

Partners for
Child Passenger Safety

State Farm
TraumaLink at The Children's Hosp. of Phila.
University of Pennsylvania

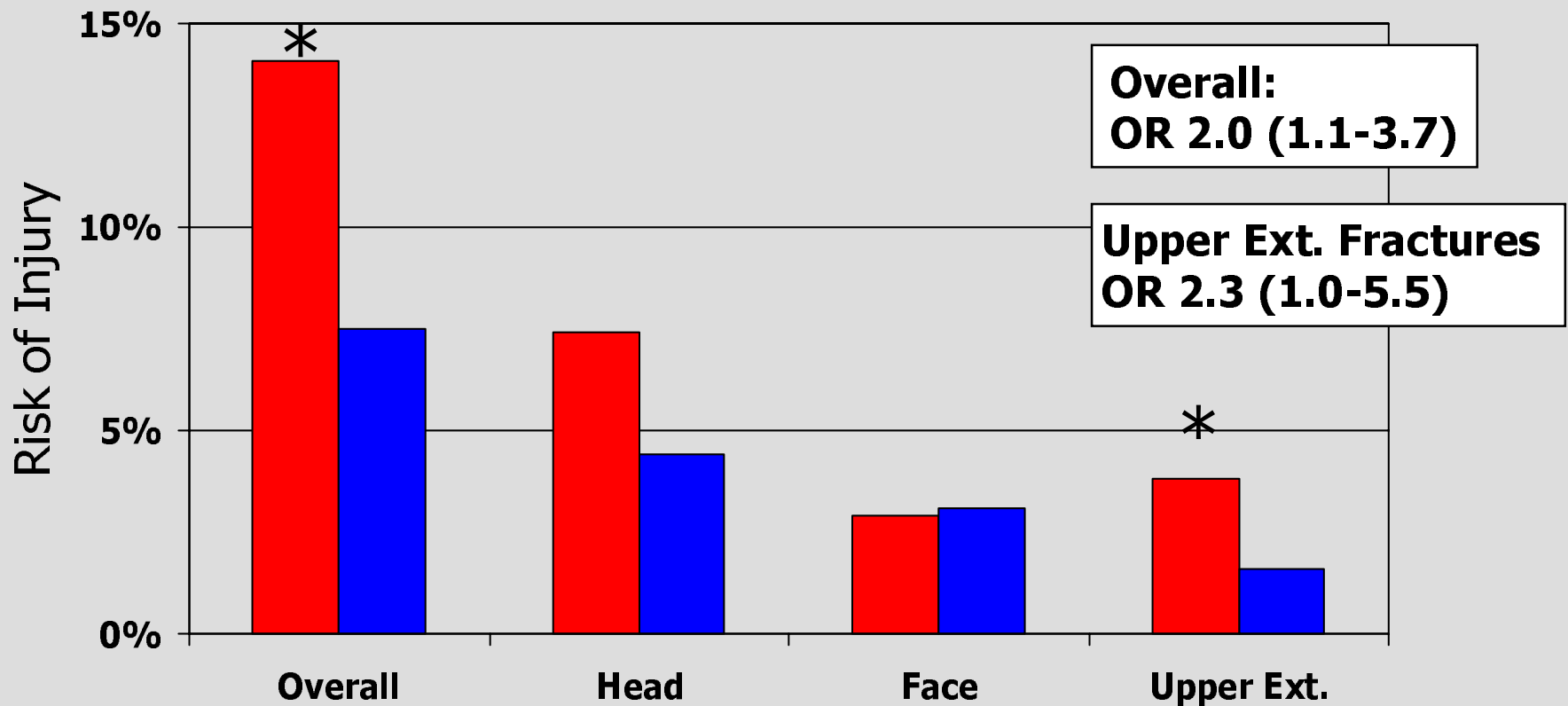


Variation in
Performance Of Second
Generation Air Bags For
Child Occupants
by Type of Vehicle

Kristy Arbogast, PhD
Associate Director, Field
Engineering
TraumaLink
The Children's Hospital of
Philadelphia

