

UPDATE ON NHTSA'S OBLIQUE RESEARCH PROGRAM

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CURRENT RESEARCH OBJECTIVE

- **QUESTION**

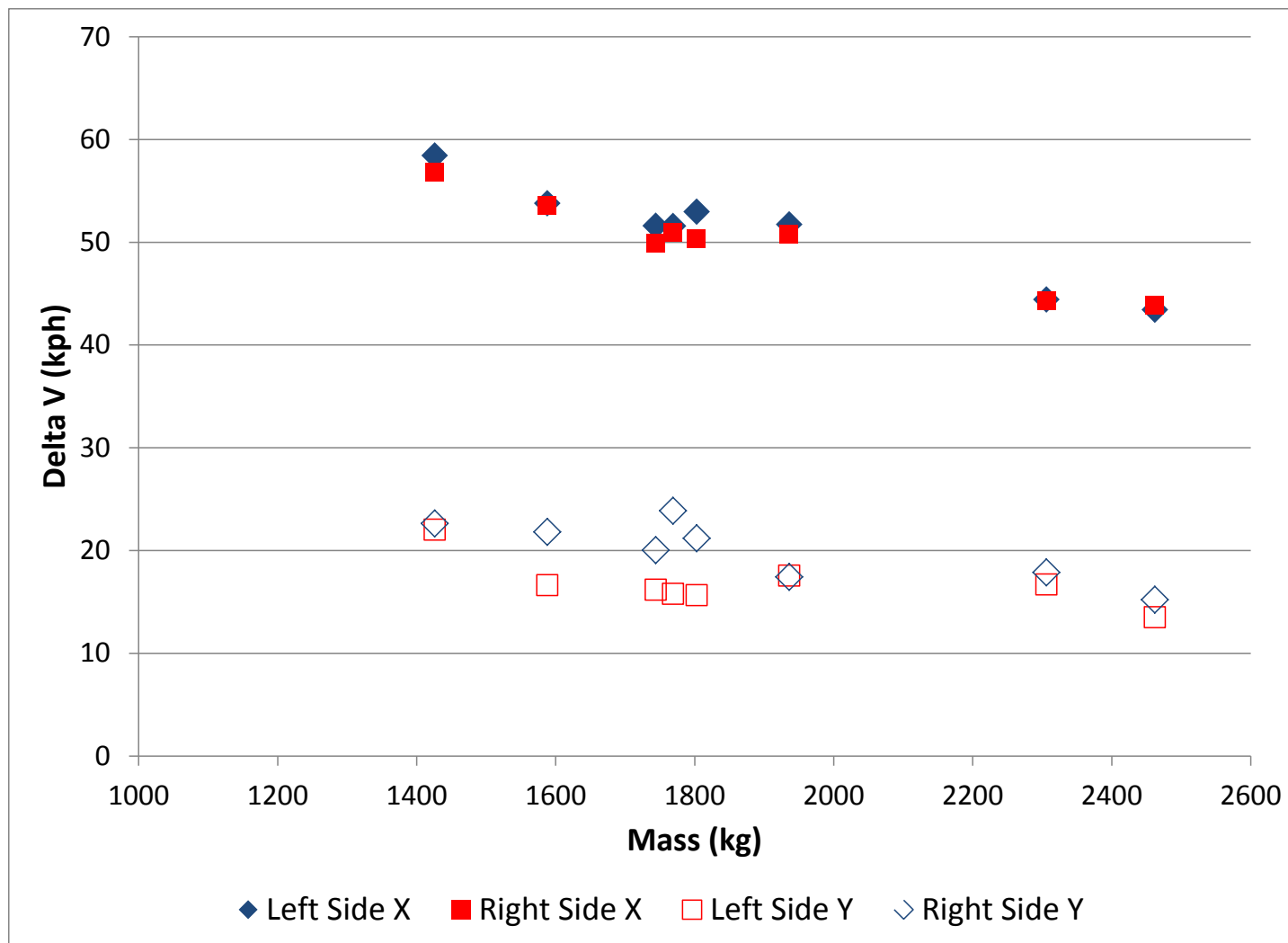
- Is there a difference in vehicle response, occupant response, and injury risk between left-side and right-side impacts?

- **APPROACH**

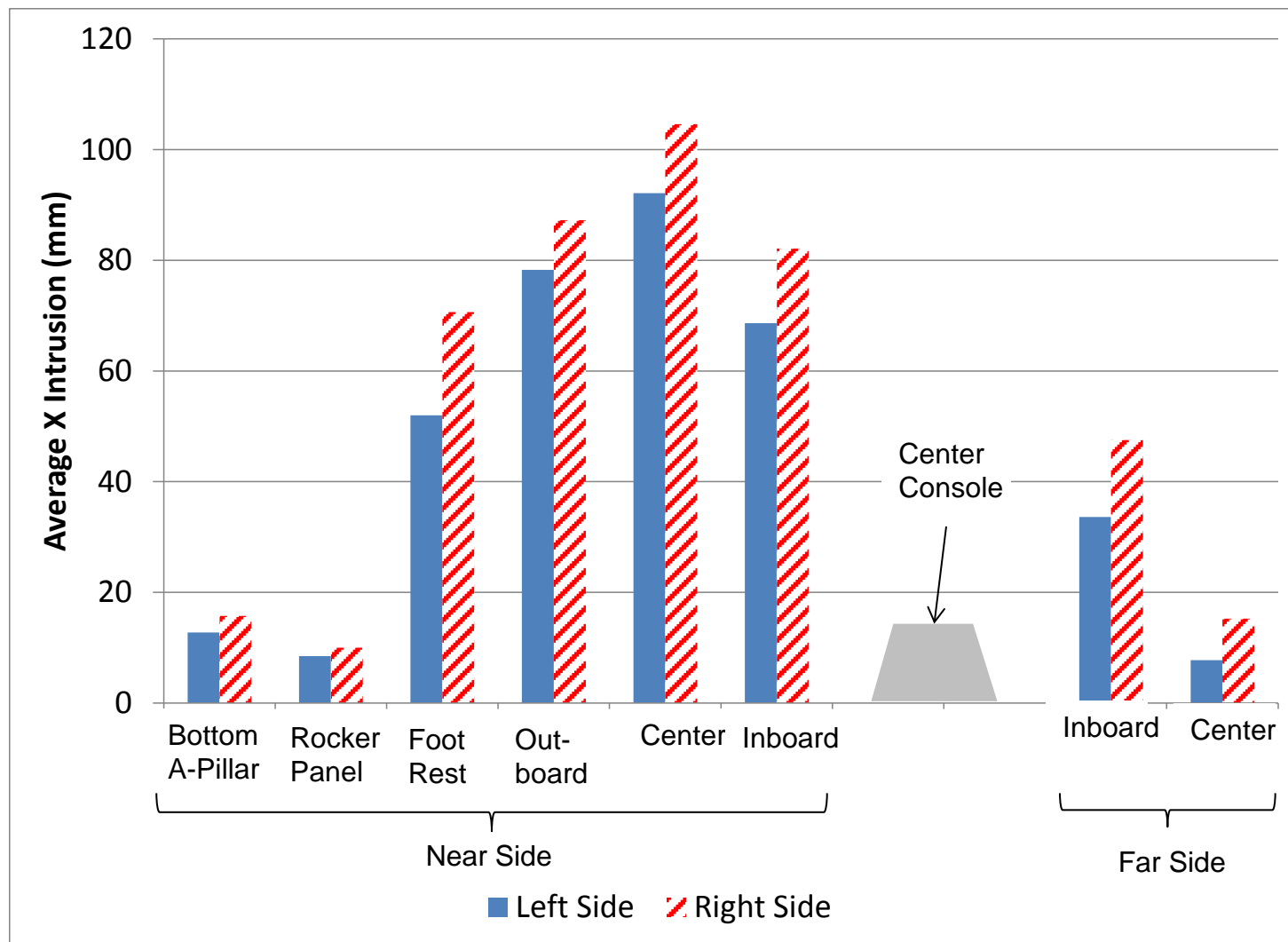
- Test eight pairs of vehicles that comply with FMVSS No. 226 side curtain and achieved an acceptable or better rating in the IIHS Small Overlap Impact test procedure in the NHTSA Oblique RMDB test procedure

