LIFESAVERS
National Conference on Highway Safety Priorities

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We Can't Keep Doing the Same Things & Expect Different Results

Safe Systems

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Center for Applied Transportation Sciences (CATS)
College of Engineering

NHTSA
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Agenda

- Safe System Overview
- Data Talks
  - Nationwide
  - Georgia
  - Arizona
- Speed Management Strategies
  - Introduction
  - Overview
  - Solutions
  - Case Study
- Post Crash Care
  - EMS/Response time
- Q/A

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Safe System Overview

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Introduction

Safe System

Picture source: FHWA

Introduction

Traditional VS Safe System

Rather than focusing on changing human behavior and preventing all crashes, the Safe System approach refocuses transportation system design and operation on anticipating human errors and reducing impact forces to reduce crash severity and save lives.

Traditional		Safe System
Prevent crashes	→	Prevent deaths and serious injuries
Improve human behavior	→	Design for human mistakes/limitations
Control speeding	→	Reduce system kinetic energy
Individuals are responsible	→	Share responsibility
React based on crash history	→	Proactively identify and address risks

Source: FHWA

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Data Talks

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Changes in Driving Behavior

Contributing factors including driving too fast for conditions, driving under the influence, and reckless driving are experiencing upward trends

- Vehicle miles traveled decreased Georgia in 2020
- Trends in these contributing factors continued to increase
- Serious injuries and fatalities rose in 2020, 2021

