Insurance Institute for Highway Safety
Highway Loss Data Institute

Protection of rear seat occupants in frontal crashes: IIHS research activities

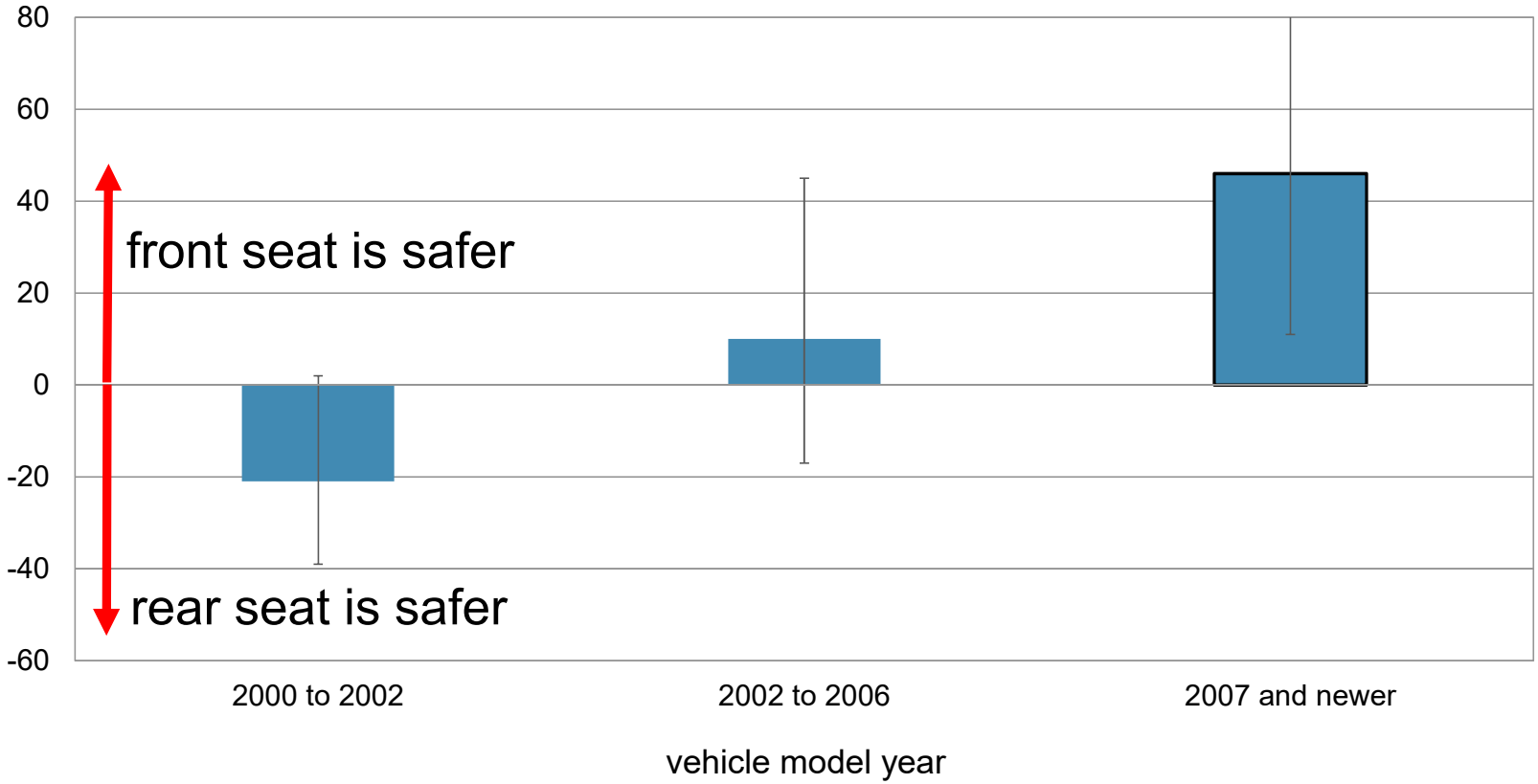
Child occupant protection:
Latest knowledge and challenges in future mobility
September 4, 2019

