



CASPER

CHILD ADVANCED SAFETY PROJECT FOR EUROPEAN
ROADS

Biomechanical Approach

*COVER Workshop November 29th/30th
Munich, Germany*



Agenda



1. How to acquire data?
2. Available results
3. CASPER Approach
4. CASPER priorities for accident selection
5. Examples car occupants

1. How to Acquire Biomechanical Data



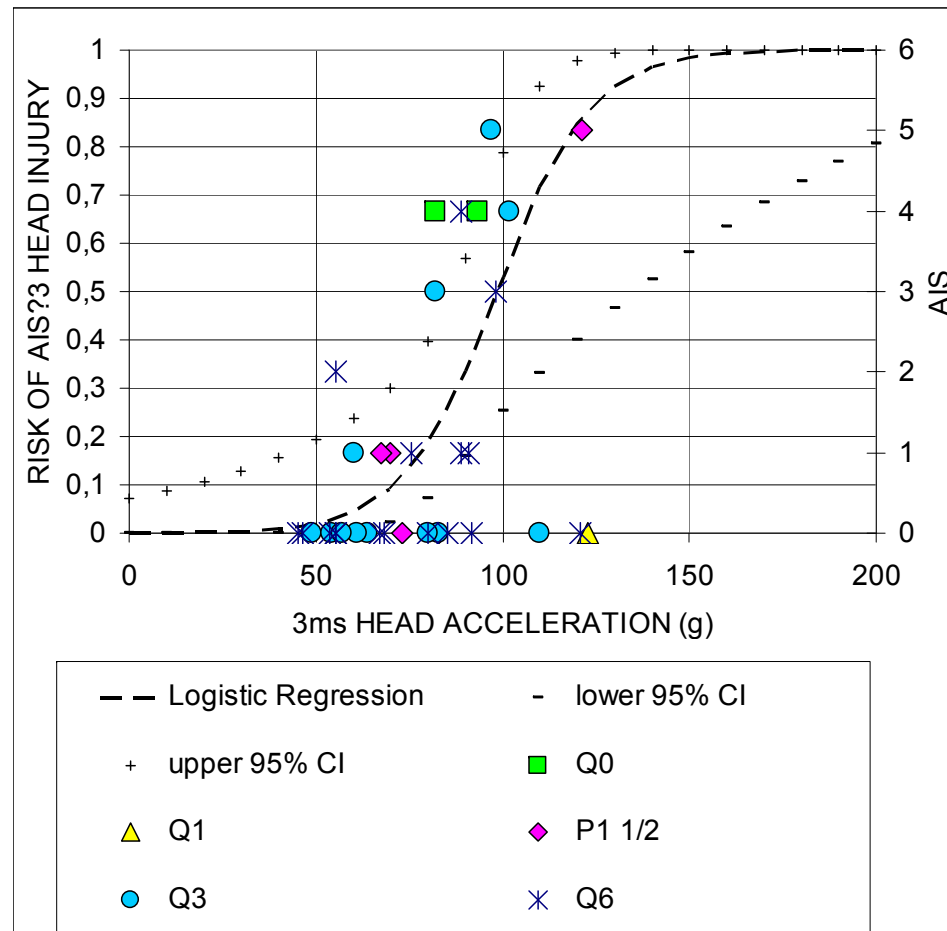
General approaches for acquiring data

- Cadaver tests
 - almost impossible for children
- Volunteer tests
 - For children possible under certain circumstances at a very low level
- Reconstruction of documented accidents