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Data Talks

Case Study: State of Georgia

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Collisions

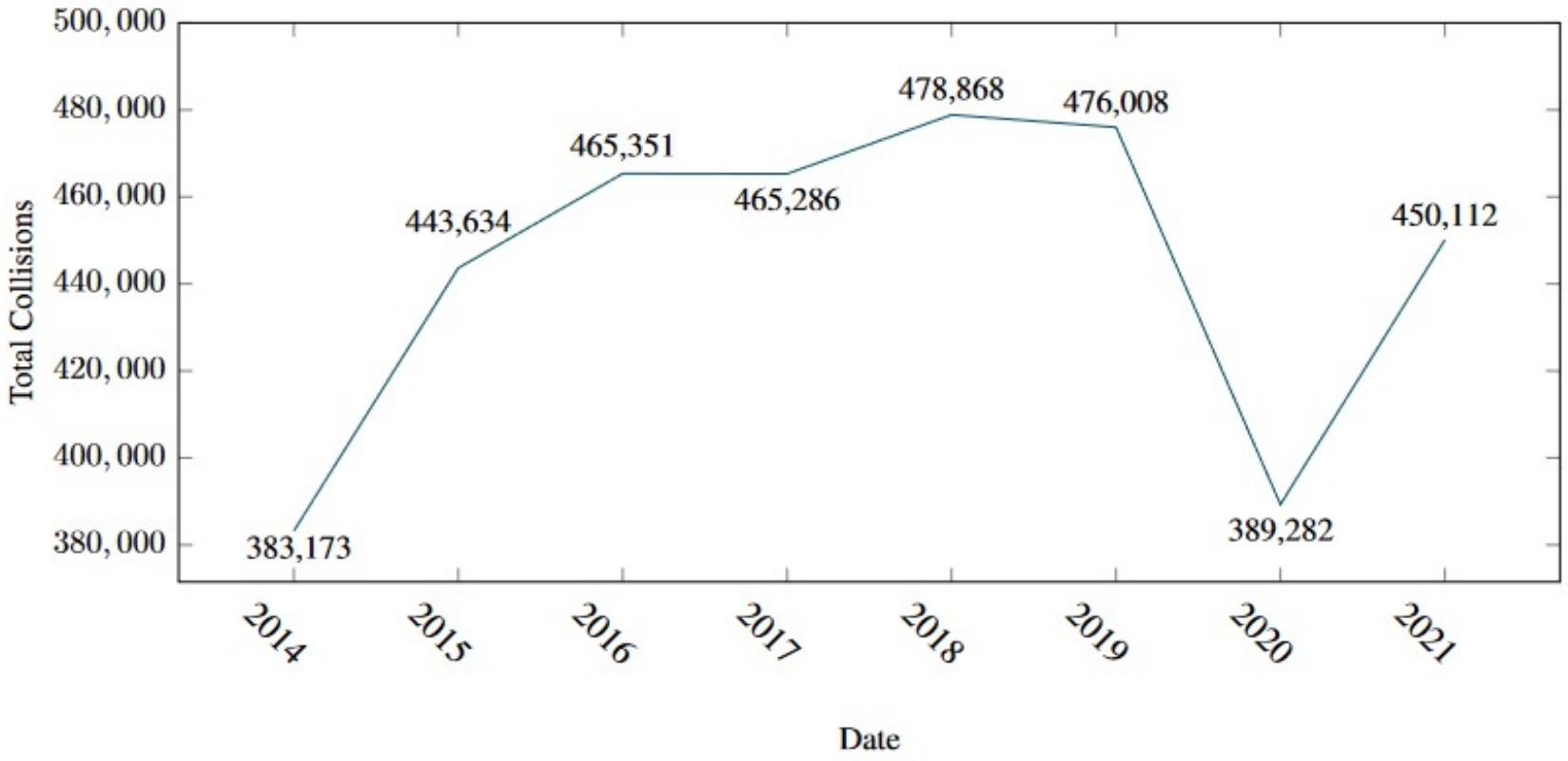

Figure 3: Georgia Total Collisions, 2014-2021

Collisions

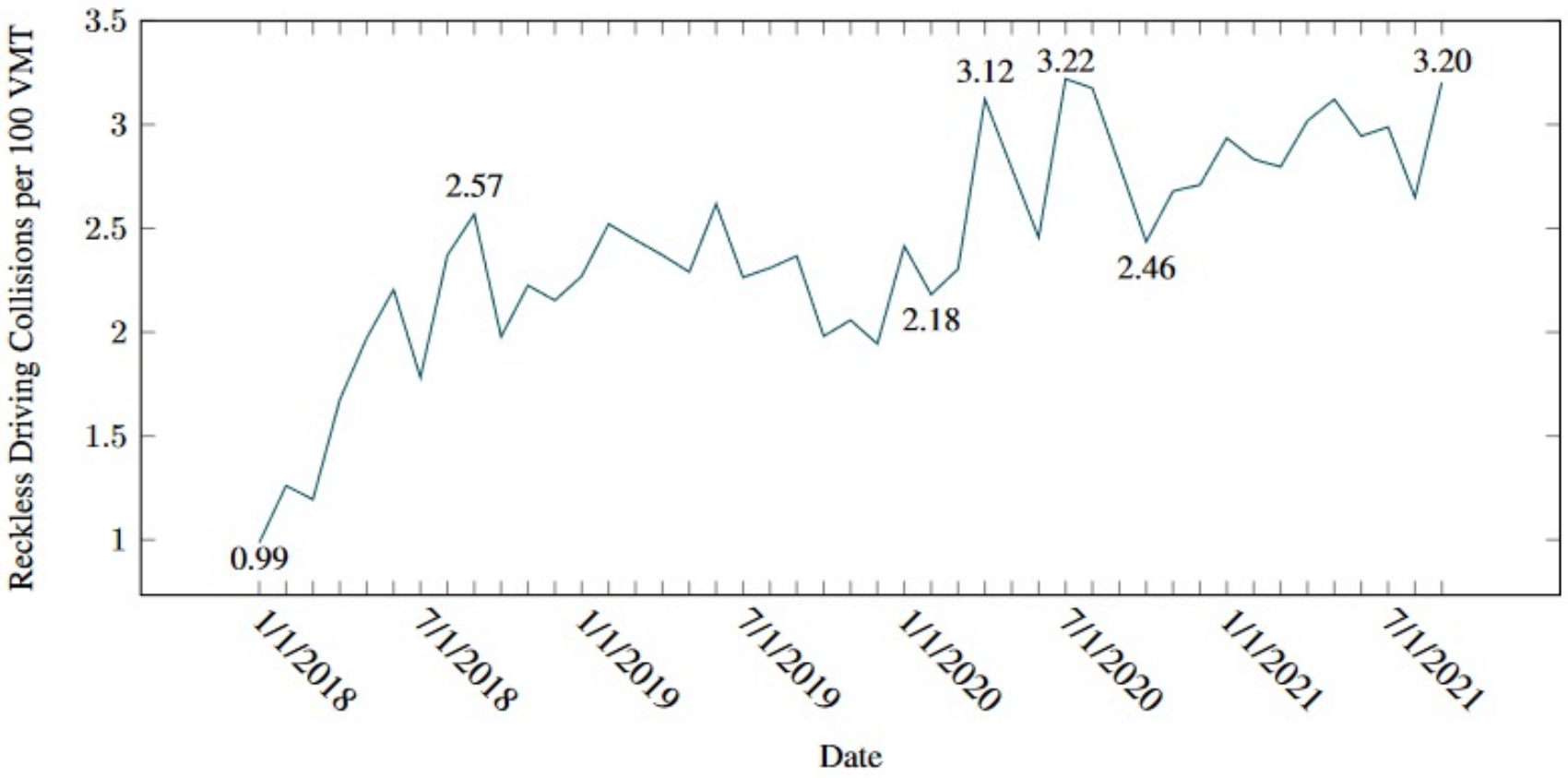

Figure 2: Georgia Reckless Driving Collisions per 100 VMT, Jan. 2018 - Sep. 2021

Collisions

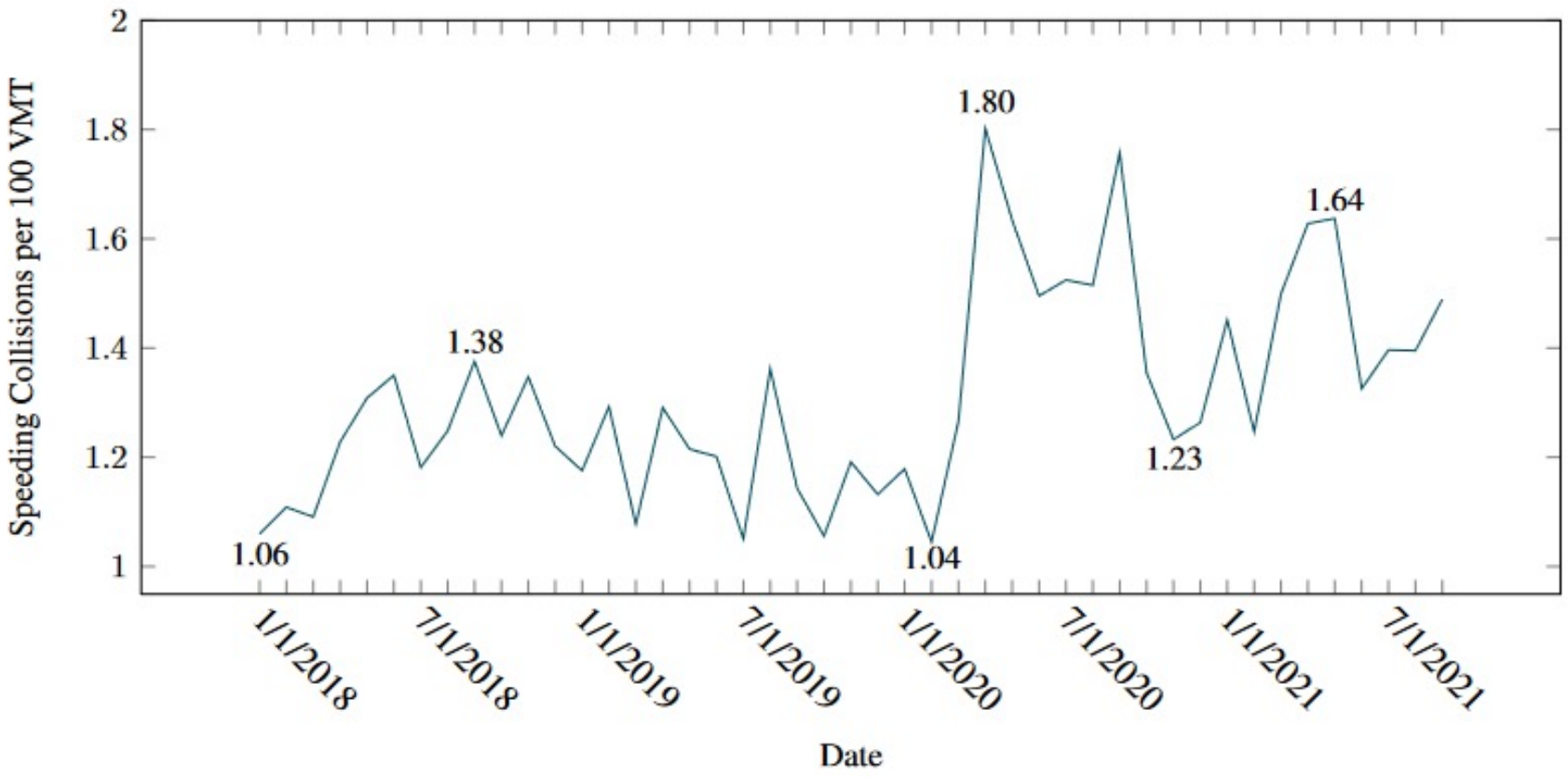

Figure 1: Georgia Speeding Collisions per 100 VMT, Jan. 2018 - Sep. 2021

Injuries

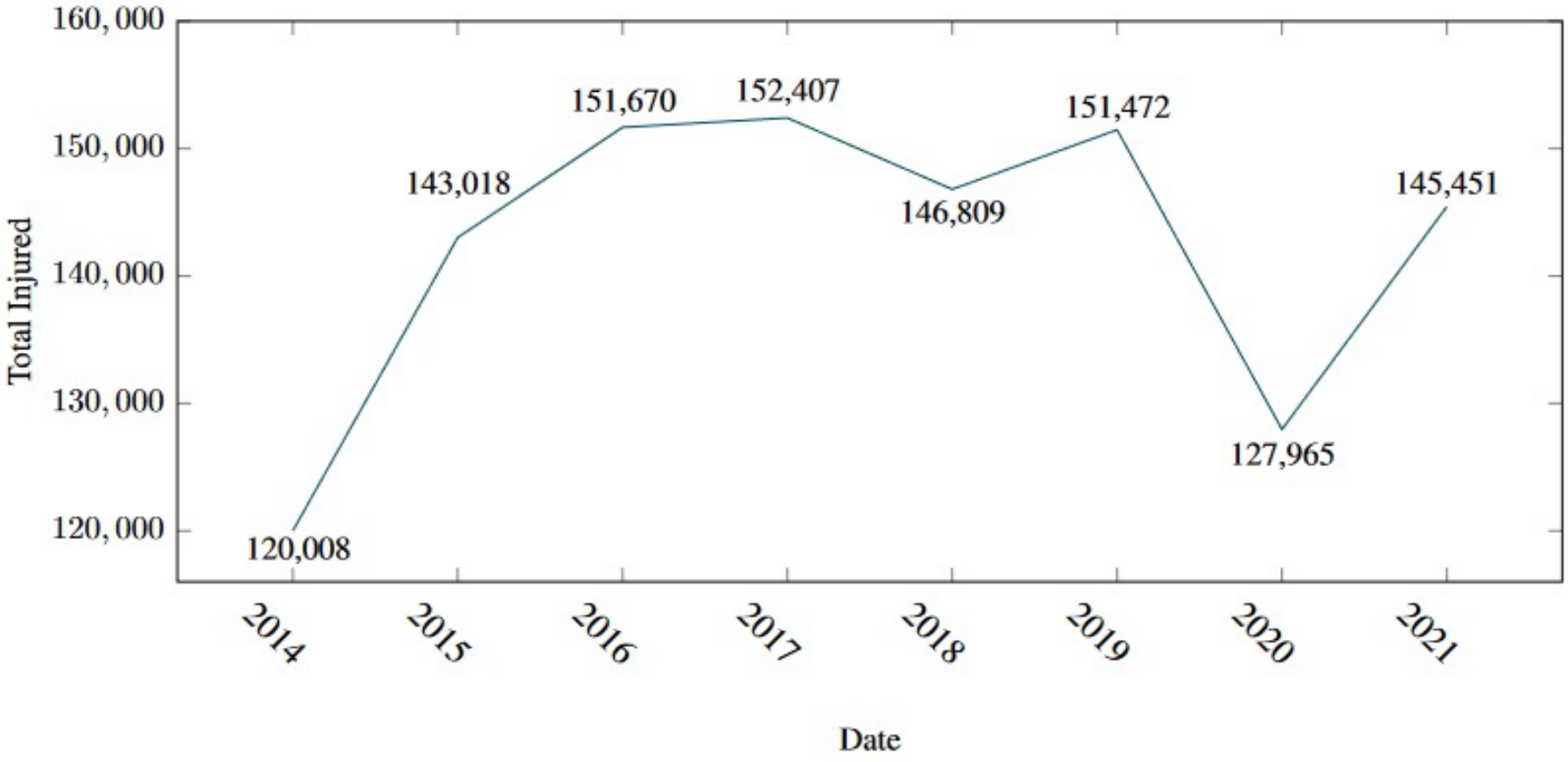

Figure 5: Georgia Total Injured, 2014-2021

Serious Injuries Criteria

- **Case 1**
  - Injury Status is either Suspected Serious Injury OR (Suspected Minor/ Visible Injury AND Unit was transported) AND Person type is Pedestrian OR Vehicle Type is Pedalcycle, Bicycle
- **Case 2**
  - Injury Status is Suspected Serious Injury AND Unit was Transported
- **Case 3**
  - Injury Status is Suspected Minor/Visible Injury AND Unit was transported AND Damage to Vehicle is either Disabling Damage