Previous analyses

Injury risk from airbags



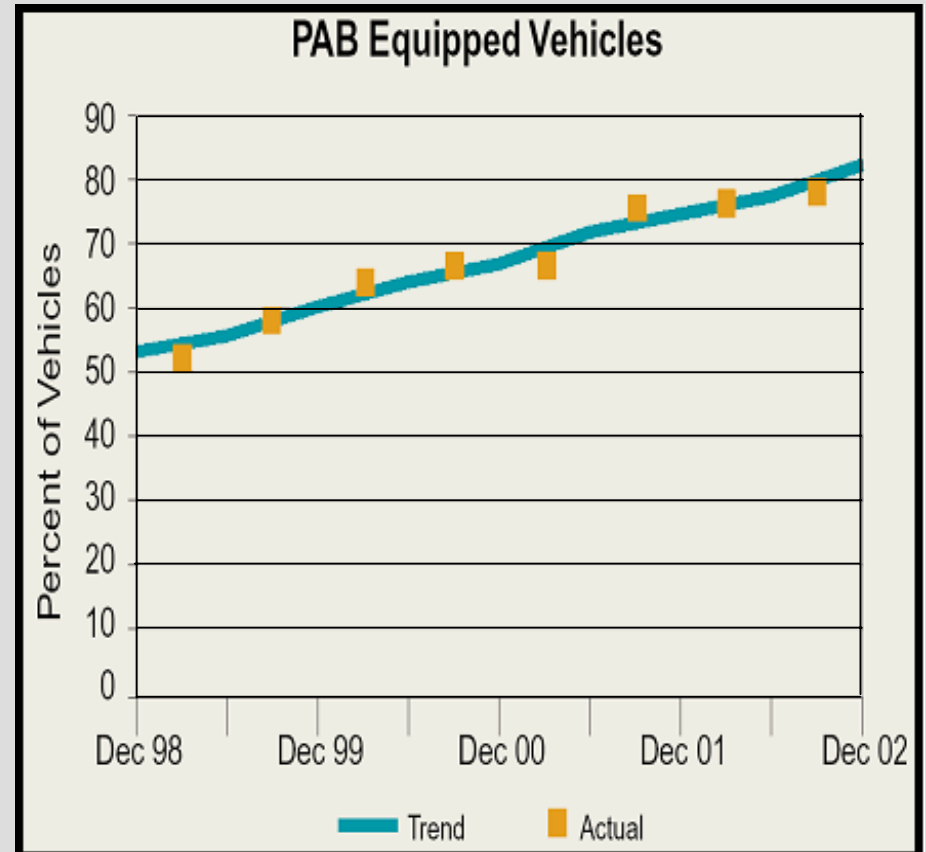
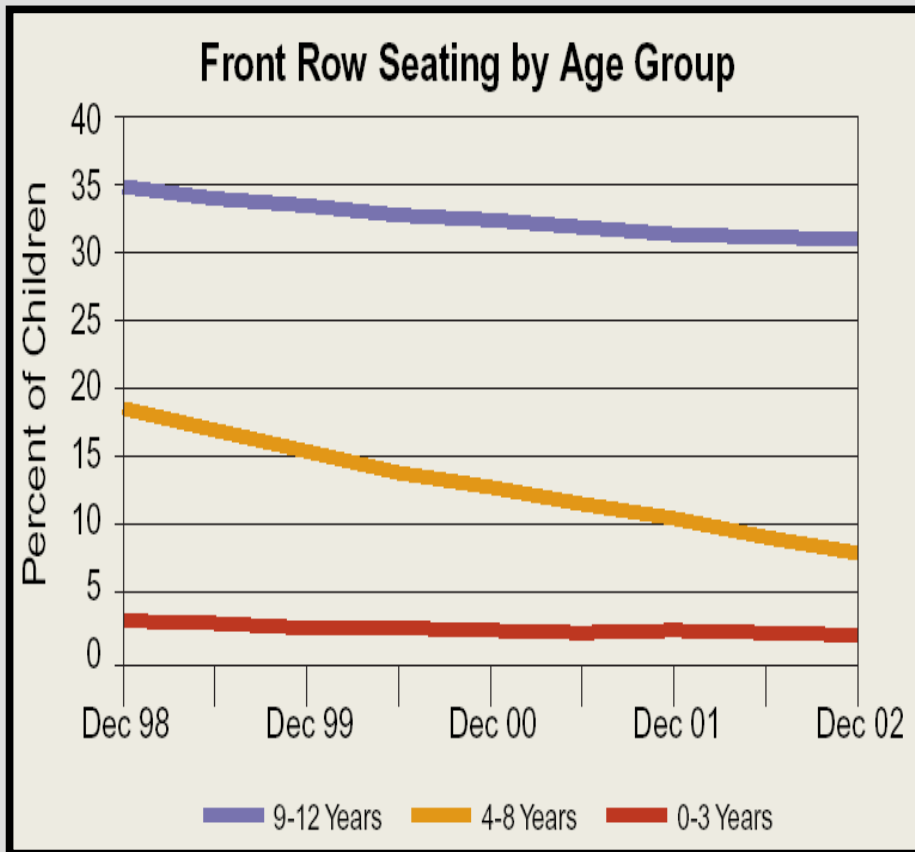
AAAM, 2002

