



# Massachusetts Department of Public Health

## Enhanced Surveillance of Work-Related Motor Vehicle Crash Injuries and Deaths in Massachusetts

NYC Vision Zero Annual Research on the Road Symposium

November 19, 2025

Presenting Author:

**Franchesca Molina, MPH**

Former CSTE Applied Epidemiology Fellow,  
Massachusetts Department of Public Health  
(DPH) Injury Surveillance Program

Contributing Authors:

**Jeanne Hathaway, MD, MPH** – Epidemiologist,  
DPH Injury Surveillance Program

**James Laing** – Workplace Fatality Coordinator,  
DPH Occupational Health Surveillance Program

# Background

Nationwide, motor vehicle crashes (MVCs) are the leading cause of fatal work-related injuries<sup>1</sup> and the 6<sup>th</sup> leading cause of nonfatal work-related injuries.<sup>2</sup>



- The Occupational Safety and Health Administration (OSHA) has limitations on which motor vehicle events it is authorized to investigate.<sup>3</sup>
- Surveillance sources (death data, police reports, news coverage, etc.) do not always identify these events as work-related.
- It is especially difficult to identify work-related injuries among gig workers.



<sup>1</sup> The National Institute for Occupational Safety and Health (NIOSH) (2022, Aug 30). *Motor Vehicle Safety At Work: Burden, Need, and Impact*. Centers for Disease Control and Prevention (CDC). <https://www.cdc.gov/niosh/motorvehicle/ncmvs/BNI.html>

<sup>2</sup> U.S. Department of Labor: Bureau of Labor Statistics (BLS) (2023, Nov 8). *Employer-Reported Workplace Injuries and Illnesses – 2021-2022*. BLS. <https://www.bls.gov/news.release/pdf/osh.pdf>

<sup>3</sup> U.S. Department of Labor: Occupational Safety and Health Administration (OSHA) (n.d.). *Motor Vehicle Safety: Standards*. OSHA. <https://www.osha.gov/motor-vehicle-safety/standards>

# Purpose and Objectives

**Purpose:** To improve statewide surveillance of fatal and nonfatal work-related motor vehicle crash injuries among motorists and non-motorists<sup>1</sup> using data sources in the Massachusetts Crash-Related Injury Surveillance System (MA CRISS).

## **Objectives:**

1. Create algorithms that identify potentially work-related indicators in MA CRISS data sources.
2. Develop criteria to identify gig workers among available MA CRISS data sources using narrative fields.

<sup>1</sup> Motorists = car and truck occupants (drivers and passengers) and motorcyclists. Motorist injuries relating to buses, taxis, and ridesharing services were limited to drivers only; Non-Motorists = cyclists and pedestrians.

# Definitions

- **Work-related motor vehicle crashes (MVCs)**

– crashes involving a motor vehicle, that occurred in MA, and in which a motorist or non-motorist<sup>1</sup> was working at the time of the crash and sustained fatal or nonfatal injuries



- Includes: Traffic and non-traffic crashes<sup>2</sup>; car, truck, and heavy vehicle occupants, motorcyclists, pedestrians, and cyclists; limited to drivers of buses, taxis, rideshare vehicles and other livery
- Excludes: Non-collision injuries involving a motor vehicle<sup>3</sup>; people injured in an MVC while commuting to work

- **Gig workers** – motorists and non-motorists who get paid for work by the job/task rather than by the hour/year



