

More Lives Saved



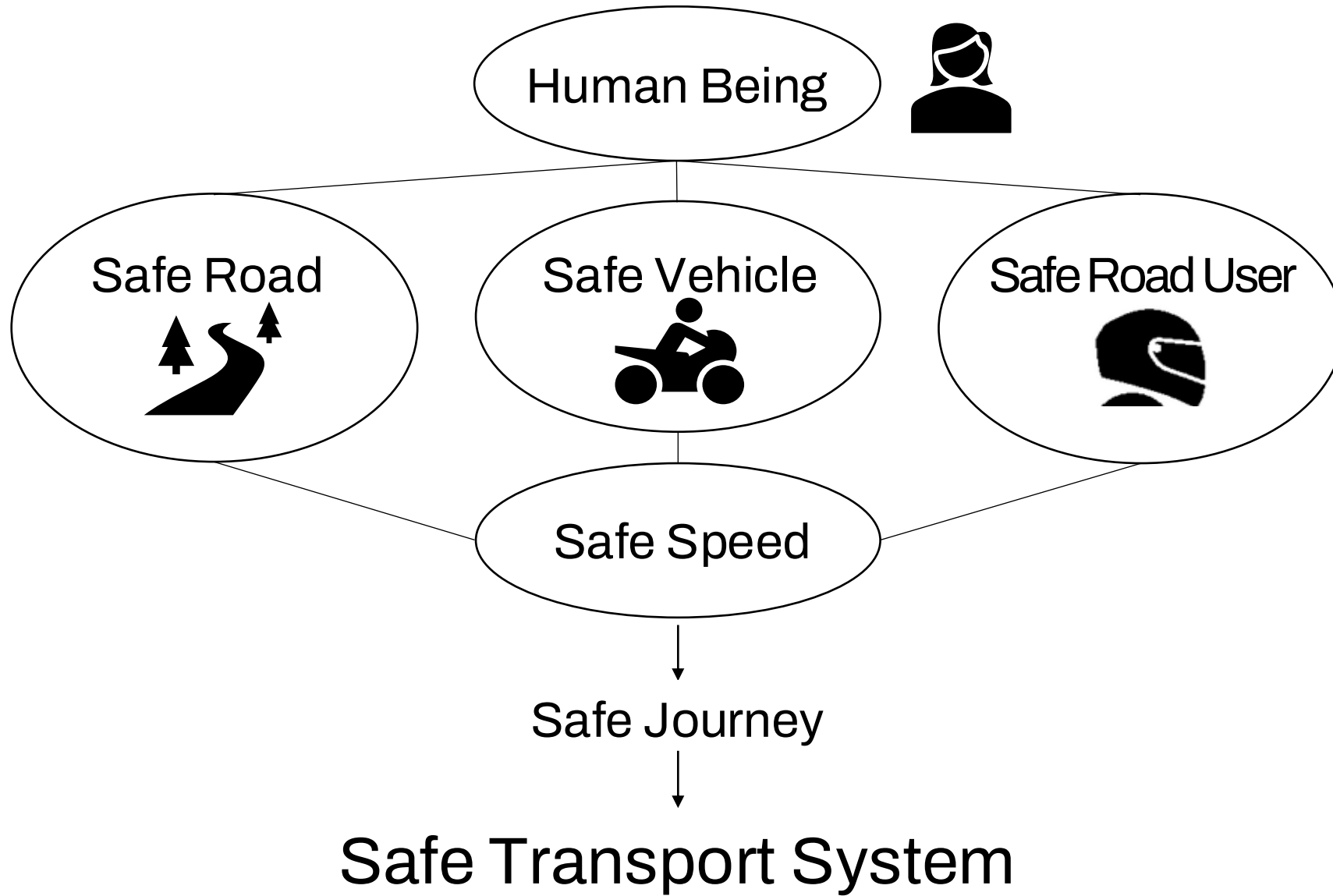
More Life Lived



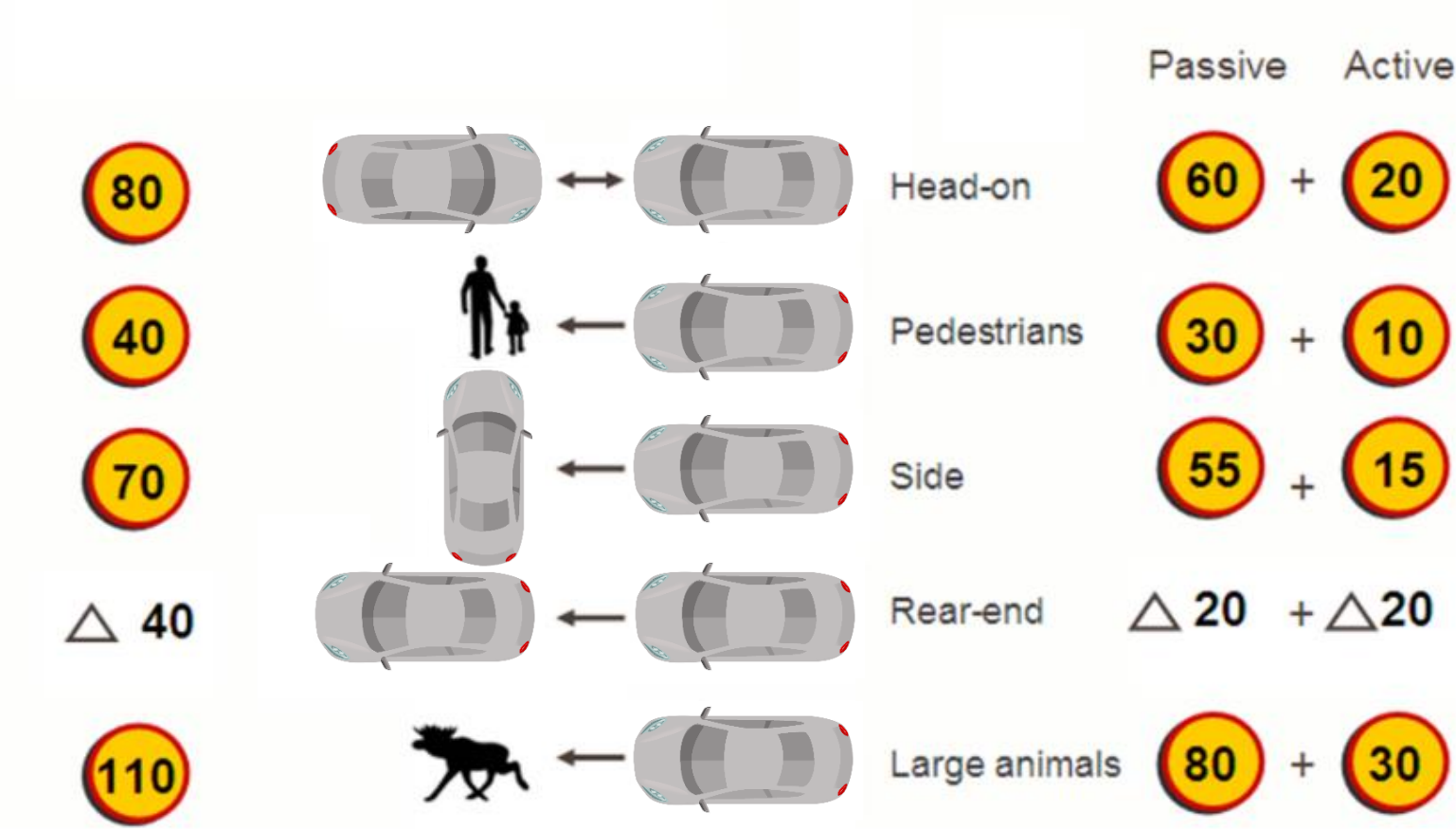
Injury risk curves from field data to inform safe speeds: Latest results and methodological advances