2. Available Results



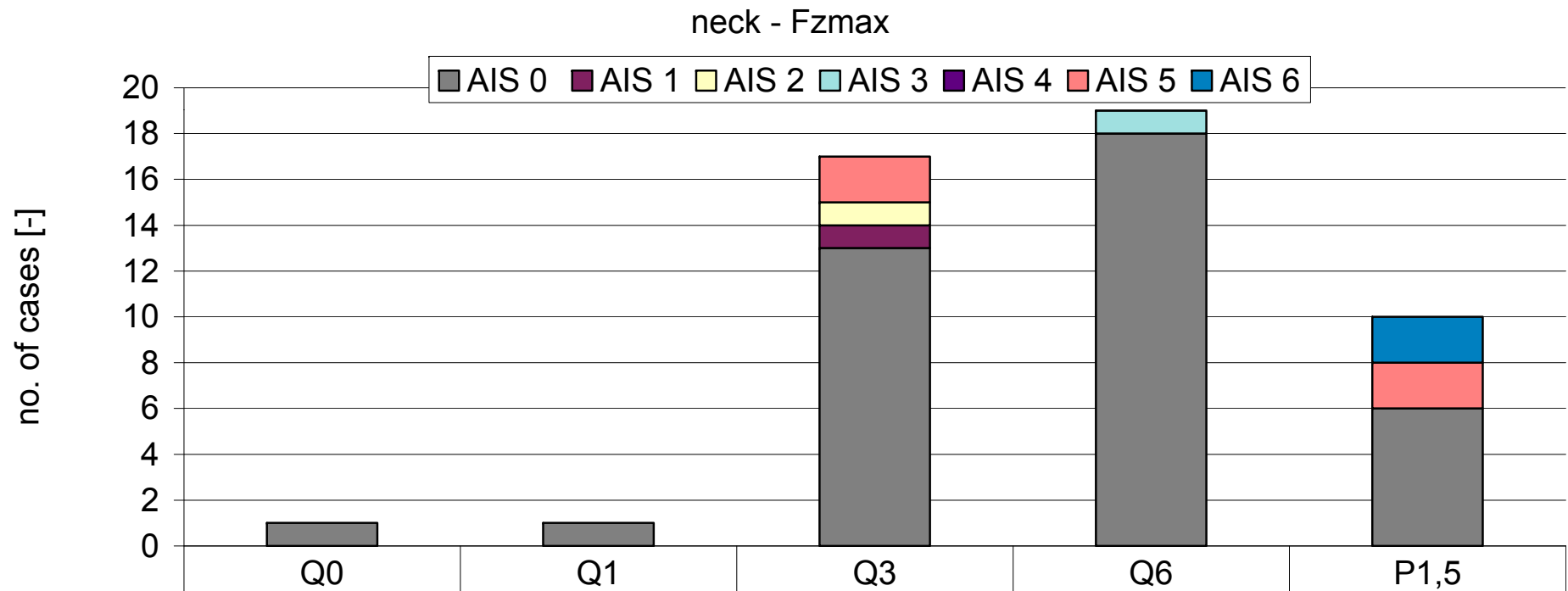
Injury risk functions from CHILD project