Injuries

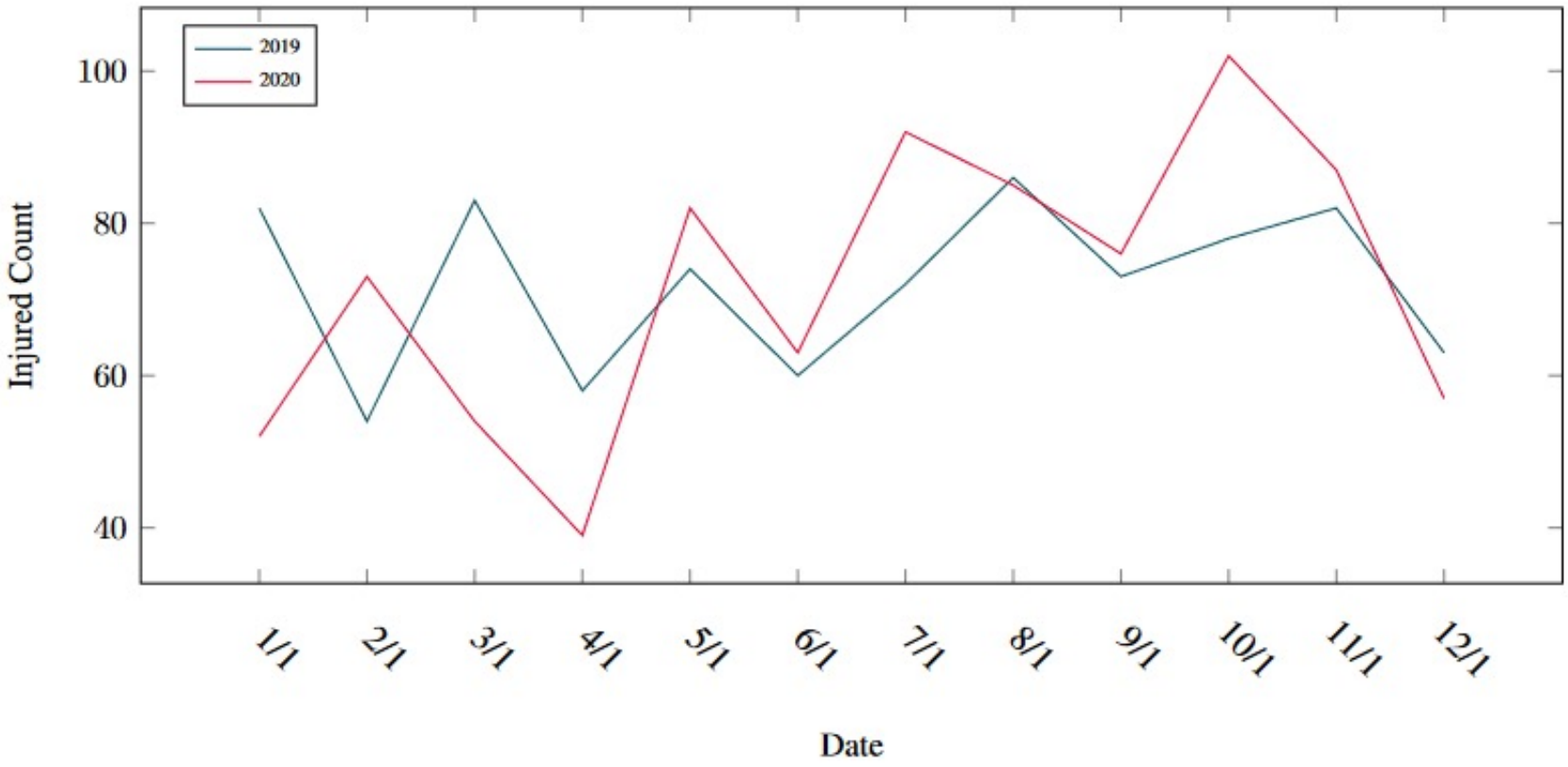

Figure 2: All Reckless Injuries, Jan - Dec

Injuries

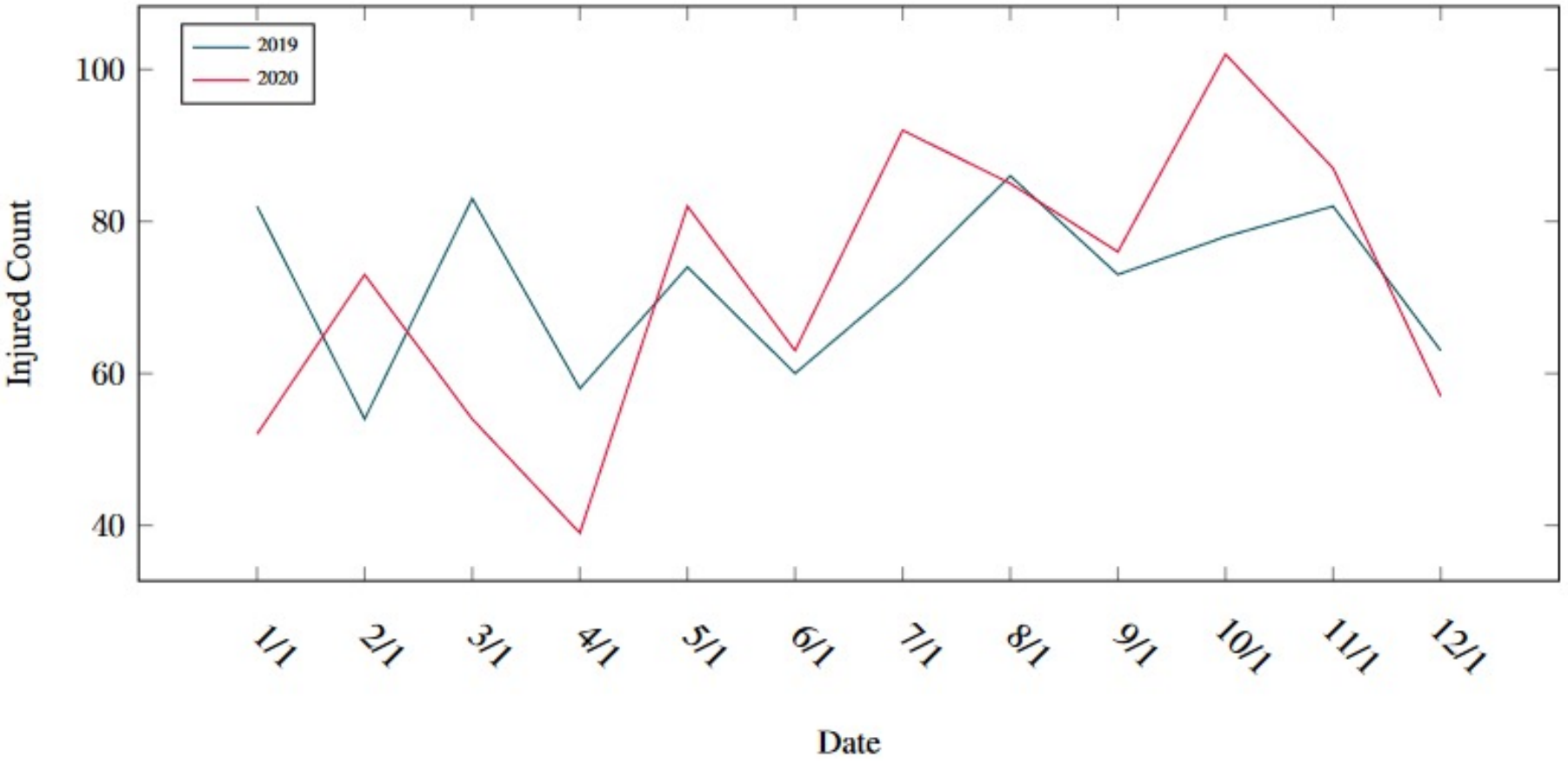

Figure 2: All Reckless Injuries, Jan - Dec

Injuries

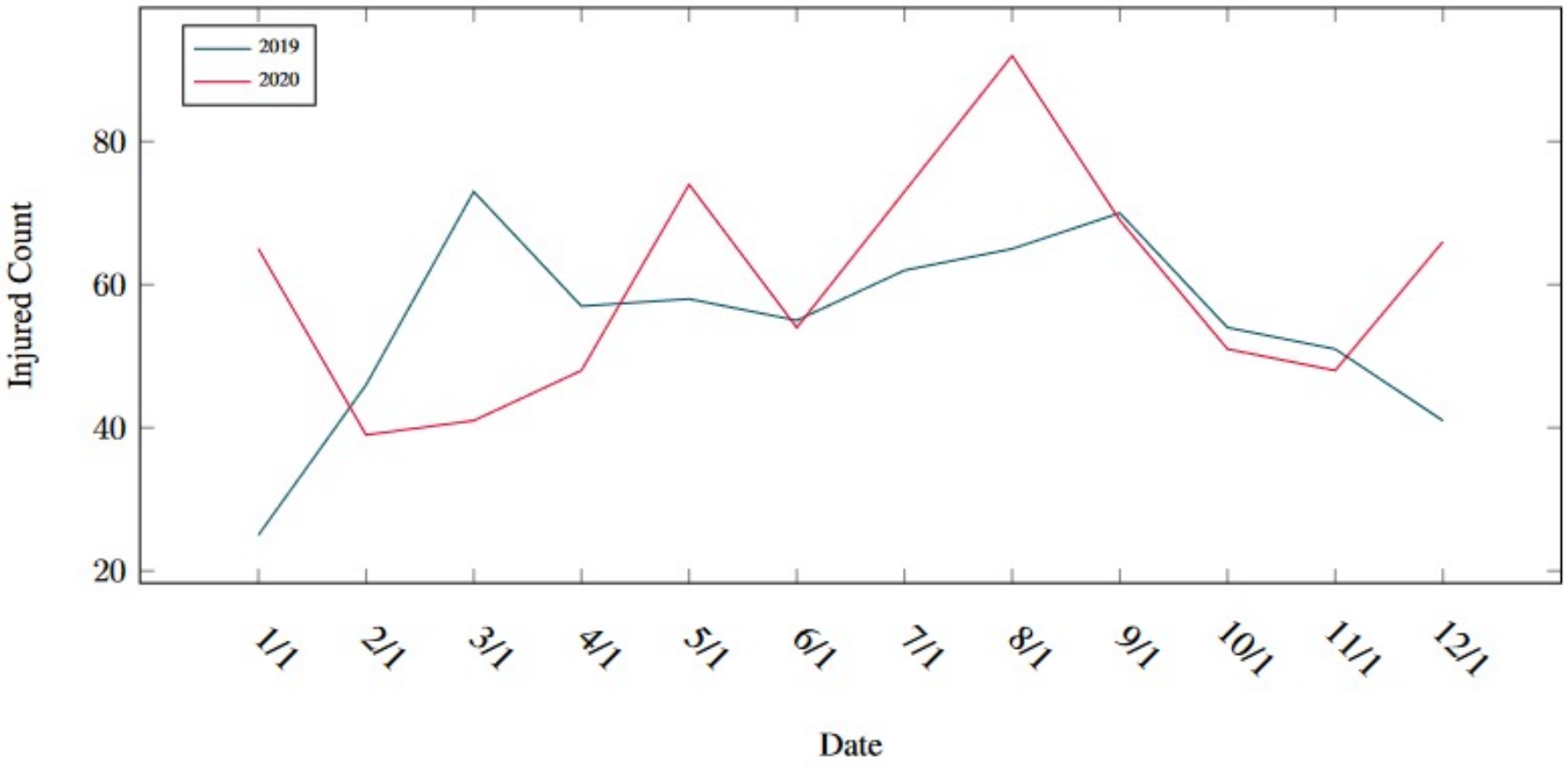

Figure 8: Reckless Driving Serious Injuries, Jan - Dec

Injuries

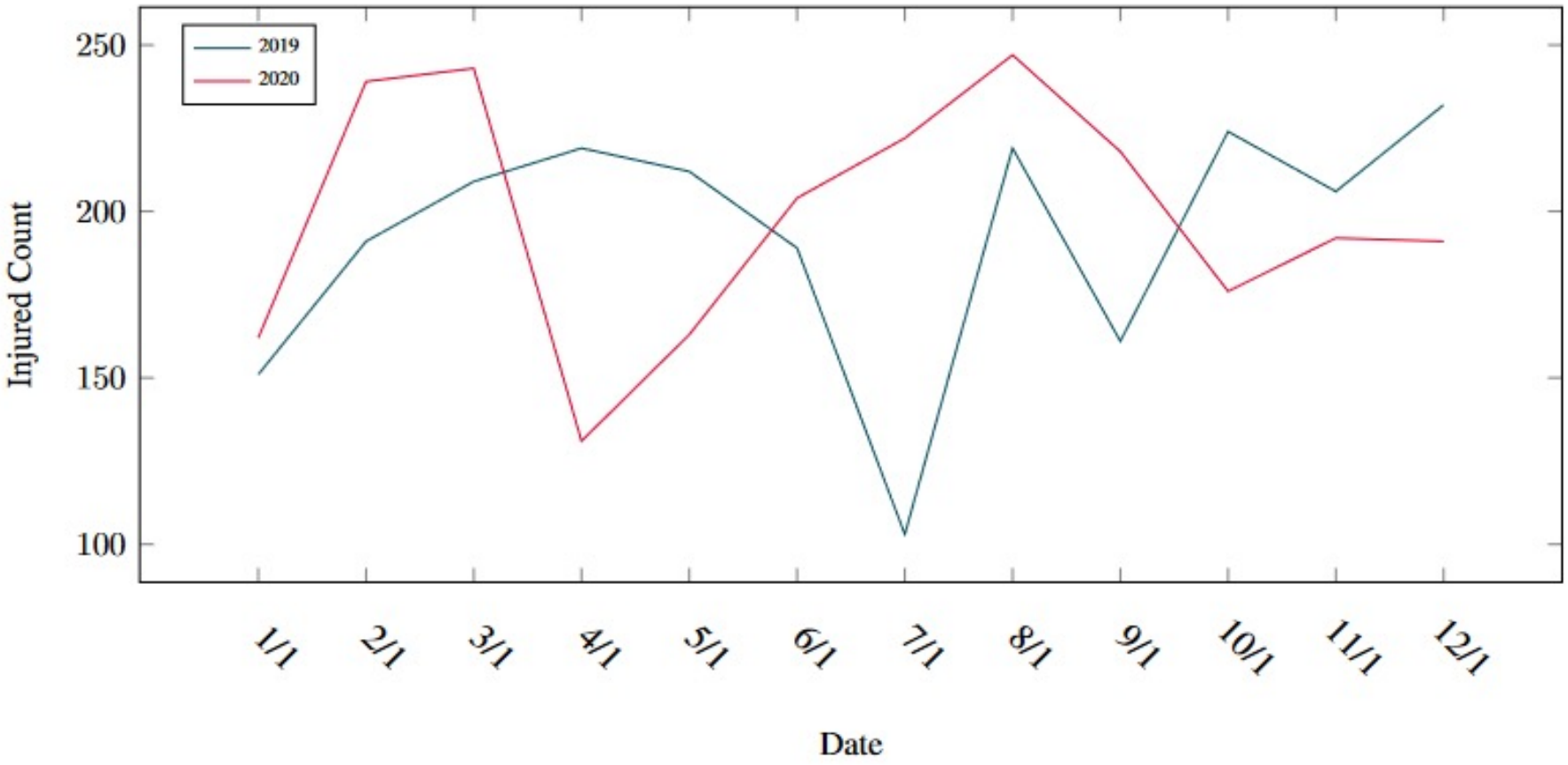

Figure 9: Too Fast for Conditions Serious Injuries, Jan - Dec

Fatalities

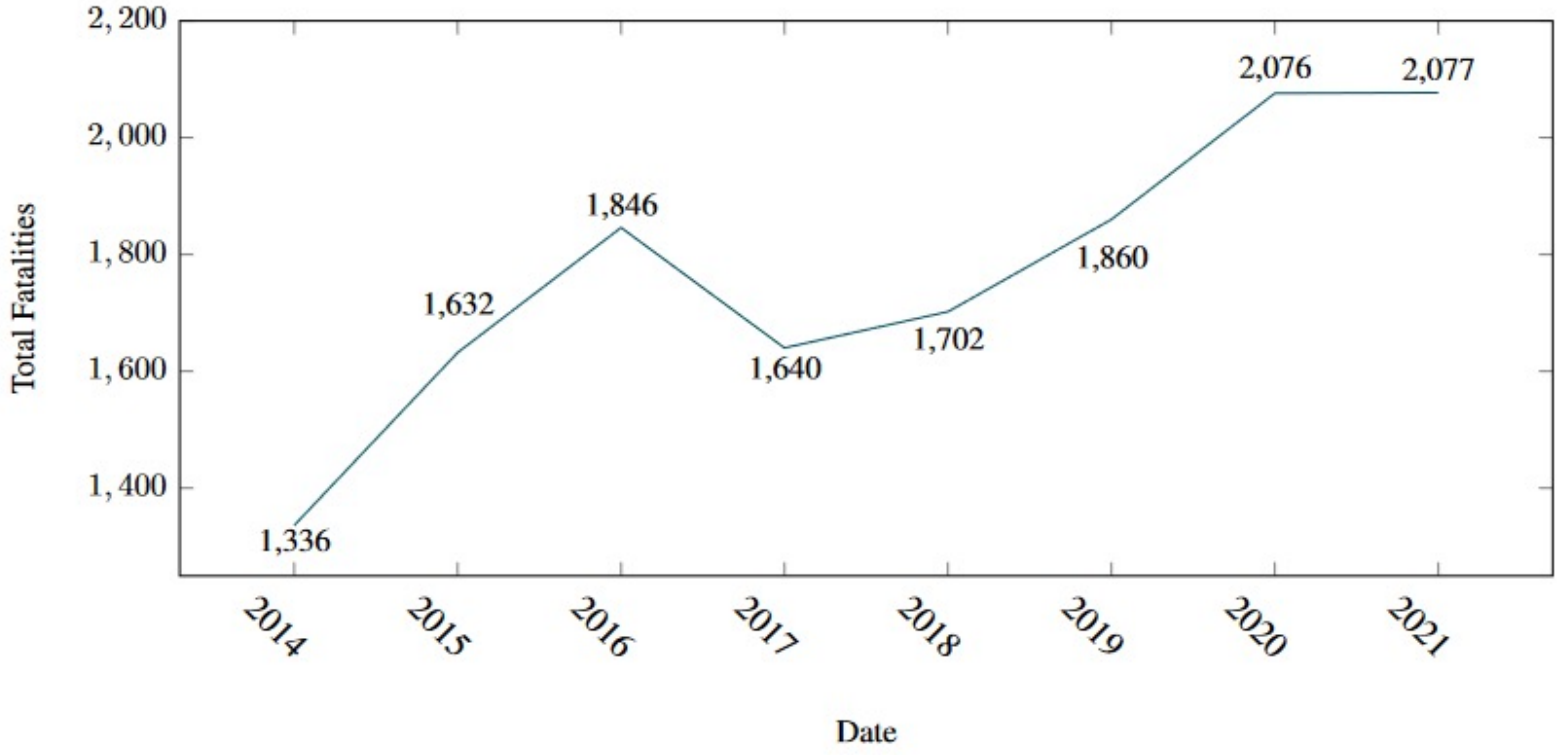

Figure 4: Georgia Total Fatalities, 2014-2021

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Data Talks

Case Study: State of Arizona

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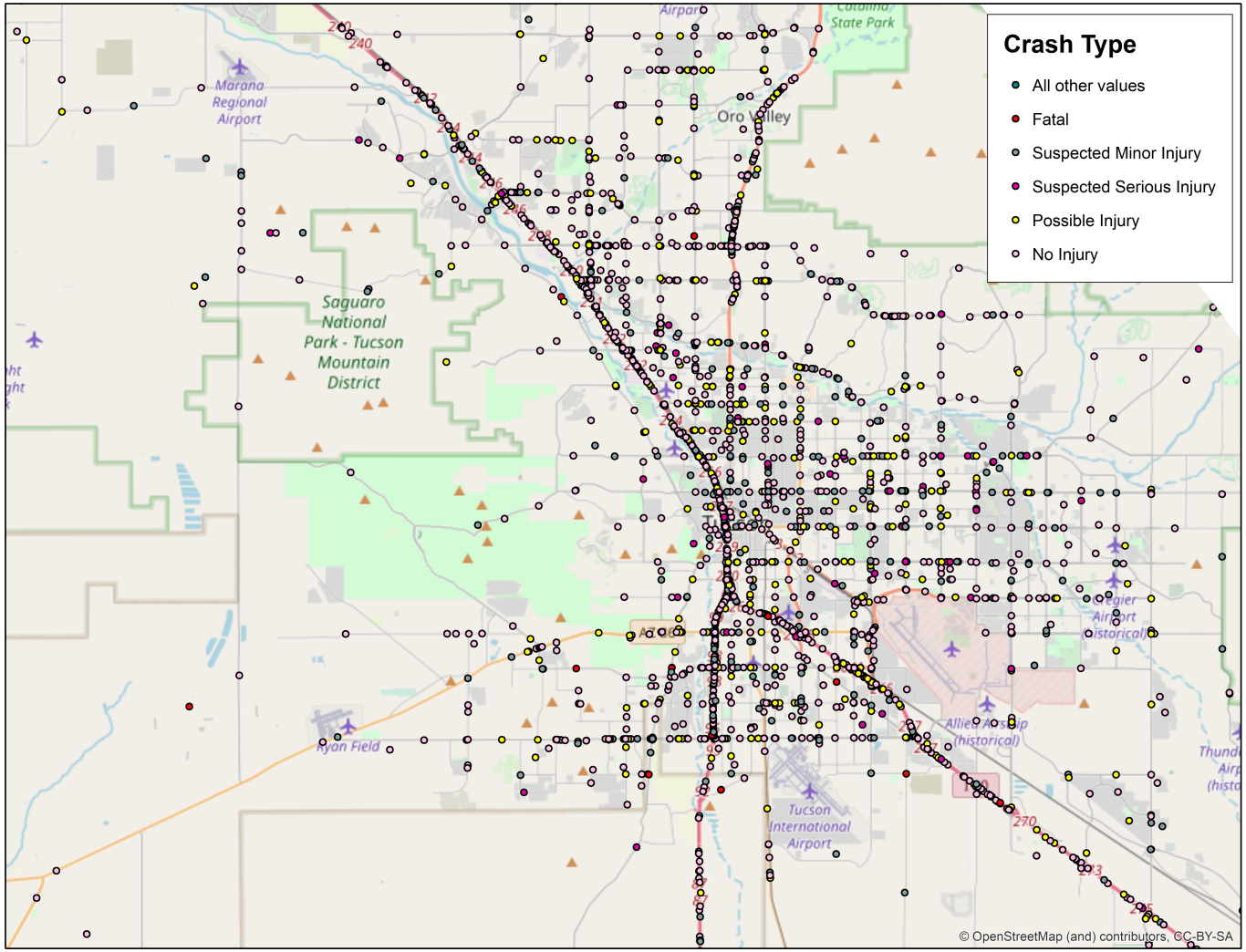
Collisions



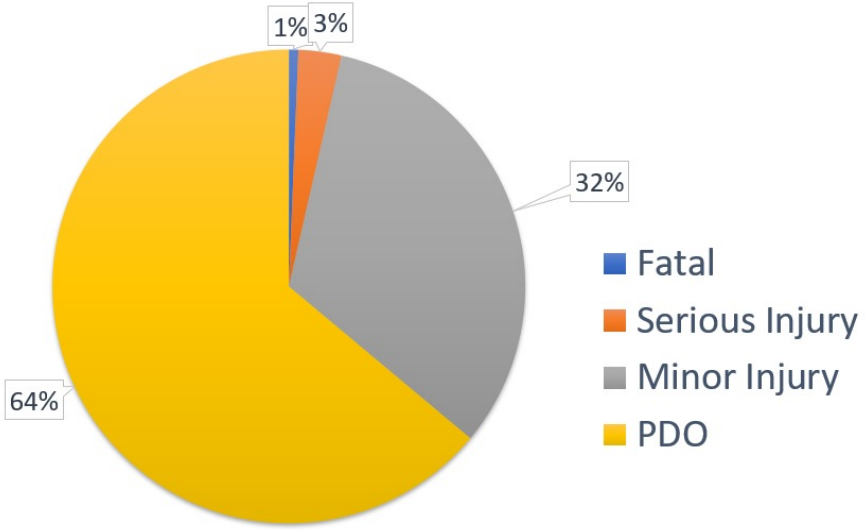
2018 crash Data

Fatal	19
Suspected Serious Injury	87
Suspected Minor Injury	414
Possible Injury	546
No Injury	1889