Dr Nils Lübke

Senior Director of Research at Autoliv
Adjunct Professor at Chalmers University of Technology

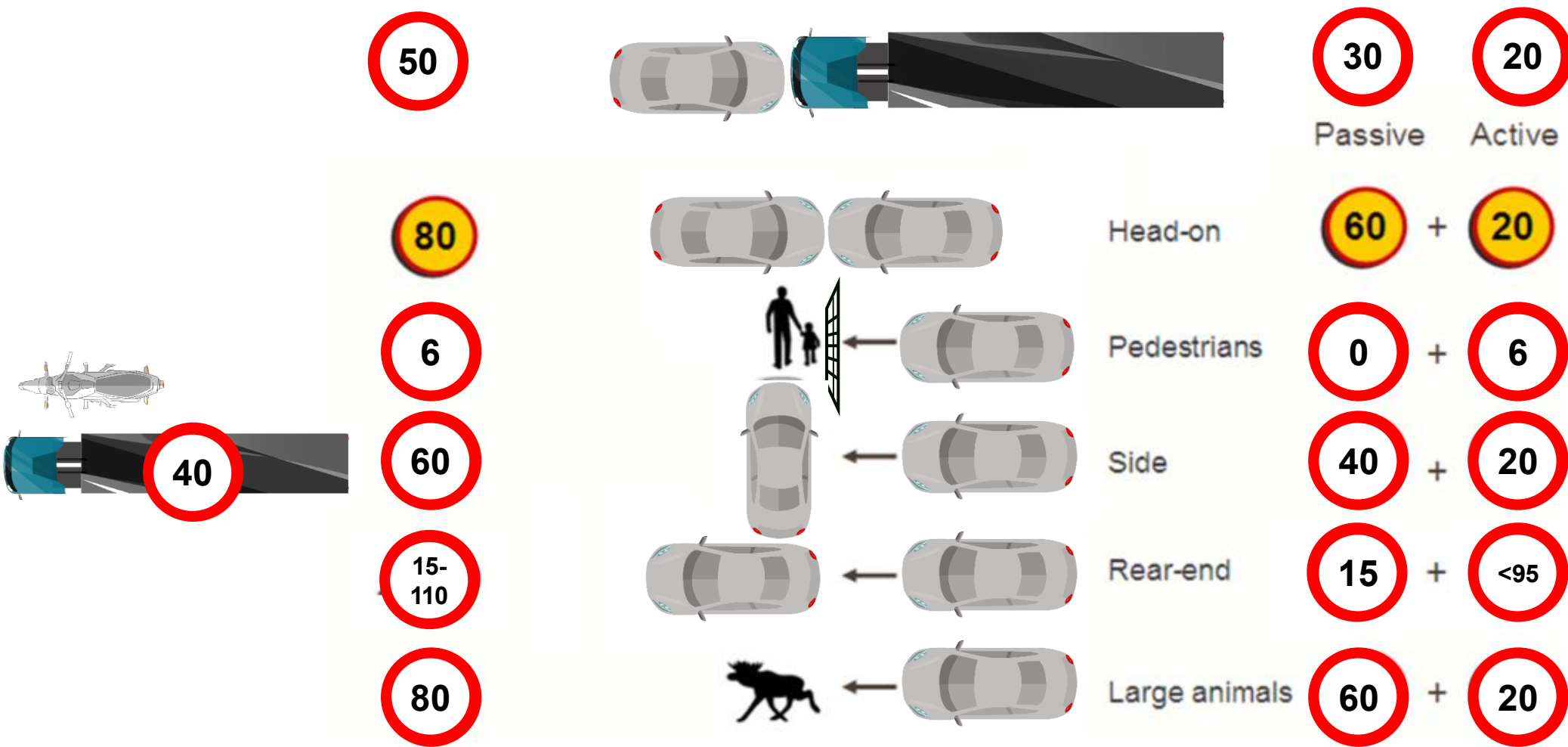


Safe speeds (2011)