Jessica S. Jermakian

iihs.org

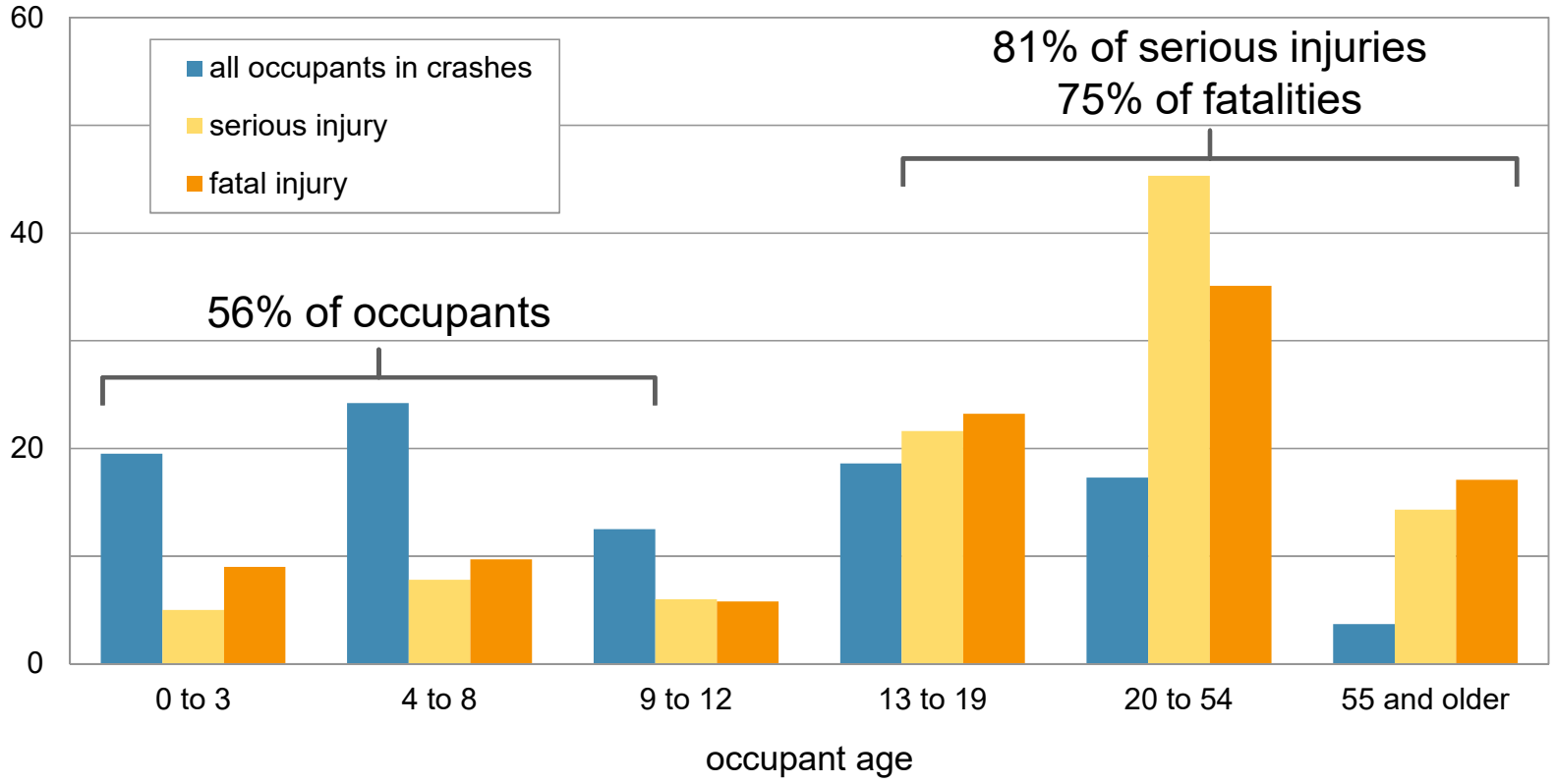
Percent difference in risk of fatal injury for rear vs. front row by vehicle model year

Belt restrained occupants



Source: Durbin, et. al. (2015) Rear seat safety: variation in protection by occupant, crash and vehicle characteristics. *Accid Anal Prev*. 80;185-192.