				NHTSA TEST NUMBER	
MAKE	MODEL	YEAR	VEHICLE CLASS	LEFT SIDE	RIGHT SIDE
HONDA	FIT	2015	MINICAR	9043	9482
MAZDA	3	2014	SMALL PC	8787	8999
HONDA	ACCORD	2014	MIDSIZE PC	8789	9042
VOLVO	S60	2015	MIDSIZE PC	8488	9783
SUBARU	FORESTER	2015	SMALL SUV	8478	9354
MAZDA	CX-5	2014	SMALL SUV	8788	8998
TOYOTA	HIGHLANDER	2015	MIDSIZE SUV	9481	9480
FORD	F150	2015	LARGE PU	9479	9478

VEHICLE DELTA-V VS. MASS



AVERAGE INTRUSIONS



STATISTICAL ANALYSIS

LEFT SIDE IMPACT VS. RIGHT SIDE IMPACT

Paired T-Test, Significance Level = 0.05

Metric	Location/Axis	Left Side Impact (LSI) vs. Right Side Impact (RSI)
Crash Severity	Total Delta-V, X-axis	LSI > RSI
Crash Severity	Total Delta-V, Y-axis	LSI > RSI
Intrusion	Bottom A-Pillar	Not Significant
Intrusion	Rocker Panel	Not Significant
Intrusion	Foot Rest	RSI > LSI
Intrusion	Near-side Outboard Toeapan	Not Significant
Intrusion	Near-side Center Toeapan	Not Significant
Intrusion	Near-side Inboard Toeapan	Not Significant
Intrusion	Far-side Inboard Toeapan	Not Significant
Intrusion	Far-side Center Toeapan	Not Significant

SMALL SUV (TSTNO 8788)

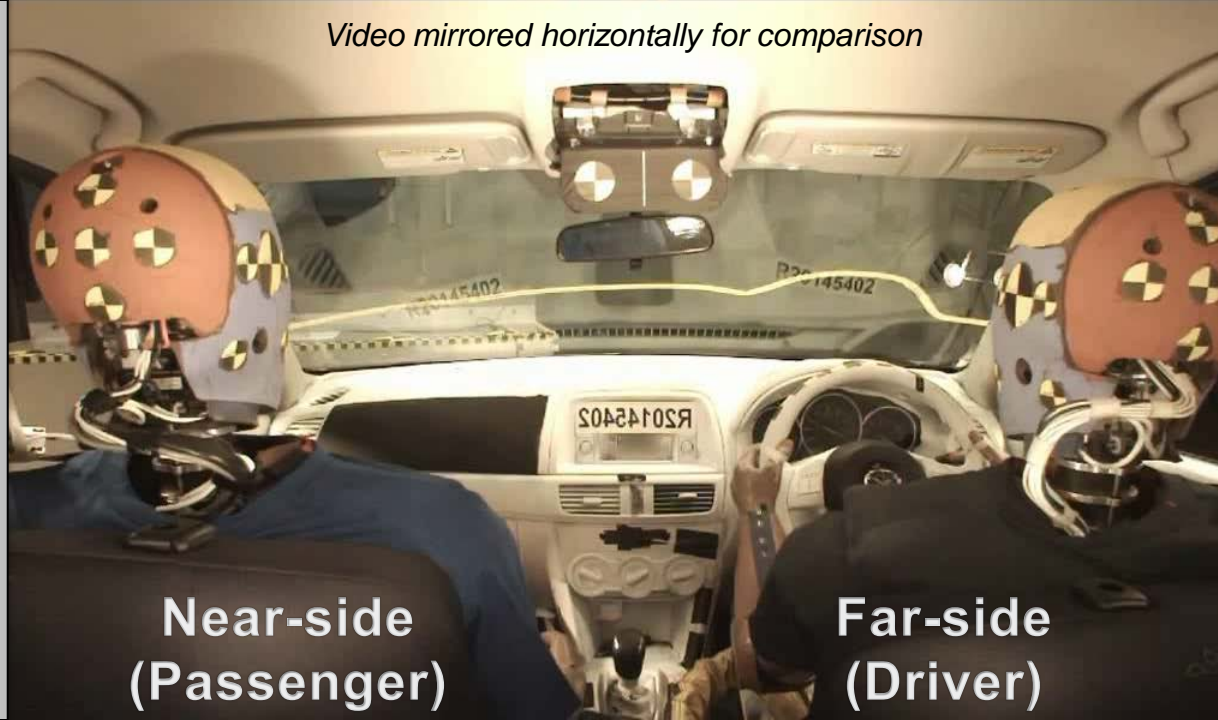
Left-side Impact



- Near-side
 - Similar head interaction with frontal and side curtain air bags
 - Similar head rotation (primarily about Y-axis)

