# Development of an Injury Risk Curve for Child Pedestrians in the U.S.

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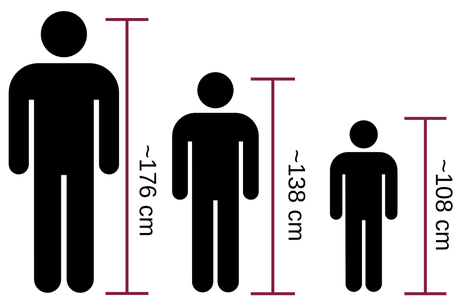
## Background

- In 2017, 214 children under the age of 15 were fatally struck in vehicle-pedestrian collisions.
- Children interact with vehicles differently than adults due to their smaller stature and differing biomechanics [1].




Average U.S. Adult Male | Average U.S. 10 year old | Average U.S. 5 year old

Toyota Camry
#7 most common vehicle in the US
Roof Height = 4'9"

Ford F150
#1 most common vehicle in the US
Roof Height = 6'3"

The objective of this study is to develop an injury risk curve for children using U.S. vehicle-pedestrian crash data.

## Data Sources

1. Pedestrian Crash Data Study (PCDS)
   → Collected by NHTSA from 1994-1998
   → Contains detailed injury information (AIS-90) and impact speeds
   → Children defined as less than 15 years old (n = 92)
   → 23 had an MAIS 3+F injury
   → 47 had MAIS 2+F injury

2. General Estimates System (GES)
   → used to weight PCDS data by injury prevalence

## Methods

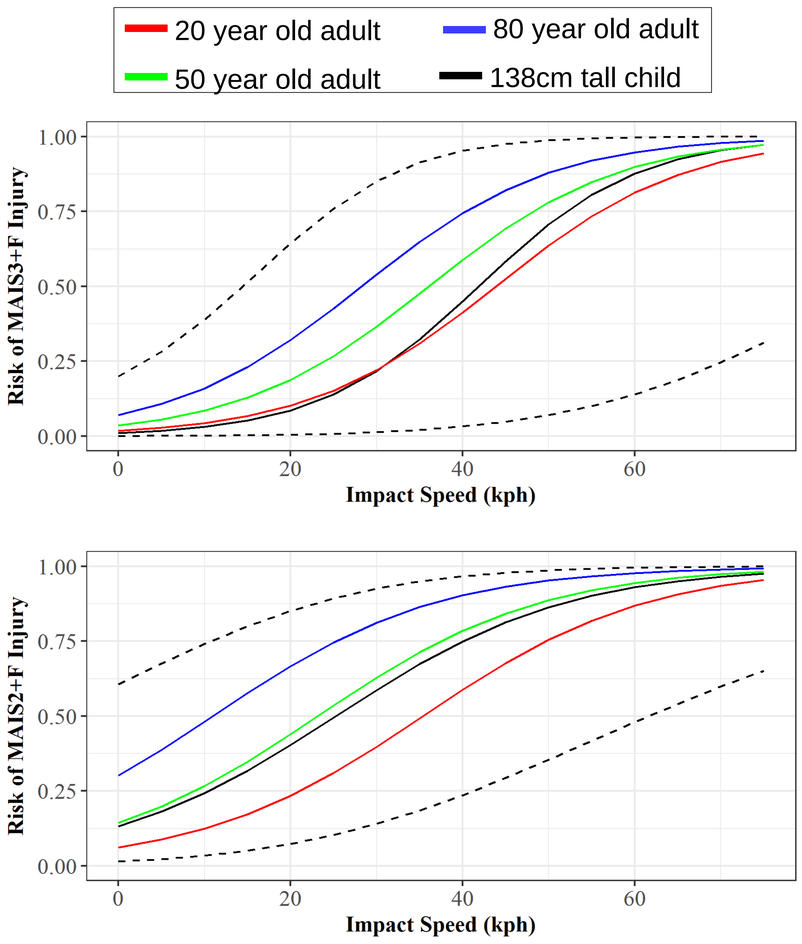
Fit data with a logistic model:

$$P_{MAIS3+F}(v, height) = \frac{1}{1+\exp(-A_{MAIS3+F} - B_{MAIS3+F} * v - C_{MAIS3+F} * height)} \quad (1)$$