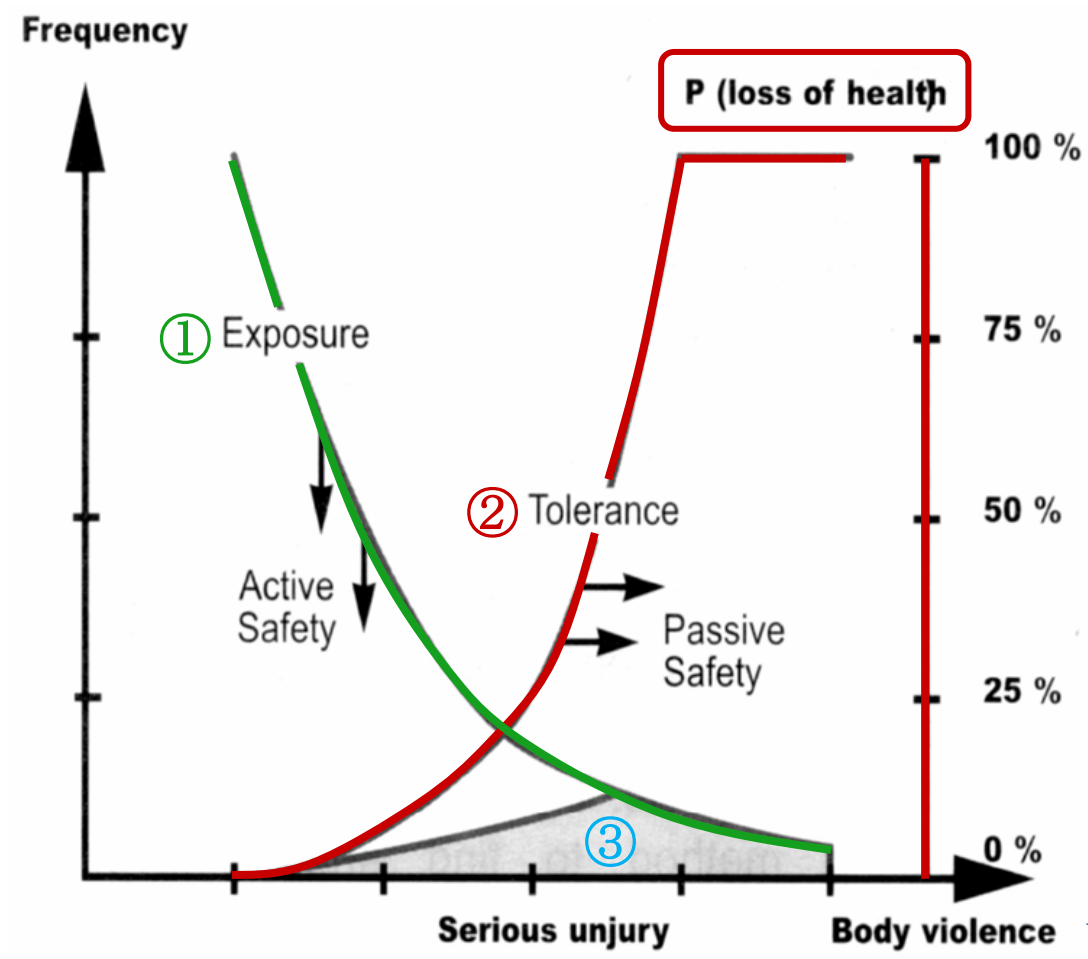
Eugensson et al. Cars are Driven on Roads, Joint Visions and Modern Technologies Stress the Need for Co-operation. ESV conference 2011

Safe speeds 2030



Matteo Rizzi, Ola Boström, Rikard Fredriksson, Anders Kullgren, Nils Lubbe, Johan Strandroth, Claes Tingvall. PROPOSED SPEED LIMITS FOR THE 2030 MOTOR VEHICLE. ESV Conference 2023

Human Tolerance expressed as Injury Risk Curve



ISO 12353-2 Guidelines for the use of impact severity measures

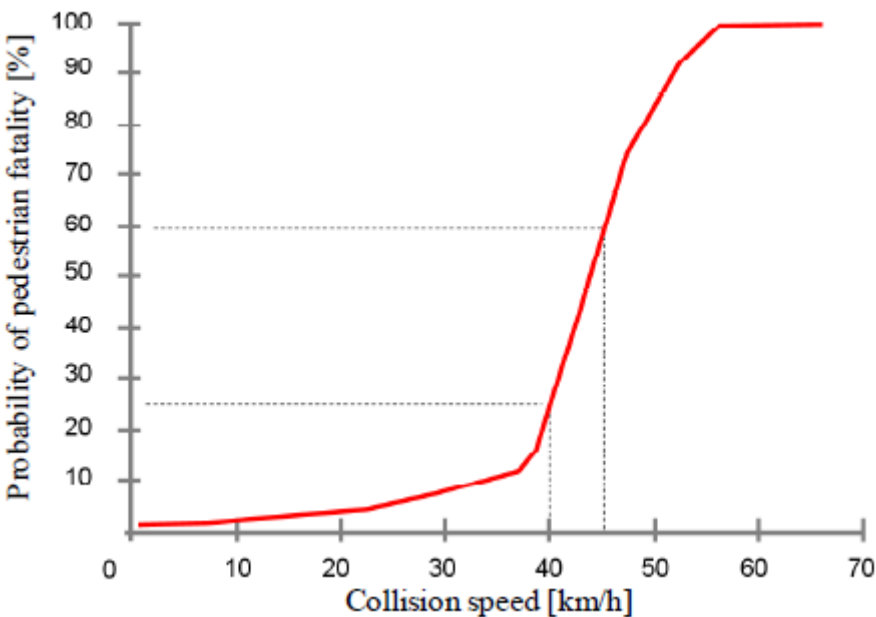
Rumar (1999) <https://archive.etsc.eu/documents/etsl1.pdf>

How to create an Injury Risk Function $P(\text{loss of health})$?

- Logistic regression
 - Not necessarily monotonously increasing
 - Fits logistic function to data
 - Can extend to piecewise cubic polynomials
 - No reflection of data censoring
- Survival analysis
 - Non-parametric and parametric
 - Data censoring is reflected
 - Goes through 0/0 and increasing with load
 - Commonly used in biomechanics (ISO/TS 18506)
- Both can model several predictors (e.g., speed and age)
- Understanding sampling bias is key!



