Statistical Forecasting of Traffic-Related Pedestrian Fatalities in the United States

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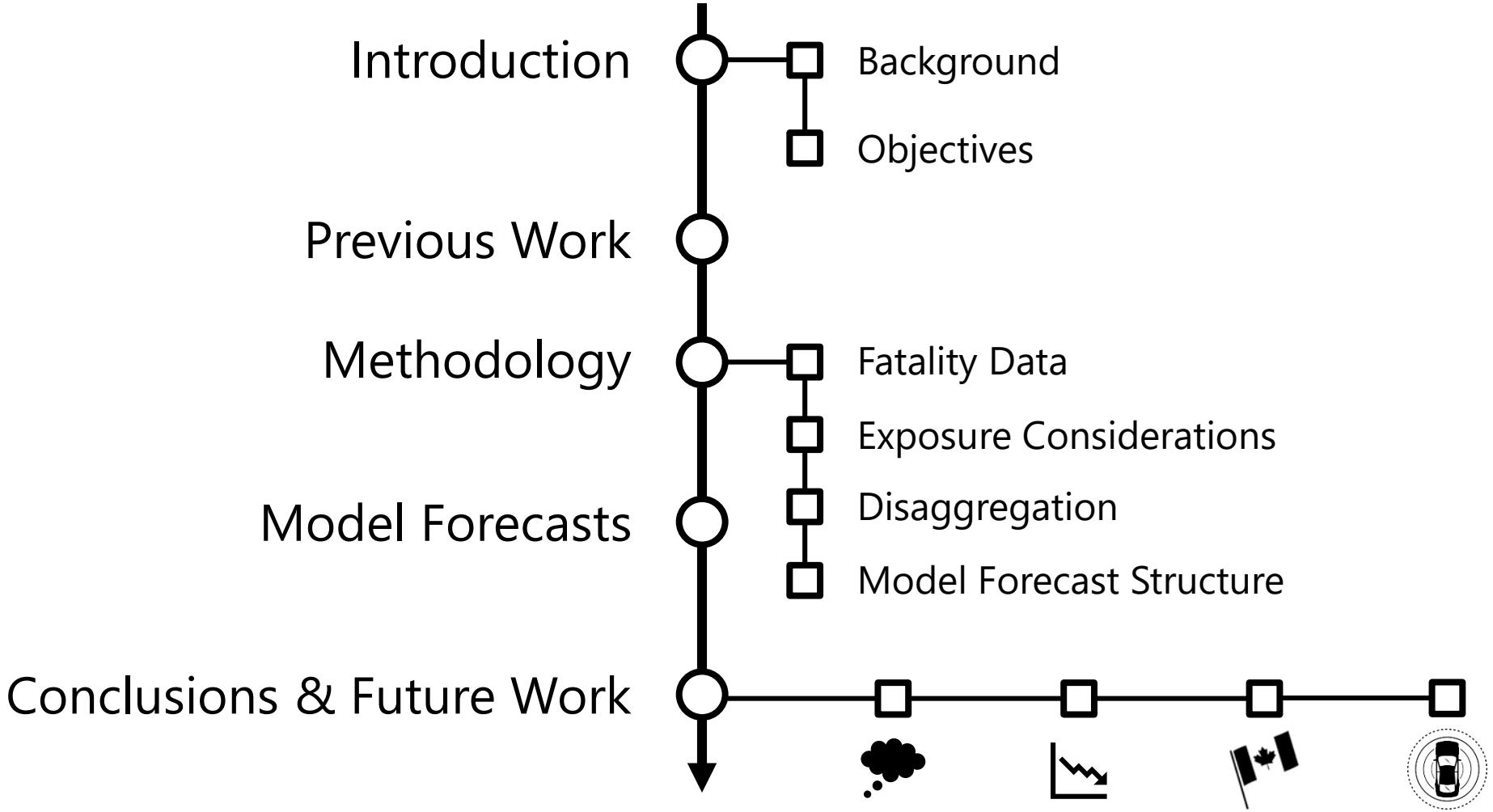
Overview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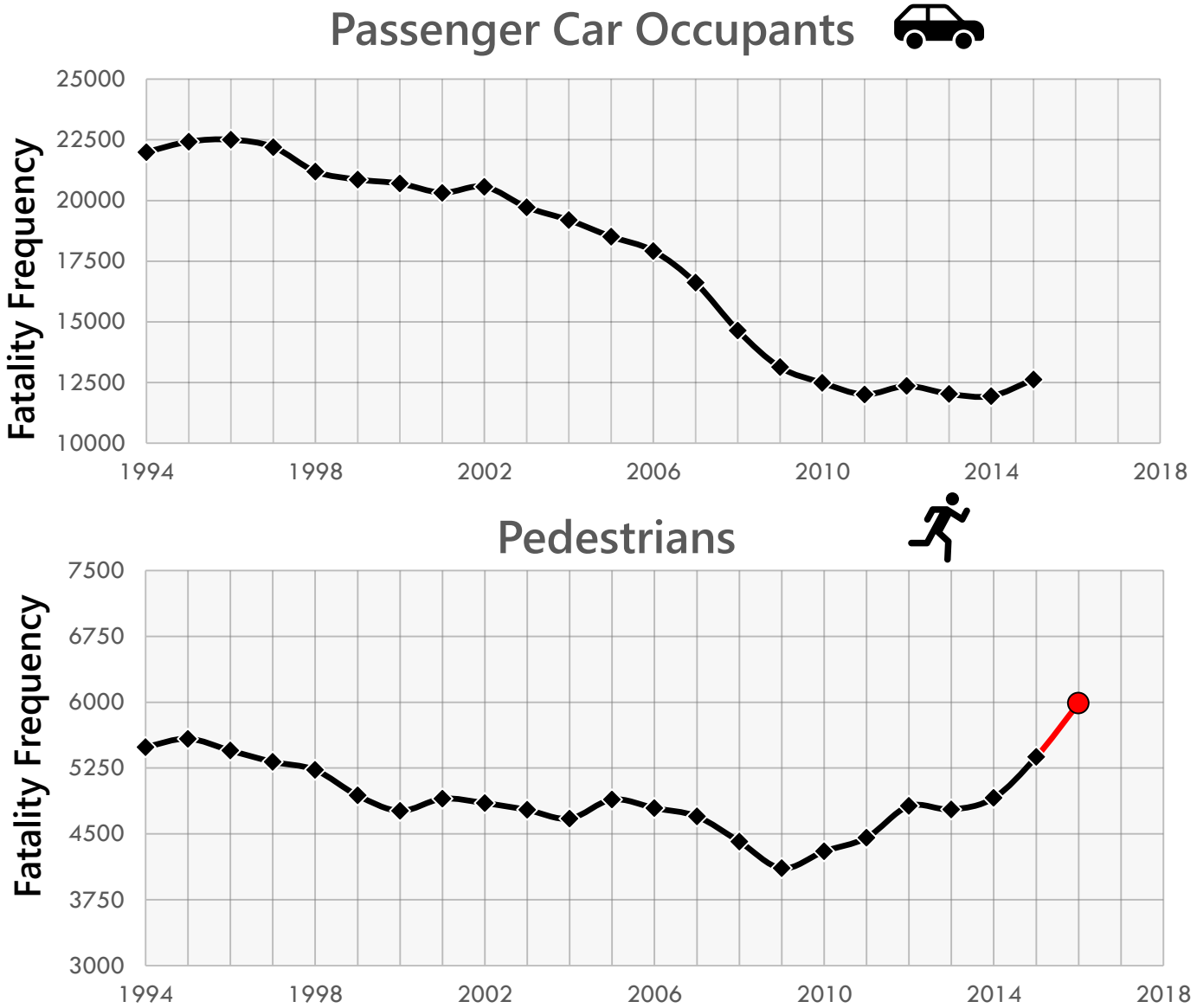
Pedestrians are the most vulnerable of all road users.