SMALL SUV (TSTNO 8998)

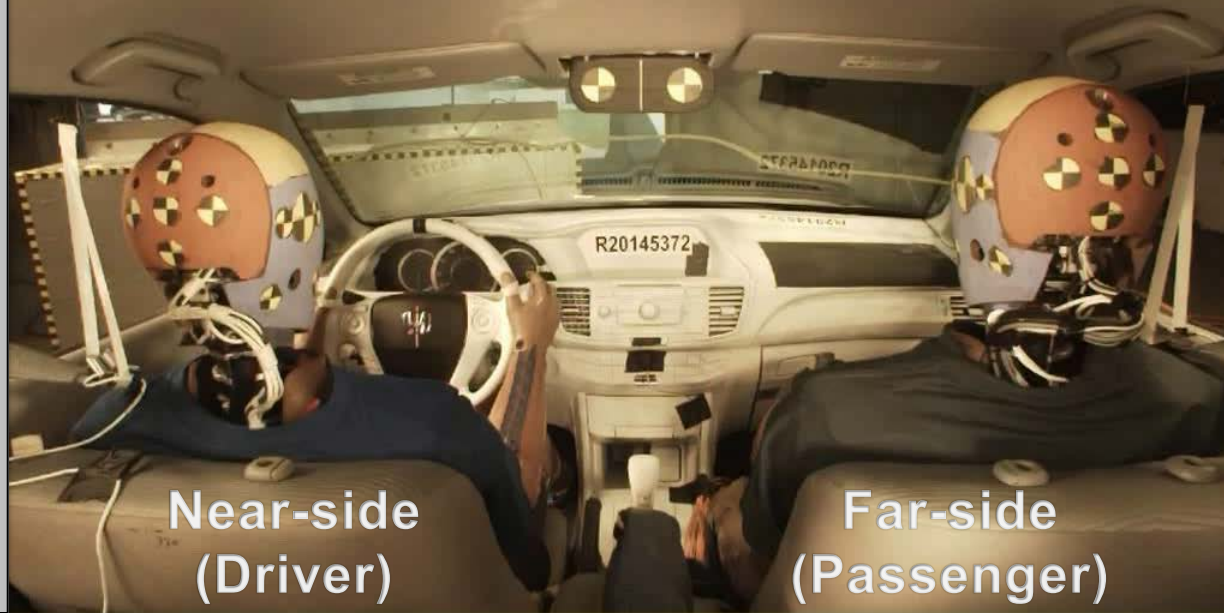
Right-side Impact



- Far-side
 - Similar head rotation (primarily about Z-axis)

MIDSIZE PC (TSTNO 8789)

Left-side Impact



Near-side
(Driver)

Far-side
(Passenger)

Video mirrored horizontally for comparison

MIDSIZE PC (TSTNO 9042)

Right-side Impact

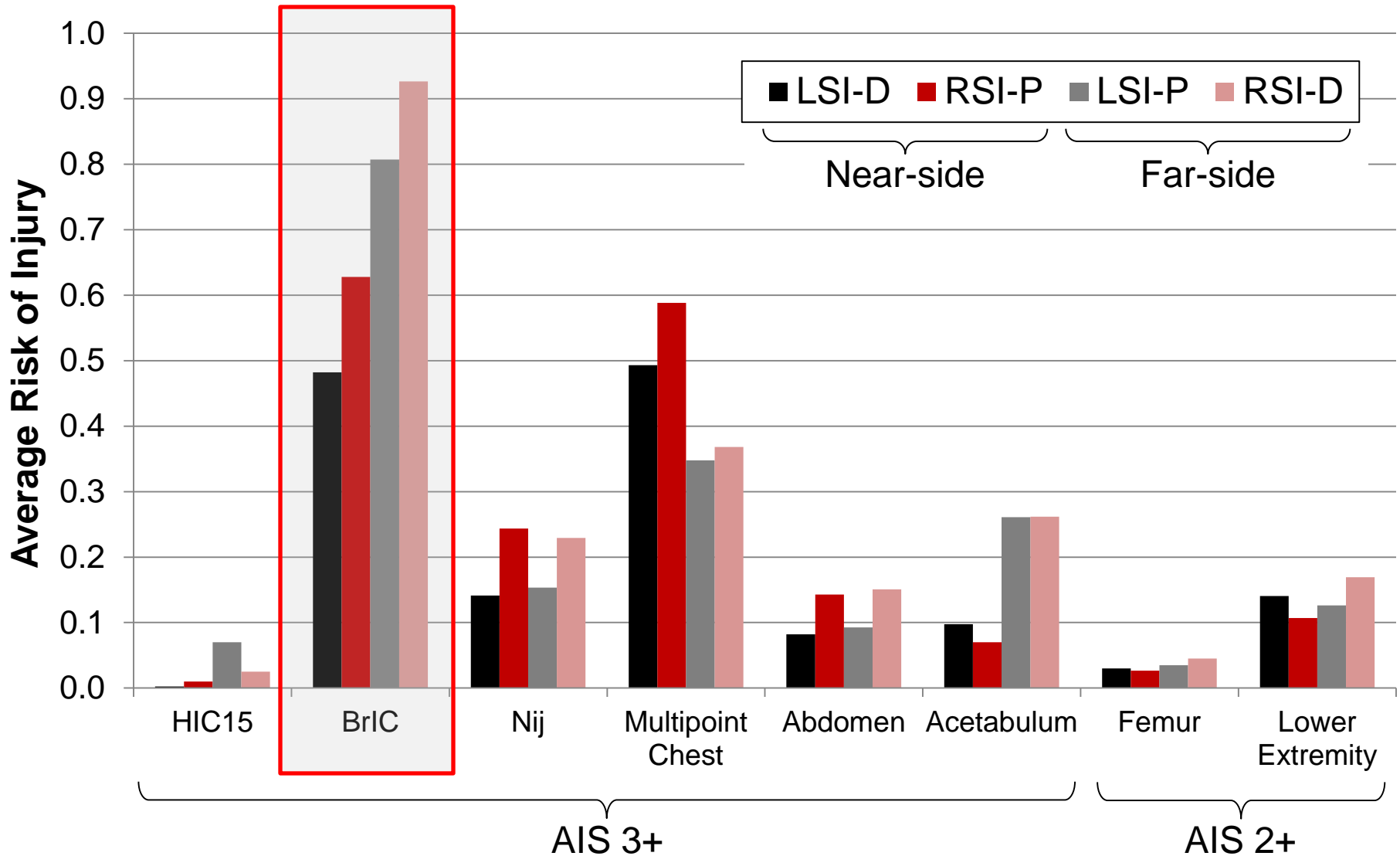


Near-side
(Passenger)