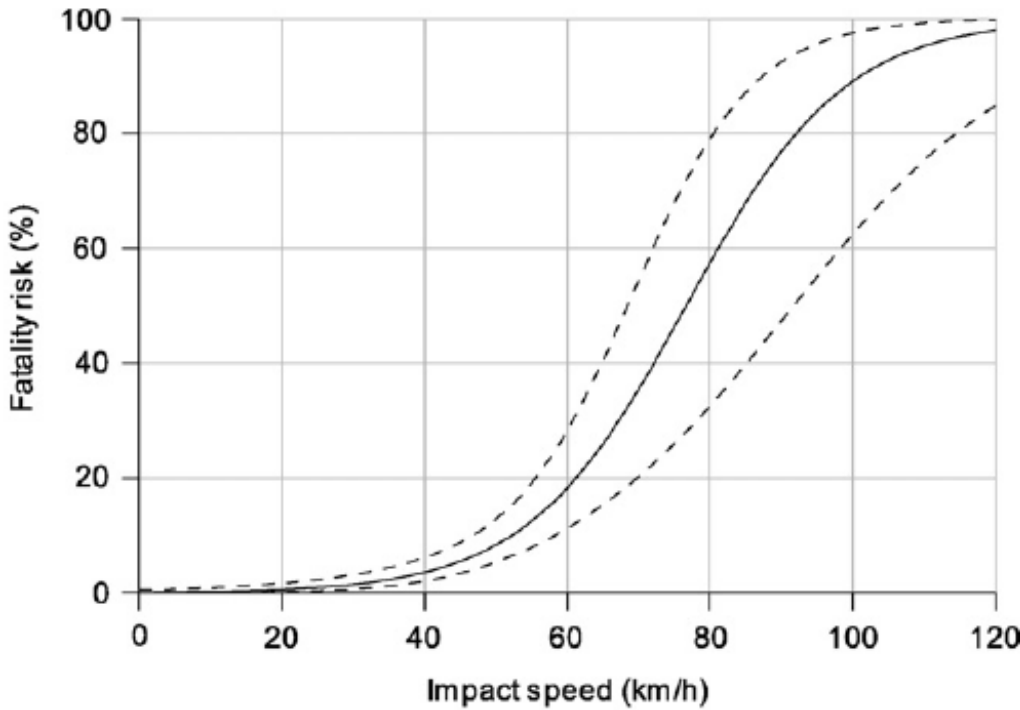
Any good? Sample bias & weighting



Andersson et al. (1995)

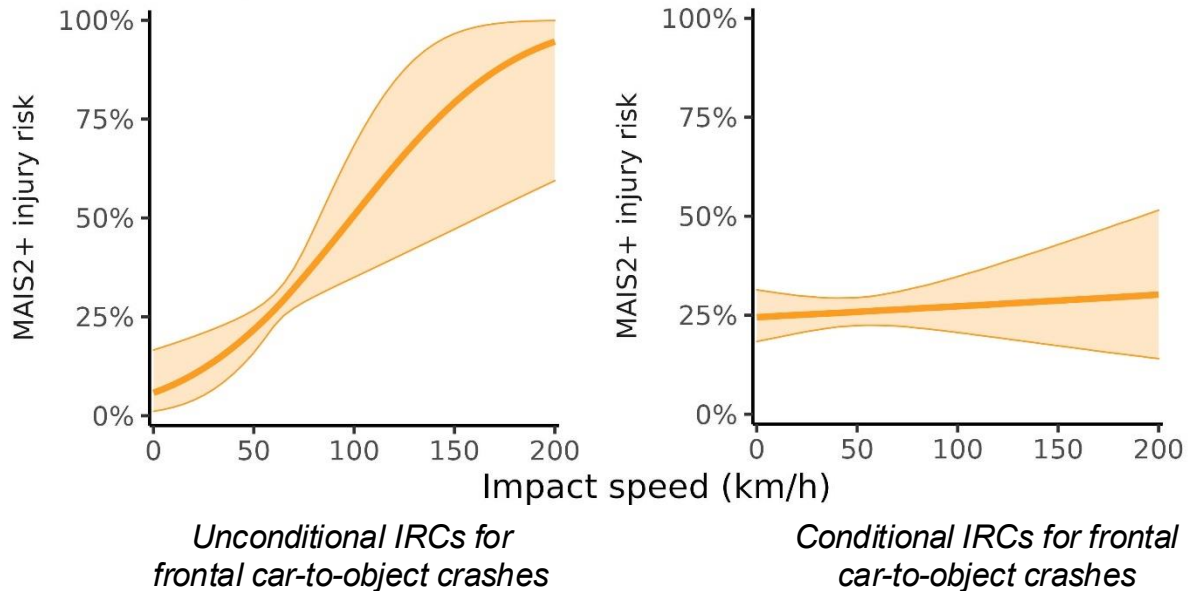
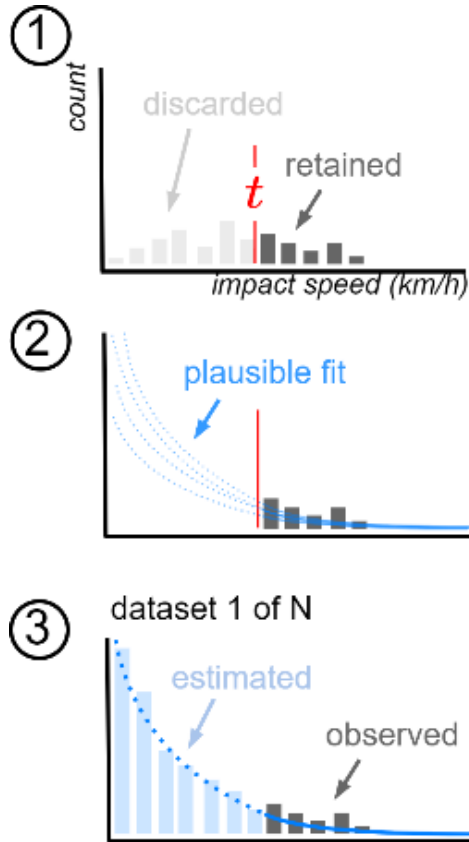
Distributions of pedestrian injury severities.