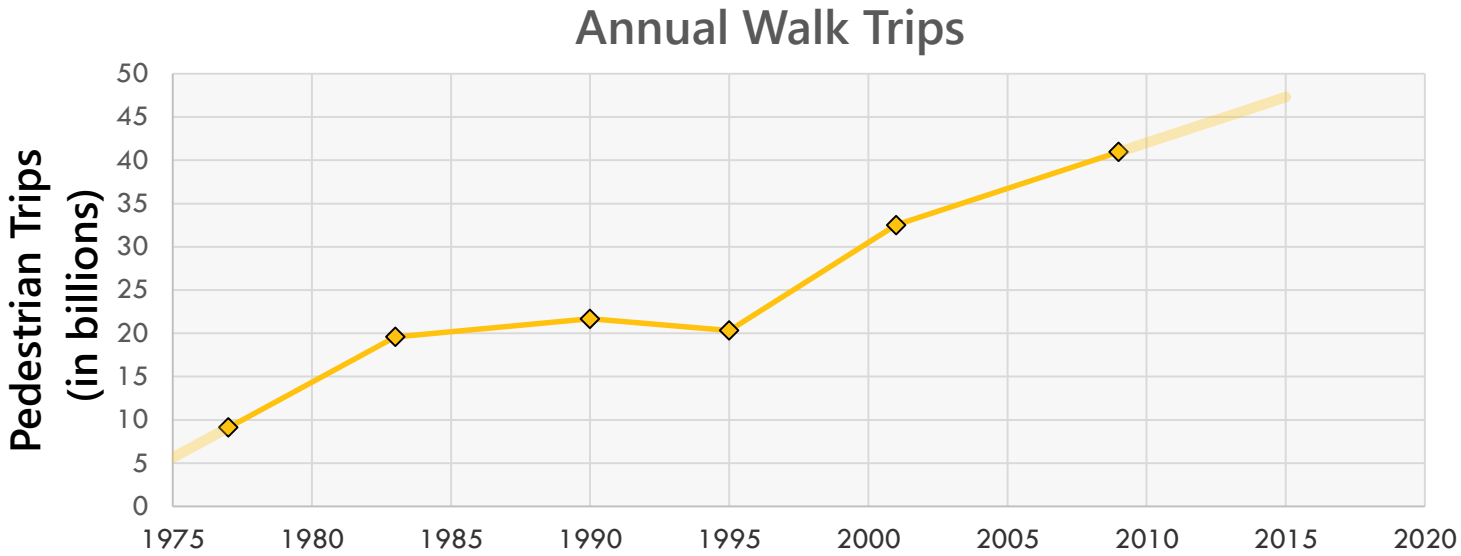
Source: NHTSA Fatality Analysis Reporting System (FARS) [1]

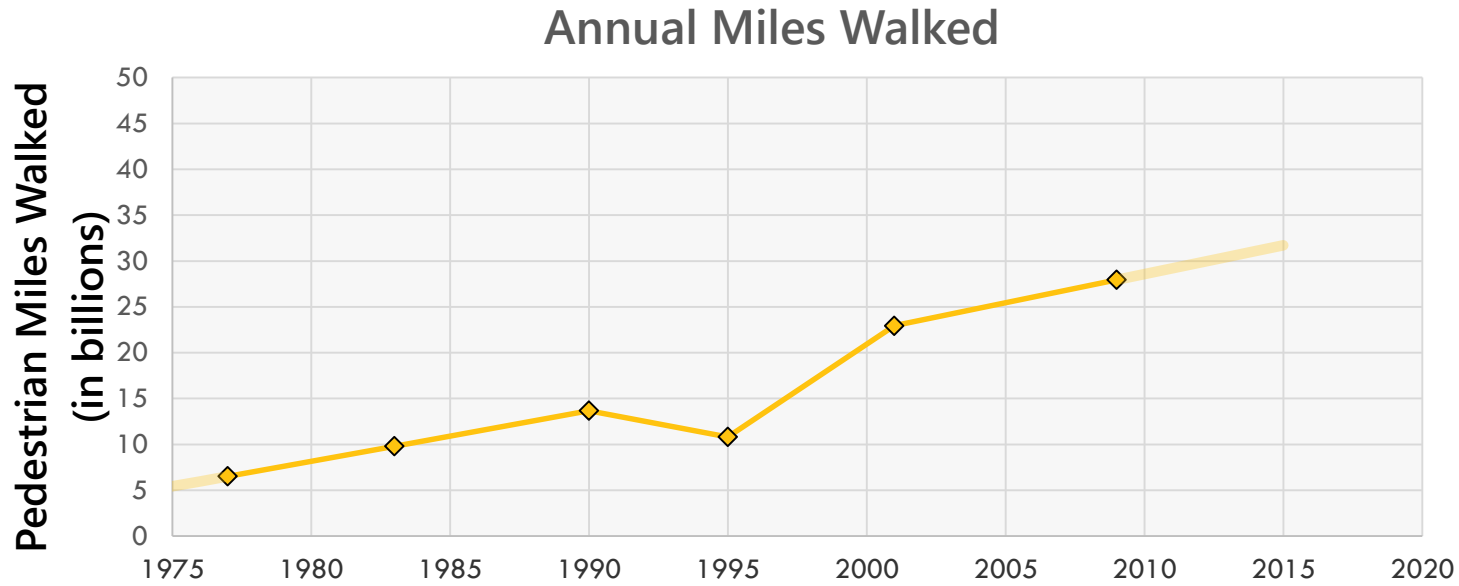
Figure 1: Annual U.S. Fatalities by Person Type (1994-2015).