■ PAB exposed ■ DAB crashes

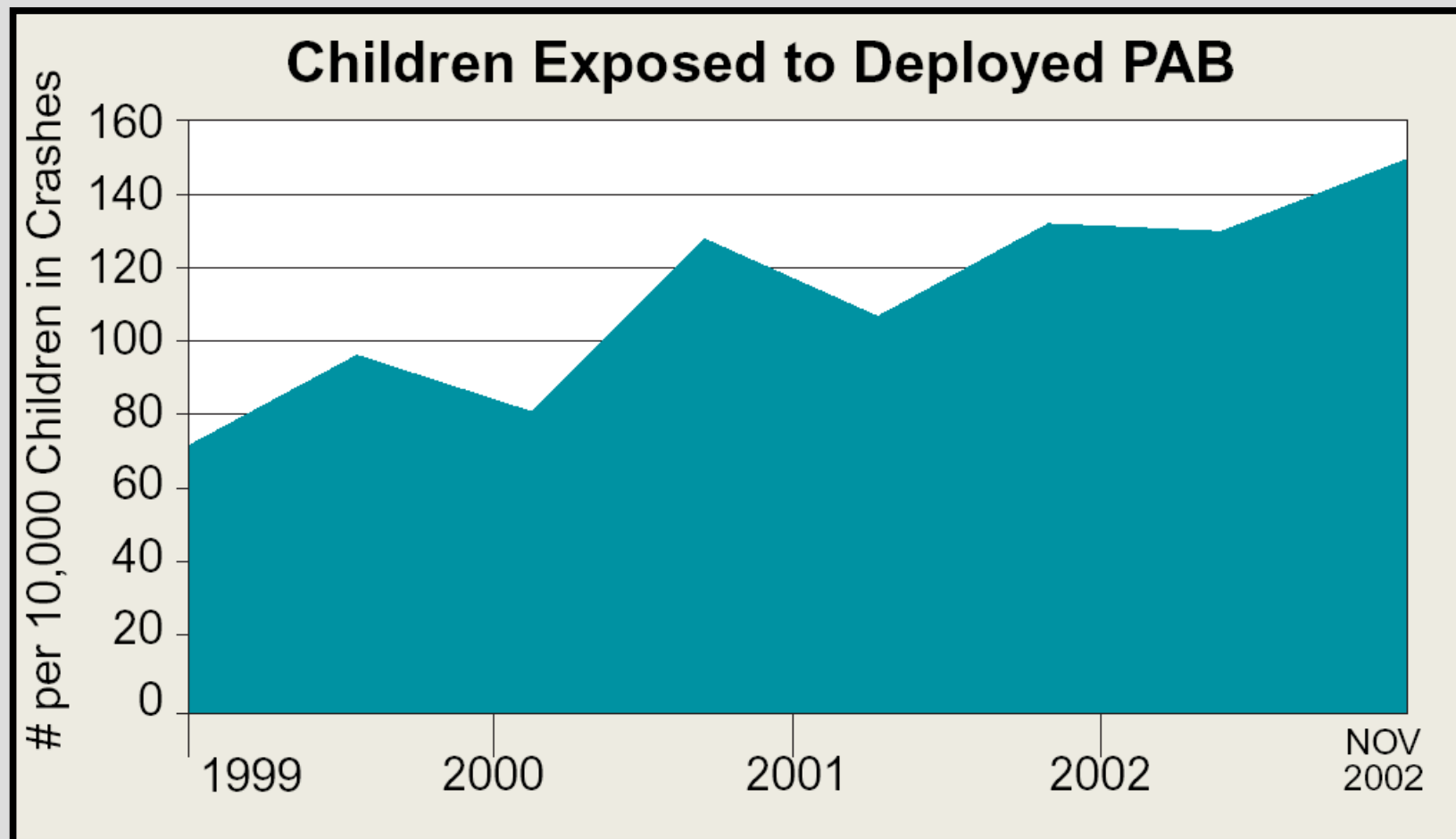
Air bag landscape has been dynamic

- Educational focus on rear seating
- Regulatory and design changes
 - NHTSA issued changes to regulation with MY 1998 to address air bags risks
 - ▶ To youngest children
 - ▶ In lower severity crashes
 - Manufacturers implemented various design changes
 - “Advanced” air bags soon to be implemented

How is exposure changing?

