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RESEARCH INSTITUTE

Child Passenger Safety Then & Now: Data & Partnerships Fuel Advances

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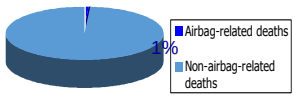
The Modern Era of CPS

July 8, 1996: *USA Today* publishes article describing how children are killed by passenger air bags

Education and laws increase
- Rear seating for children
- Use of age-appropriate restraints

US Child Occupant Deaths At The Time



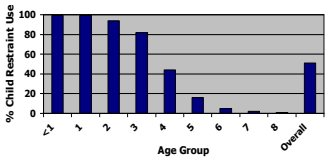
Airbags were a small part of the problem
Needed to think beyond airbags

Research-driven change for improved safety for children

- Needed a data source

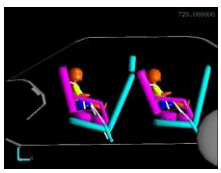
Partners for Child Passenger Safety
State Farm Insurance Companies
The Children's Hospital of Philadelphia
Neighbors working together

State of Child Passenger Safety Circa 1999



Source: Winston et al, *AAAM*, September 1999

Quantified Risks, Evaluated Technology

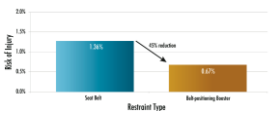


Air bags

Forward-facing Child Restraints

Elliott *Arch Pediatr Adol Med* 2006

Booster seats



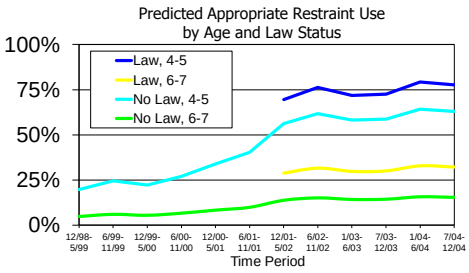
Arbogast et al., Pediatrics, 2009

AAP, NHTSA, CDC, Car Seat Techs and More…

www.cdc.gov/vitalsigns

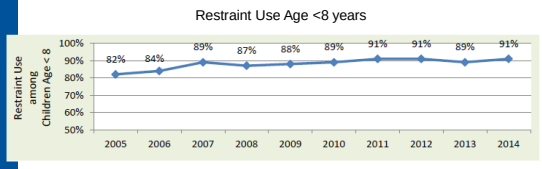
Advocate for Upgraded Laws

Laws Change Behavior



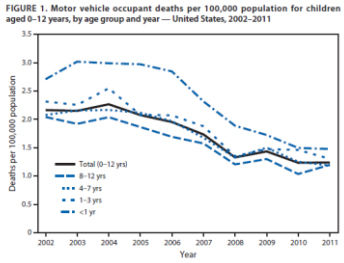
Winston et al. *Arch Pediatr Adol Med*, 2007

Sustained Response



Source: NHTSA NOPUS 2014

US Motor Vehicle Deaths Among Children Ages 12 and Younger



Decreased 43% in past decade

CDC Feb 2014

How To Make Further Gains?

- Keep eye on the goal – protecting real children in real cars
  - Align research and advocacy priorities with potential impact
- Surveillance is the foundation for all efforts
  - Contemporary, child-specific data is critical
  - Science is the starting point for action
- Include partners & rely on them
  - Include them from the beginning
  - But make their action easy - translate research

Our Approach

Action

Inform Safety Products & Regulations

Advocate for Evidence-based Laws

Provide Recommendations

American Academy of Pediatrics

NHTSA
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

For Real World Impact… Collaboration is Essential

- Collaborate in all phases of research and advocacy: From project definition to project conduct, analysis and dissemination
- Partners – leverage & buy-in
  - Influencers of the target population
    - Government – laws and policies
    - Industry – makes the products families buy
    - Advocacy orgs – deliver messages to families
    - Medical community – source of respected info
  - Communities and families

Center for Child Injury Prevention Studies (CChIPS)

- Need: a neutral collaborative space where typically competing organizations could work together
  - Essential to moving the needle further on reducing injury/deaths-
- Part of CIRP at CHOP
- National Science Foundation Industry University Cooperative Research Center
- Conduct fundamental research to spur industrial R & D
- Composed of Faculty from
  - CHOP/Penn – founding site in 2005
  - Ohio State University – second site brought on in 2009

CChIPS | Center for Child Injury Prevention Studies

CChIPS Mission

"To advance the safety of children by facilitating the conduct of scientific inquiry into childhood injuries and to translate these findings into commercial applications and public education programs for prevention."