Pedestrian activity appears to be on the rise.

~ 20 billion walk trips in 1983.

~ 40 billion walk trips in 2009.





Source: U.S. DOT FHWA NHTS [2]

Figure 2: Annual U.S. pedestrian travel trends (1977-2009) with linear interpolations and extrapolations.

What will pedestrian safety look like in the future?

CARSP 2018 – Pedestrian Safety

FHWA's *Strategic Agenda for Pedestrian and Bicycle Transportation* [3]:

1. **Targets to increase AT mode share:**

   "Increase the percentage of short trips represented by bicycle and walking from 20.1% (2009) to 30%..."

30%
2025

AT: Active Transportation

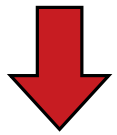
What will pedestrian safety look like in the future?

CARSP 2018 – Pedestrian Safety

FHWA's *Strategic Agenda for Pedestrian and Bicycle Transportation* [3]:

2. AT injury reduction targets:

a) *"Achieve an 80 percent reduction in pedestrian and bicycle fatalities and serious injuries in 15 years..."*



80%
2031

AT: Active Transportation

What will pedestrian safety look like in the future?

CARSP 2018 – Pedestrian Safety

FHWA's *Strategic Agenda for Pedestrian and Bicycle Transportation* [3]:

2. **AT injury reduction targets:**

b) "…***zero*** *pedestrian and bicycle fatalities and serious injuries in the next 20 to 30 years."*

100%

~ 2036 - 2046

AT: Active Transportation

Research Objectives

1. To quantitively assess long-term pedestrian safety on a national scale.

2. To identify at-risk pedestrian cohorts that are more susceptible to traffic-related fatality.

Previous Work

Current State of Research

- Few studies have exclusively forecasted safety of non-motorized transportation modes
- Majority of pedestrian safety literature is cross-sectional [4]
- Previous studies utilize macro-level predictor variables [5,6]
- VMT is changing among American millennials and baby-boomers [7, 8]

Previous Work

Setting Road Safety Targets

Three general approaches to establishing road safety targets [9]**:**

a) Aspirational

- relatively arbitrary
- limited numerical justification
- "top-down"

b) Model-Based

- data-driven, reliant on assumptions
- model structure dictates trend
- "baseline forecasts"

c) Evidence-Based

- quantitatively-based targets
- accounting for recent and future trends
- "bottom-up"

Methodology

Fatality Data

- **NHTSA FARS**
  - Fatality *Analysis* Reporting System (1975 - present)
- census of all reported vehicle-related crashes that:
  - are on publicly-available roadways.
  - resulted in death of at least one motorist or non-motorist
  - victim pronounced fatally injured within 30 days of crash.

Methodology

Exposure Considerations

- **FHWA NHTS**
  - National Household Travel Survey (1969 - present)
- sample-based inventory of American travel
  - demographics, trip metrics, etc.
  - representative weights for national estimates.

Methodology

Disaggregation

- **classify fatality and travel data**
- **12 age-sex categories**
- model forecasts for cohorts marked with ★ are shown in the next section.

Age Group	Sex: Male		Sex: Female
	5 - 15	★	5 - 15
	16 – 19		16 – 19
	20 - 34		20 - 34
	35 - 54		35 - 54
	55 - 64	★	55 - 64
	65+	★	65+