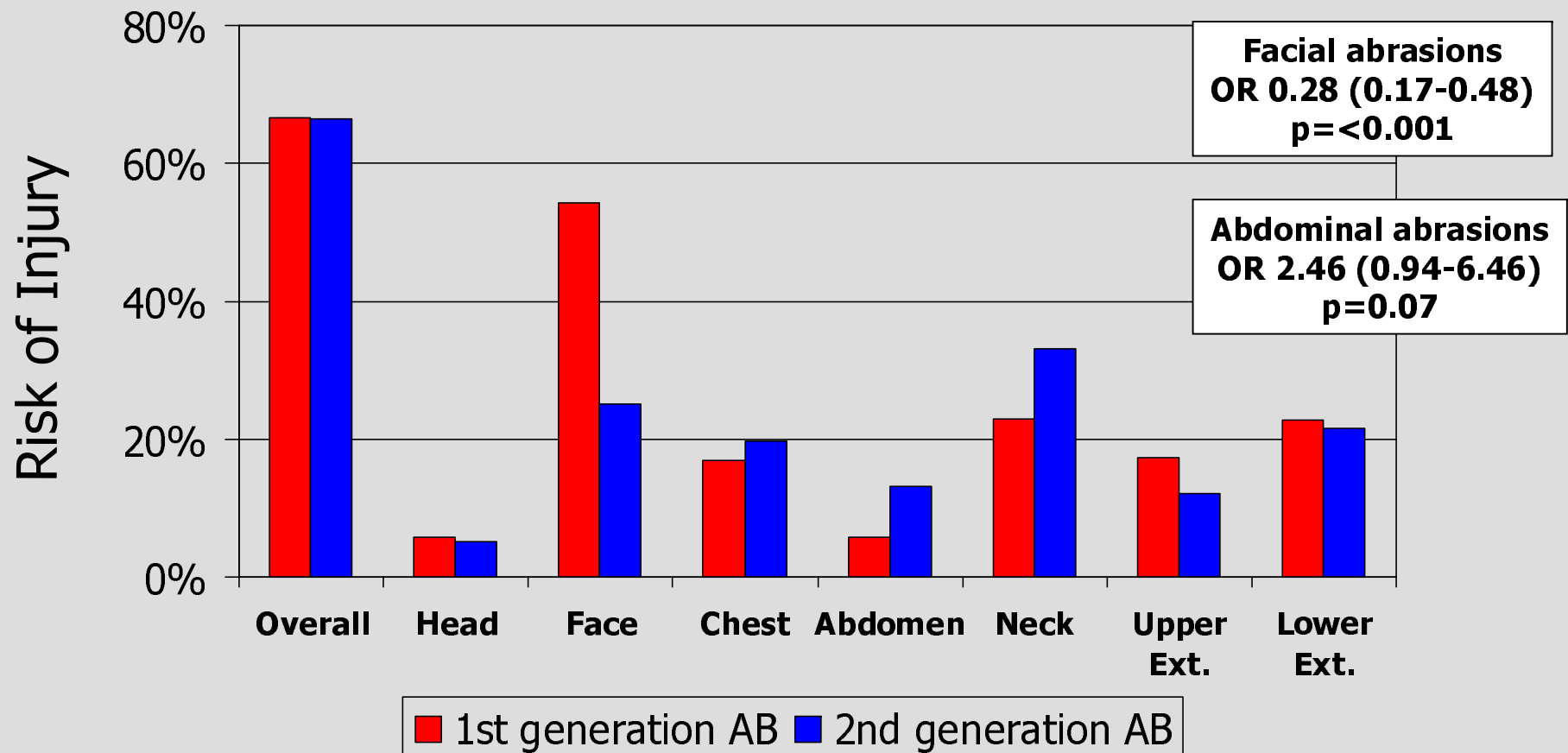


Number of children exposed to air bags is increasing



Comparison of air bags designs

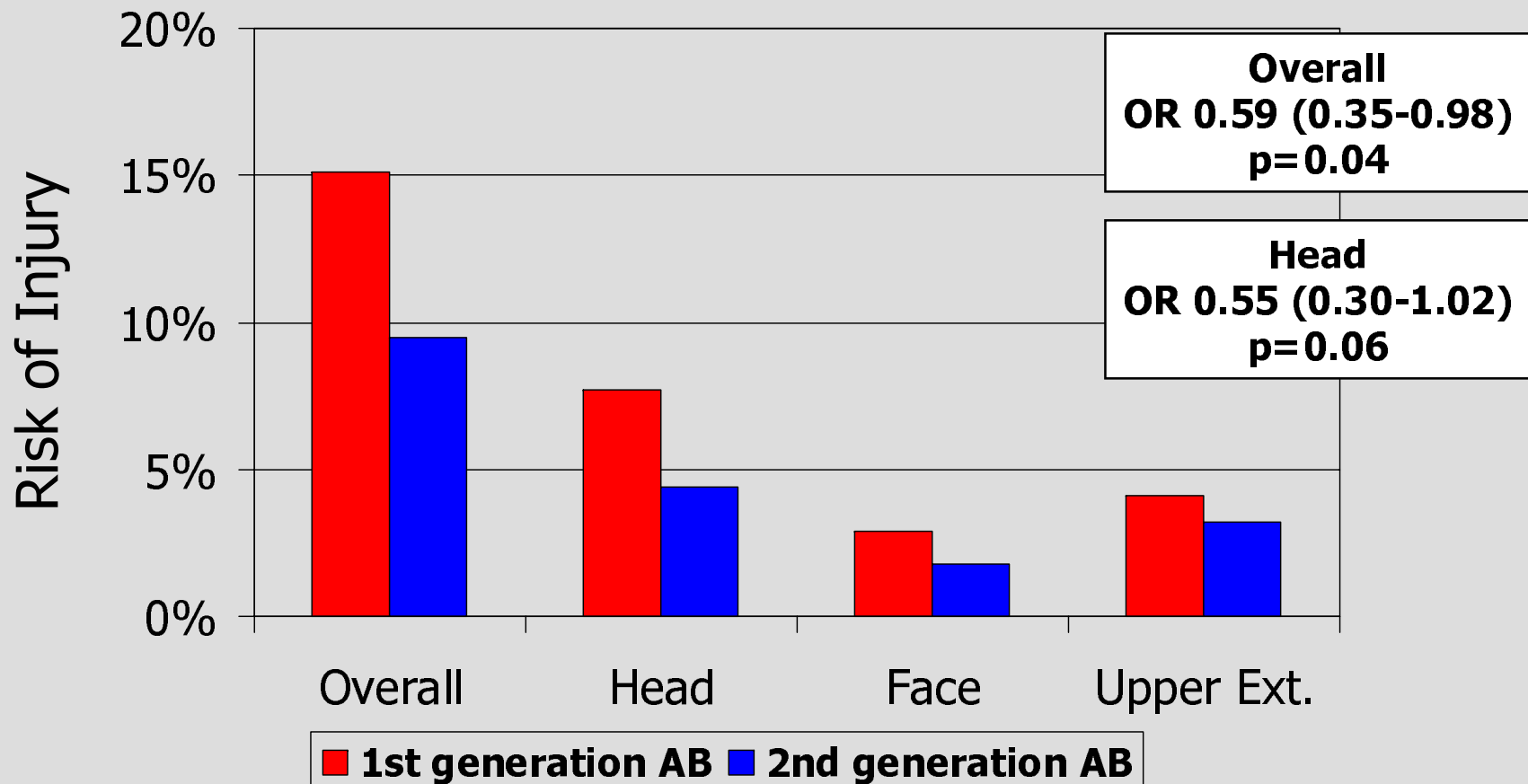
Minor injury



Frontal crashes, restrained 3-15, all vehicle types, 12/1/98-11/30/02

Comparison of air bag designs

Serious injury



Frontal crashes, restrained 3-15, All vehicle types, 12/1/98-11/30/02

Objective

- To explore the differential performance of 1st versus 2nd generation air bag systems for child occupants by type of vehicle:
 - Deployment rate
 - Risk of injury

Methods

Partners for Child Passenger Safety

- Research collaboration
 - State Farm, CHOP, Penn
- Studying how and why children are injured in crashes