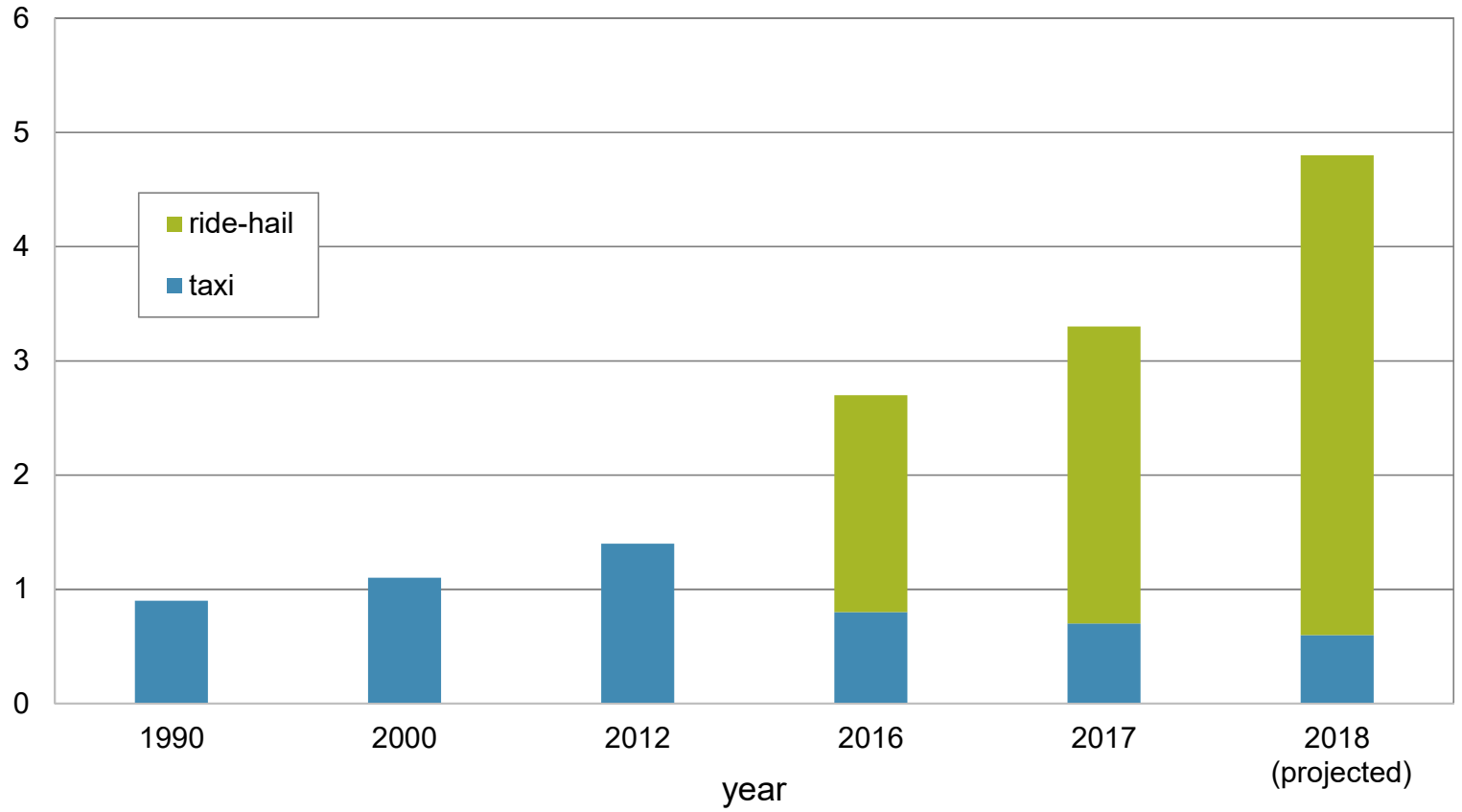
Percent distribution of rear-seat occupants across age groups for injury outcome categories



Source: Durbin, et. al. (2015) Rear seat safety: variation in protection by occupant, crash and vehicle characteristics. *Accid Anal Prev*. 80;185-192.

Hired-vehicle ridership in the U.S.

Annual ridership in billions, 1990–2017



Source: The New Automobility: Lyft, Uber and the Future of American Cities, Schaller Consulting, 2018.