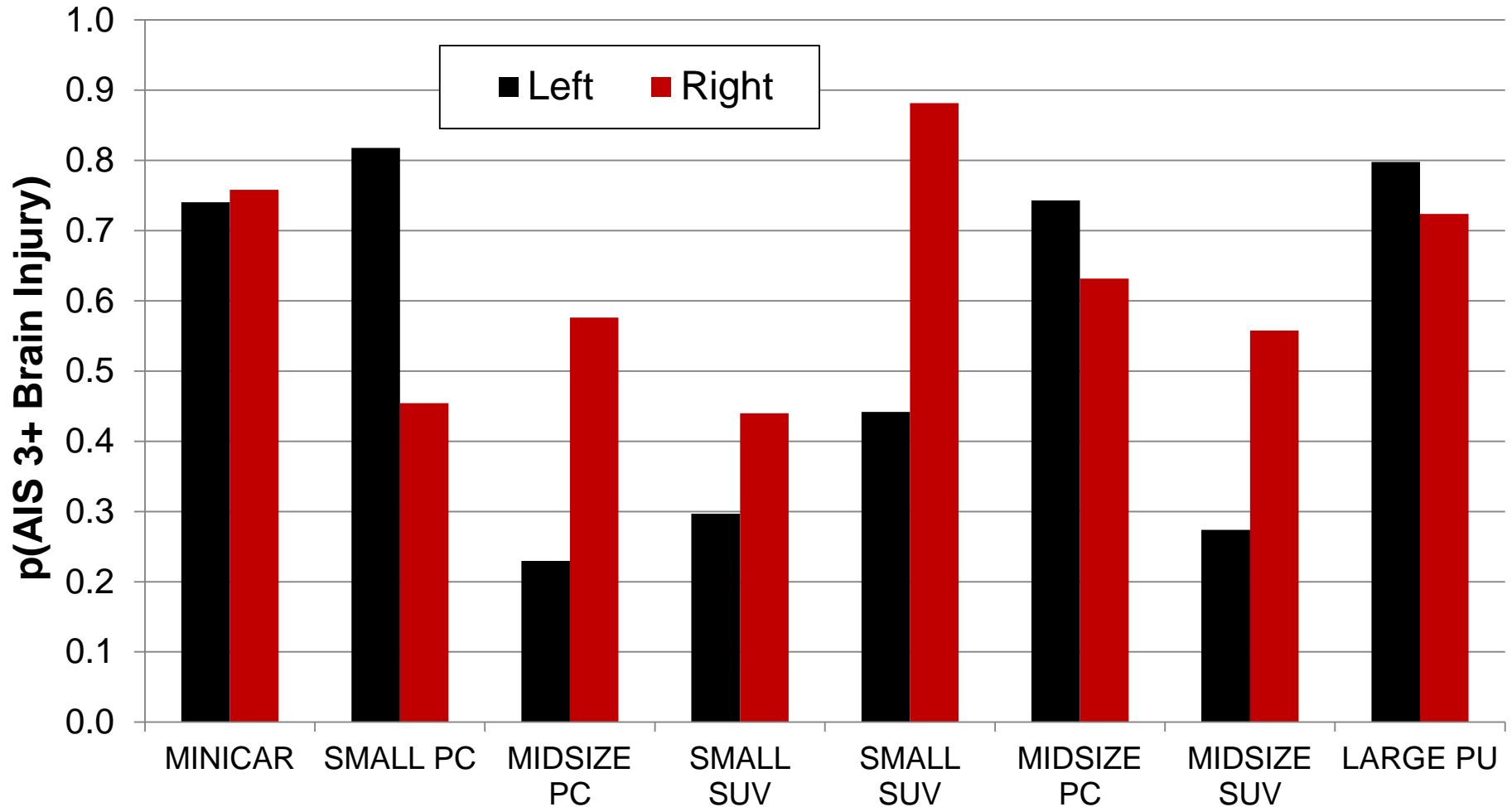
Far-side
(Driver)

- Near-side
 - Driver's head contacts frontal air bag first
 - Primarily Y-axis rotation with minimal Z-axis rotation
 - Passenger's head contacts side curtain air bag first
 - Outboard Z-axis rotation outboard
- Far-side
 - Driver's head rotates earlier and faster than passenger's head about Z-axis