Methodology

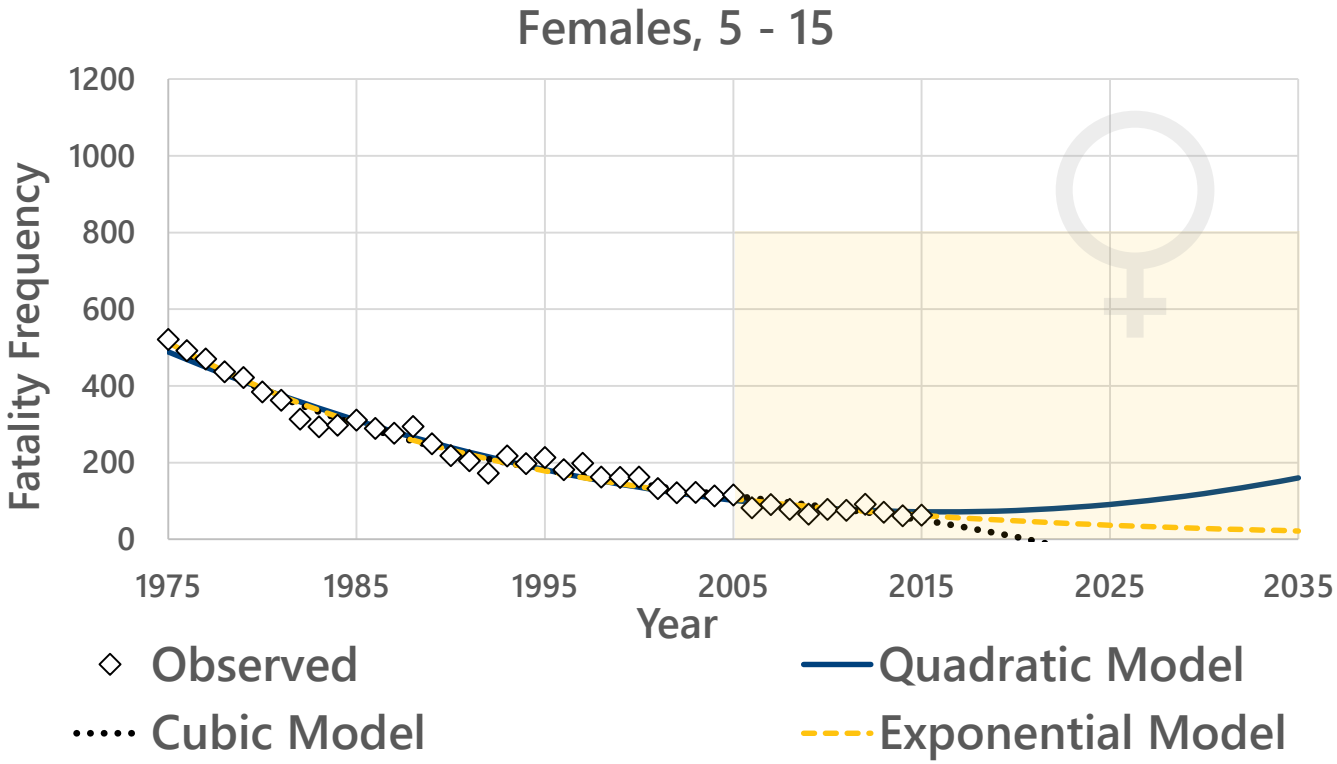
Model Forecast Structure

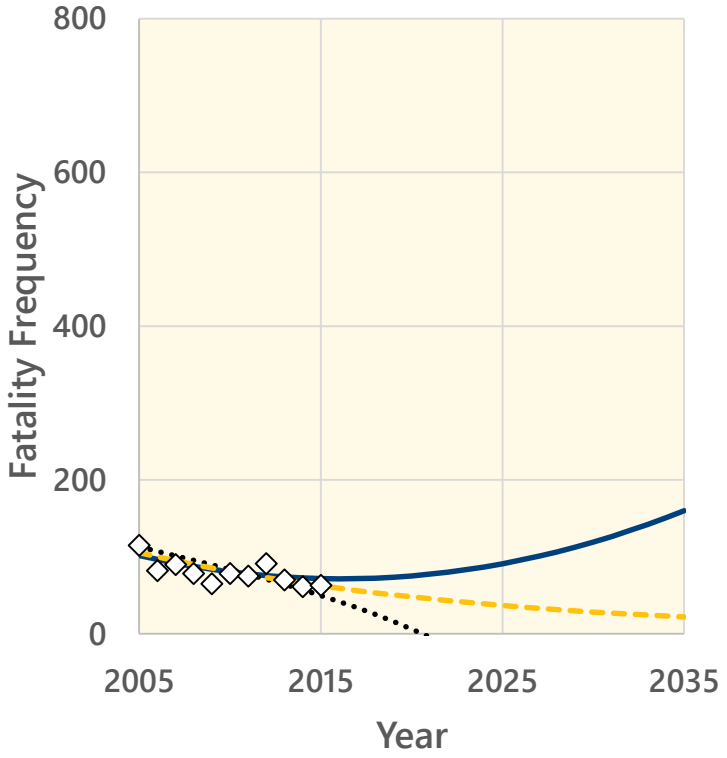
- **SPSS CURVEFIT**
  - **11 regression models including (but not limited to):**
    - **Polynomials***
    - **Logistic**
    - **Exponential / Logarithmic**