2. Available Results



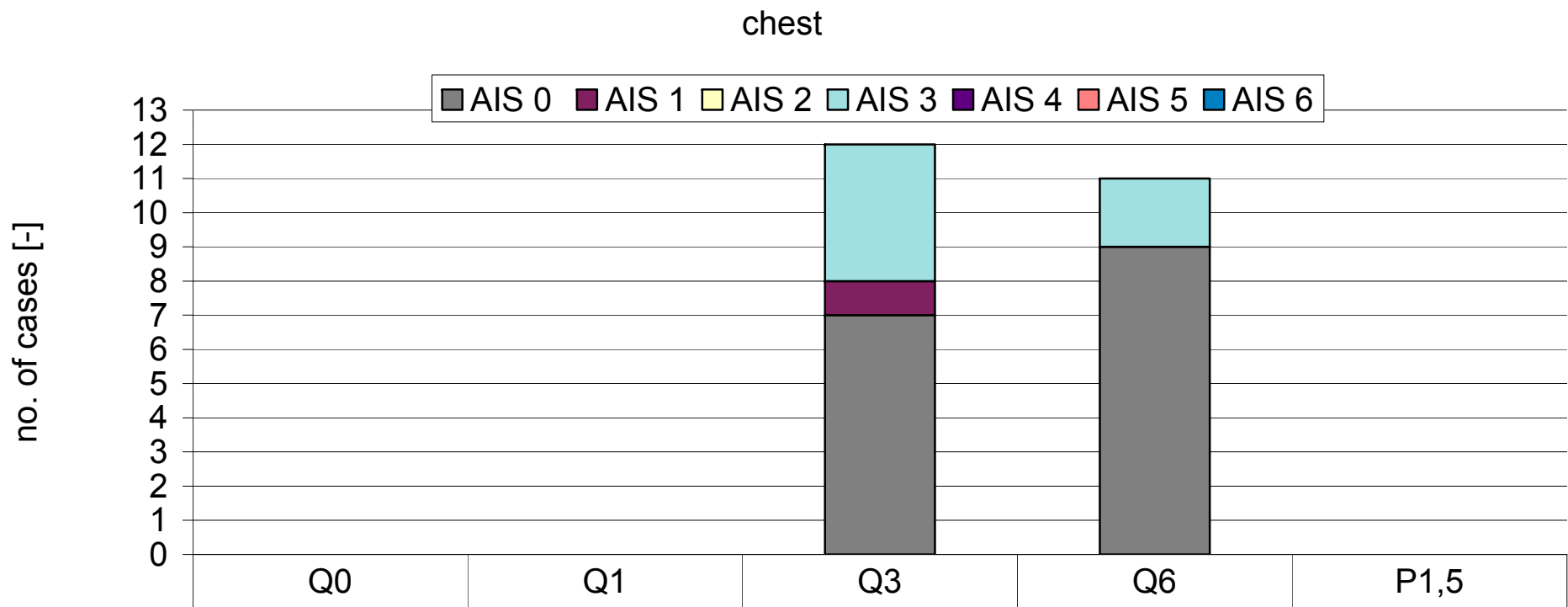
Data points from CHILD project



2. Available Results



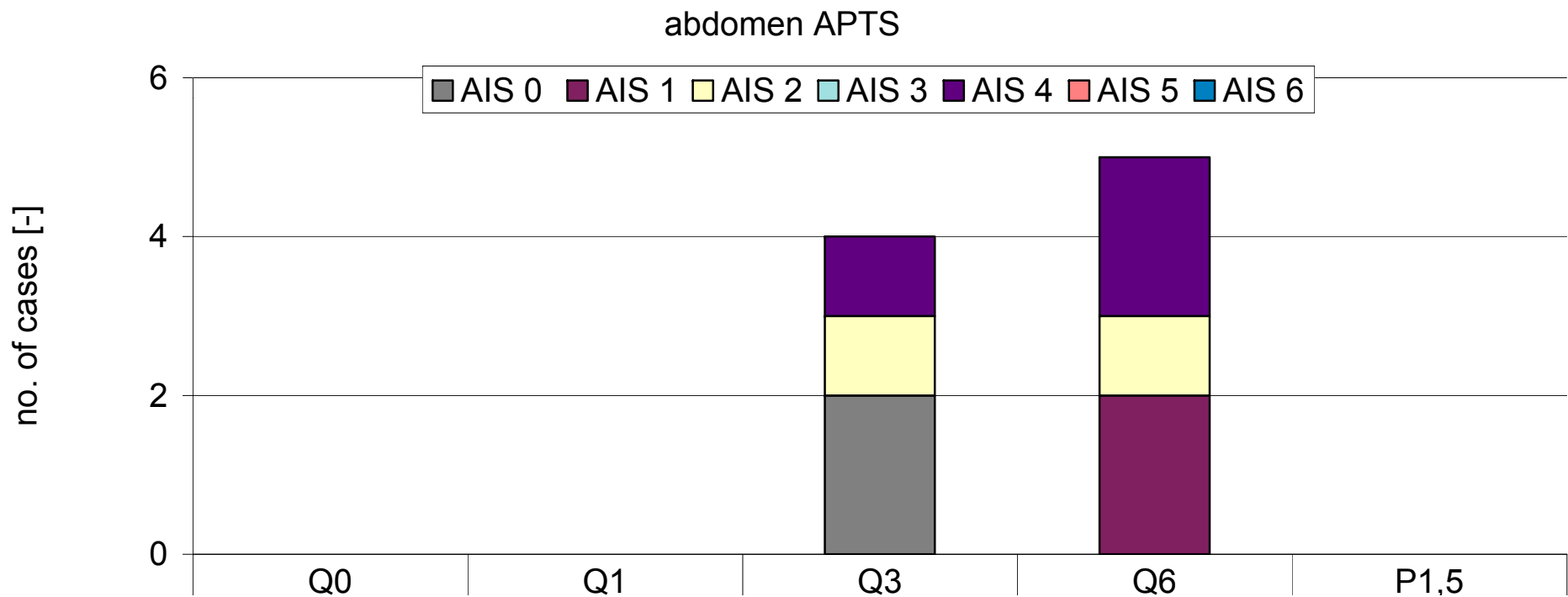
Data points from CHILD project



2. Available Results



Data points from CHILD project



3. CASPER Approach



Accident reconstructions

- Car occupants
- Pedestrians / Cyclists
 - criteria: injury pattern comparable with car occupants
- Domestic accidents
 - criteria: injury pattern comparable with car occupants

3. CASPER Approach



Accident reconstructions 2

- Tests
 - dummies
- Simulation
 - dummy models
 - human models

3. CASPER Approach



Validation of reconstructions

- Global
 - Car deformation / energy input ok?
- Dummy
 - Kinematics ok (e.g., head contact, submarining etc.)?
- Body region
 - Sensor ok?

3. CASPER Approach



Validation of reconstructions

- If validation not ok
 - repeat (e.g., if reconstruction globally not ok)
 - parametric studies by sled tests (e.g., if dummy kinematics in not ok)
 - simulation
 - not considered

3. CASPER Approach



Analysis

- Comparison of injury severity level and dummy readings
- Scaling of results towards Q3 (if scalable)
- Development of injury risk function using logistic regression

4. CASPER Priorities for Accident Selection



Frontal impact 1

- Head injuries without contact
 - head injuries with contact will be further analysed if cases are selected for other reasons
- Neck injuries in Q1, Q1.5 and Q3 in FF CRS
 - neck injury happen seldom in older children and in children using RF CRS