AVERAGE INJURY RISK

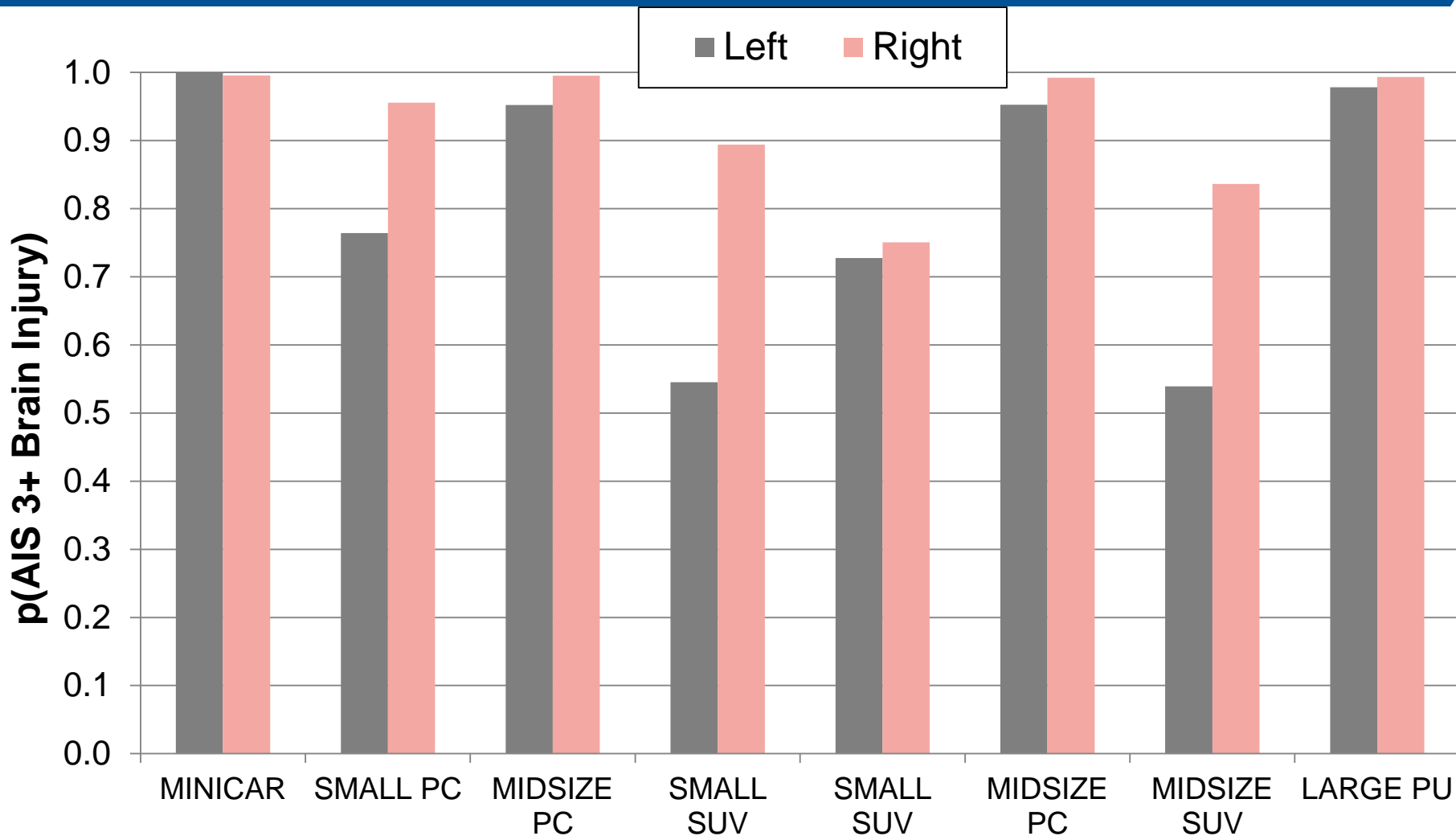


MATCHED PAIR COMPARISON, NEAR-SIDE INJURY RISK – HEAD (BrIC)



Observation: some large differences, but no consistent trend in brain injury risk left-to-right

MATCHED PAIR COMPARISON, FAR-SIDE INJURY RISK – HEAD (BrIC)



Observation: brain injury risk to far-side occupant is higher for right-side impacts in 7 of 8 vehicles

STATISTICAL ANALYSIS

LEFT SIDE IMPACT VS. RIGHT SIDE IMPACT

Paired T-Test, Significance Level = 0.05

Body Region	Injury Metric	All Occupants	Near-side Only	Far-side Only
Head	HIC15	Not Significant	Not Significant	Not Significant
Head	BrIC	Not Significant	Not Significant	RSI > LSI
Neck	Nij	RSI > LSI	RSI > LSI	Not Significant
Chest	Peak Resultant Deflection	Not Significant	Not Significant	Not Significant
Abdomen	Compression	RSI > LSI	Not Significant	Not Significant
Acetabulum	Peak Resultant Force	Not Significant	Not Significant	Not Significant
Femur	Axial Force	Not Significant	Not Significant	Not Significant
Lower Extremity	Axial Force, Revised Tibia Index	Not Significant	Not Significant	Not Significant

OBSERVATIONS

- **Vehicle response**

- Vehicle Delta-V higher for LSI vs. RSI
- Footrest intrusion greater for RSI vs. LSI
- For both RSI and LSI, intrusion extends to far-side toepan

- **Near side occupant response**

- Neck injury risk higher in RSI vs. LSI
- In matched vehicle pairs, head kinematics are not always symmetric due to differences in driver and passenger frontal air bags