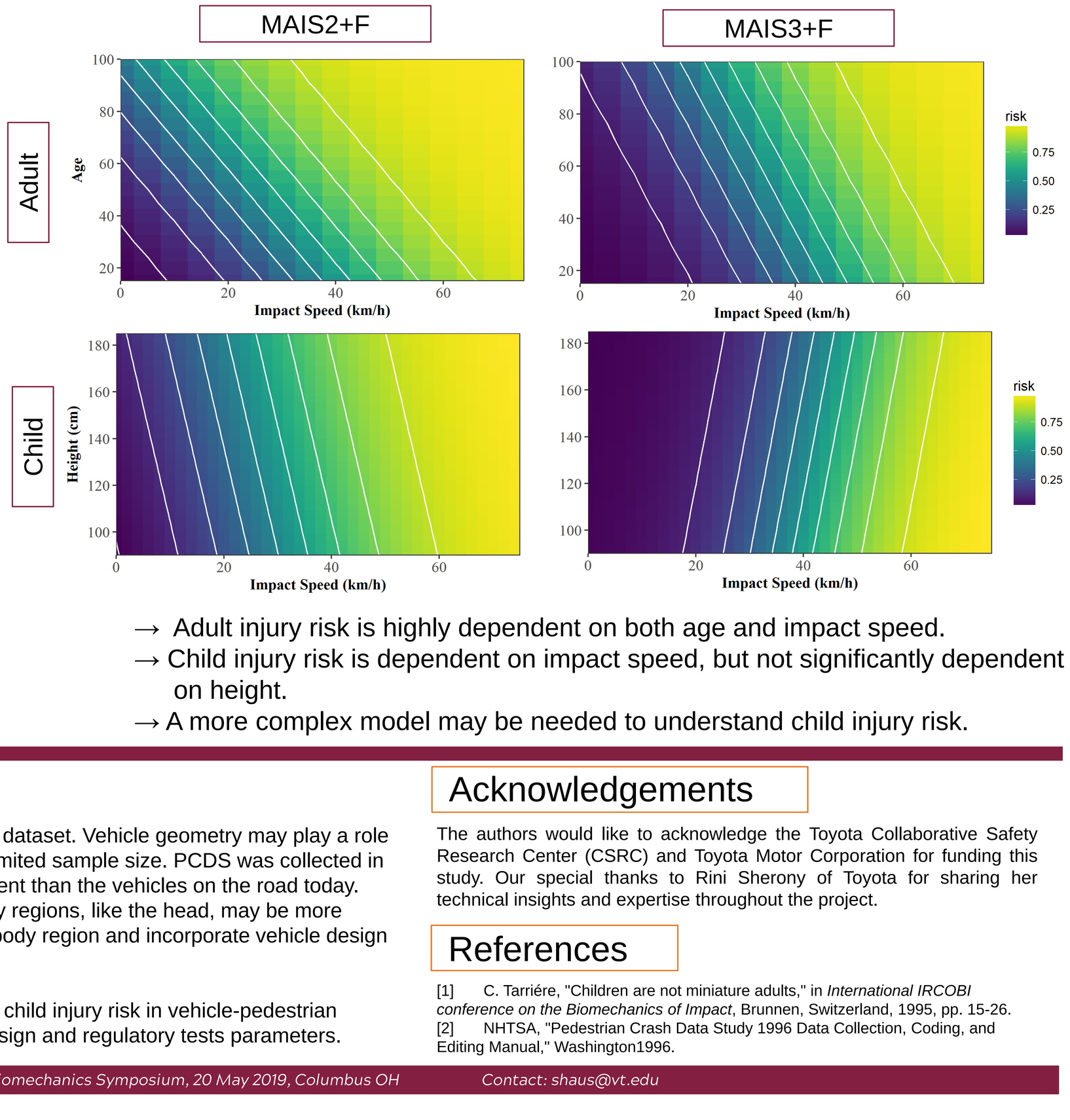
$$P_{MAIS2+F}(v, height) = \frac{1}{1+\exp(-A_{MAIS2+F} - B_{MAIS2+F} * v - C_{MAIS2+F} * height)} \quad (2)$$

| | A | B | C |
|---|---|---|---|
| MAIS3+F Injury Risk | -3.382 | 0.1069 | -0.007984 |
| MAIS2+F Injury Risk | -2.919 | 0.07438 | -0.007533 |

## Results




*Dashed lines correspond to 95% confidence interval for child




→ Adult injury risk is highly dependent on both age and impact speed.
→ Child injury risk is dependent on impact speed, but not significantly dependent on height.
→ A more complex model may be needed to understand child injury risk.

## Conclusions

This study was limited by the small sample size and age of the dataset. Vehicle geometry may play a role in injury severity, but that analysis could not be done with the limited sample size. PCDS was collected in the 1990s which means that the vehicles in the study are different than the vehicles on the road today. Due to the height difference of children, injuries to specific body regions, like the head, may be more common. In the future, we would like to create risk curves by body region and incorporate vehicle design in the model.

Despite these limitations, these curves provide an early look at child injury risk in vehicle-pedestrian collisions and may help inform pedestrian cognizant vehicle design and regulatory tests parameters.

## Acknowledgements

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## References

[1] C. Tarriére, "Children are not miniature adults," in *International IRCOBI conference on the Biomechanics of Impact*, Brunnen, Switzerland, 1995, pp. 15-26.
[2] NHTSA, "Pedestrian Crash Data Study 1996 Data Collection, Coding, and Editing Manual," Washington1996.

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