury
Seat position
Occupant compartment intrusion
Crash direction
Crash severity
Vehicle crashworthiness
Post-crash events

Assessment

CRS usage

Rear-facing CRS

0-3y

4-6y if < 125cm

Boster

> 125cm

Estimation

Potential outcome

Likely survivable
could have been mitigated
with the CRS

Potentially survivable could
potentially have been
mitigated

Non-survivable
could not have been
prevented

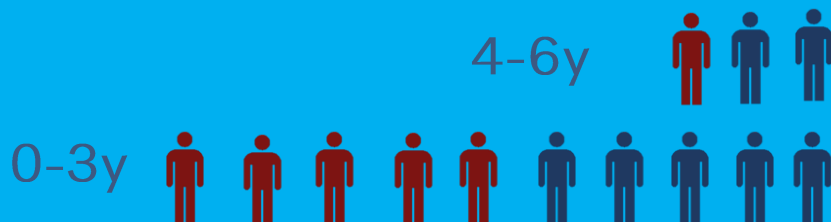
Estimated survivability

Likely and potentially survivable crashes

Estimated survivability: Survivable

Rear-facing

- Up to **48%** of fatally injured children aged 0-3 might have survived if using a rear-facing CRS
- Additionally, **27%** of the 41 children aged 4-6



Forward-facing

- Up to five children aged 0-6 would have survived in forward CRS

Estimated survivability: Survivable

Unrestrained

- 33% unrestrained (0-6y)
- 68% were estimated as likely survivable (0-3y)
- Approximately half of the unrestrained children (53%) were ejected from the vehicle
 - half were estimated to have survived in a rear-facing CRS

Estimated non-survivable

Non-survivable crashes irrespectively of CRS

Estimated survivability: non-survivable

In the remaining 53 cases, the CRS use was unlikely to change the outcome

- 30 (0-3y)
- 23 (4-6y)

Contributing factors

- 79% High severity crashes
 - 87% >90km/h
- 57% Counter part
 - heavy goods vehicle/bus/ train/ moose
- 18% Post crash events

Concluding remarks

This study highlights the critical role of proper CRS use in preventing fatalities among young children in car crashes.

99 fatally injured children 1992-2024

Rear-facing CRS matters

i Neck

i Large headsize

... Small size

Estimated survivability

47% 0-3y

27% 4-6y

Vehicle age

The majority of the cases , cars manufactured before 2003. 89% were unsurviable cases

2013

Accident year

The majority of the cases occurred before 2008

80%
< 2008



**33% unrestrained
whereof 68%
estimated survivability**

Thank you for your attention

Papers:

- Bohman et al. A review of all child car occupant fatalities in Sweden from 1992 to 2024, ESV 2026.
- Klingegård M. et al. Child Restraint System (CRS) usage in fatal car crashes in Sweden and the potential of rear-facing CRS to influence injury outcomes, Protection of Children in Cars, 2025.