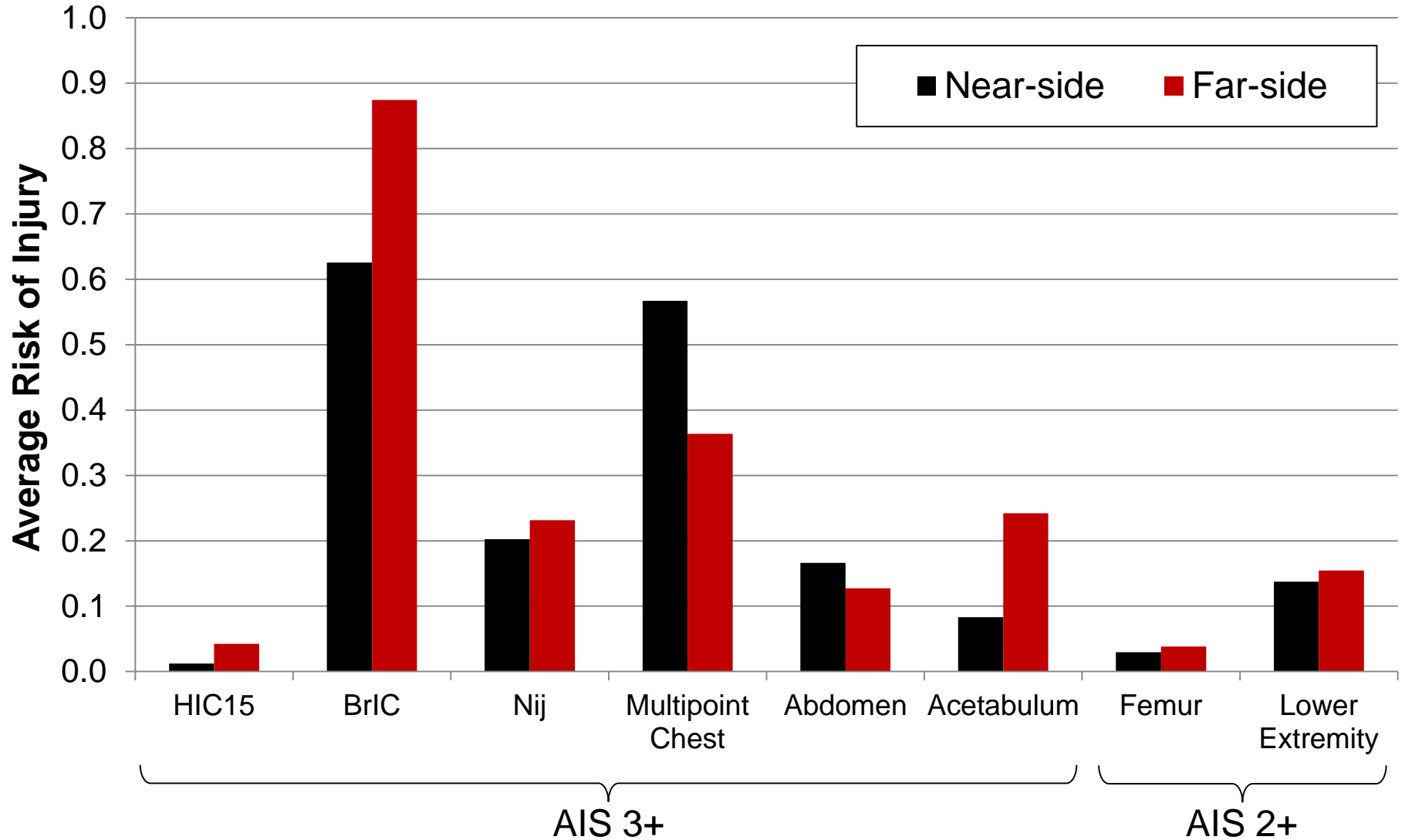
- **Far side occupant response**

- Head injury risk (BrIC) higher in RSI vs. LSI
- In matched vehicle pairs, head kinematics are typically symmetric (outboard rotation about Z-axis)