- **models chosen based on AIC & appropriateness**

Model Forecasts

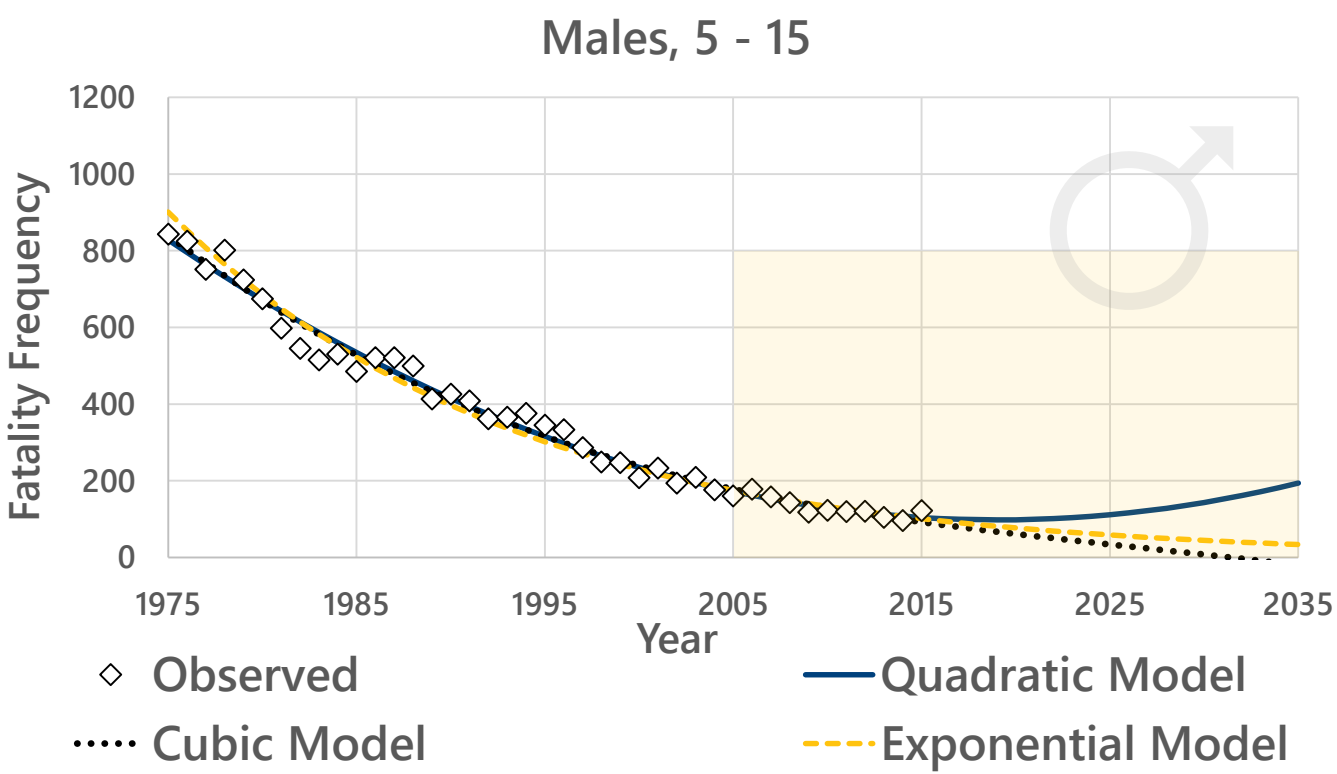
Females, Aged 5 - 15

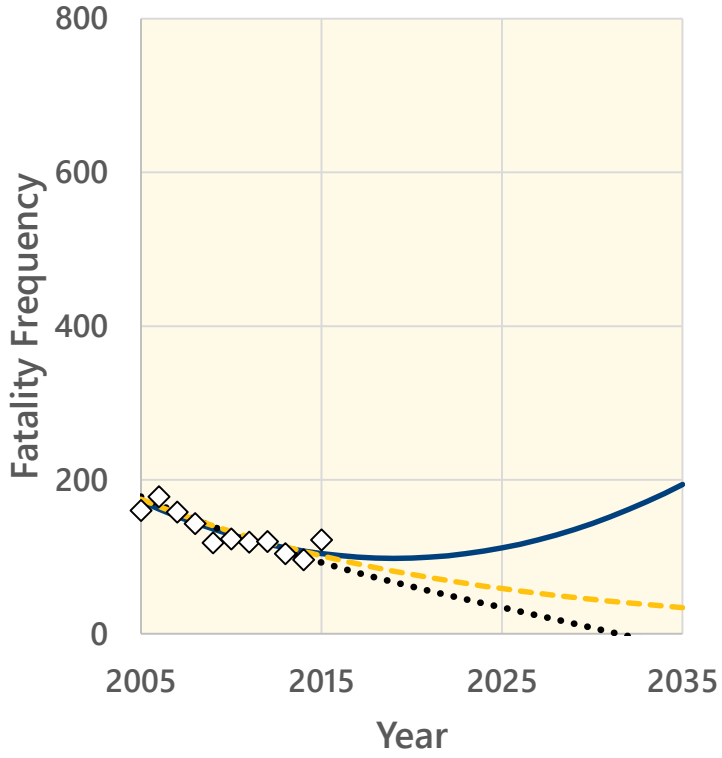




Model Forecasts