4. CASPER Priorities for Accident Selection



Frontal impact 2

- Chest injuries
 - injury pattern are different in younger and older children
 - younger children sustain mainly organ injuries without rib fracture
 - older children sustain chest injuries with and without injuries
 - Q1 and Q1.5: with and without injuries
 - Q6: with severe injuries

4. CASPER Priorities for Accident Selection



Frontal impact 3

- Abdomen injuries in Q3 and Q6
 - Abdominal injuries are mainly applicable for children using booster CRS
 - Q3 and Q6
 - both dummies can be equipped with abdominal sensors

4. CASPER Priorities for Accident Selection



Lateral impact

- Head injuries
 - head injuries are considered as the most important ones for lateral impact test procedures
 - head injuries are considered as a start for lateral impact injury criteria

4. CASPER Priorities for Accident Selection



Scaling of reco results towards Q3

	Q0	Q1	Q1.5	Q3 (harness)	Q3 (booster)	Q6
Head a_{3ms}	0.95	1.12	1.07	1	1	0.91
HIC	1.49	1.59	1.35	1	1	0.72
Neck F	RF	to be specified			1	0.74
Neck M	RF	to be specified			1	0.67
Chest DS	n/a	to be specified			to be specified	
Chest VC	n/a	to be specified			to be specified	
Abdomen	n/a	n/a	n/a	n/a	1	1

4. CASPER Priorities for Accident Selection



Example case car occupant (1)

- Accident
 - Mini van hit tree (frontal impact)
 - Adults in front seats with minor injuries
 - Children
 - 1 YO FF Group 1 seat, rear left: died from severe head and neck injuries
 - 3 YO FF Group 1, 2, 3 seat rear right: minor head injuries