Data source: Arizona Crash Information System

Speeding VS Severity

2018 Speeding-Related Crash Data-Tucson



Total Crash	2,955
Fatal	19
Serious Injury	87
Minor Injury	960
PDO	1889

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Speed Management Strategies

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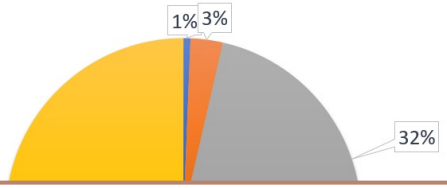
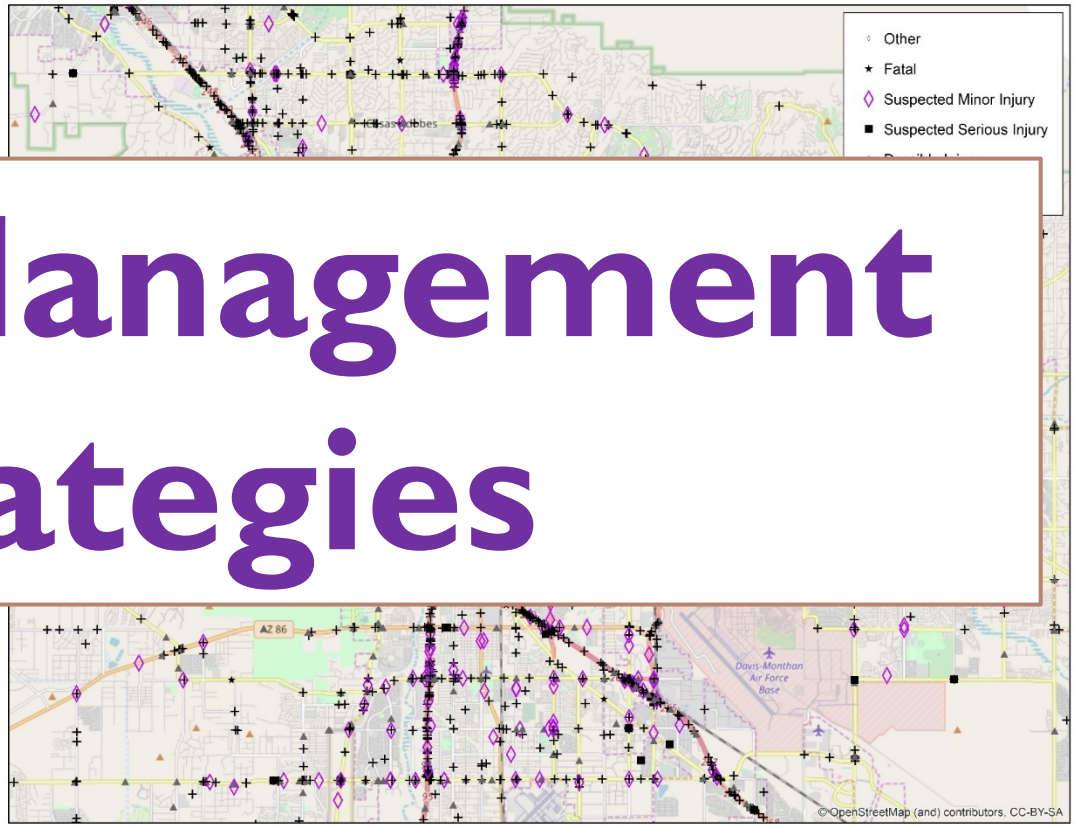
Example: Tucson, AZ

Overview

Problem Statement: Speeding

2018 Speeding-Related Crash Data-Tucson, AZ



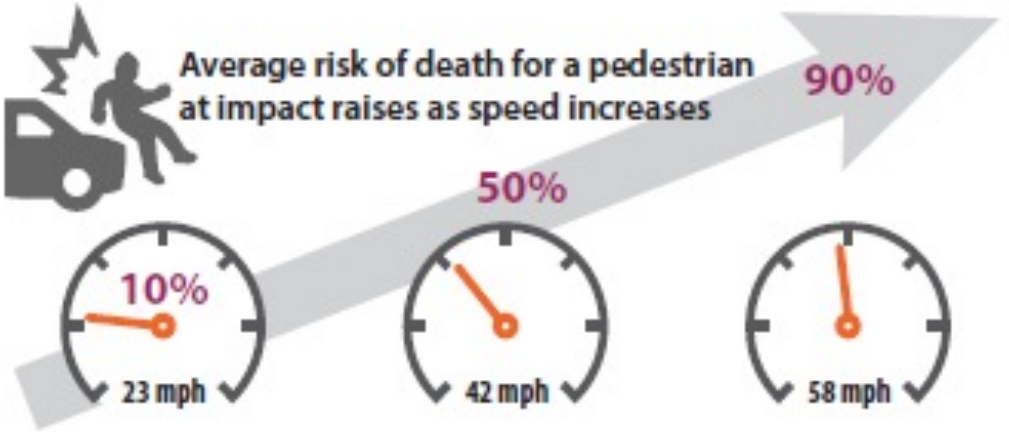


Serious Injury	87
Minor Injury	960
PDO	1889

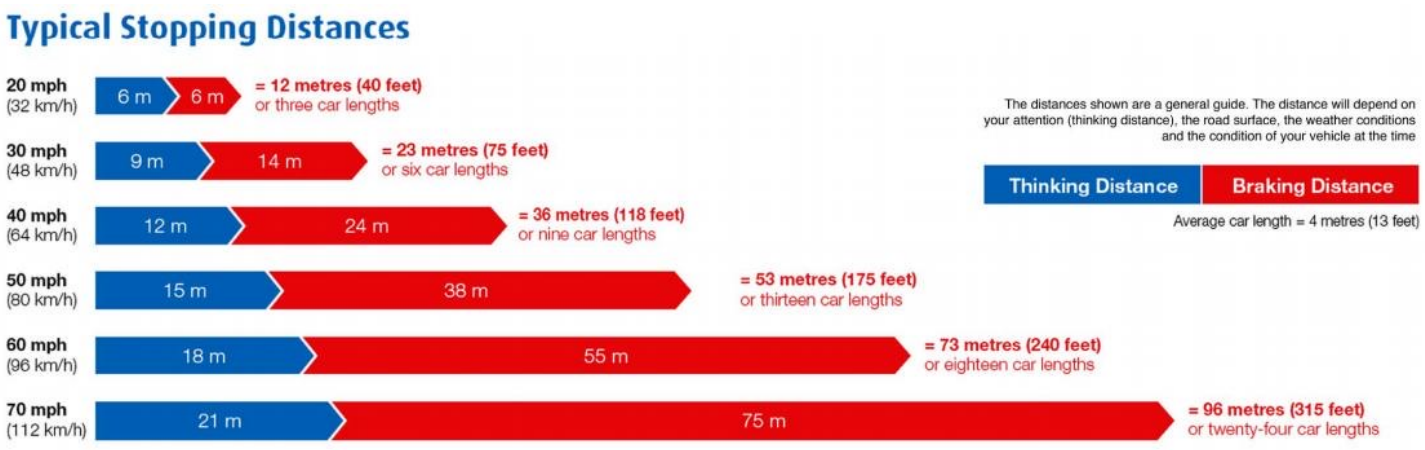
Speed Management Strategies

Introduction

Speeding VS Severity



Source: FHWA



Source: https://www.wri.org/blog/2017/05/need-safe-speed-4-surprising-ways-slower-driving-creates-better-cities

Overview

Effective Speed Management Strategies

- What are the primary outcomes of an effective speed management strategy?

Improve mobility and vehicle progression by:

- ✓ Reducing nonrecurrent delays
- ✓ Reducing incident-induced delays

Improve public health and traffic safety by:

- ✓ Reducing the number of speeding-related crashes
- ✓ Reducing average speed
- ✓ Increasing speed limit compliance

(NHTSA, 2014; NHTSA, 2017)

Engineering | Enforcement

Existing Studies

Engineering: Roadway Design (FHWA 2014)

Countermeasure	Road Environment
Speed Table	1- Small town
Transverse Rumble Strips	1- Posted Speed Limit=70mph 2- High-speed intersections
Converging Chevron Marking Pattern	1- Main Roads
Transverse Markings	1- Horizontal Curves 2- Interstate Work Zone
Speed humps	1- Local roadways
Optical Speed Bars	1- Main roads 2- Freeway Curves
Speed Limit Pavement Legend	1- Main roads
"Slow" Pavement Legend	1- Main roads


Speed Table


Transverse Rumble Strips


Speed humps

Cons:

- **Not applicable to all type of roadways**

Existing Studies

Engineering: Speed Feedback Sign

- School zone
  - Texas (G. Ullman & Rose, 2005) => **Avg. Speed reduced by 9 mph**
  - South Korea (Lee et al., 2006) => **Avg. Speed reduced by 17.5%**
- Work zone
  - US, Interstate 80 (Pesti & McCoy, 2001;) => **Avg. Speed reduced by 5 mph**
- Transition areas
  - New Zealand (Wrapson et al., 2006) => **Avg. Speed reduced by 6 mph**
- Urban and rural road
  - London (Walter & Broughton, 2011) => **Avg. Speed significantly reduced**
  - Wisconsin (Santiago-Chaparro, 2012)

Cons:

- **Spatial Halo Effect**

Existing Studies

Enforcement: Law Enforcement

- Reduced aggressive and risky driving
  - United Kingdom (Stanojević et al., 2018)
- Reduce both mean speeds and variance in speed
  - London (Elliott and Broughton, 2005; Walter et al, 2011)
- Target the fatal crash
  - Queensland, Australia (Newstead, 2004)
- Increase seat belt use
  - London and Saudi Arabia (Bendak S, 2005; Stanojevic et al., 2012)

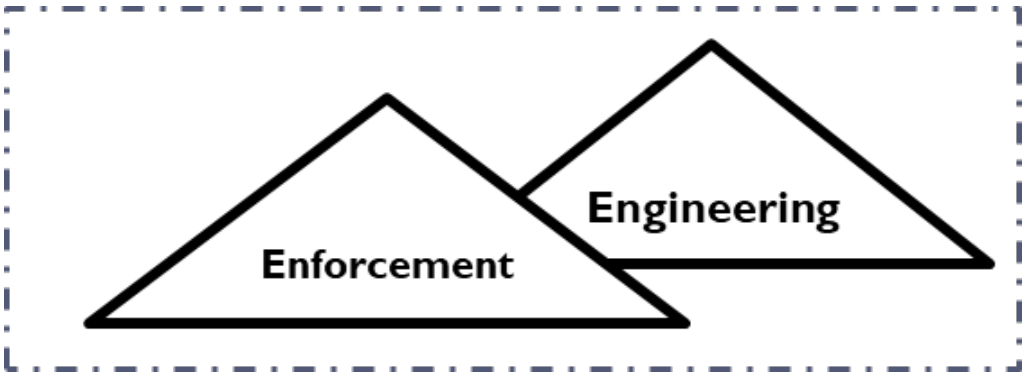
Cons:

- **Continuous enforcement is costly**

Challenges

- Roadway Design are not Always Applicable
- Continuous Enforcement is Costly
- Spatial Halo Effect (Fixed-point)
- Speed Enforcement Cameras are not legal in all states

Potential Solution



SFS + PERIODIC LAW ENFORCEMENT

Methodology:

- Developed a cross-sectional study design
  - ❑ Before and after study for strategy evaluation and comparison
  - ❑ Halo Effect Exploration
- Mixed Robust ANOVA test
  - ❑ Identify the most effective strategy