- Telephone interviews, on-site crash investigations, in-depth analyses
- 15 states and DC
- Comprehensive:
 - All injury and crash severities
 - Large population – representative of US Census



Methods

Definition

- Second generation
 - All model year 1998 redesigned systems
 - ▶ Information re: redesign date obtained from NHTSA's Special Crash Investigation Group
 - All 1999 and newer

Study sample

12/1/98-11/30/02

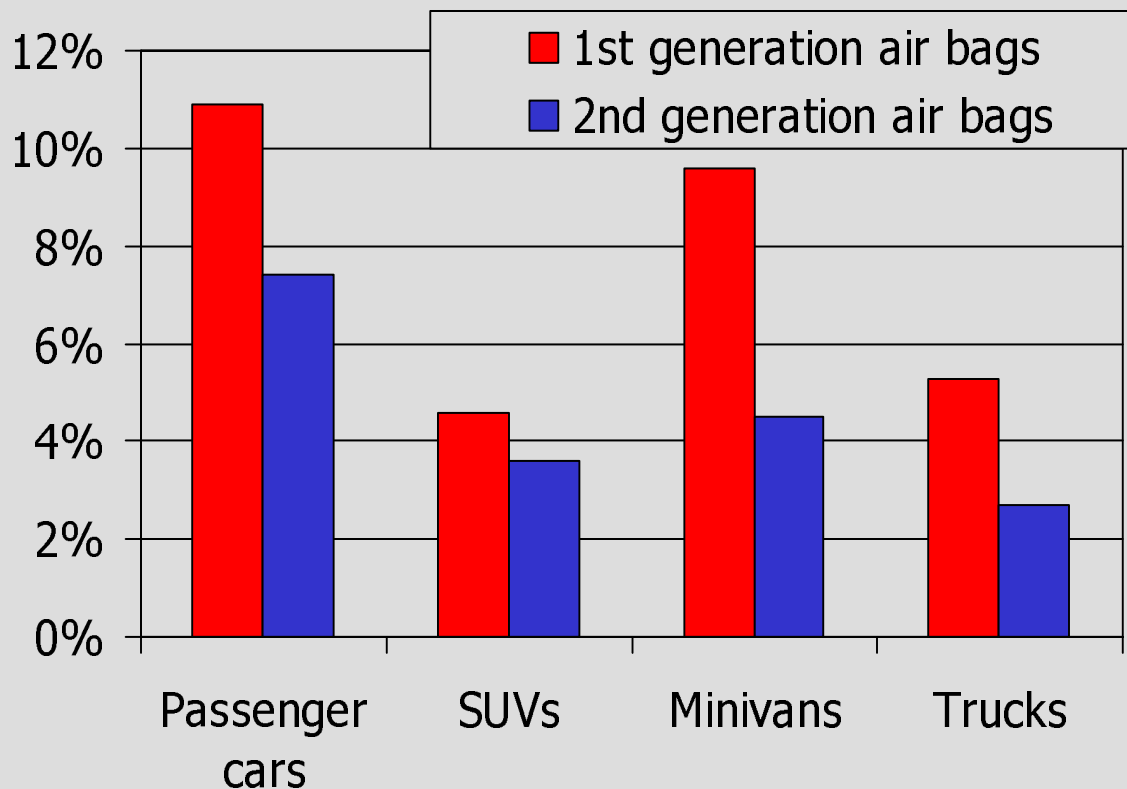
- Deployment rates
 - 106,890 vehicles (MY \geq 1990) equipped with PAB in frontal crashes
 - ▶ 44% first generation
 - ▶ 56% second generation
- Risk of injury
 - Frontal crashes with belted child (age 3-15) exposed to deploying PAB
 - ▶ N=1,772