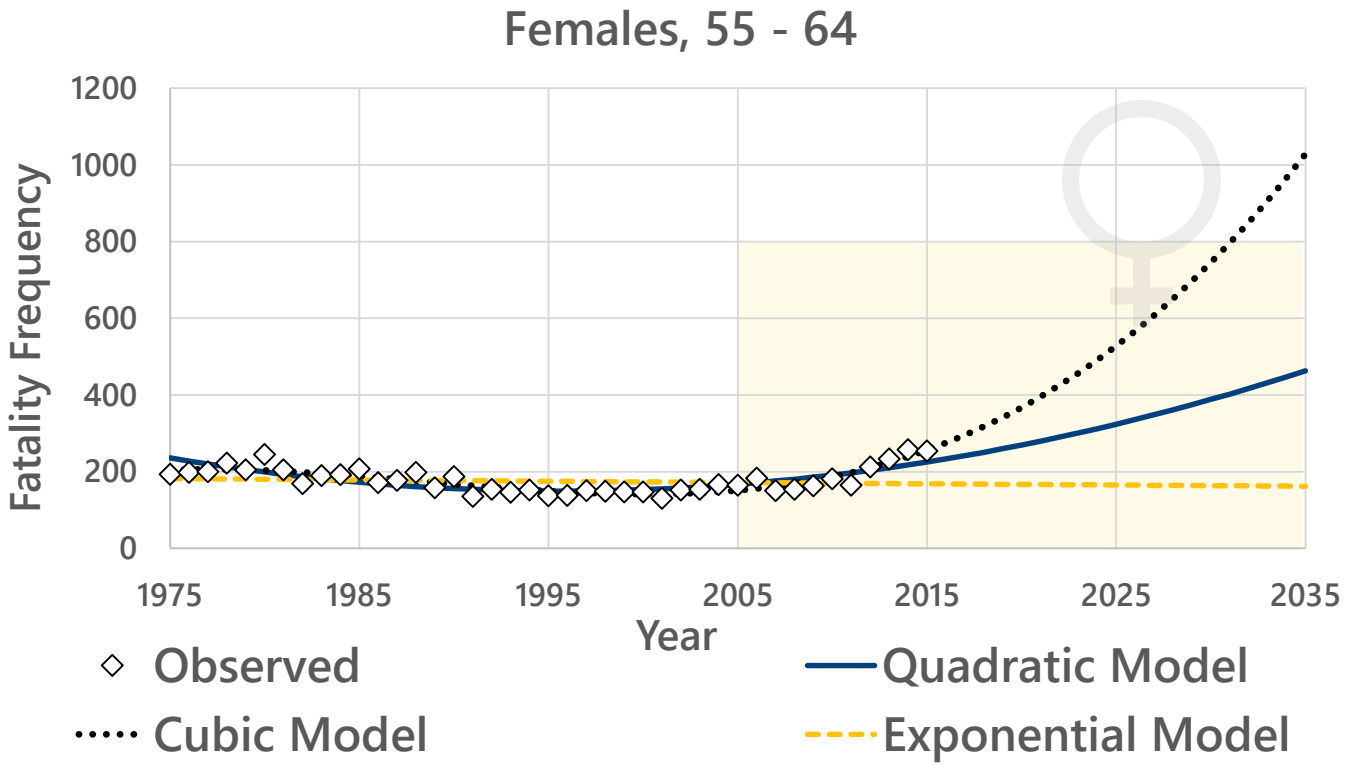
Males, Aged 5 - 15

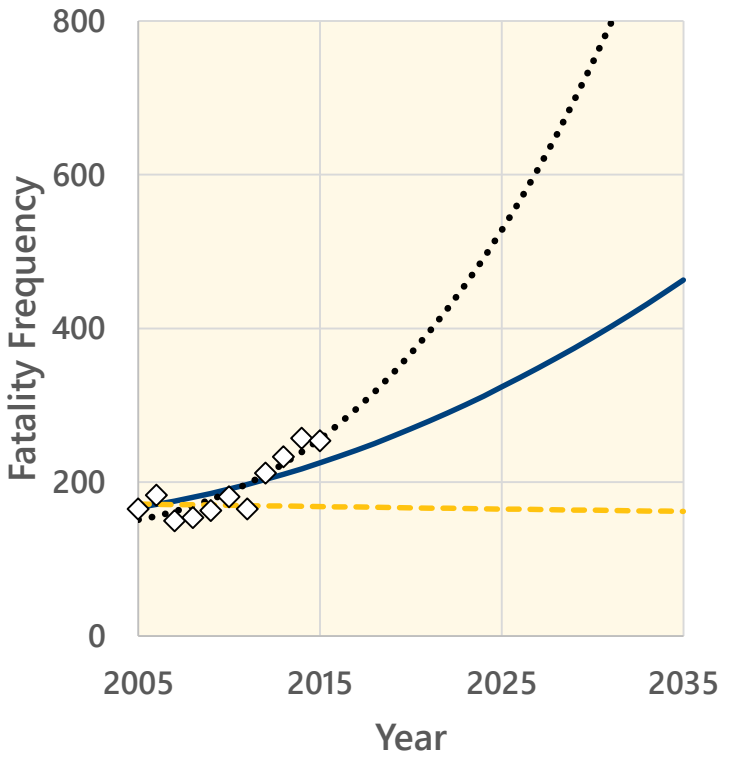




Model Forecasts

Females, Aged 55 - 64





Model Forecasts