Experimental Setup

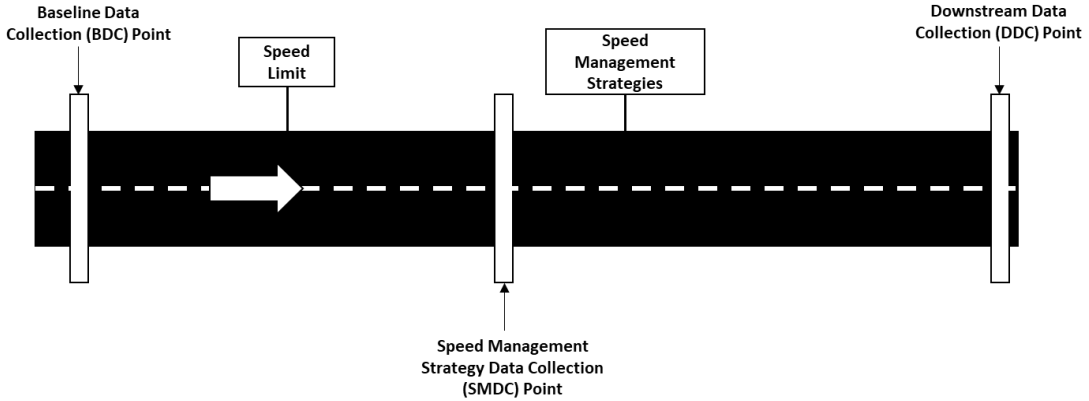
Site Selection and Layout

Study Sites

Three Sites with SFS-only

Three Sites with Periodic Law Enforcement

Three Sites with Periodic Law Enforcement + SFS



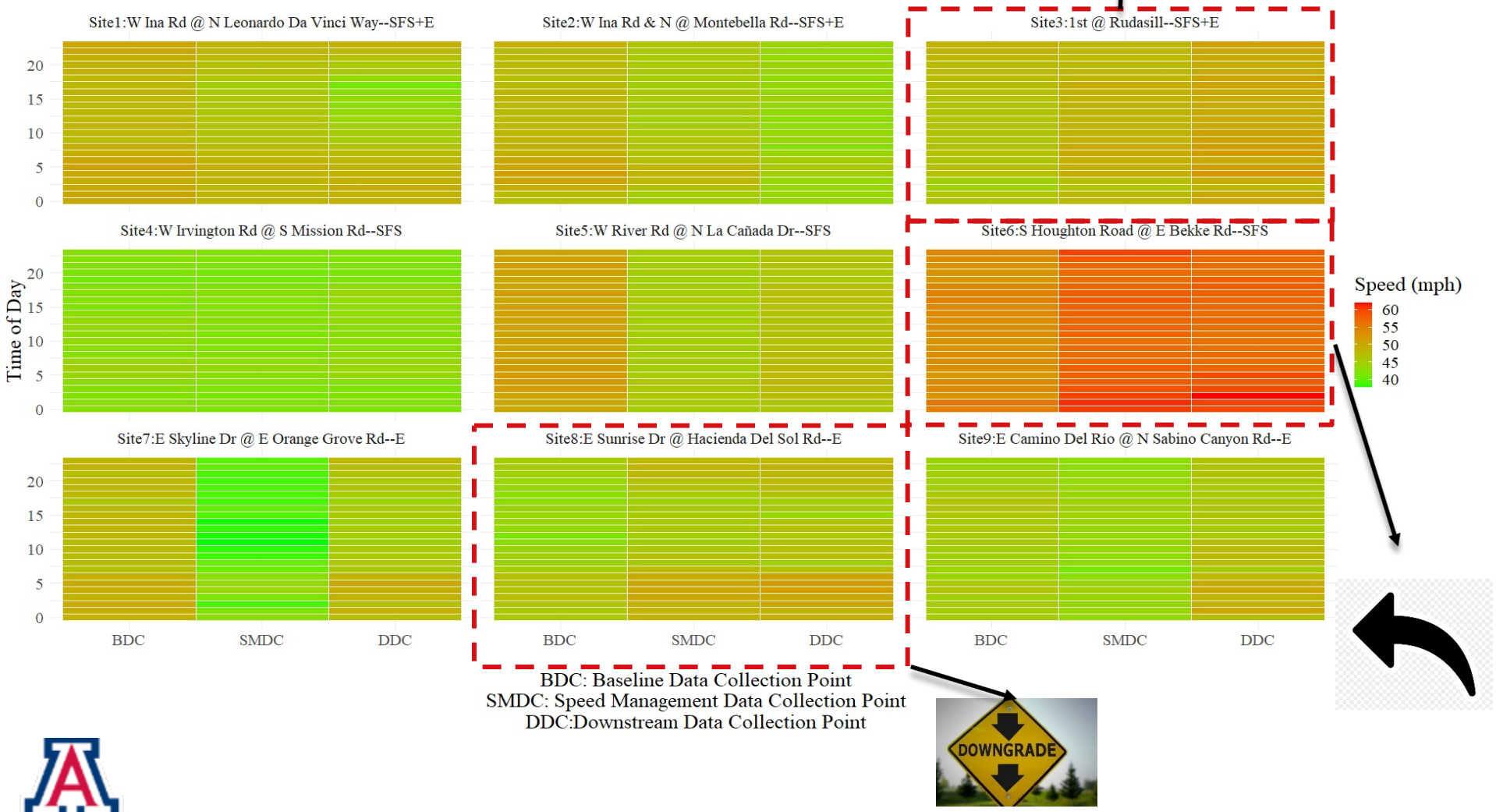
Evaluation Metrics

Behavior

Compliance

Overall Results

Speed Heatmap



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Post-Crash Care

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Post-Crash Care

- The Safe System Approach combined with a focus on redundancy, means that our responsibility does not end when a crash occurs.
- Caring for people injured in a crash to prevent their injuries from becoming fatal is just as critical.
- Timing is critical!

The National EMS Information System

The National EMS Information System provides standardized EMS documentation and data collection practices to facilitate the sharing of EMS data with local, state and national organizations.

COLLECT – CLEAN – STORE – SHARE

Core Components of NEMSIS

- **Documentation standard** for EMS response and care
- **Data definitions** for point of care data collection
- **Compliance testing** for EMS ePCR software
- **Interoperability** and exchange standards
- National EMS **Database**

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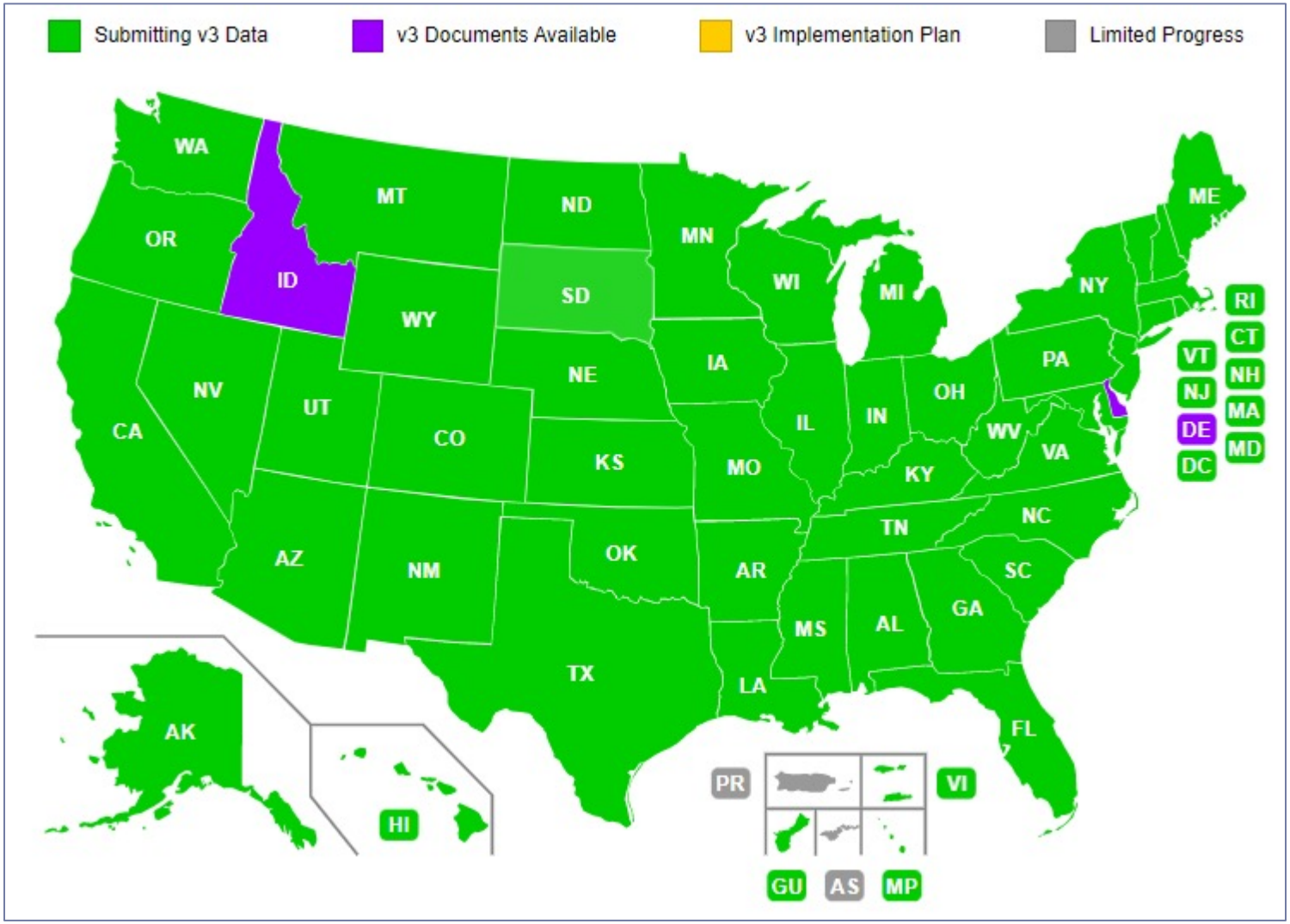
Participating States/Territories



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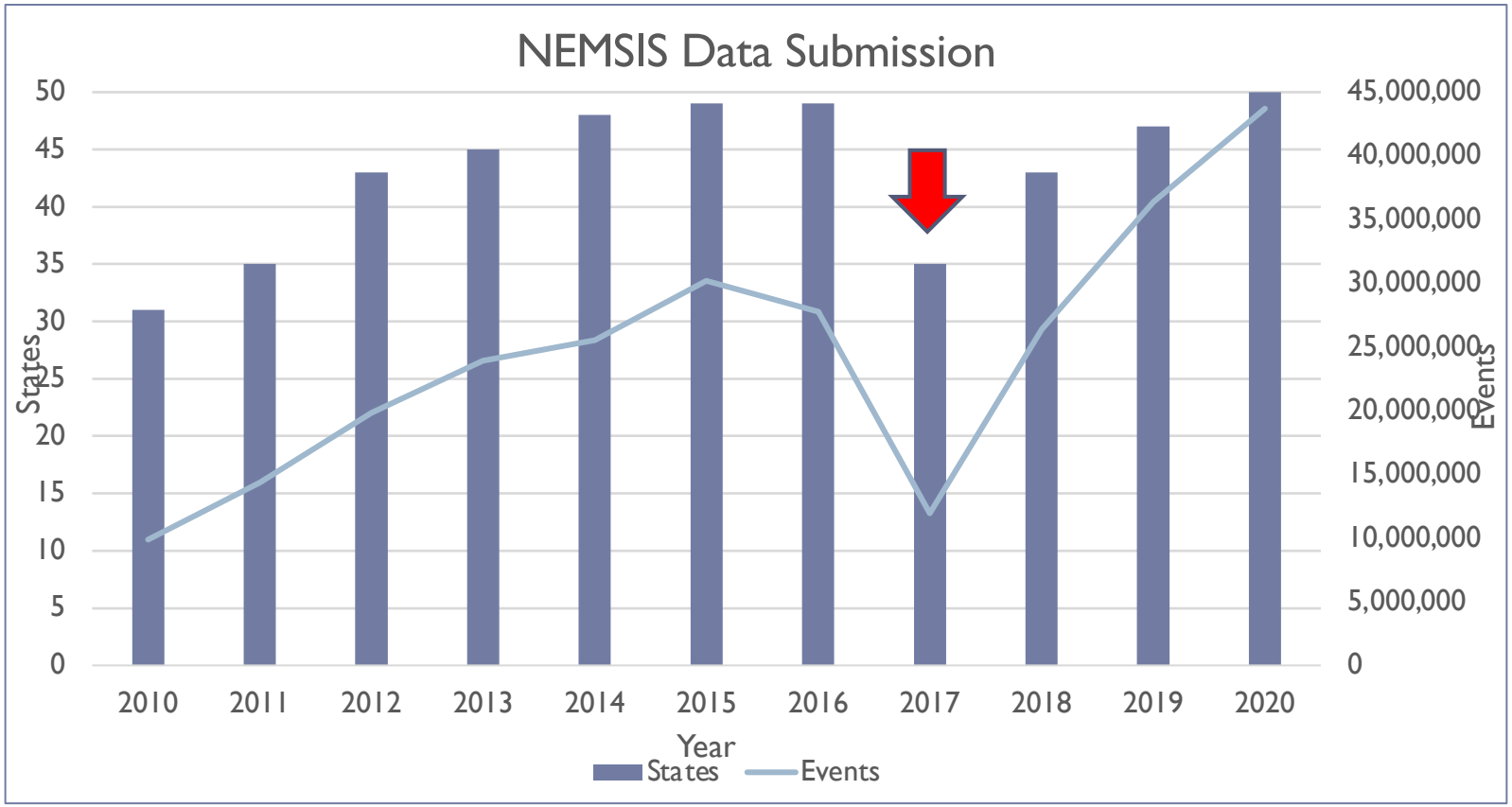
State Participation and Submissions



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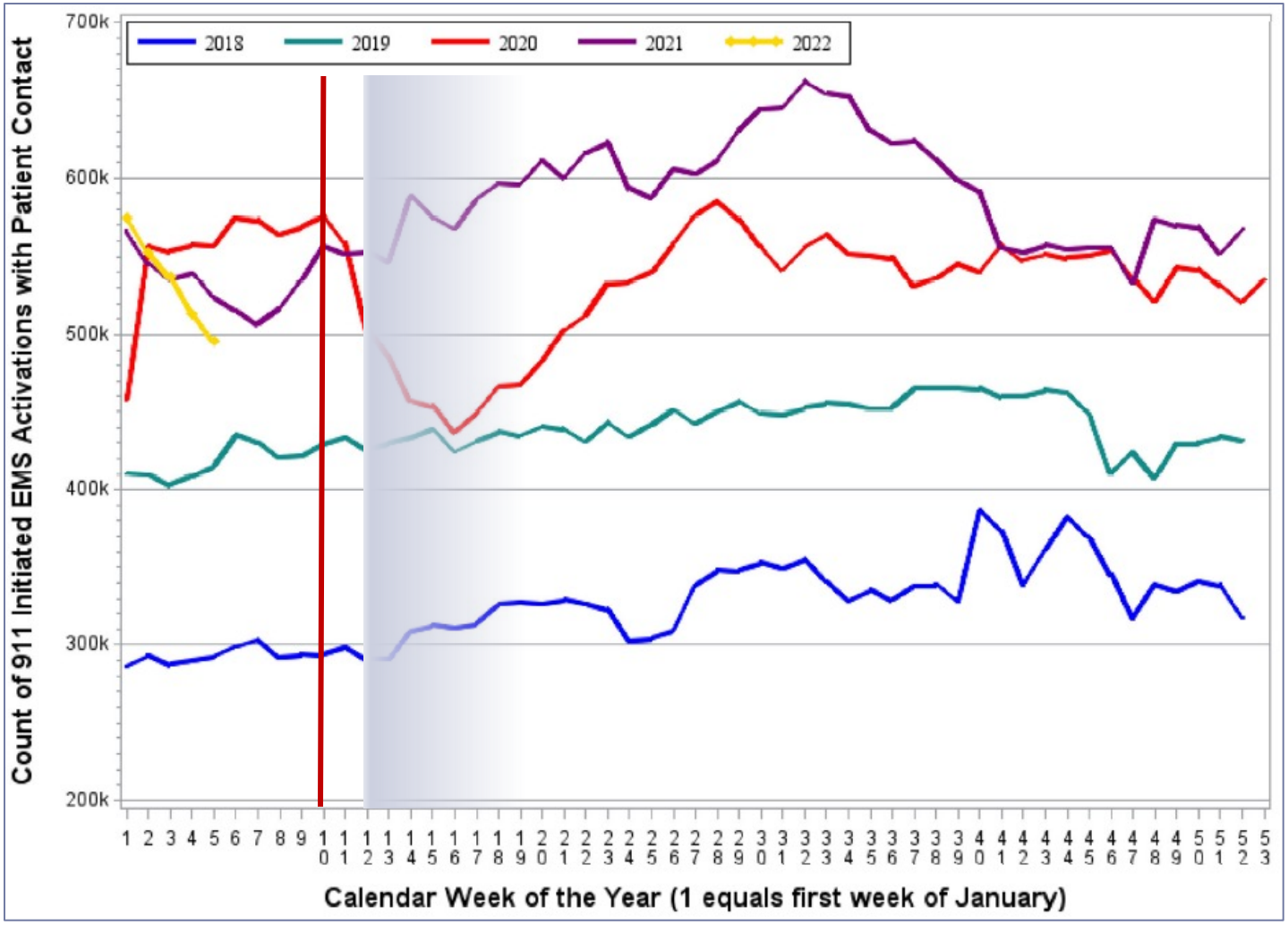
Count of All EMS Activations