...In brief: *Science + Impact*

CChIPS | Center for Child Injury Prevention Studies

Our Members

LEAR CORPORATION, britax, FCA, NHTSA, NISSAN, StateFarm, TRC Transportation Research Center Inc, MHS, HONDA The Power of Dreams, GRACO, SAFE KIDS WORLDWIDE, TOYOTA, TAKATA, HUMANETICS Innovative Solutions, Calspan Safer Highways. Safer Skies, GM, Realtime technologies, inc, Consumer Reports, gb evenflo

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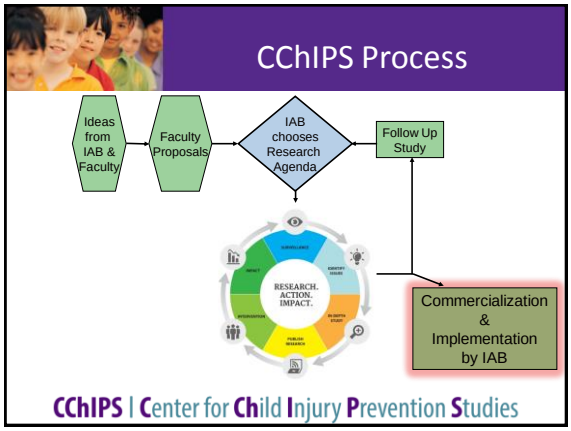
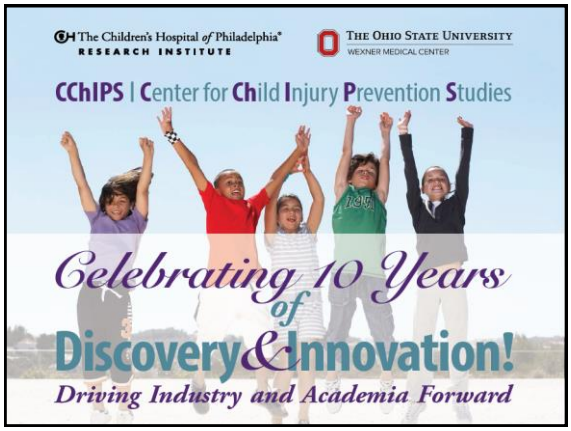

CChIPS Process
Ideas from IAB & Faculty
Faculty Proposals
IAB chooses Research Agenda
Follow Up Study
RESEARCH. ACTION. IMPACT.
Commercialization & Implementation by IAB
CChIPS | Center for Child Injury Prevention Studies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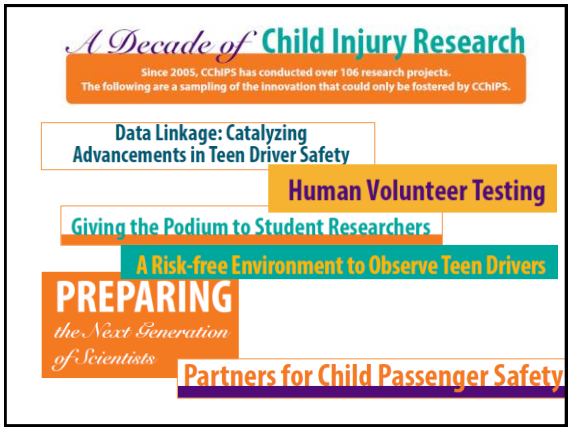
WEXNER MEDICAL CENTER
CChIPS | Center for Child Injury Prevention Studies
Celebrating 10 Years of
Discovery & Innovation!
Driving Industry and Academia Forward


A Decade of Child Injury Research
Since 2005, CChIPS has conducted over 106 research projects.
The following are a sampling of the innovation that could only be fostered by CChIPS.
Data Linkage: Catalyzing Advancements in Teen Driver Safety
Human Volunteer Testing
Giving the Podium to Student Researchers
A Risk-free Environment to Observe Teen Drivers
PREPARING the Next Generation of Scientists
Partners for Child Passenger Safety

Industry Perspective

- "One great project is the digitization of car seats. Not only would it have been very difficult for the auto and car seat manufacturers to do without CChIPS, the researchers would not have thought of doing it without the influence of the companies. So it worked from both directions."
- "Being involved in CChIPS has multiple benefits for our company. Not just the value of the research for our company…but being involved has helped us generate other ideas and forge partnerships…so that we can put together a safer products for kids."
- "The scientists are able to evolve with industry instead of just being focused on a scientific problem. Because they collaborate with manufacturers who face real-life consequences of technology, their research is forever relevant."

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Child Occupant Protection Targeted Issues for the Future

1. COP is currently complex for families
   - How do we help families make the right choice?
   - How do we make typical behavior safe?
   - How do we simplify usage?
   - How do we improve compatibility?
2. Improve rear seat protection for children
   - How to advance consumer information programs and regulations
3. Autonomous vehicles
   - Different demands for safety?