Vehicle type distribution

	<u>1st</u> <u>generation</u> <u>PAB</u>	<u>2nd</u> <u>generation</u> <u>PAB</u>	<u>Total</u>
Passenger cars	795 (60%)	495 (40%)	1290 (100%)
Minivans	182 (54%)	157 (46%)	339 (100%)
SUVs	39 (38%)	63 (62%)	102 (100%)
Pickup trucks	10 (24%)	31 (76%)	41 (100%)

2nd Generation Air Bags

Deployment rates

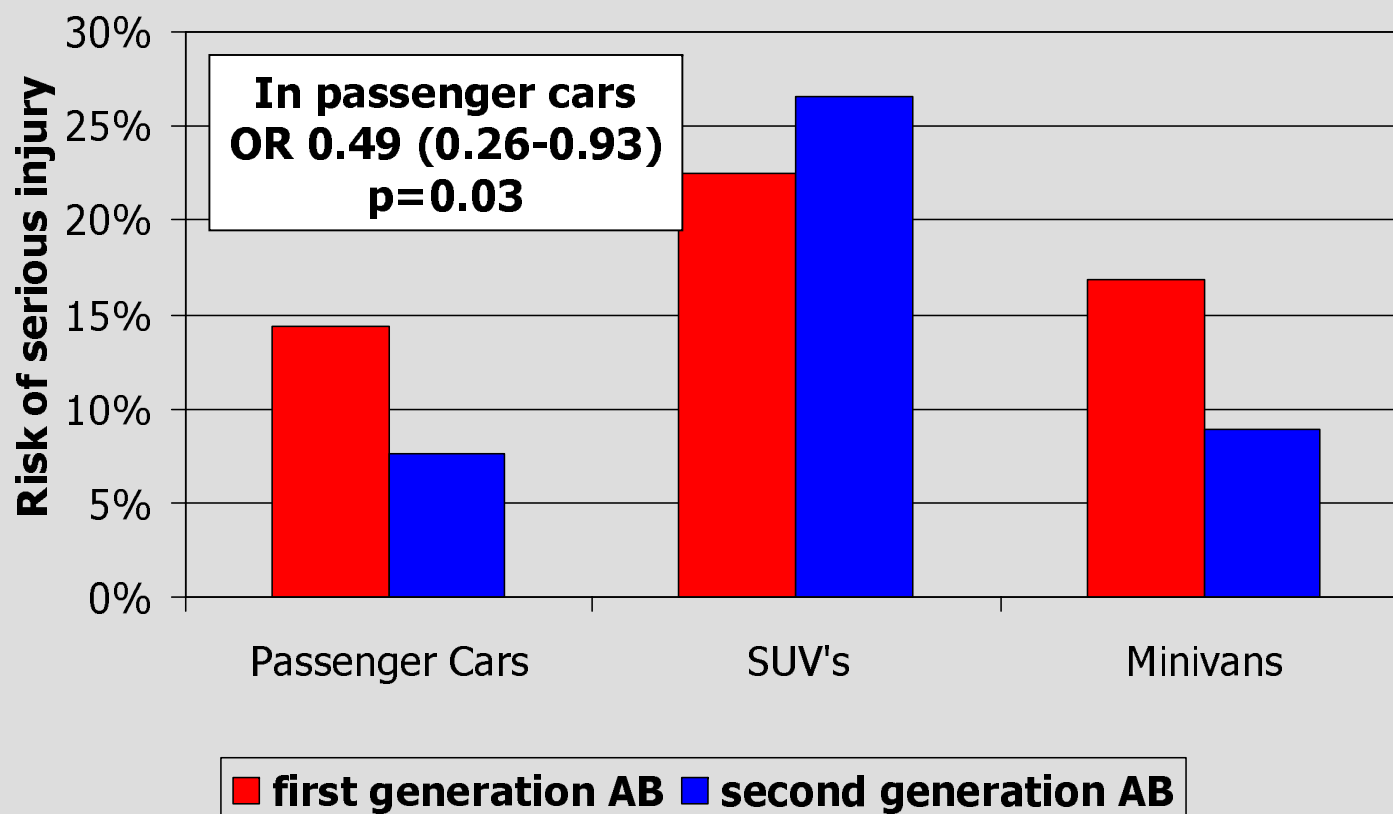


Deployment rate
PC: OR 0.65 (0.50-0.84)
p=<0.001
MV: OR=0.45 (0.27-0.73)
p=0.002
SUV: OR 0.78 (0.41-1.5)
p=0.46
Trucks: OR=0.50 (0.19-1.38)
P=0.18