4. CASPER Priorities for Accident Selection



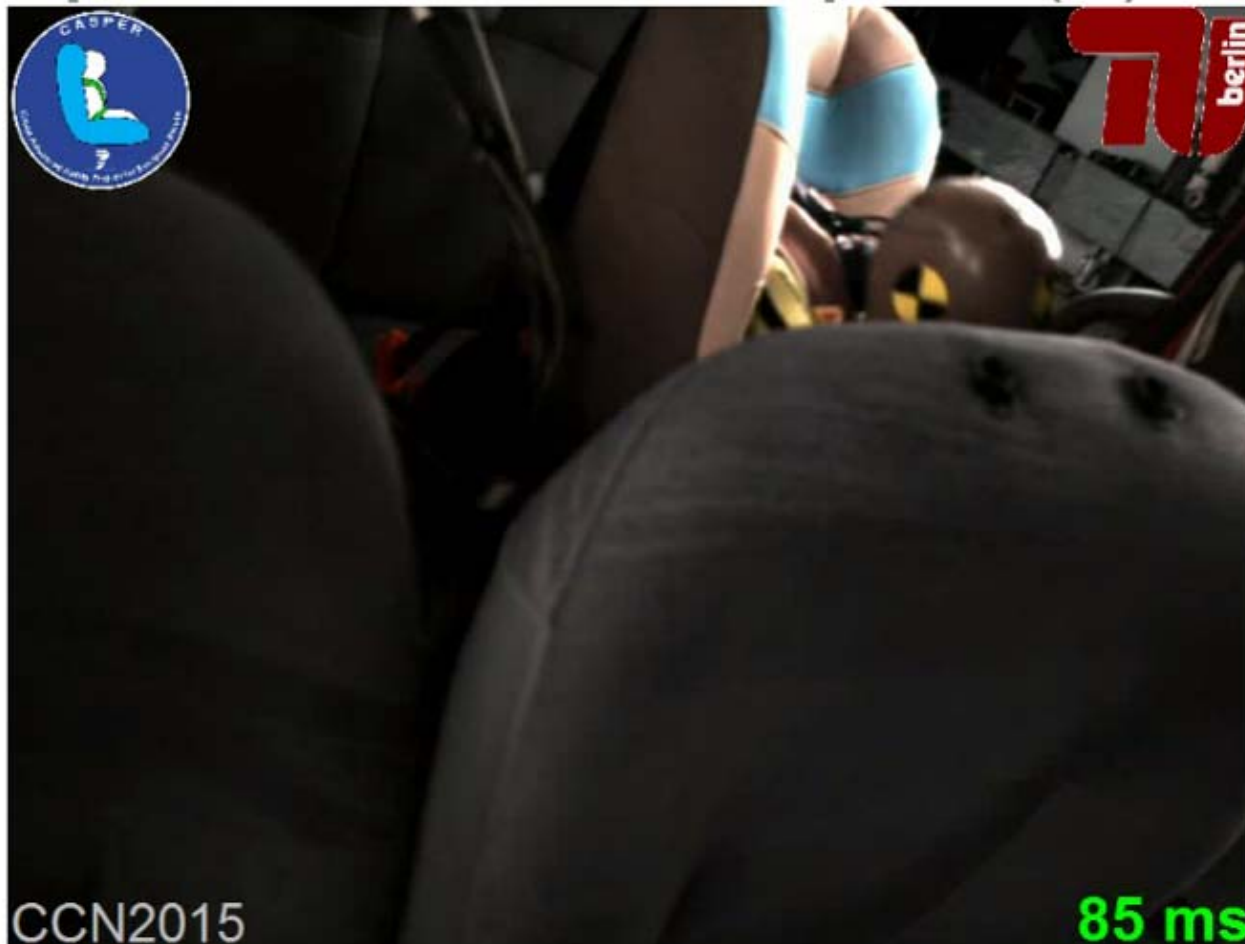
Example case car occupant (2)



4. CASPER Priorities for Accident Selection



Example case car occupant (3)



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4. CASPER Priorities for Accident Selection



Example case car occupant (4)

- Validation (first analysis not yet completed)
 - Car deformation and energy input seems to be ok
 - Q1 dummy
 - seems to be ok
 - Q3 dummy
 - hard head impact occurred in reconstruction while it unlikely happened in accident