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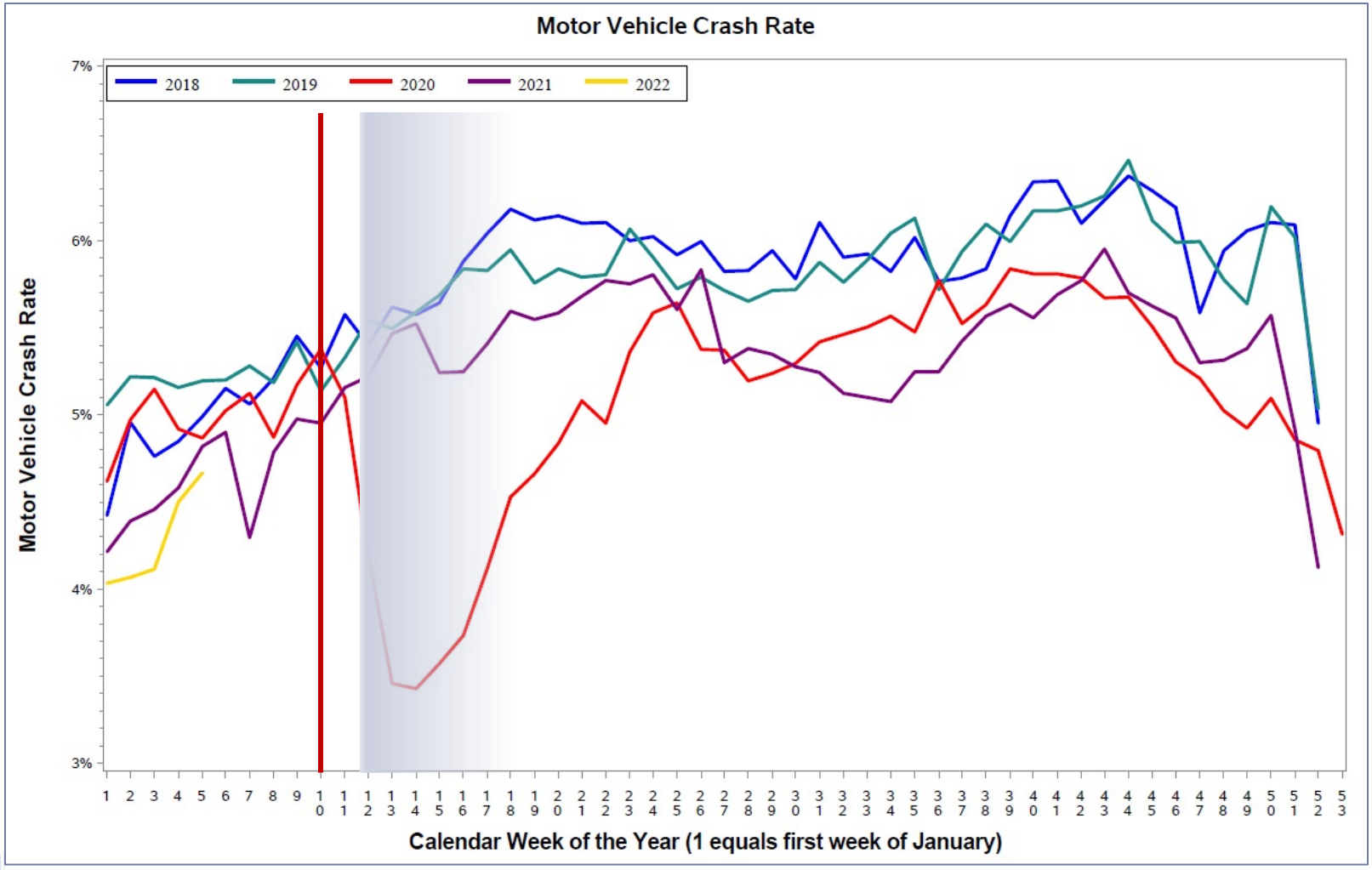
MVC Rates by Year



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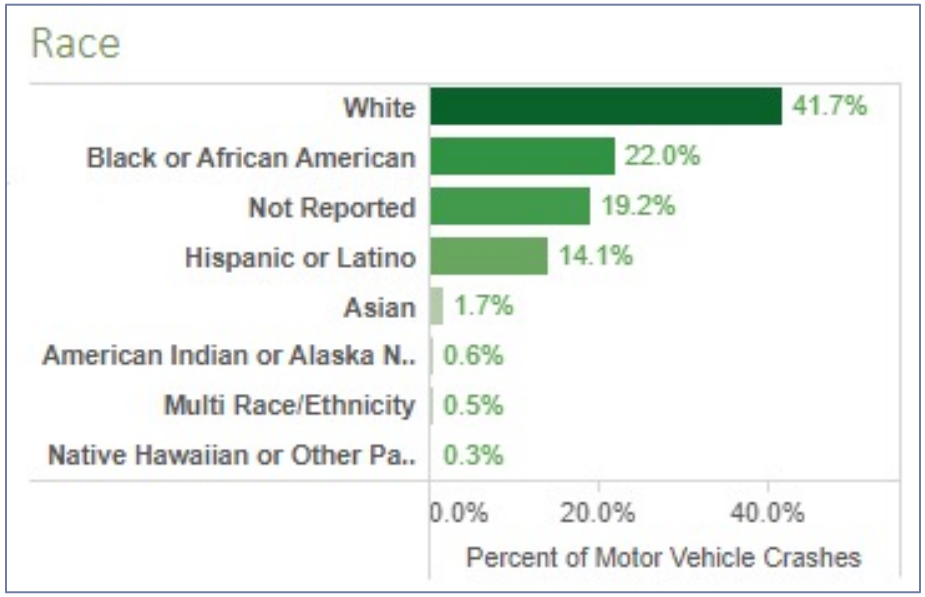
MVC Patient Characteristics

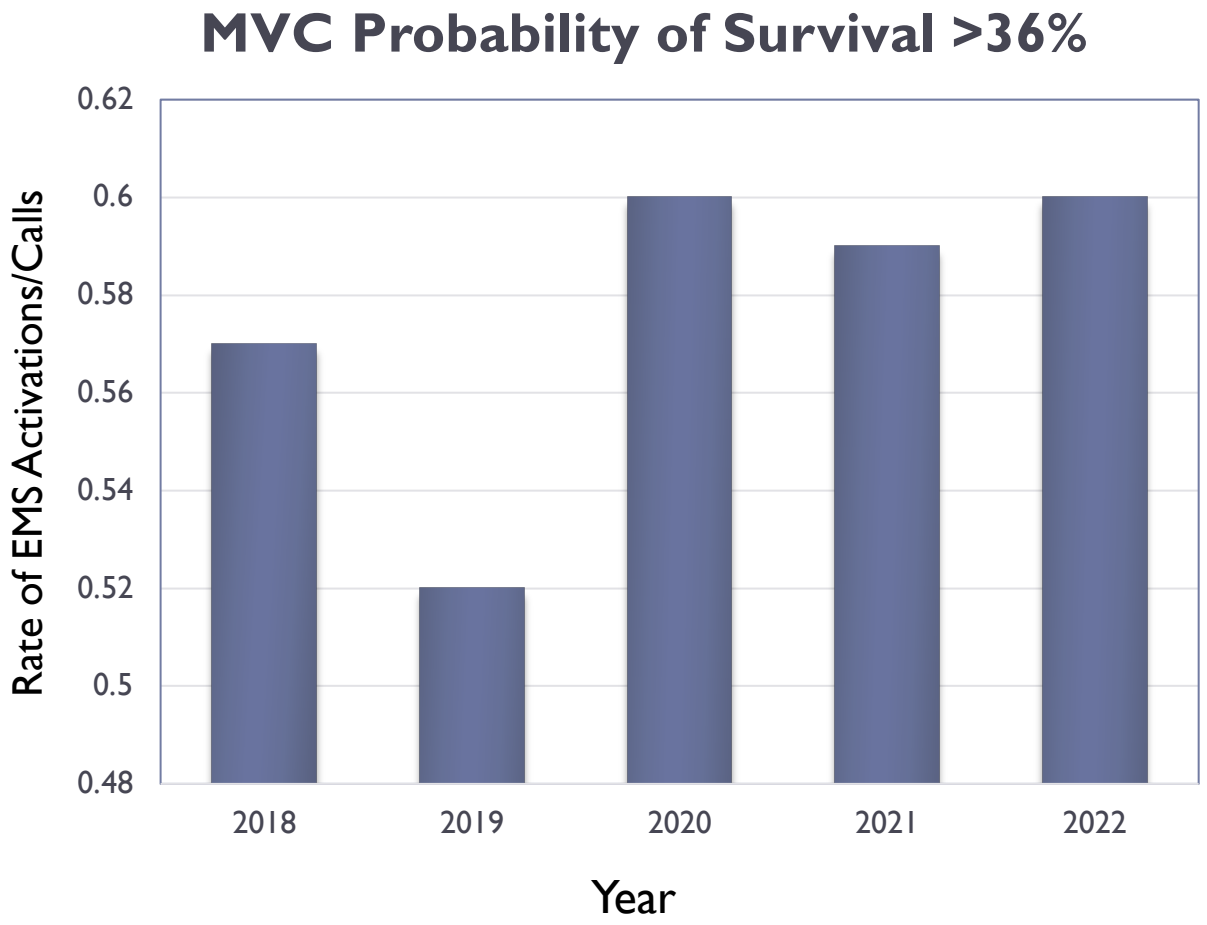


Date Range: January 01, 2020 – December 31, 2021

Age and Gender

	Gender	
Age Range	Female	Male
0-4 Years	0.2%	0.2%
5-9 Years	0.0%	0.0%
10-14 Years	3.3%	3.5%
15-19 Years	5.1%	4.8%
20-24 Years	6.2%	6.2%
25-29 Years	5.2%	5.6%
30-34 Years	4.5%	5.2%
35-39 Years	3.8%	4.3%
40-44 Years	3.3%	3.7%
45-49 Years	2.9%	3.2%
50-54 Years	2.9%	3.3%
55-59 Years	2.8%	3.3%
60-64 Years	2.4%	2.8%
65-69 Years	1.9%	2.0%
70-74 Years	1.5%	1.5%
75-79 Years	1.0%	0.9%
80-84 Years	0.6%	0.6%
85-89 Years	0.3%	0.3%
90-94 Years	0.1%	0.1%
95-99 Years	0.0%	0.0%
100+ Years	0.0%	0.0%
Unknown	0.1%	0.1%

MVC Severely Injured Patients



Defining Severe Injury using NEMSIS

Need for time-sensitive care	Need for Critical Trauma Care	Probability of Patient Survival
Transport from the scene using Lights and Sirens	Transport to a Level-1 or Level-2 Trauma Center	Based on Patient's vital signs
Provider assessment of Final Patient Acuity = "Critical" or "Emergent"		Revised Trauma Score (RTS) translated to a probability of survival

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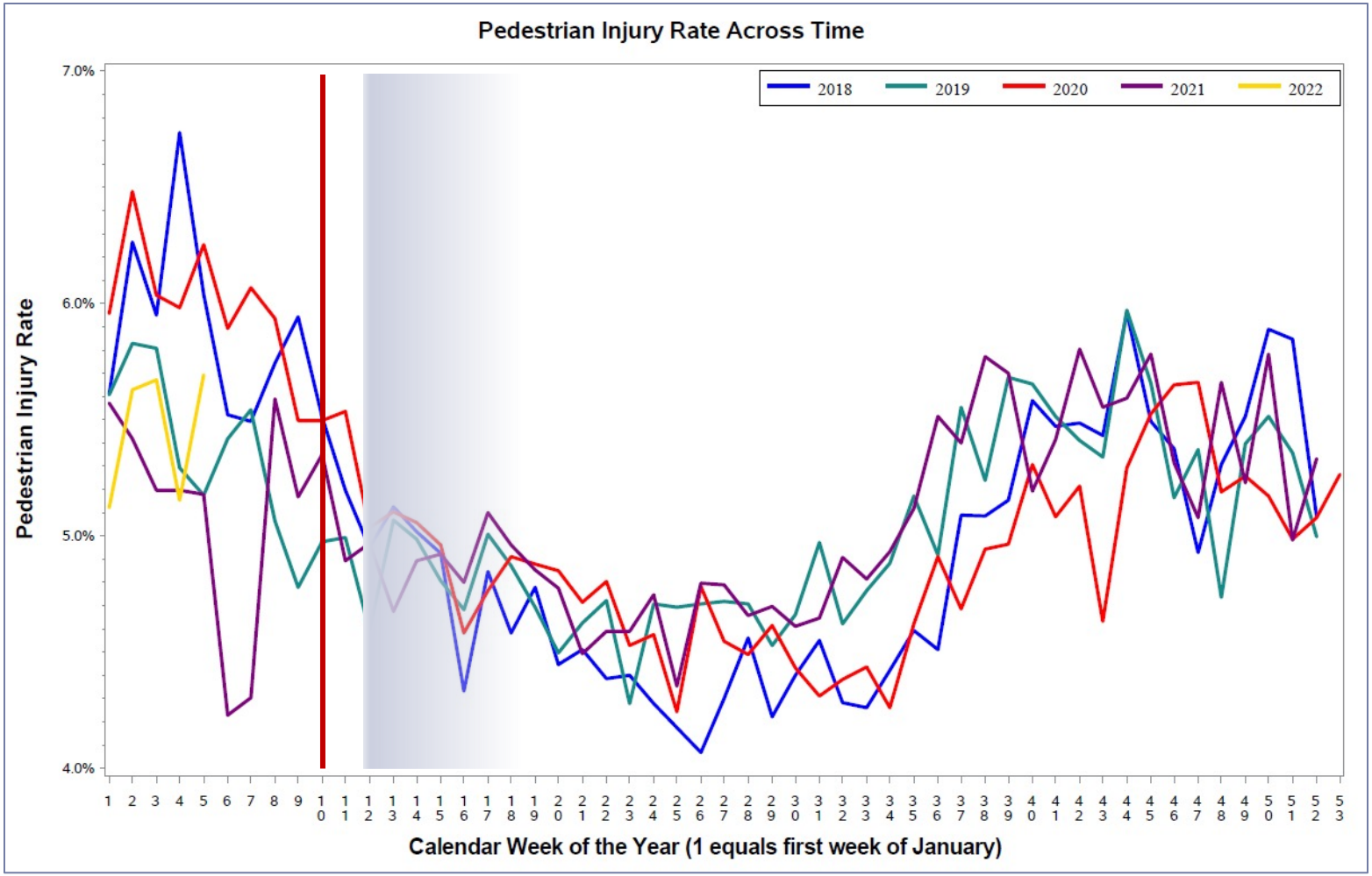
MVC v. Pedestrian Injury Rates