	Slight	Severe	Fatal
National (2003–2007)	70.9%	27.0%	2.2%
Total GIDAS	53.2%	42.1%	4.7%
Final sample	44.4%	48.2%	7.3%



Rosen & Sander (2009)

Sample bias: weighting for the unknown (almost magic)



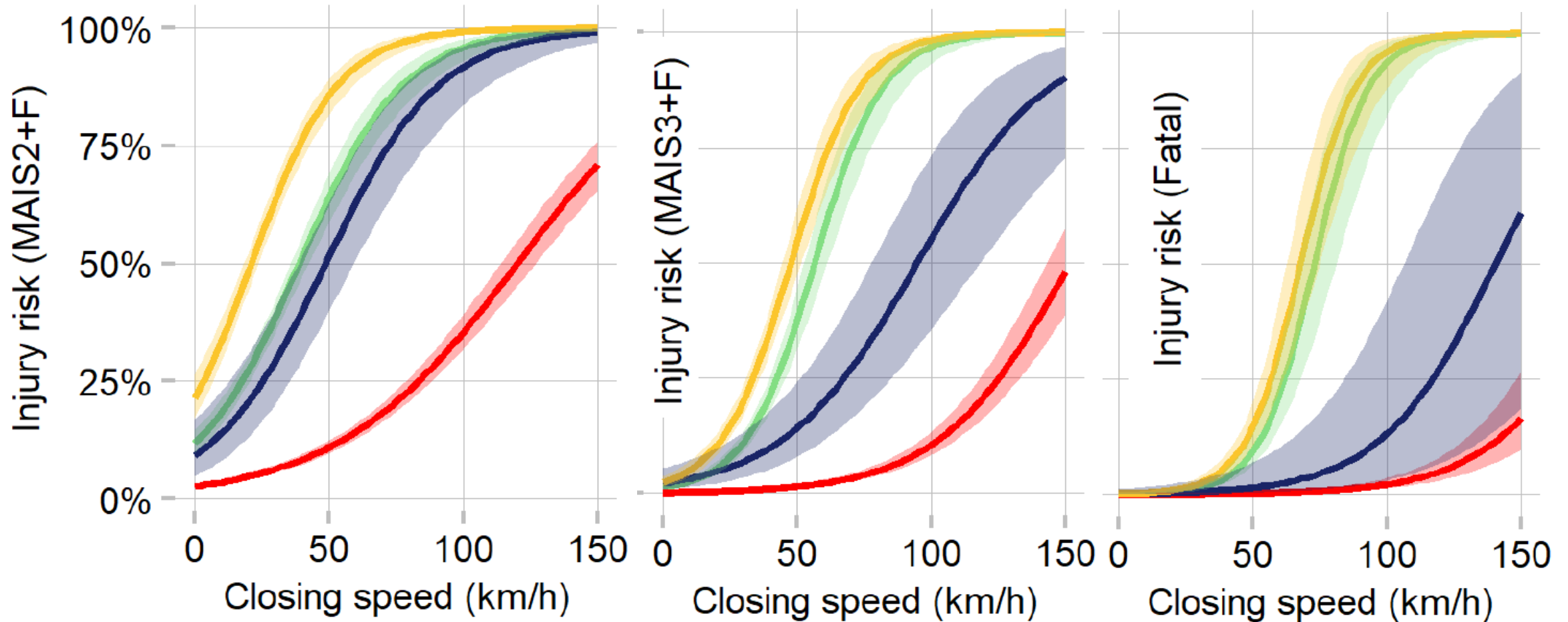
Lubbe, Nils and Jeppsson, Hanna and Sternlund, Simon and Morando, Alberto, Injury Risk Curves to Guide Safe Speed Limits on Swedish Roads Using German Crash Data Supplemented with Estimated Non-Injury Crashes. Accident Analysis & Prevention. <https://doi.org/10.1016/j.aap.2024.107586>
Morando, Alberto (preprint) Method for recovering data on unreported low-severity crashes <https://doi.org/10.48550/arXiv.2503.04529>