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1. Simplify Child Restraint Use

- Misuse rates remain high
  - even with LATCH/ISOFIX
- Tremendous investment to educate parents re: best practice
- Ease-of-use ratings improve design
- Change narrative to "simple & positive"
- Make "typical behavior" safe
- Cannot engineer out all incorrect behavior
  - design more forgiving systems

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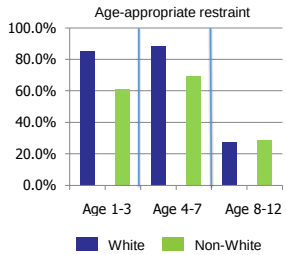
Intersection Between Behavior & Engineering

Don't Forget: Disparities In US Persist

White parents 4x more likely to report age-appropriate restraint

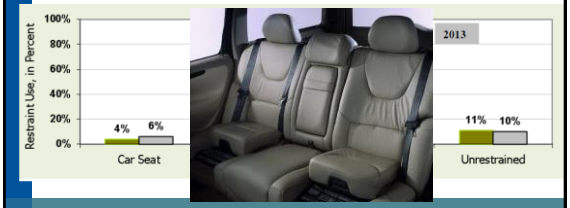
*controlling for education, income, information sources, and site



Macy et al. *Pediatrics*, 2014

2. Optimizing Rear Seat for Kids
Forgotten Children – 8-11 year olds

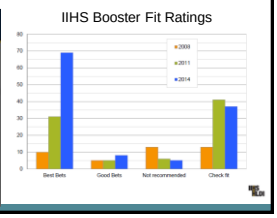
- Few 8-11 year old use booster seats
  - Many rear seat restraints do not yet fit age group
- Adapt the vehicle (dedicate seats to the older children) or increase booster usage?



NSUBS report, 2014

Regulation is a Minimum Standard

- Doesn't always rule out bad designs
- May not always incorporate all current knowledge of biomechanics or crashworthiness – ATD or test method limitations
- Consumer ratings can be powerful



US NCAP Star Ratings

When consumers use NCAP ratings to guide vehicle purchasing decisions, they may assume ratings apply to all occupants in vehicle

Do they?

US Consumer Information Programs

	Frontal impact	Side impact
NHTSA www.nhtsa.gov	Driver Right front passenger	Driver Right rear (small adult) passenger
2016 IIHS TOP SAFETY PICK+	Driver	Driver Right rear (small adult) passenger

EuroNCAP

From latest EuroNCAP news release…

"*Almost all new cars in this release not only offer low and/or high speed autonomous braking (AEB) systems …, but also have incorporated more advanced restraint technology on the rear seats to cope with the newest full-width frontal crash test.*"

- A frontal oblique crash test
- Use of a 5th percentile female dummy to enhance safety of rear seat
- New adult crash test dummies for driver tests
- A pedestrian rating
- Crash avoidance and new technology rating

Rear Seat Engineering Considerations

Seat geometry

Seat belt anchorage locations

Advanced seat belt technology

Suboptimal positions

Seat Geometry

Median length of second row seat cushion (455 mm) longer than the thigh length of 24% of adult rear seat occupants and 83% of child rear seat occupants

Only 35-55% of shoulder belts cross the mid-clavicle in 8-15 year olds

Seat pan geometry not designed for anti-submarining like front seats

But… seat pans need to be long enough for CRS

Huang and Reed, 2006; Bilston et al 2007

Advanced Restraint Technology

Seat belt load limiters

- Release excess belt webbing when a certain level of force is reached in the belt to minimize injury
- Head excursion increases as chest deformation decreases

Load sharing

- Front seat – air bag and knee bolster
- Rear seat – only the seat belt

Advanced Restraint Technology

Seat belt load limiters

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- Head excursion increases as chest deformation decreases

Combo of load limiter and pretensioners shown to improve both head and chest injury metrics in rear seat (Kent et al, 2007; Forman et al, 2009)

3. Autonomous Driving Cars
Future car fleet with different demands?

Hypothesis:

- the less control you have over a situation (the car is in control) the less likely you are to accept being injured

Increased expectation of safety in autonomous driving cars?

Further discussion and research needed:

- What are society's expectations?
- What goals are possible to aim for? AIS1? AIS2?

Targeted Issues for the Future

1. Child occupant protection is current complex for families
   - How do we help families make the right choice?
   - How do we make typical behavior safe?
   - How do we simplify usage?
   - How do we improve compatibility?
2. How to advance consumer information programs and regulations to improve protection for the rear seat
3. Autonomous vehicles
   - Different demands for safety?

Partnerships are necessary to make this happen

Free Digital Resources

WWW.CHOP.EDU/CARSEAT

DOWNLOADABLE RESOURCES @
INJURY.RESEARCH.CHOP.EDU

More Information On CChIPS

CCHIPS.RESEARCH.CHOP.EDU