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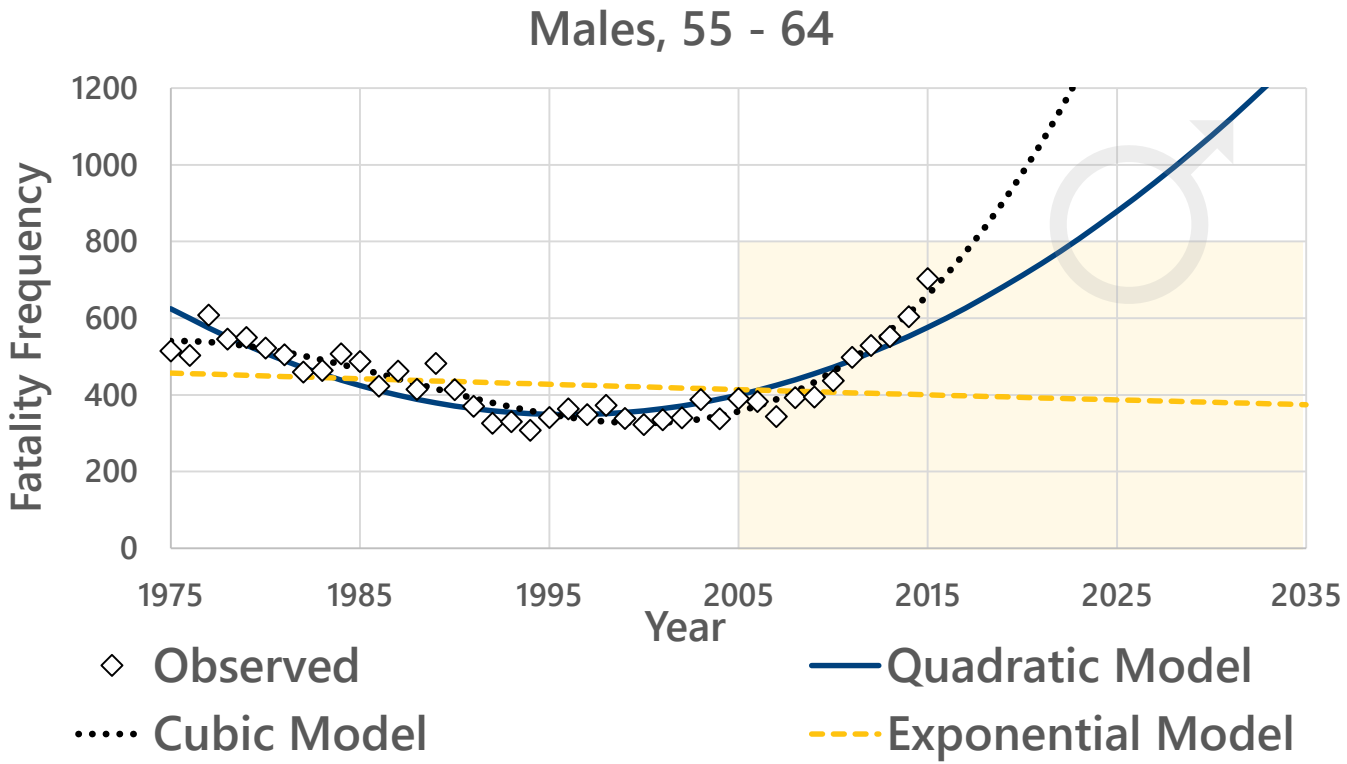
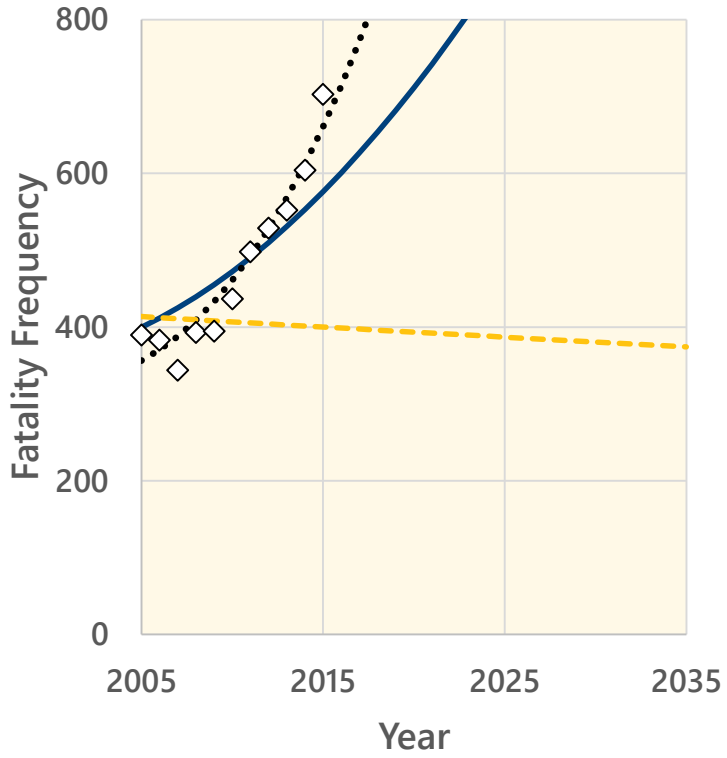
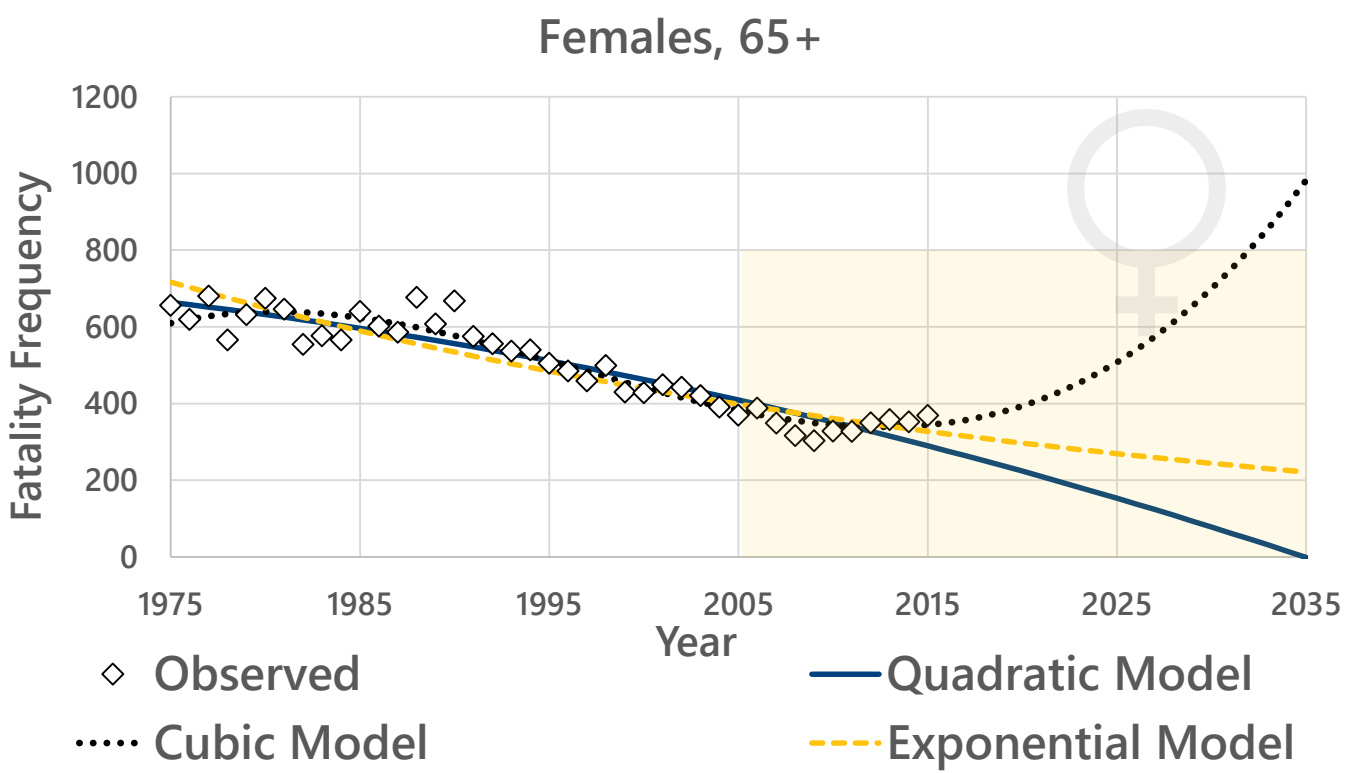
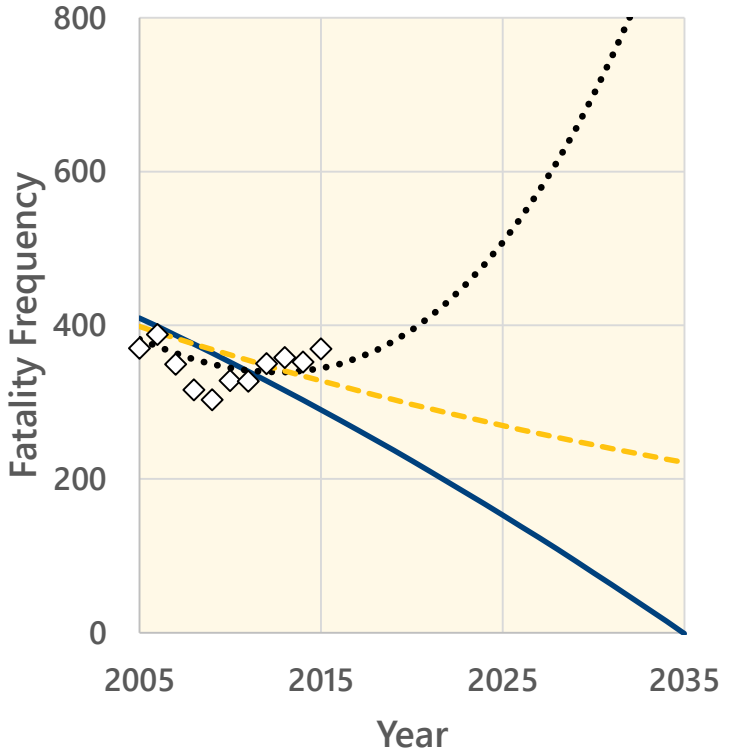