Risk for different road users

at age 65, when impacting the front of a passenger car

RoadUser

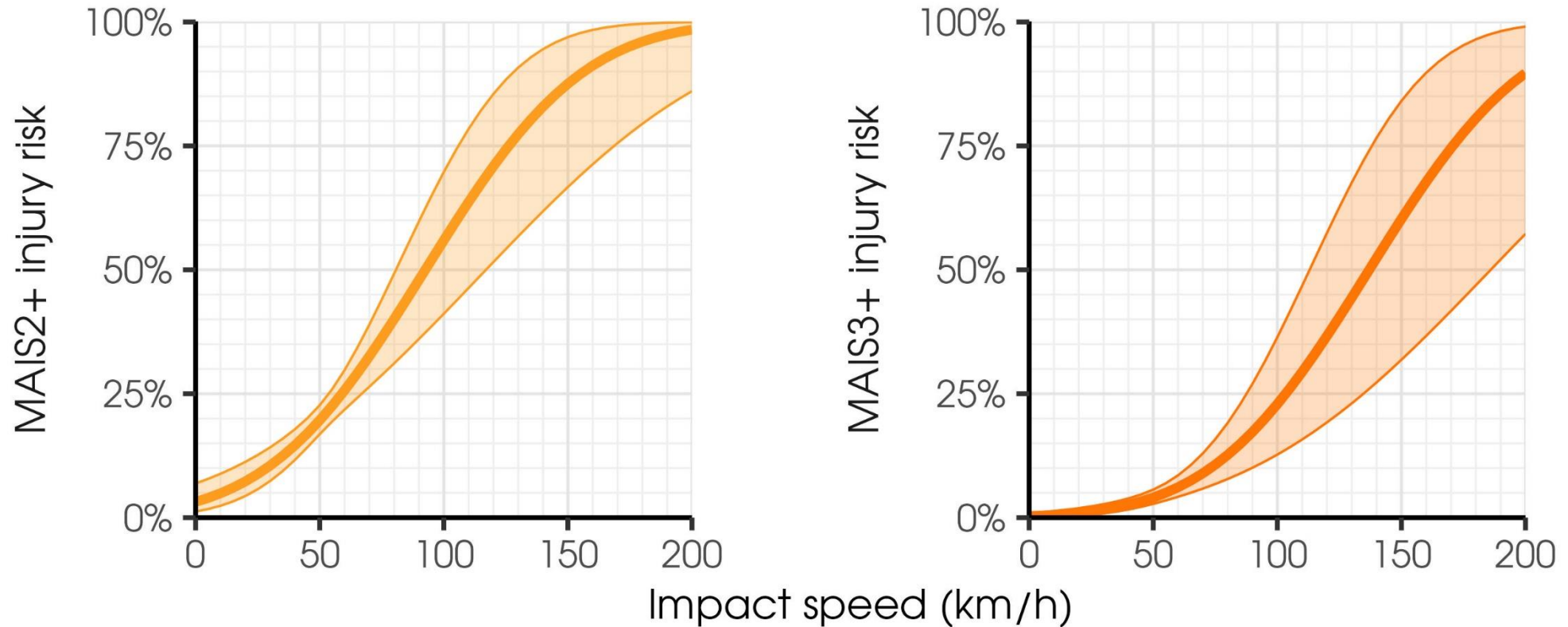
- Pedestrian
- Cyclist
- MC
- Driver



Lubbe, N., Wu, Y., & Jeppsson, H. (2022). Safe speeds: fatality and injury risks of pedestrians, cyclists, motorcyclists, and car drivers impacting the front of another passenger car as a function of closing speed and age. Traffic Safety Research, 2, 000006. <https://doi.org/10.55329/vfma7555a>

Risk for different drivers in different crash types

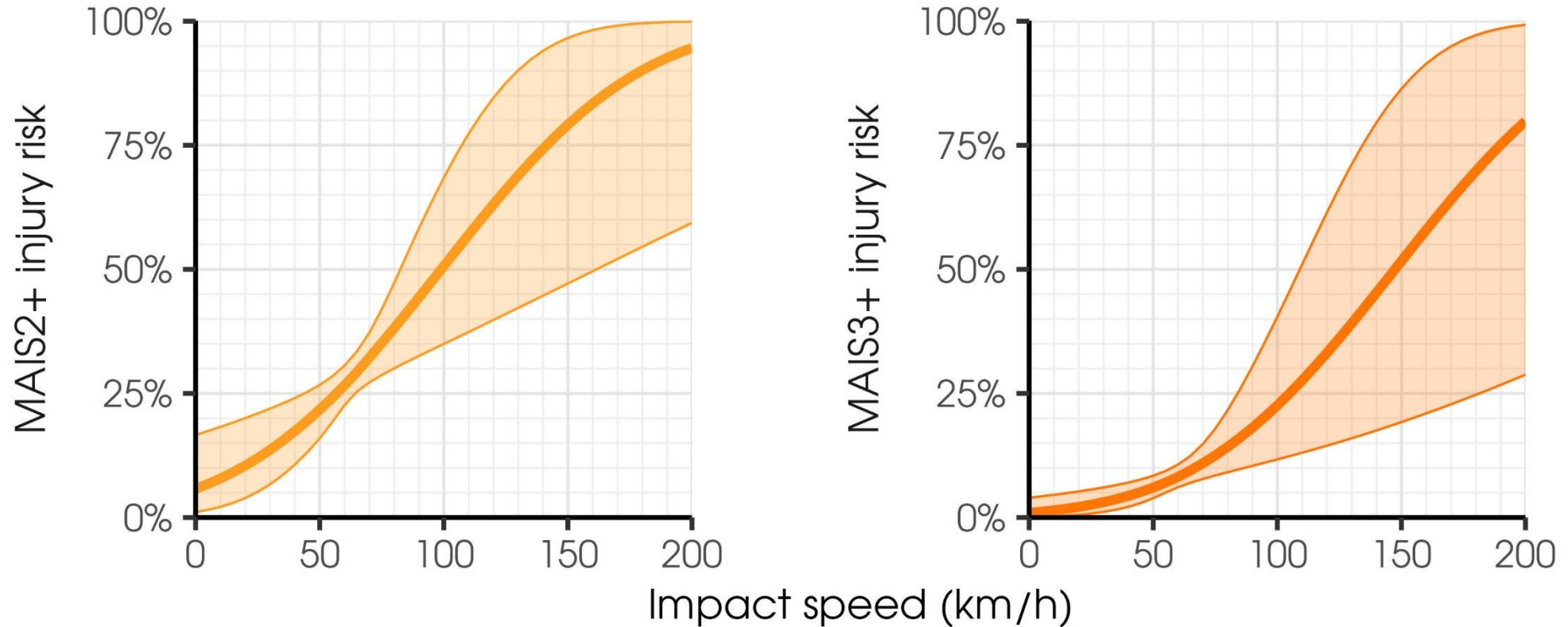
car-to-car head on



Nils Lubbe, Hanna Jeppsson, Simon Sternlund, Alberto Morando,
Injury risk curves to guide safe speed limits on Swedish roads using German crash data supplemented with estimated non-injury crashes,
Accident Analysis & Prevention, Volume 202, 2024, <https://doi.org/10.1016/j.aap.2024.107586>.