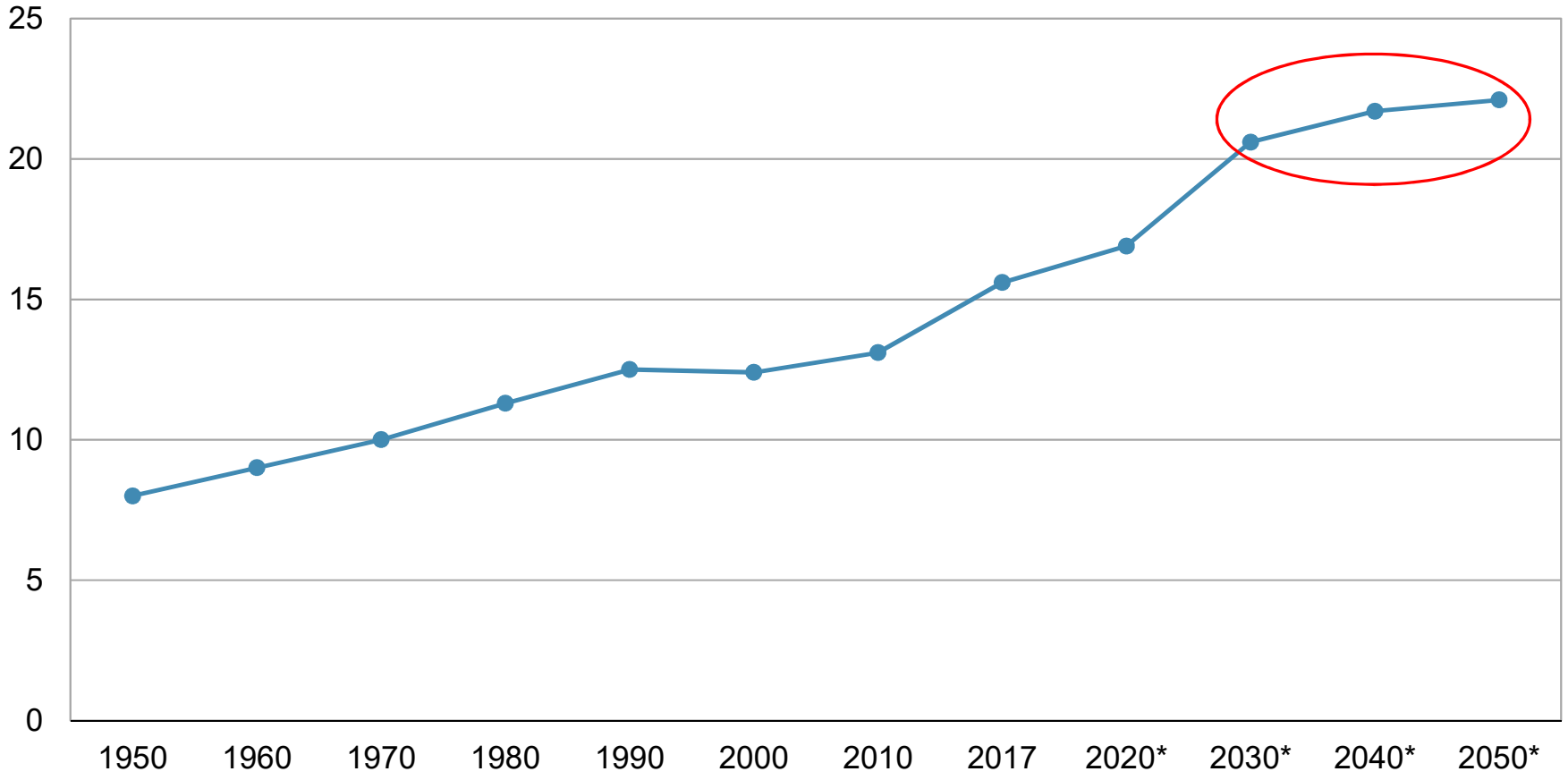
Percent difference in risk of fatal injury for rear vs. front row by occupant age

Belt restrained occupants

Source: Durbin, et. al. (2015) Rear seat safety: variation in protection by occupant, crash and vehicle characteristics. *Accid Anal Prev*. 80;185-192.