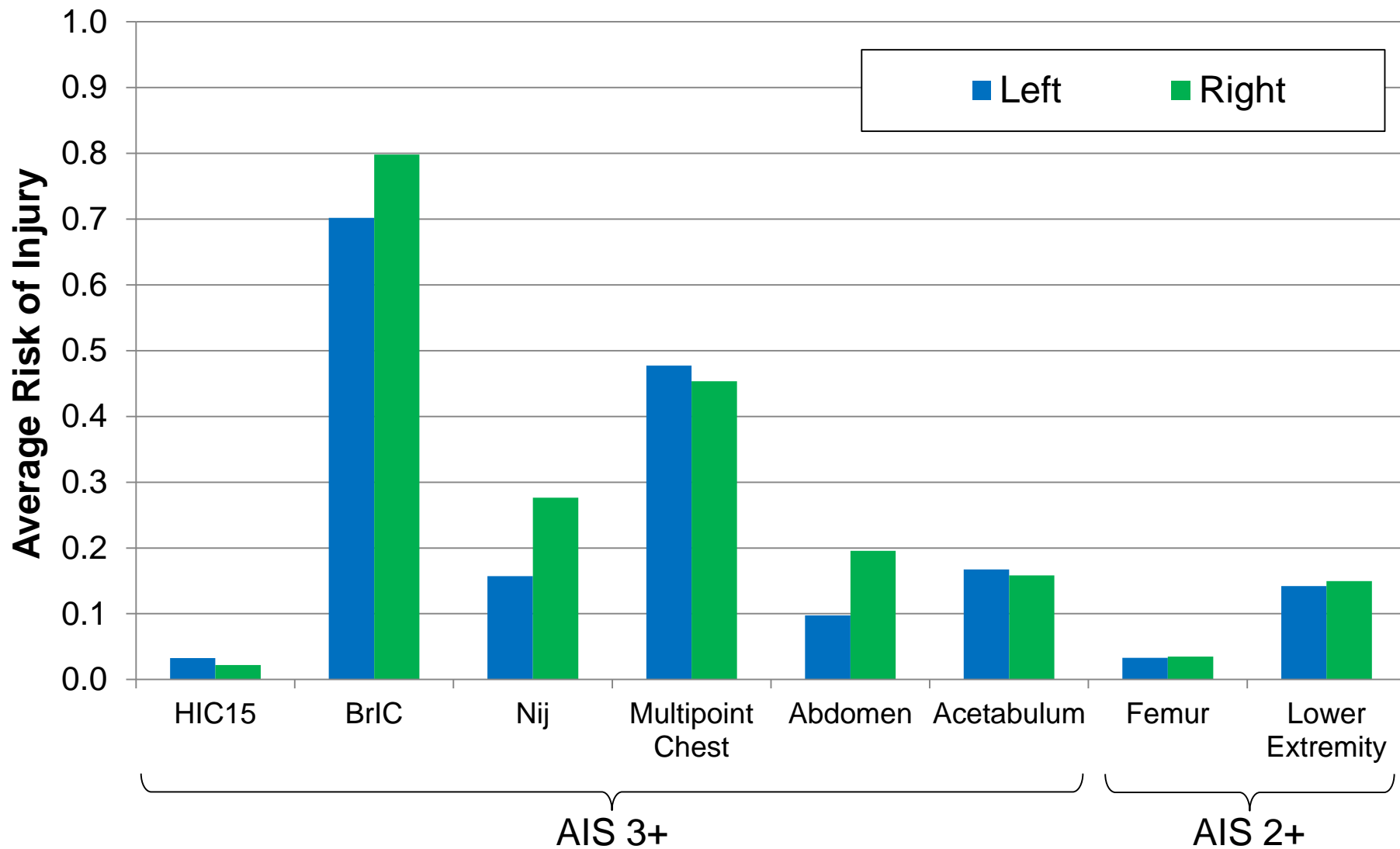
BACKUP SLIDES



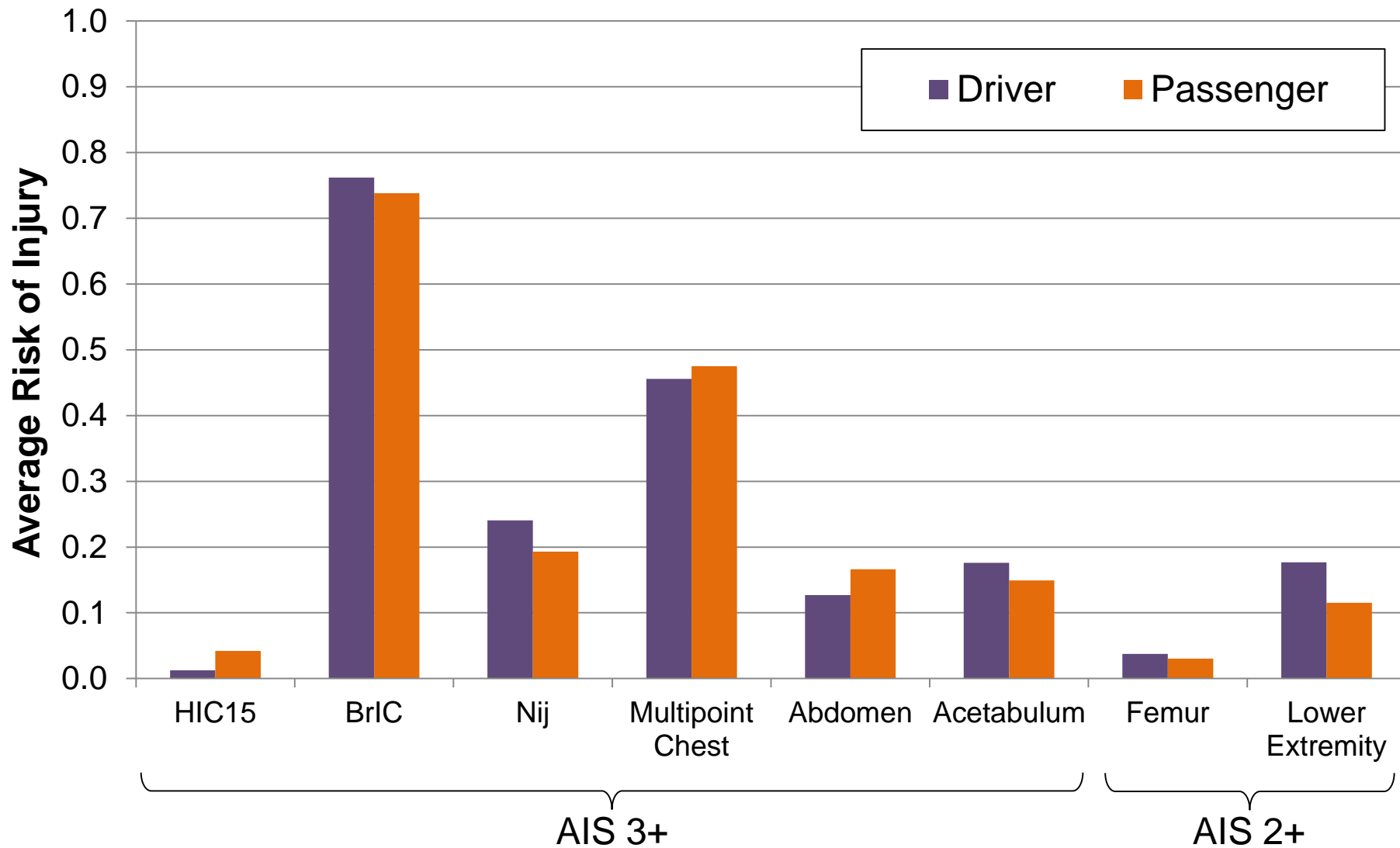
AVERAGE INJURY RISK



AVERAGE INJURY RISK



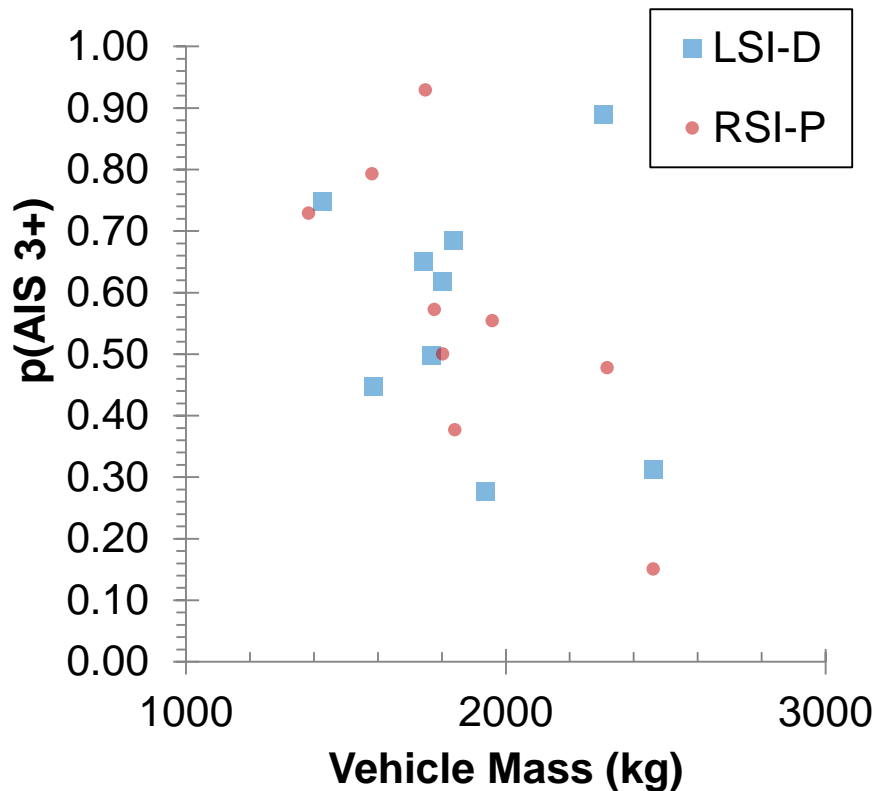
AVERAGE INJURY RISK



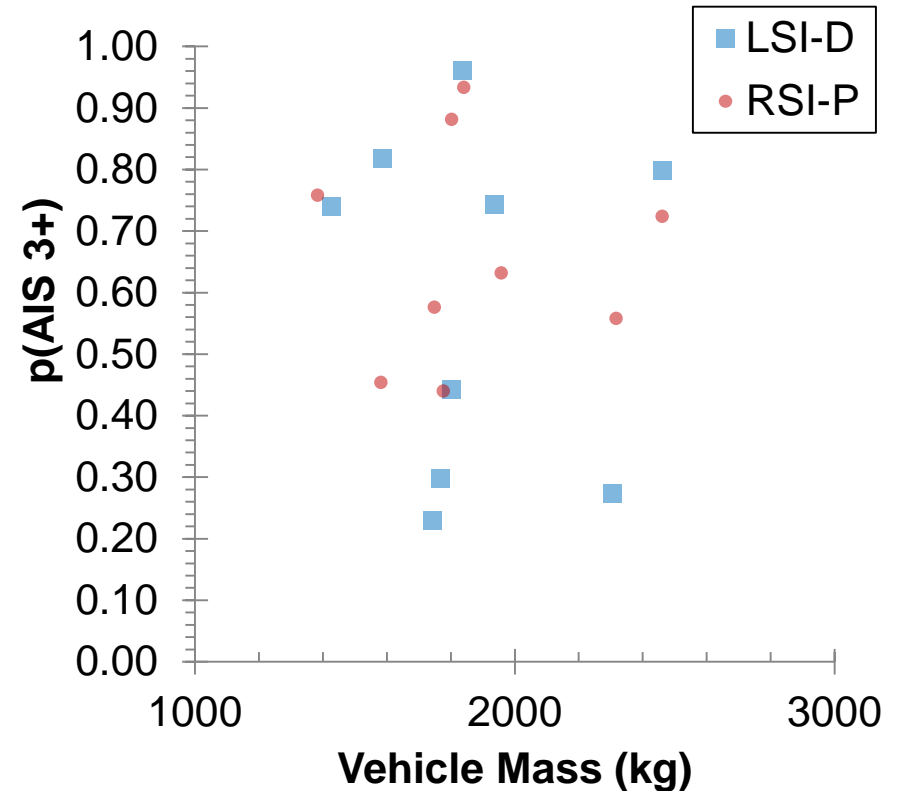