Frontal crashes, 12/1/98-11/30/02

2nd Generation Air Bags

Effect of vehicle type on injury risk



Trucks:

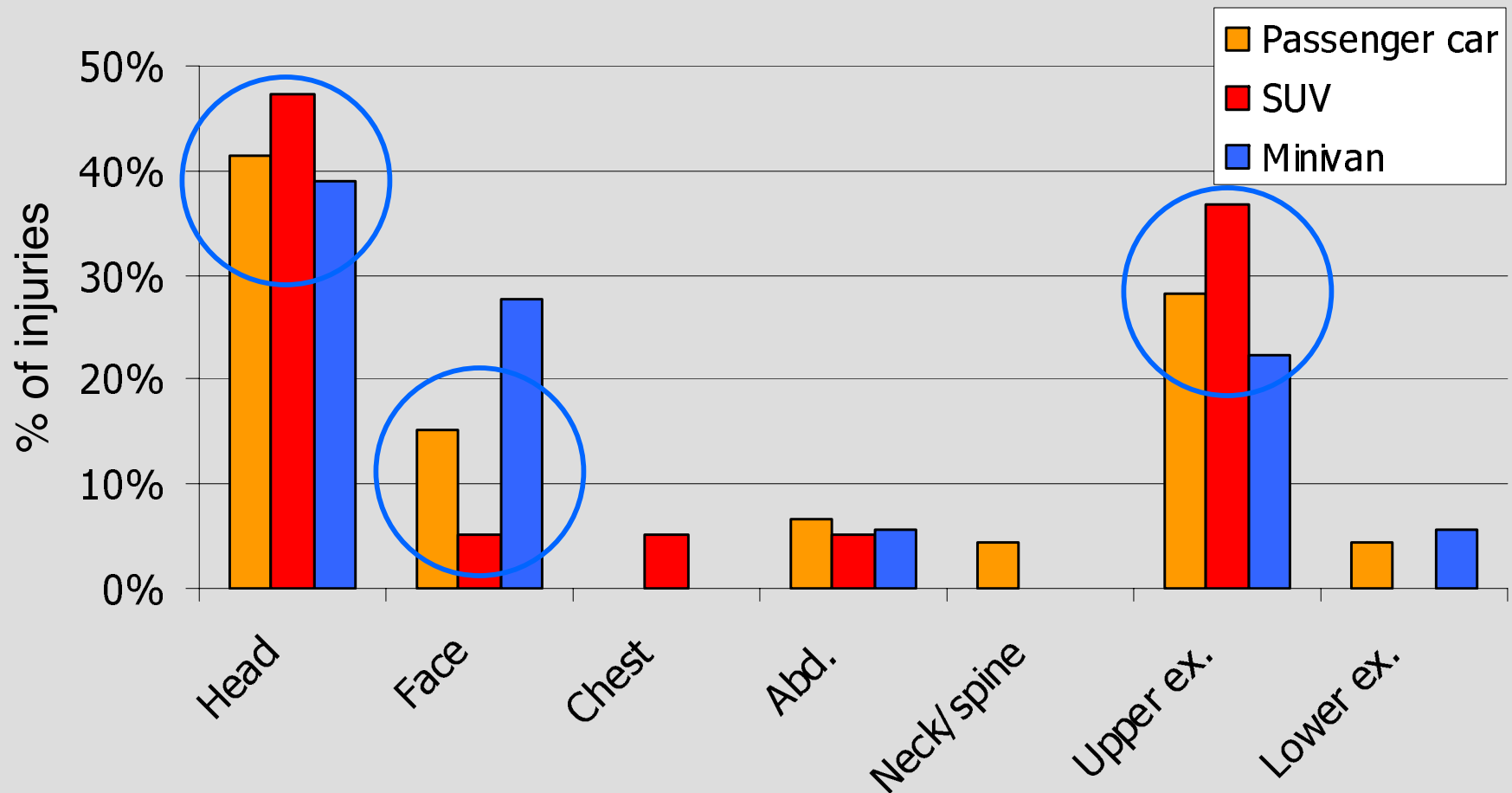
- 0/10 injured in 1st generation
- 3/31 injured in 2nd generation