Percentage of U.S. population 65 years and older

By calendar year

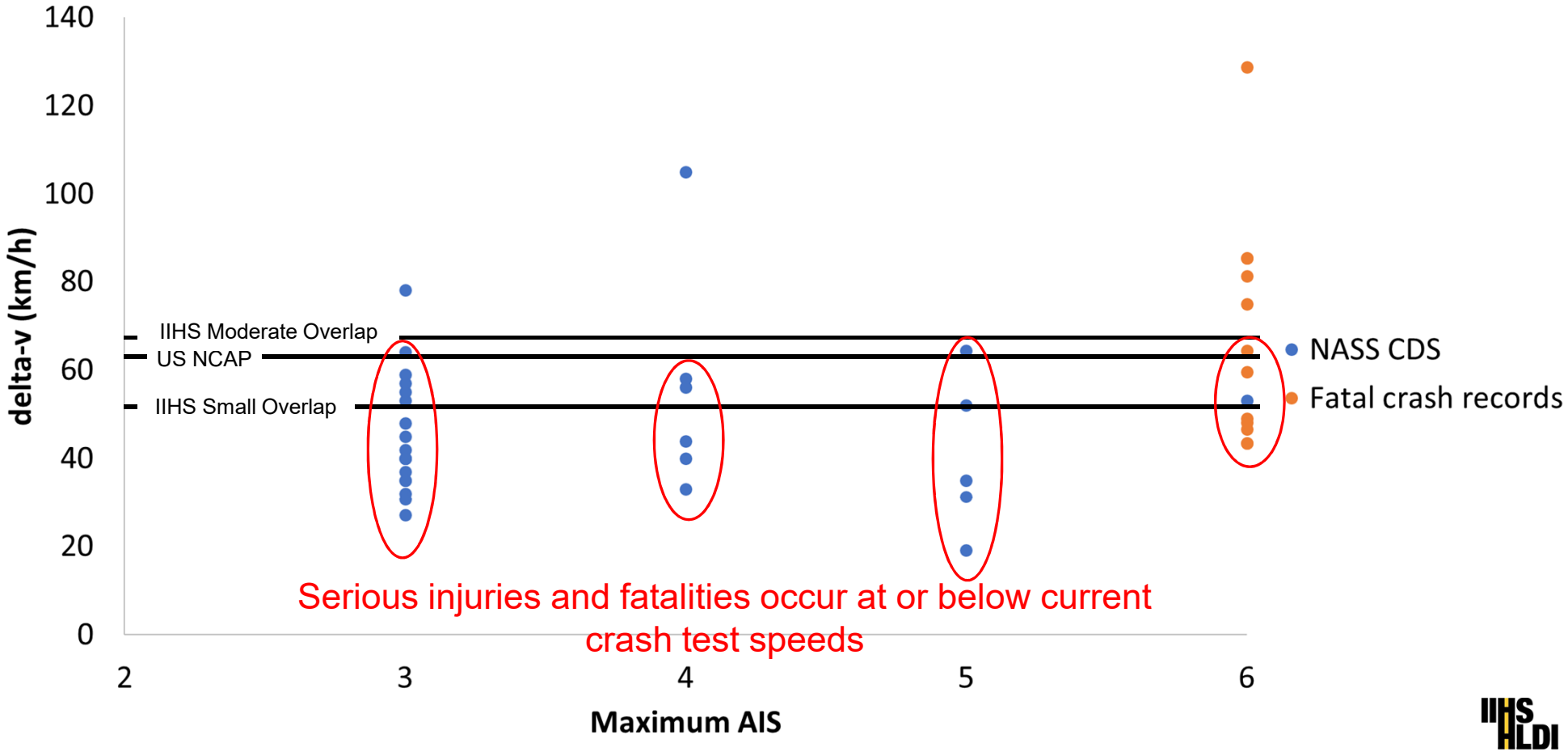


Understanding injuries in belted rear seat occupants

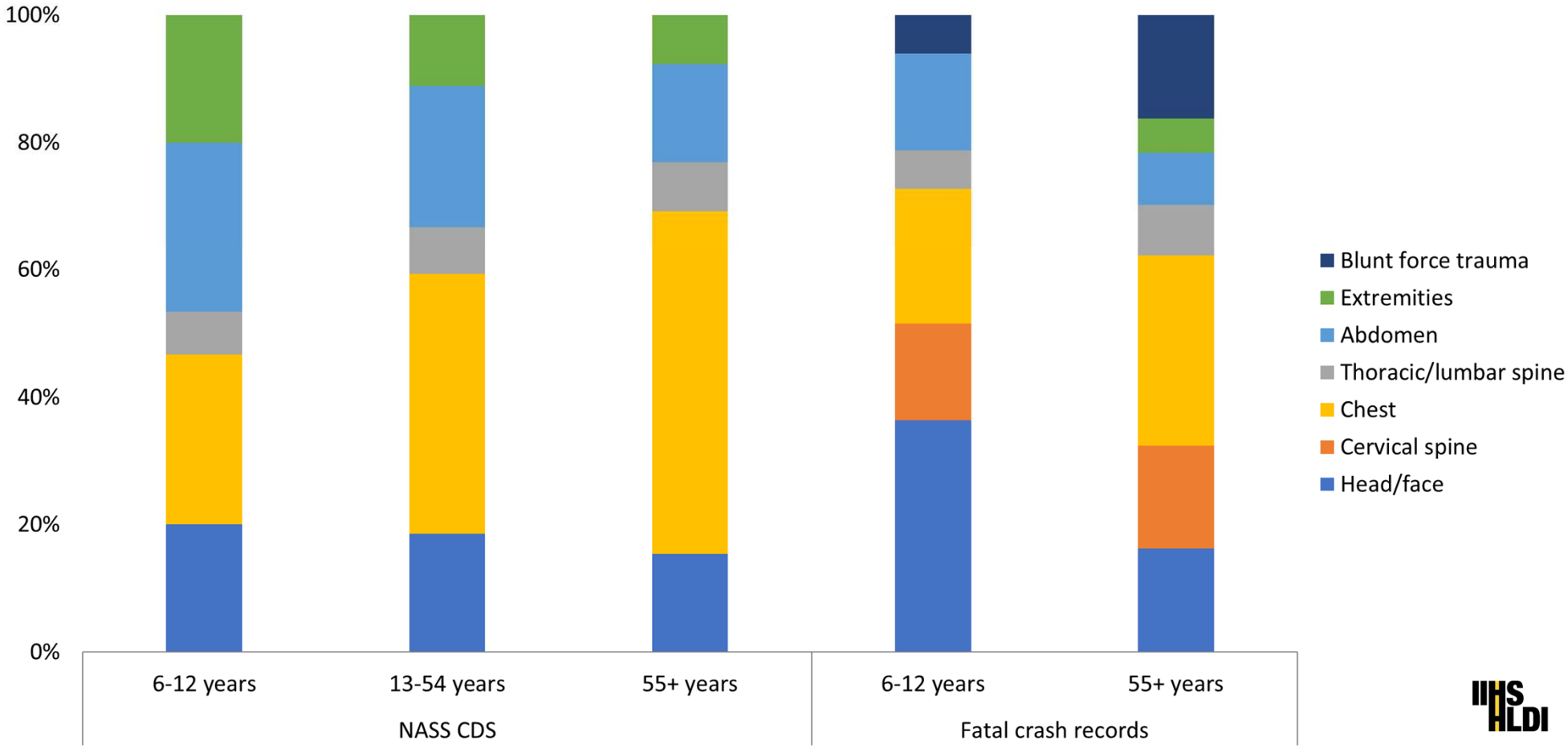
- Case series review of 117 belted rear seat occupants who sustained serious and fatal injuries in frontal crashes using 2 data sources:
  - National Automotive Sampling System – Crashworthiness Data System (NASS-CDS)
    - Crash investigation documentation, photos, injury data
    - 36 belt-restrained occupants ages 6 to 92 years
    - Crash years 2004 to 2015
  - Fatal crash records identified in Fatal Analysis Reporting System (FARS)
    - Detailed police accident report, photos, and ancillary information
    - 33 occupants ages 6 to 12 years using boosters or safety belts alone
    - 48 belt-restrained occupants over 55 years
    - Crash years 2014 to 2015