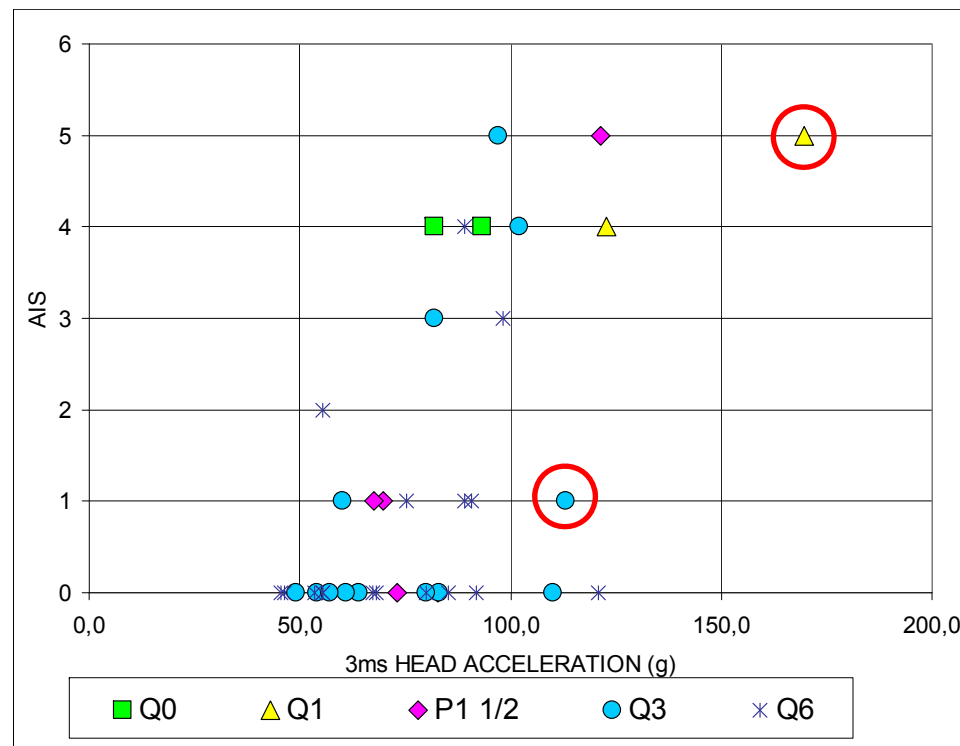
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4. CASPER Priorities for Accident Selection



Example case car occupant (5)