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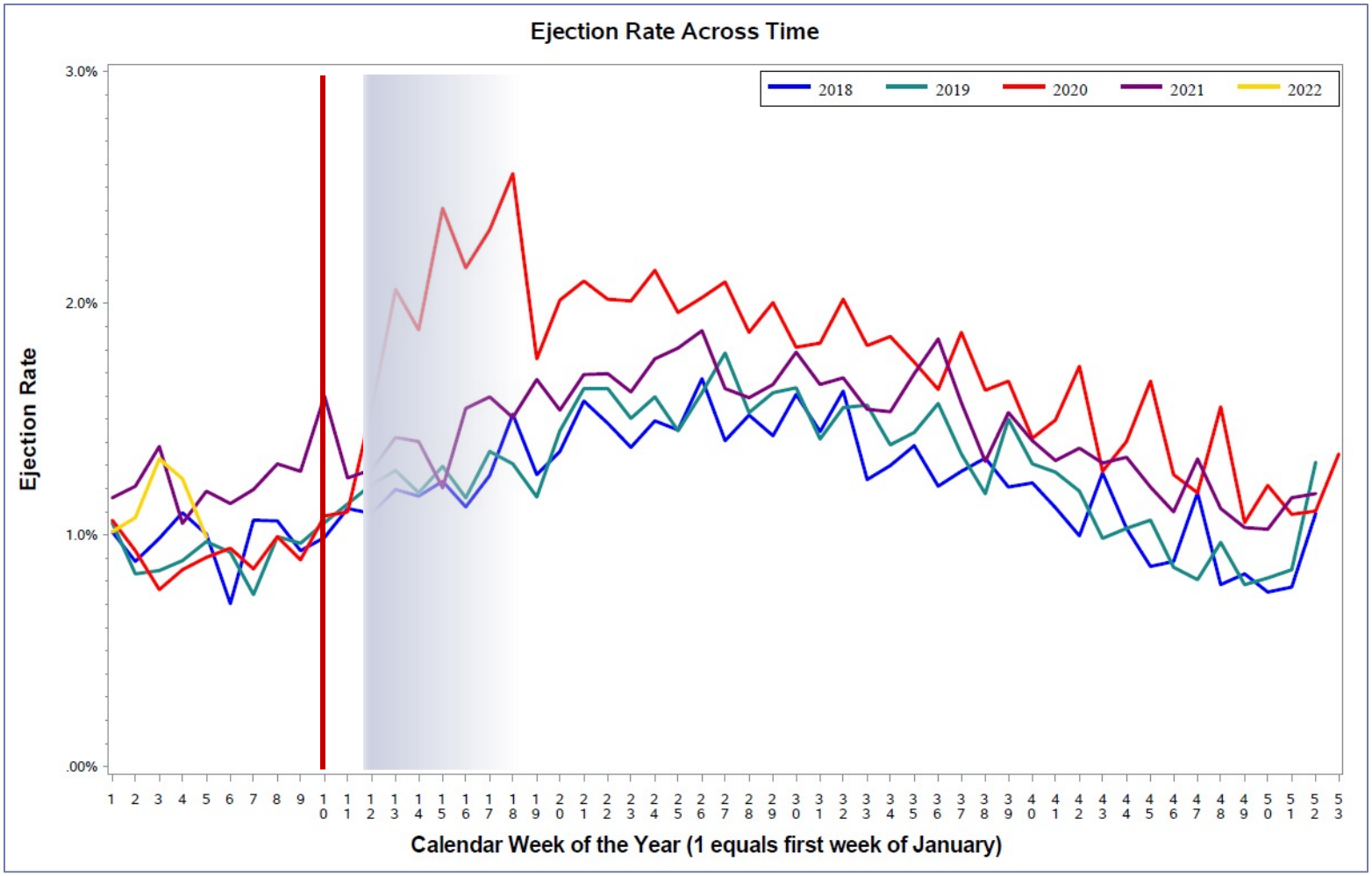
MVC Ejections



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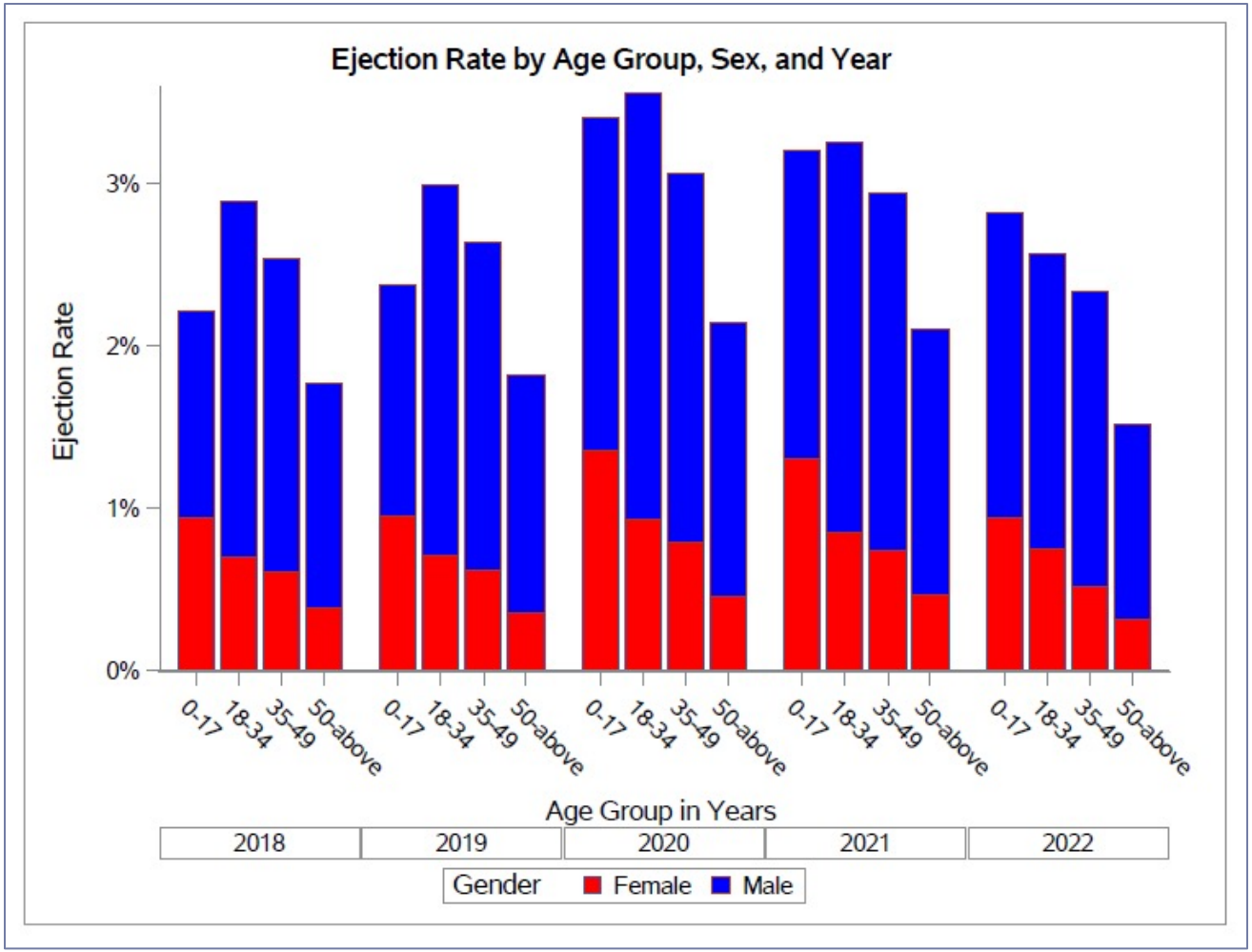
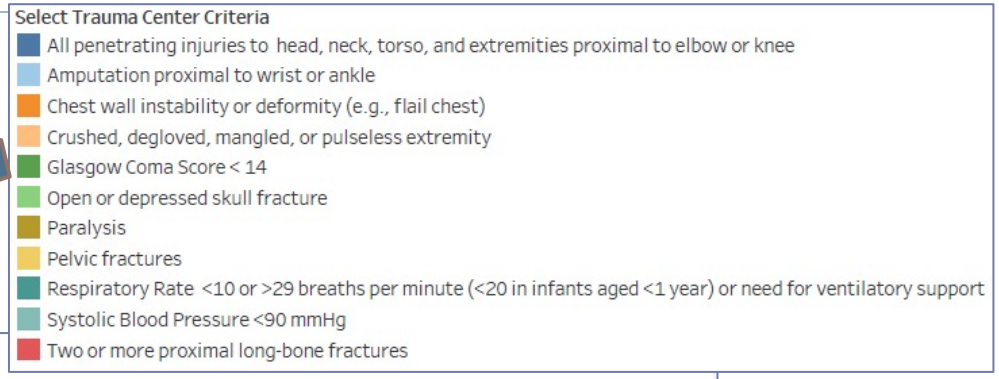
Ejections by Age and Sex

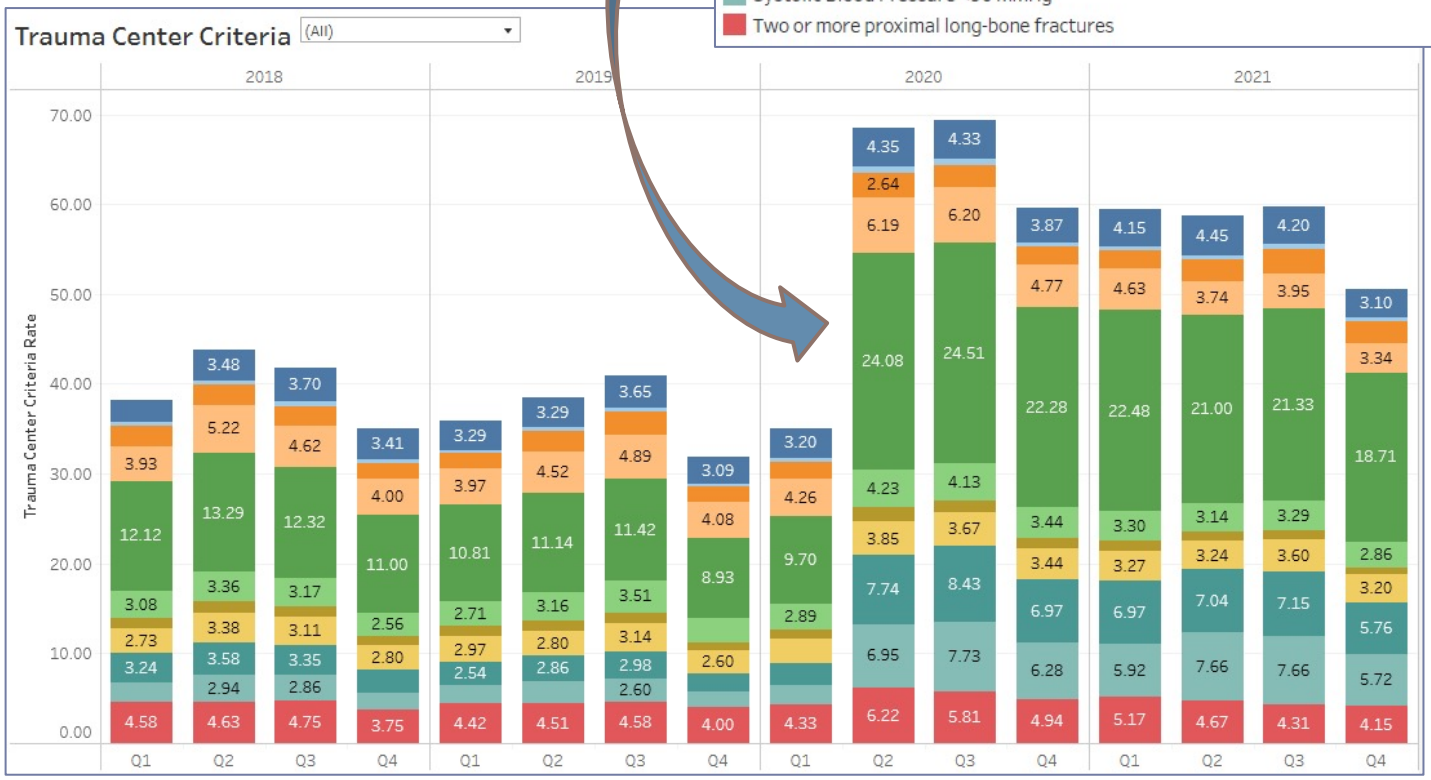


Trauma Center Criteria: Survival Probability

Table of Trauma Center Criteria

- Date Range: January 01, 2018 to December 31, 2021.
- Includes all types of MVC-related injuries.
- Demonstrates changes in WHY patients are qualified to go to a Trauma Center.