INJURY RISK VS. VEHICLE MASS

NEAR-SIDE OCCUPANTS

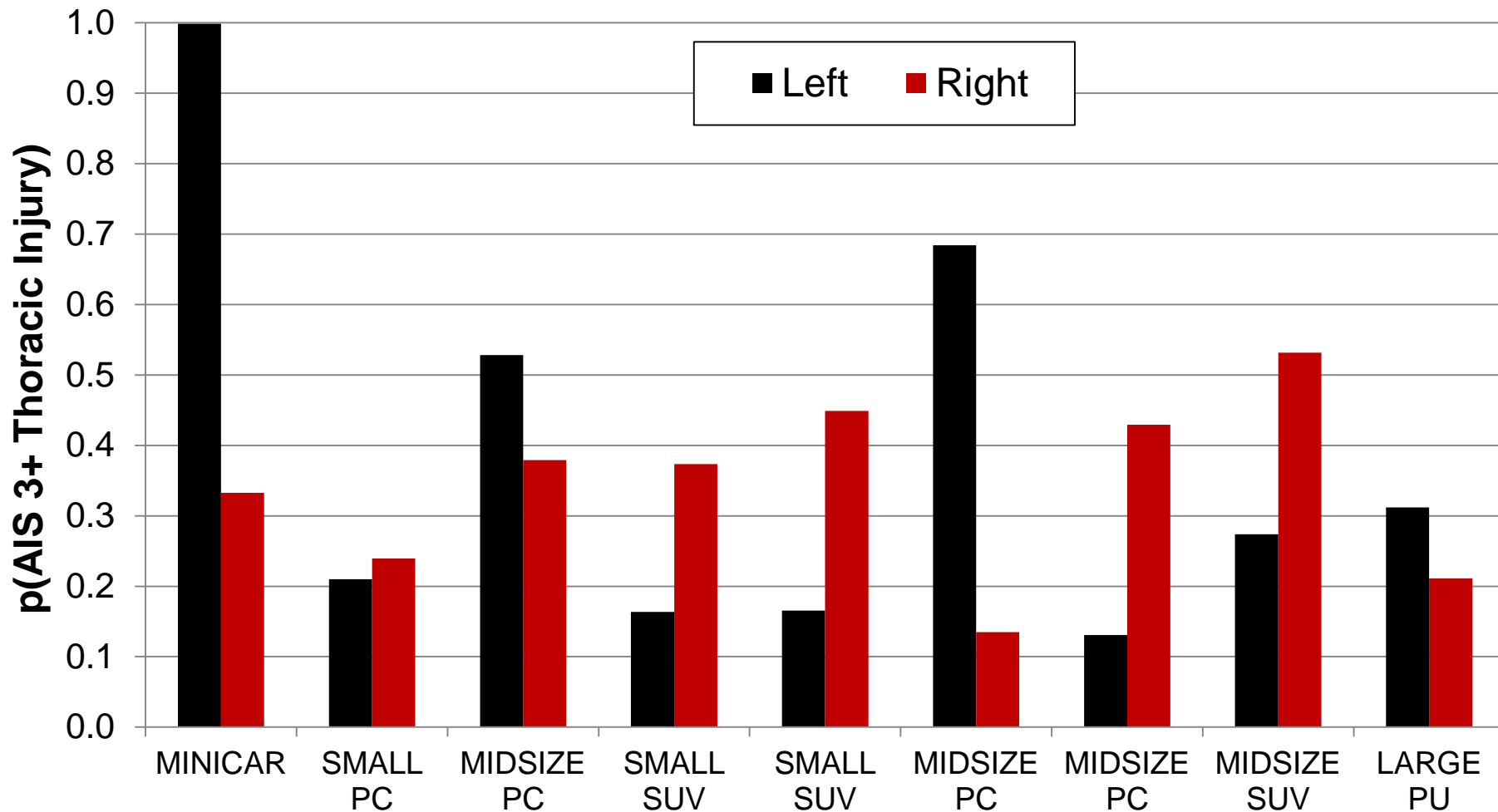
Injury Risk - Multi-point Chest



Injury Risk - BrIC



MATCHED PAIR COMPARISON, FAR-SIDE INJURY RISK – CHEST



MATCHED PAIR COMPARISON, FAR-SIDE INJURY RISK – HEAD (BrIC)