Risk for different drivers in different crash types

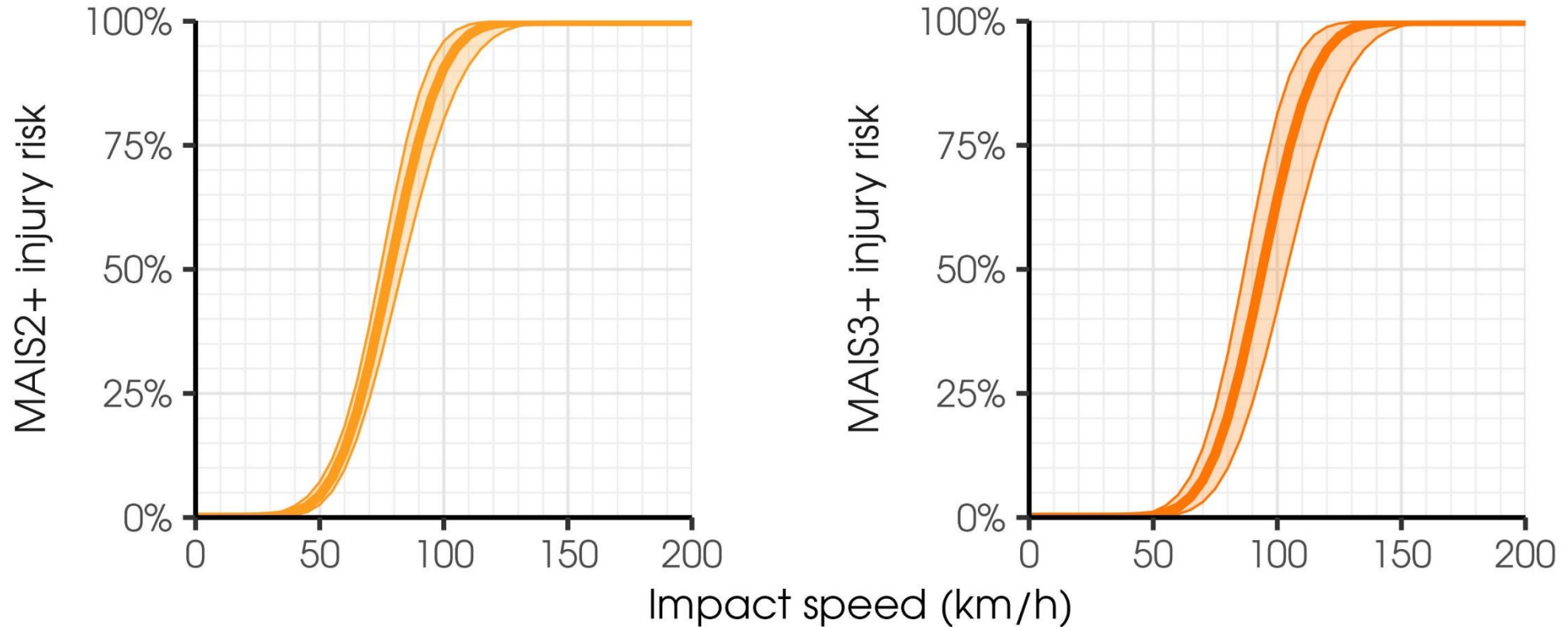
car-to-object (frontal)



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Injury risk curves to guide safe speed limits on Swedish roads using German crash data supplemented with estimated non-injury crashes,
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Risk for different drivers in different crash types

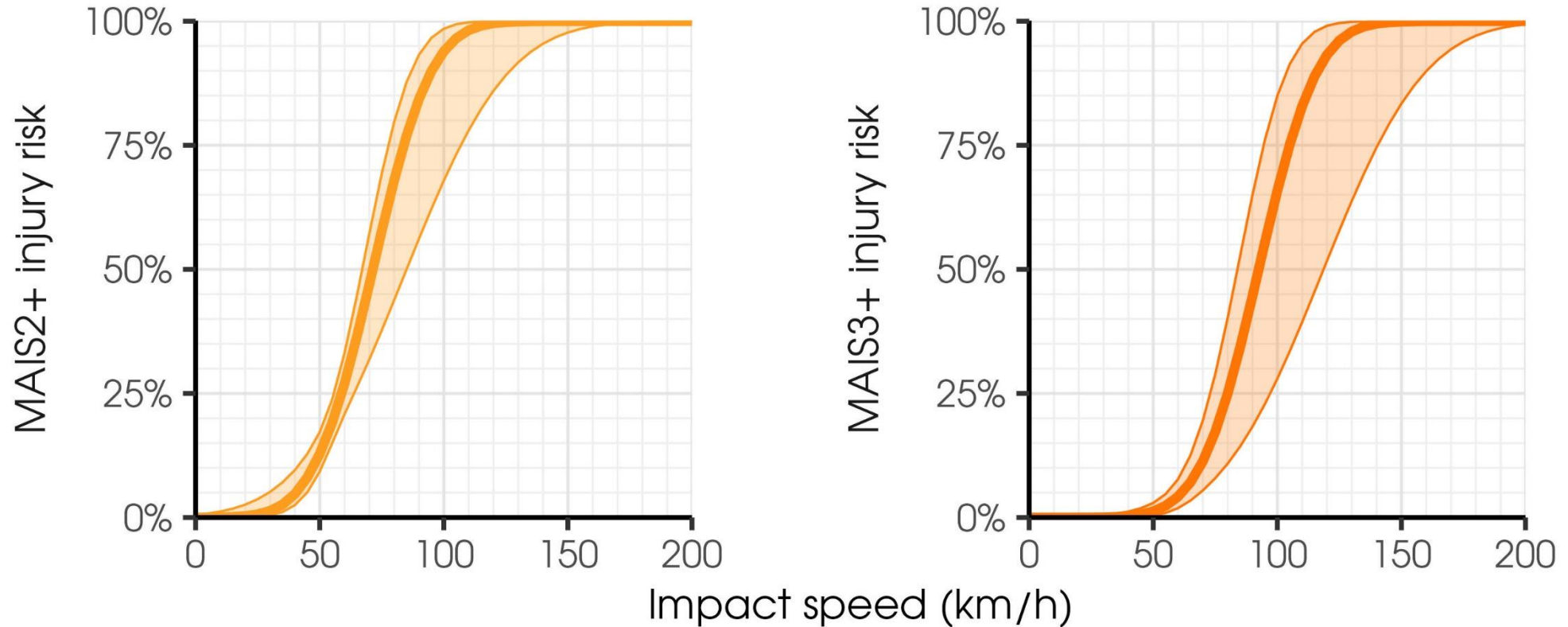
car-to-car far side



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Risk for different drivers in different crash types