Model Forecasts

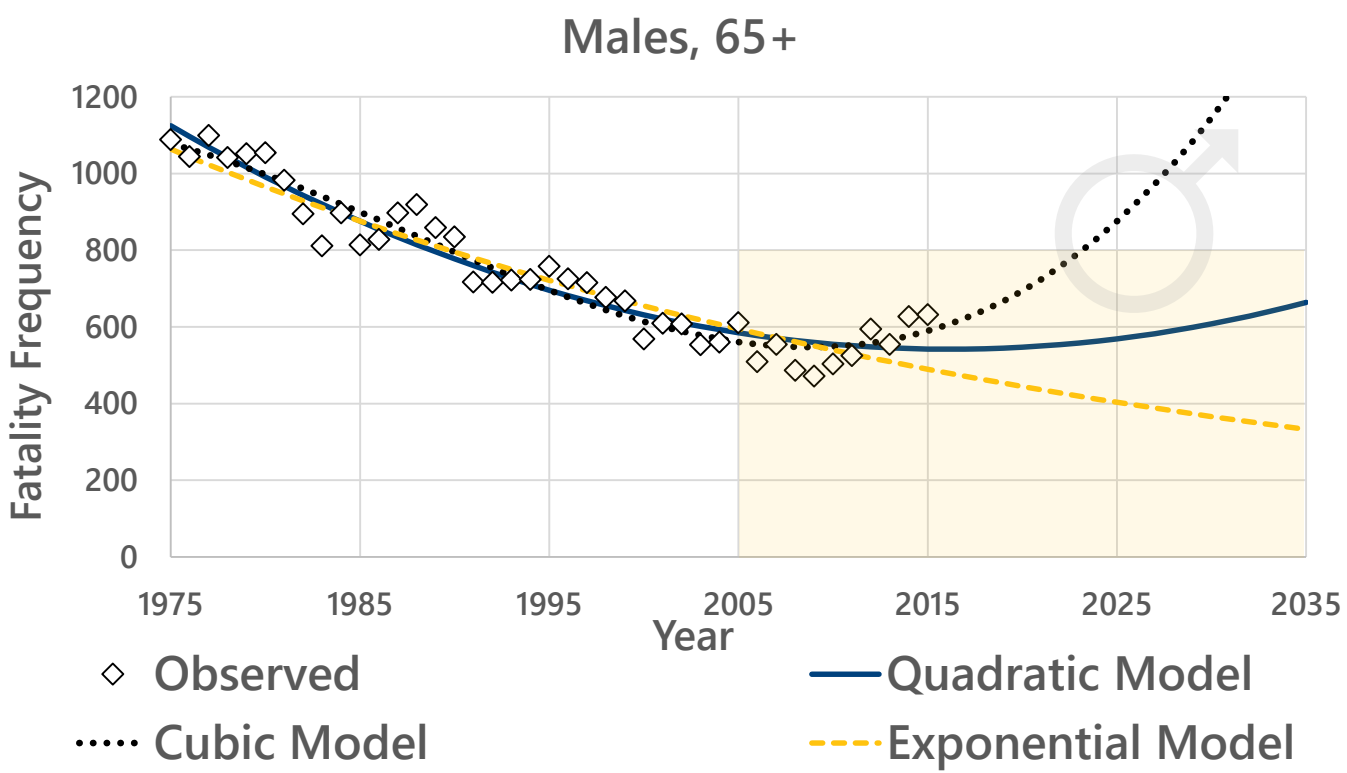
Females, 65+

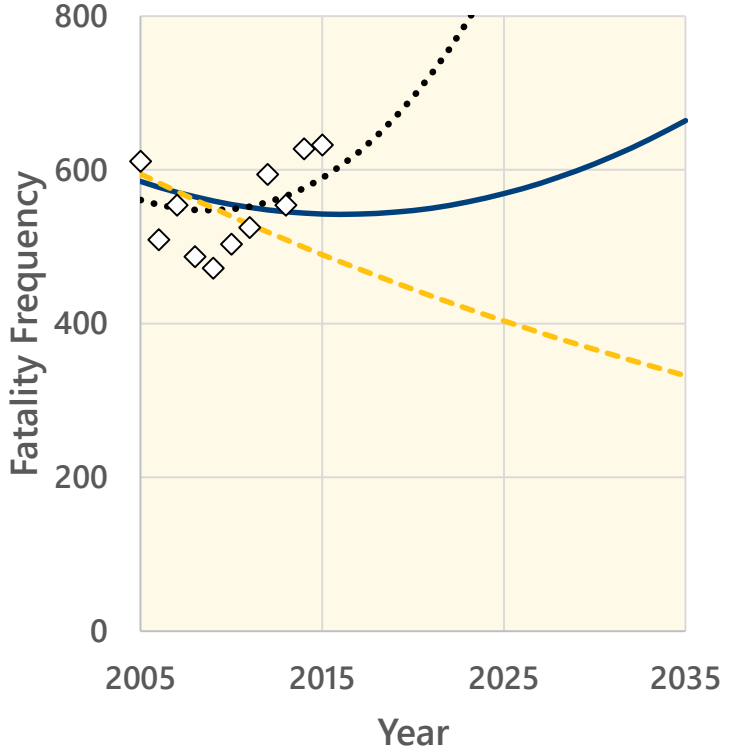




Model Forecasts

Males, 65+





Conclusions

Key Findings from Forecasts

- **Child pedestrian injuries (age 5 – 15) have been consistently declining since 1975.**
- **Pedestrian fatalities appear to be rising for those aged 55+:**
- **Generally speaking, males appear to be more at risk when compared to females.**
- **Polynomial-based forecasts can be misleading.**

Future Work

Framework Refinement

- using advanced models
- accounting for all severity levels
- rate-based metrics vs. absolute injury counts
- critical age?
- contribution of infrastructure
- quantify and incorporate safety effects of policy changes

Future Work

Implementation in Canada

- **Canada's RSS 2025** [10] does not specify any quantitative targets.
- Potential for framework implementation at sub-macroscopic geographical units:
  - Provincial / Territorial
  - Municipal
  - etc.

Future Work

The Influence of Emerging Technologies

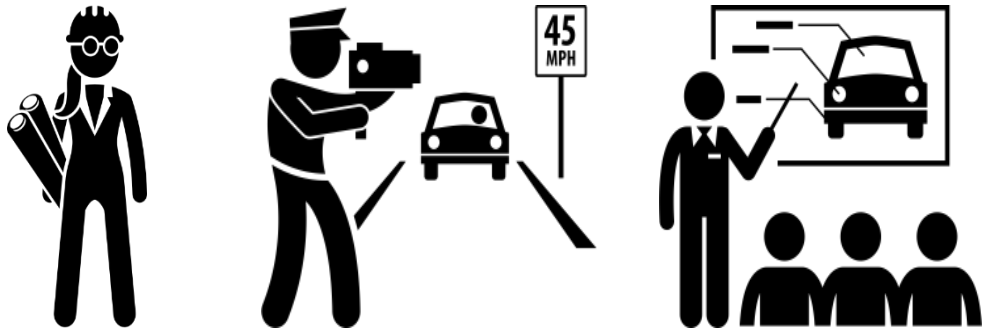
How a Self-Driving Uber Killed a Pedestrian in Arizona

By TROY GRIGGS and DAISUKE WAKABAYASHI UPDATED MARCH 21, 2018

[11]

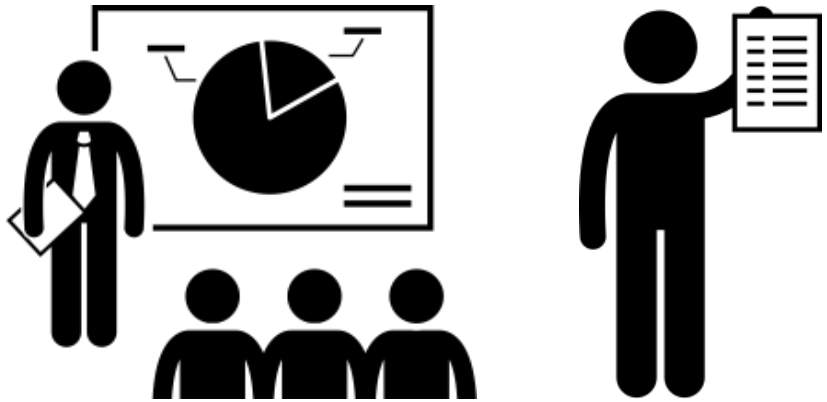
The development of an effective traffic fatality forecast would be:

collaborative



human-focused

data-driven

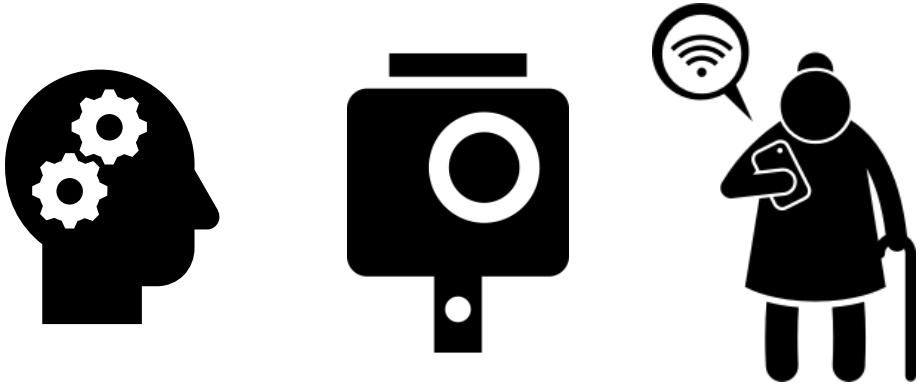


To improve forecast reliability, the quantity and quality of data should be improved.

Counterintuitive to want more injury data!

The objective is to reduce injuries!

Improvements in capturing travel data can be made!



Leveraging technology to gather “big data”!

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Questions?

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Thank you! Merci!