Case crash severities compared to average crash test severities

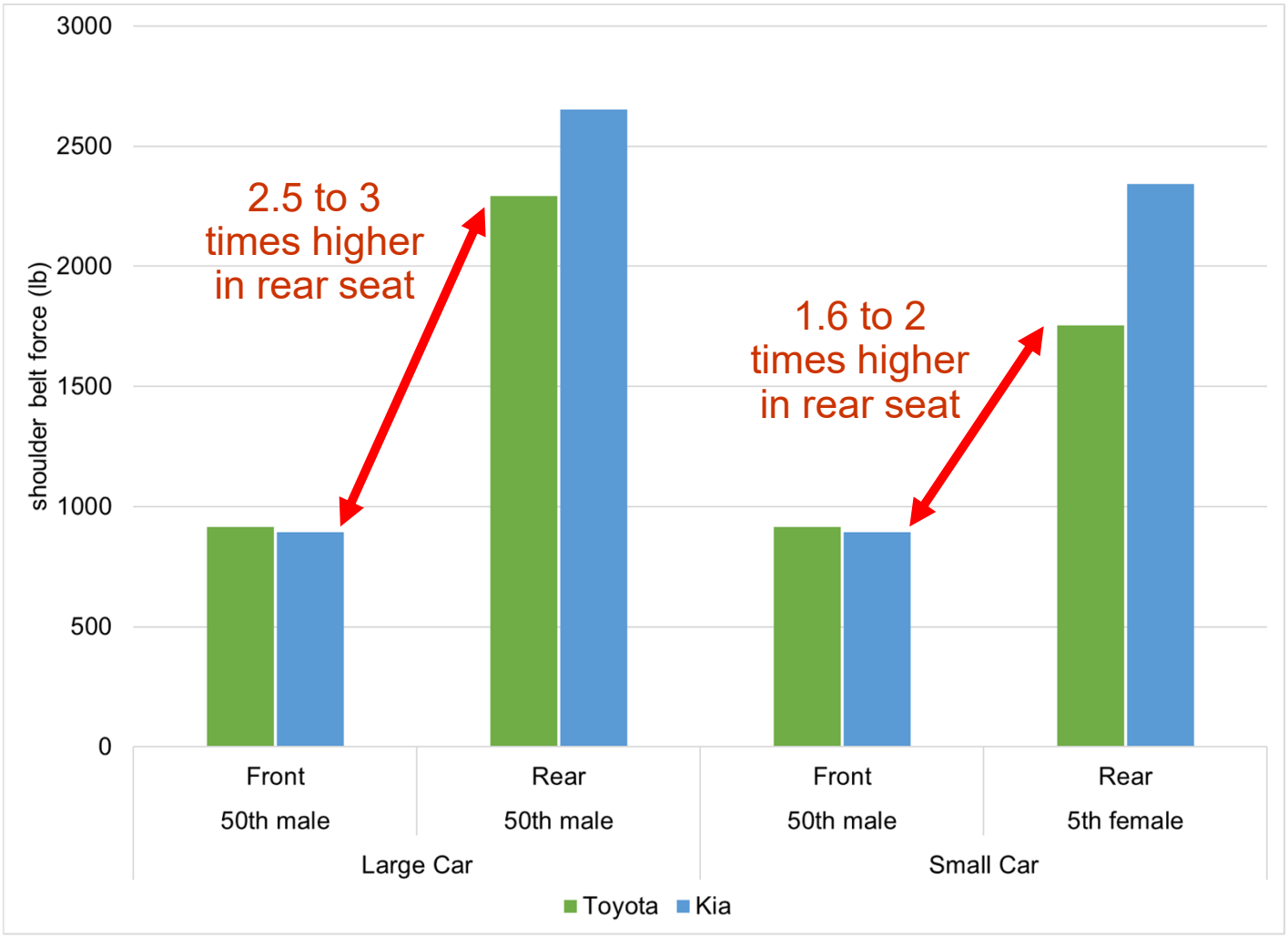
by maximum injury severity of case occupant