car-to-car near side

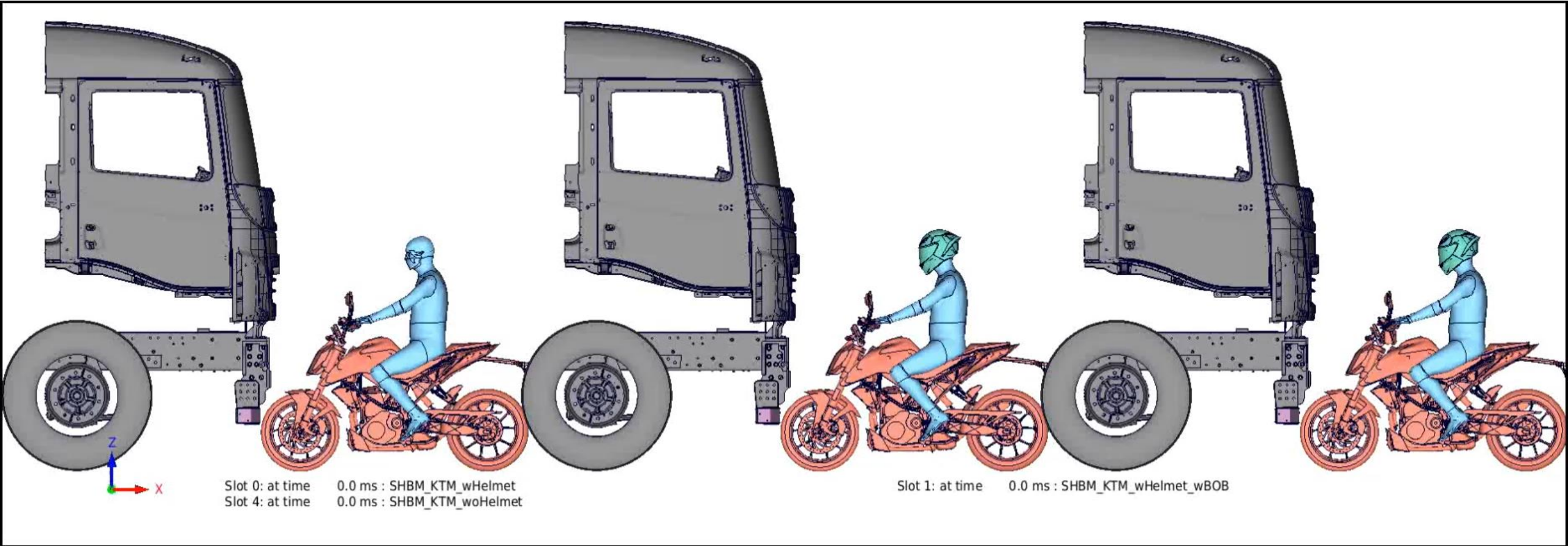
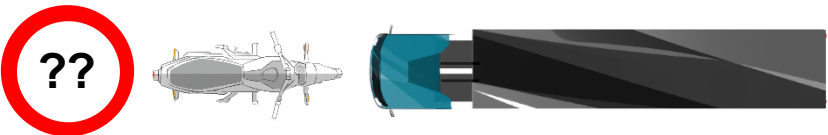


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Autoliv

Boundary conditions: PTW-truck head-on common in India



Want to know more about human tolerance?

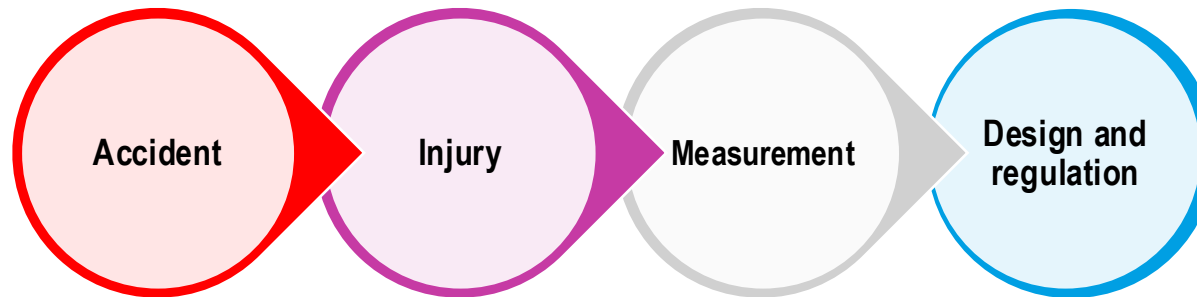
IRCOBI Academy: Biomechanics lecture series

2-4 November 2026 at KMUTNB, Bangkok, Thailand



From Injury Biomechanics to Safer Vehicle Design

Bridging Accident Data, Biomechanics, Simulation, and Safety Regulations



Speakers (tentative, subject to change)

- Prof. Matthew B. Panzer, University of Virginia, Center for Applied Biomechanics
- Assoc. Prof. Dr. Bronislaw Gepner, University of Virginia, Center for Applied Biomechanics
- Assist. Prof. Dr. Yun Seok Kang, Ohio State University, Injury Biomechanics Research Laboratory
- Dr. Valentina Graci, Children's Hospital of Philadelphia and Drexel University
- Dr. Nils Lubbe, Autoliv and Chalmers University of Technology
- Prof. Dr. Shaw Voon Wong, Chairman of the Board of Directors, MIROS, and Professor at University Putra Malaysia
- Assoc. Prof. Dr. Julaluk Carmai, King Mongkut's University of Technology North Bangkok

2 November

Accident context and
fundamentals of injury
biomechanics

3 November

Injury mechanisms and
biomechanical
assessment methods

4 November

Application to vehicle
safety

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Saving More Lives

Contact: nils.lubbe@autoliv.com

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