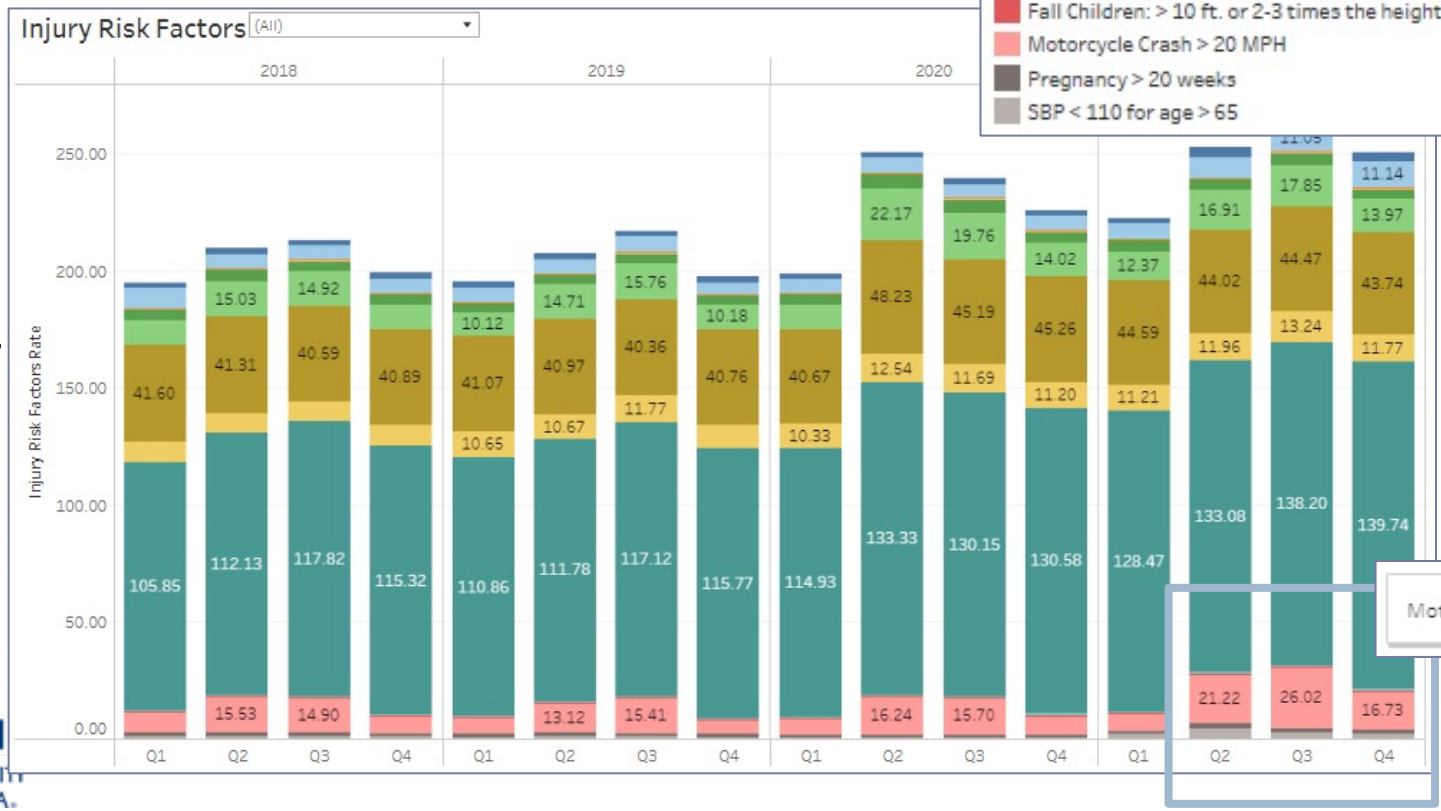


Y-axis: Rate is per 1,000 crashes

Trauma Center Criteria based on vital signs and anatomical injury.

Trauma Center Injury Risk Factors

- Date Range: January 01, 2018 to December 31, 2021.
- Includes all types of MVC-related injuries.
- Demonstrates changes in risk factors that help to inform severity and Trauma Center Criteria.



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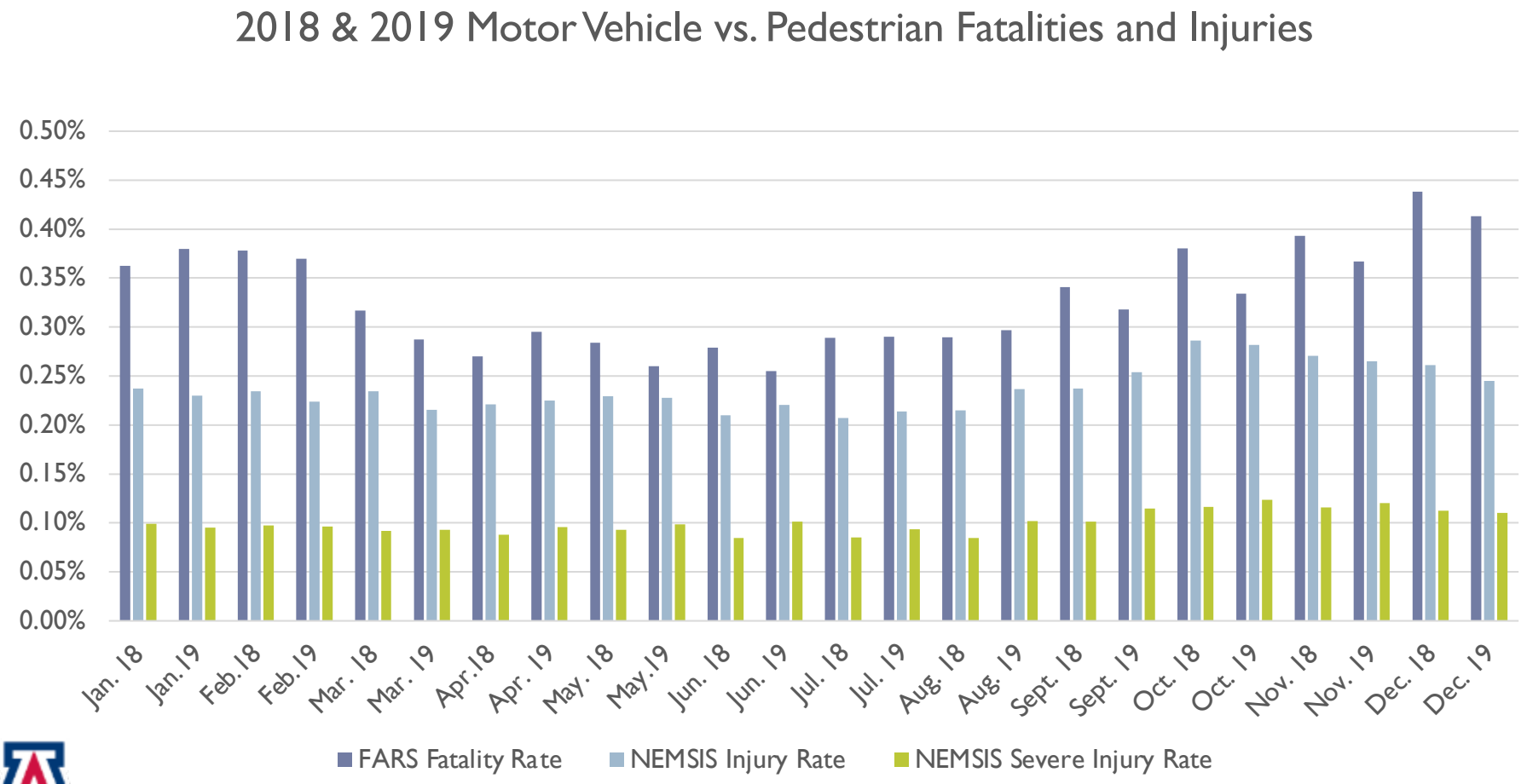
Comparing Fatalities and Injuries: Motor Vehicle vs. Pedestrian



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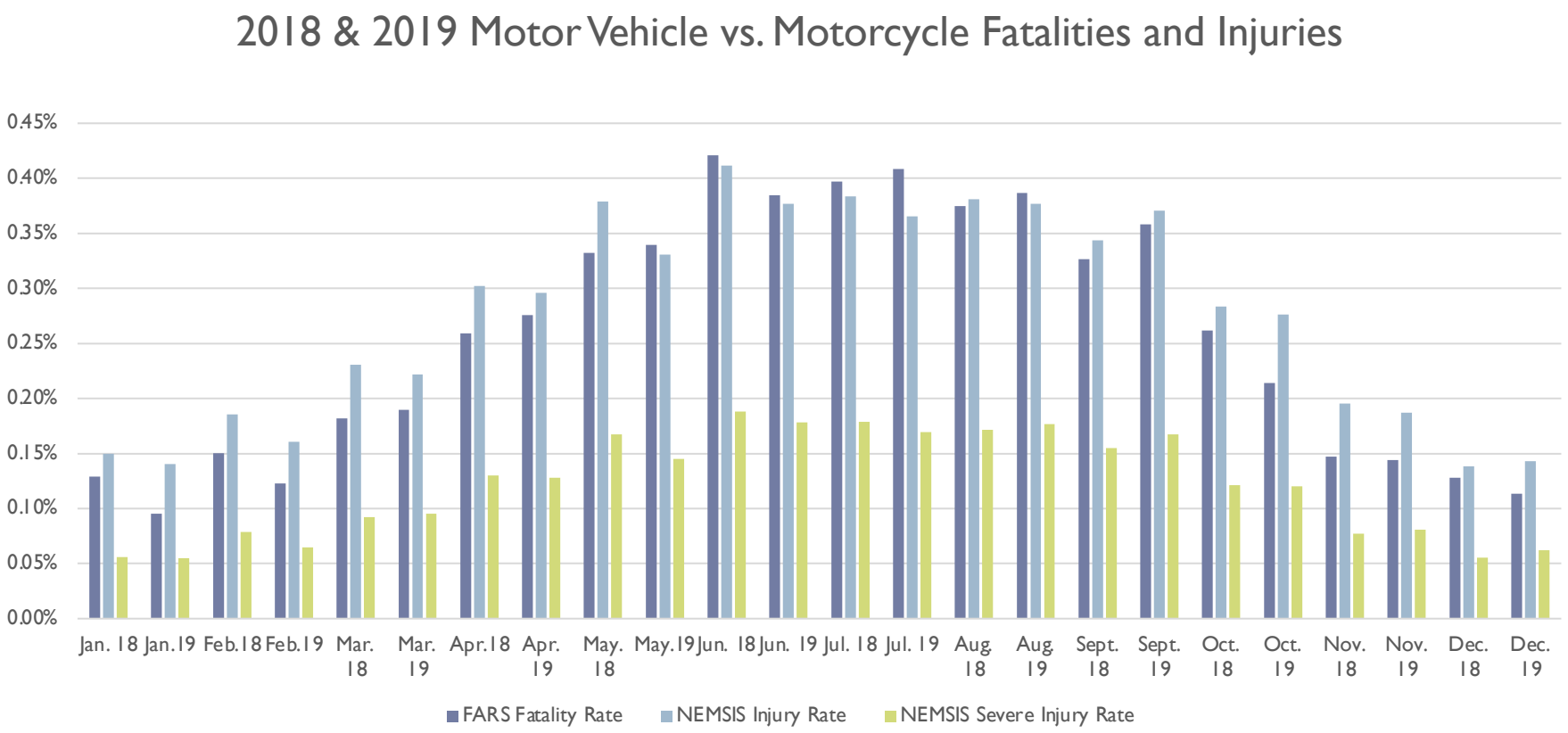
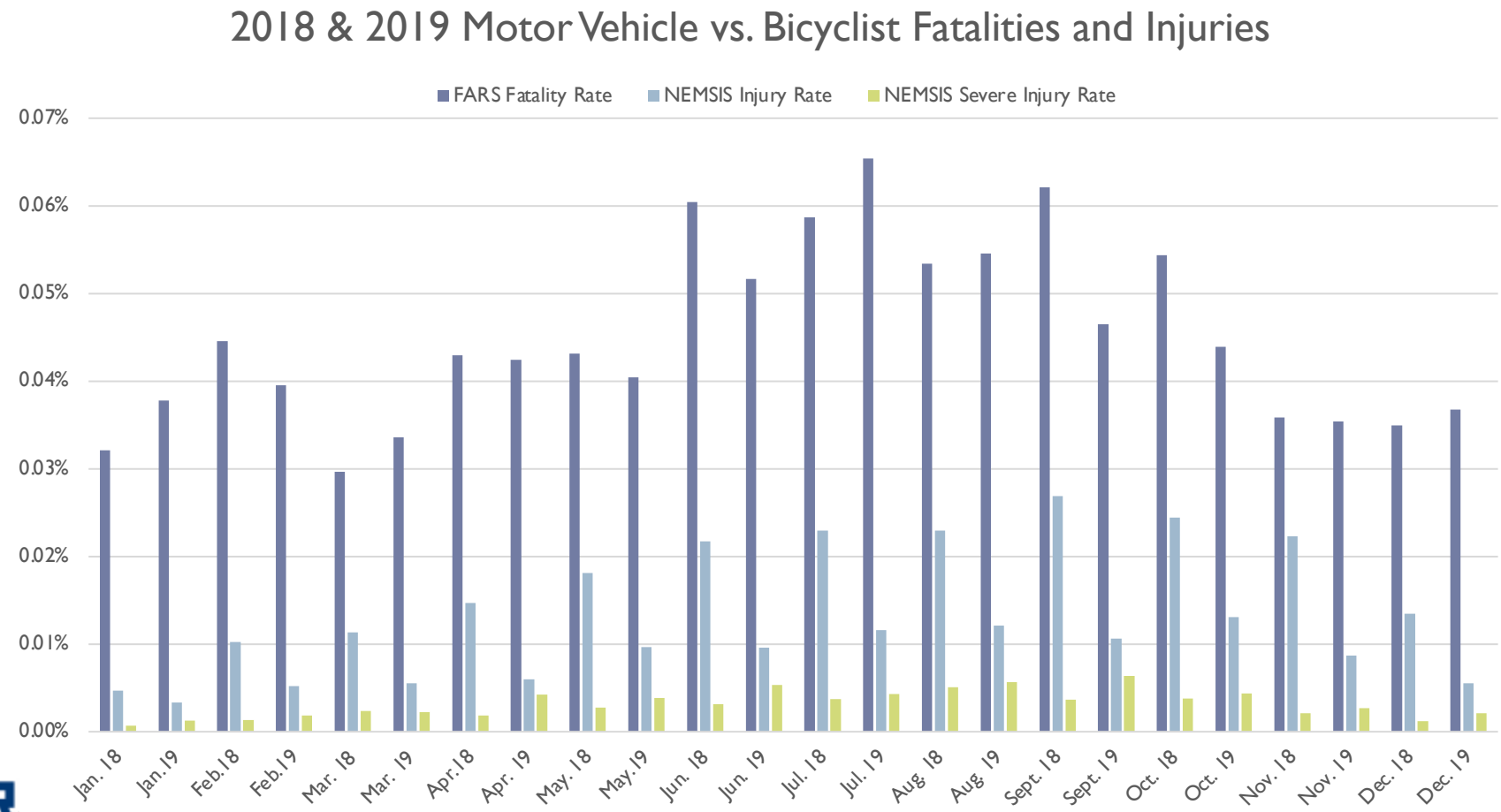
Comparing Fatalities and Injuries: Motor Vehicle vs. Motorcycle



Comparing Fatalities and Injuries: Motor Vehicle vs. Bicyclist



Conclusion


DEATH/SERIOUS INJURY IS UNACCEPTABLE
HUMANS MAKE MISTAKES
HUMANS ARE VULNERABLE
RESPONSIBILITY IS SHARED
SAFETY IS PROACTIVE
REDUNDANCY IS CRUCIAL
THE SAFE SYSTEM APPROACH
Safe Road Users
Safe Vehicles
Safe Speeds
Safe Roads
Post-Crash Care

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Thank you! Questions?