Frontal crashes, belted 3-15, 12/1/98-11/30/02

Adjusting for crash severity and child age did not affect point estimates

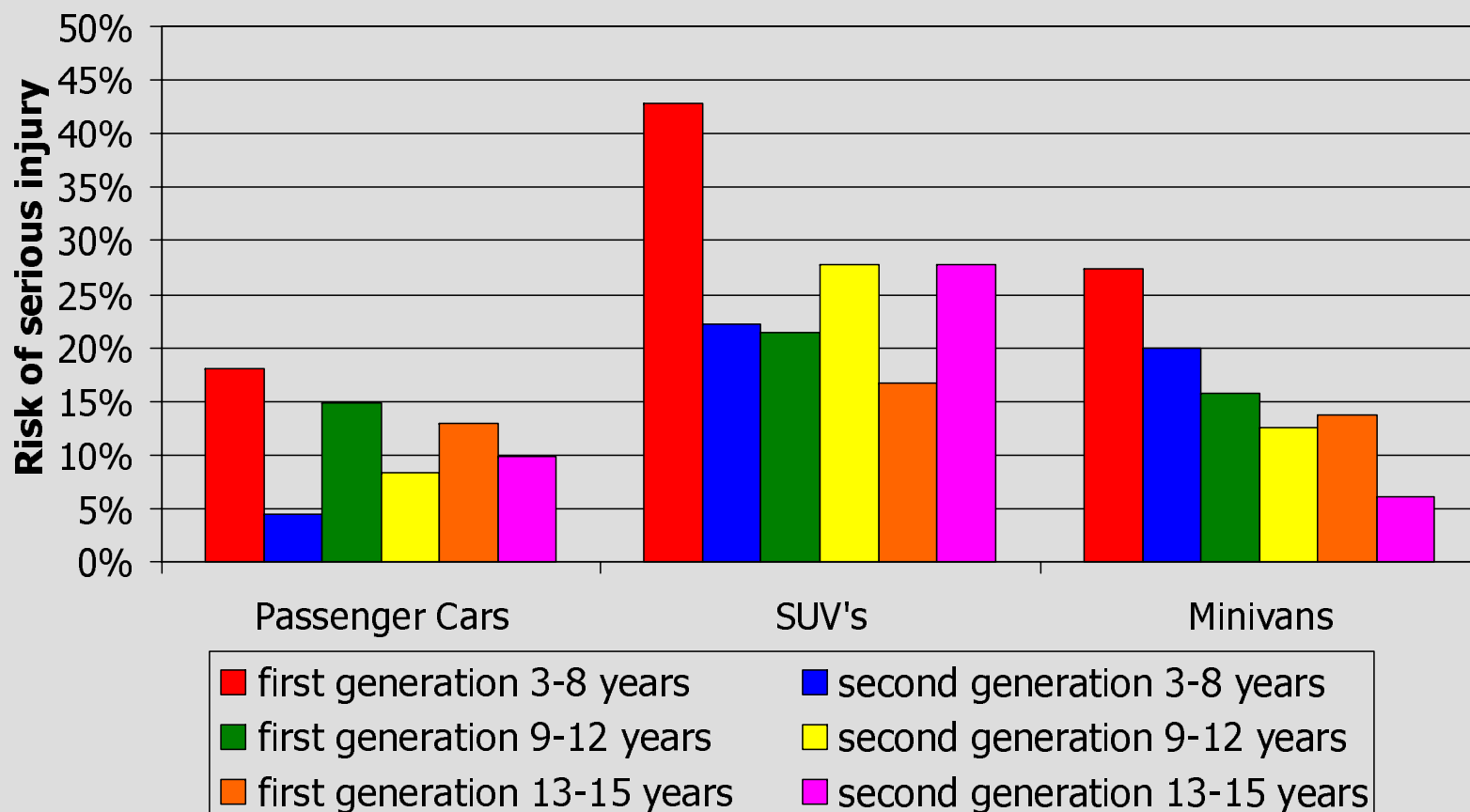
2nd generation Air Bags

Injury pattern by vehicle type



2nd Generation Air Bags

Effect of vehicle type & child age



Frontal crashes, belted 3-15, 12/1/98-11/30/02

Differential effect among vehicle types

- Benefits in passenger cars and minivans
- No apparent benefit in SUVs
 - SUVs are stiffer
 - ▶ Air bag needs to deploy quickly to be in position
 - Could result in larger OOP zone
 - ▶ Occupant may be closer to air bag module at time of deployment
 - Differences in airbag and seating geometry
 - Mix of SUV designs MY 1998+

Educational implications

- Education

- Older designs may now be used by different socio-economic subgroups
- New designs may carry conflicting messages
- Popularity of SUV as family car

Maintenance of rear seating message is crucial

Air Bags and Child Occupants

Future work

- Further explore apparent elevated risk in SUVs.
- Study the role of the air bag in injury causation.
- Monitor how findings change as airbag designs continue to evolve.