Distribution of documented AIS 3+ injured body regions in rear seat occupants in frontal crashes



Belt forces in car-to-car tests with rear seat occupants



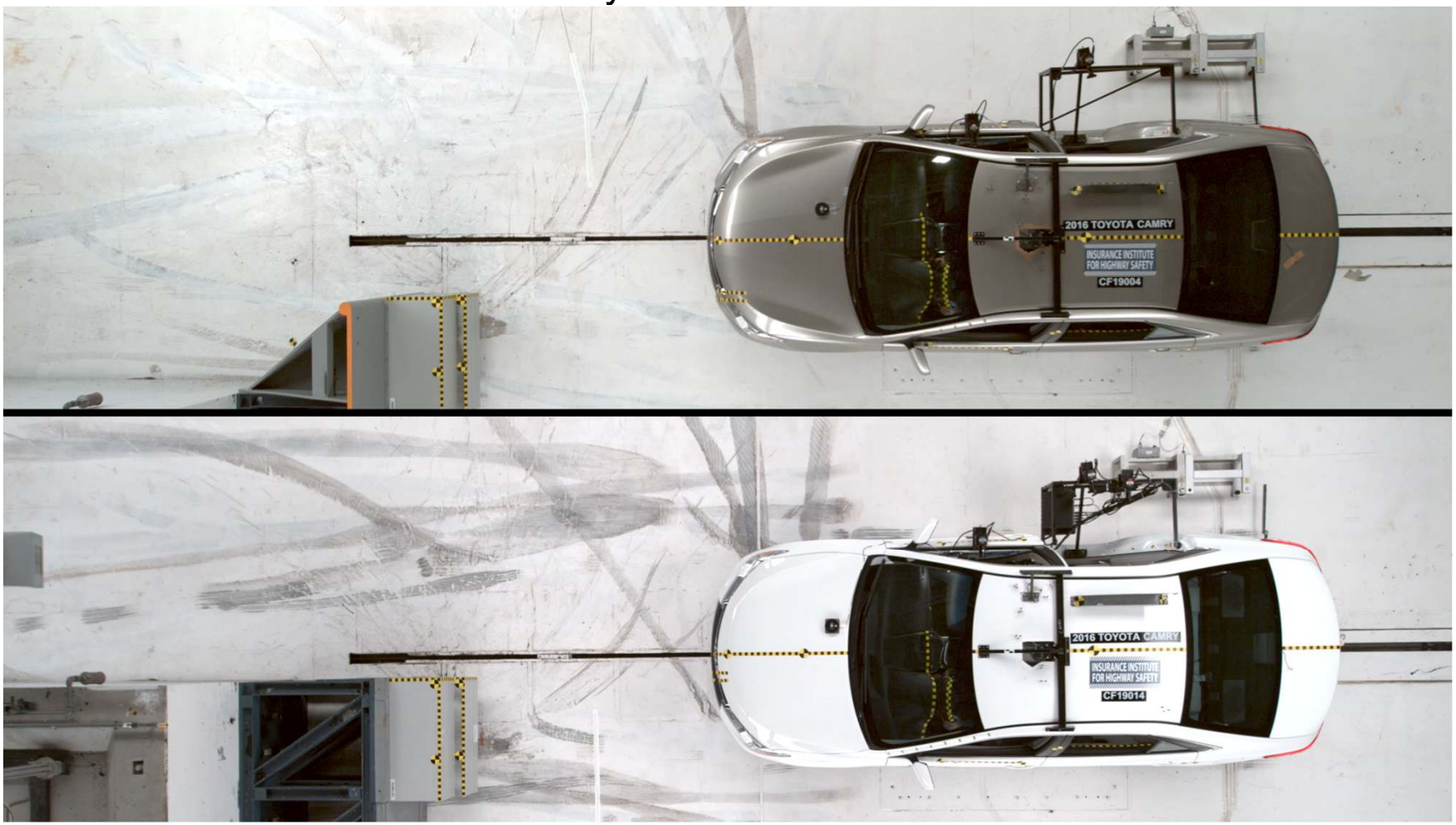
2019 research testing

Development of rear-seat occupant test protocol

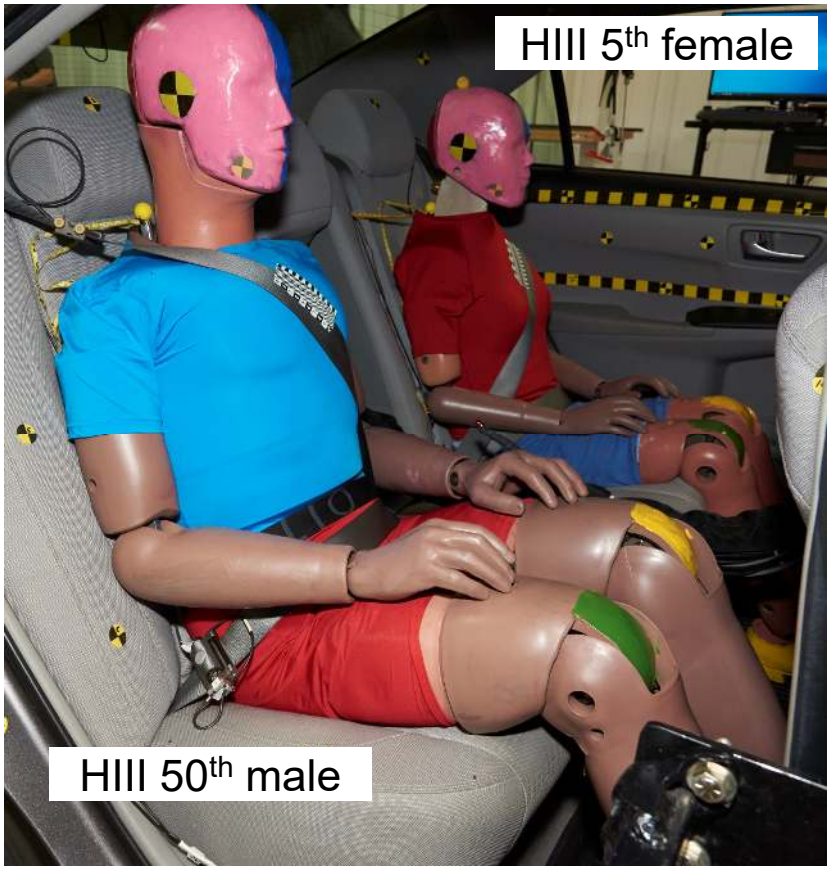
- Initial matrix of 16 tests to inform decisions on
  - Dummy size and type
  - Seat position
  - Performance and injury metrics
- Explore effect of potential countermeasures

Small vs. moderate overlap into deformable barrier at 64 km/h

40% ODB vs 25% ODB – 2016 Camry



Research testing - dummies

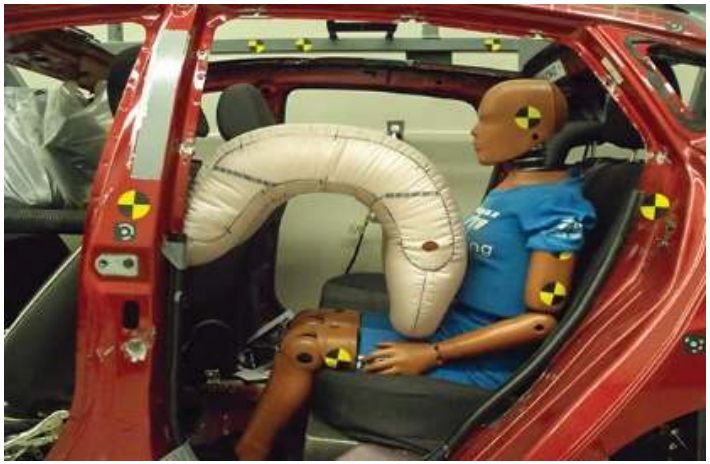



Standard belts result in high chest
forces and submarining

Technologies to reduce seat belt forces

seat belt force limiters
and crash tensioners

inflatable belts



airbags

Don’t forget the diversity in rear seat occupants

Summary and next steps

- Improved front restraint technologies are making the rear less safe by comparison
- High seat belt loads exceeding human tolerances – older occupants at particular risk
- Countermeasures exist but are not widespread
  - Current US regulatory and consumer information crash tests do not drive rear seat belt improvements

Next steps

- Continue development of rear-seat occupant test protocol and identify performance metrics

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Jessica Jermakian

Senior Research Engineer
jjermakian@iihs.org