- Contribution to injury risk functions

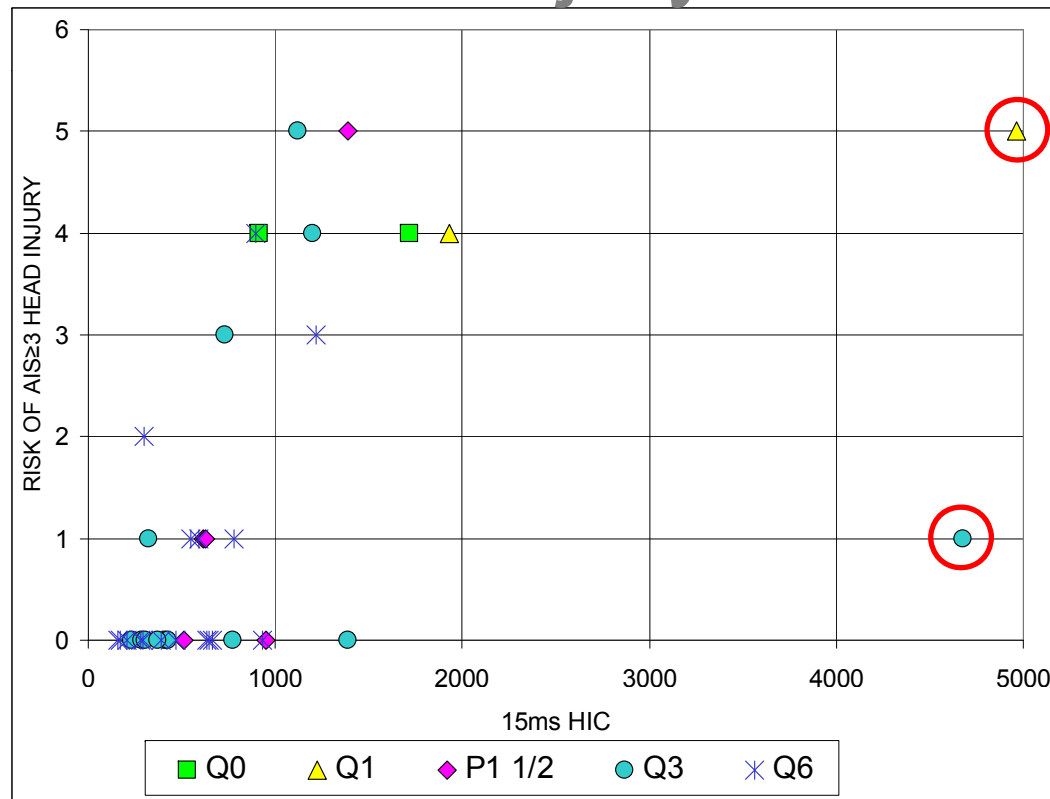


4. CASPER Priorities for Accident Selection



Example case car occupant (6)

- Contribution to injury risk functions

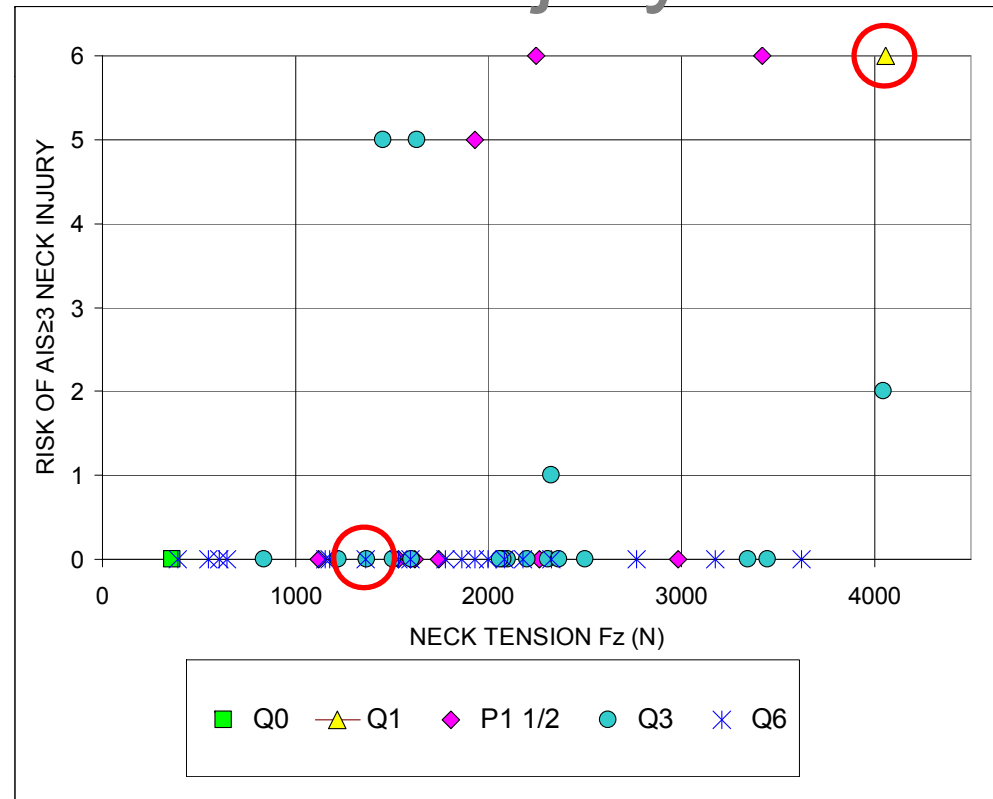


4. CASPER Priorities for Accident Selection



Example case car occupant (7)

- Contribution to injury risk functions





Questions?

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