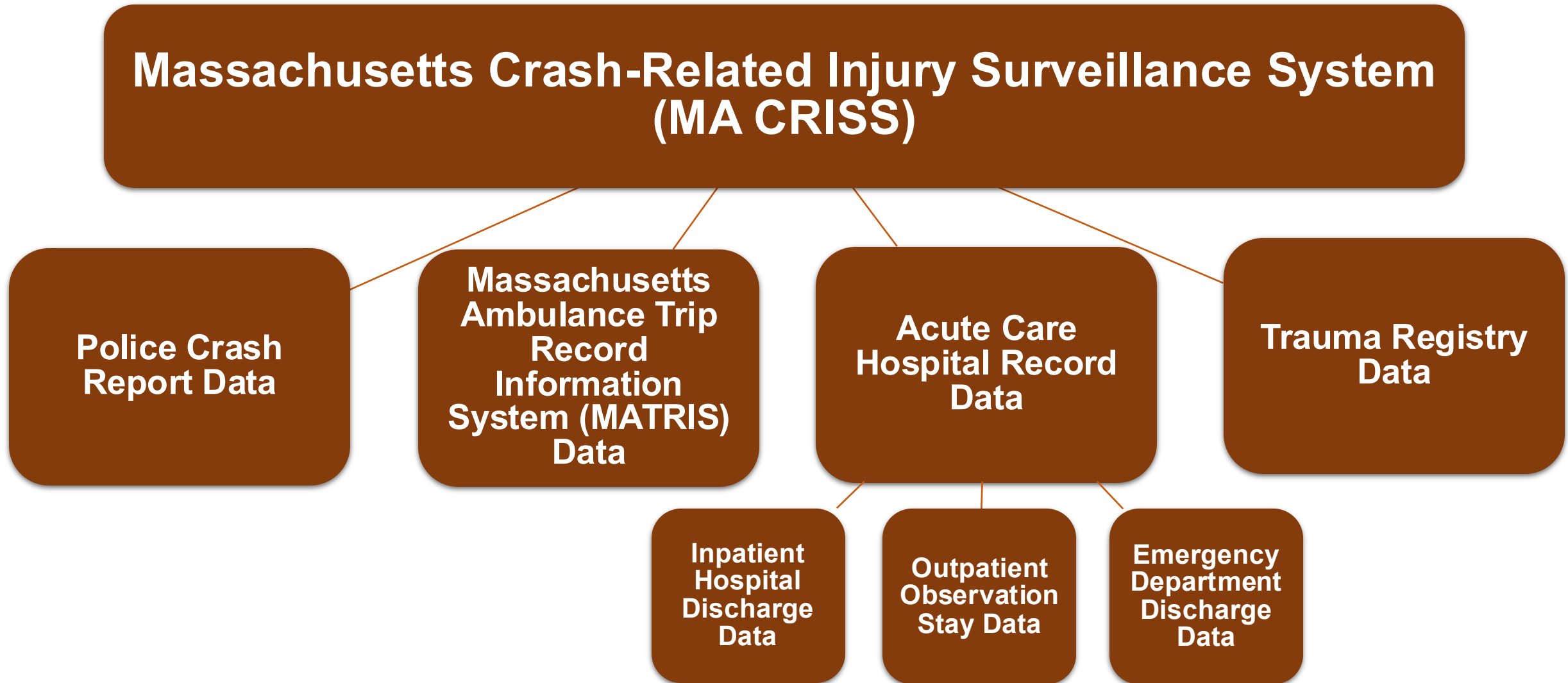
- Includes: Rideshare driver app-based food delivery persons; some private-company package delivery persons

<sup>1</sup> Motorists = car and truck occupants (drivers and passengers) and motorcyclists. Non-Motorists = cyclists and pedestrians.

<sup>2</sup> Traffic crashes occur on public roadways, i.e., highways and streets. Non-traffic crashes do not occur on public roadways, e.g., parking lots, driveways, and private roads.

<sup>3</sup> Examples include slamming a hand in the car door, falling from a vehicle, or getting injured by a moving part of a vehicle, such as the bed of a dump truck.


# Data Sources




# Methods: Overview of Steps

## For each data source:


1. Identified potential work indicators in variables and codes.



2. Assessed data quality of potential work indicators within cases involving motor vehicle crash (MVC) injuries.



3. Created an algorithm, including text searches, to find potential work-related MVC injury cases using the identified work indicators.



# Methods: Overview of Steps

## For each data source:



**4.** Assessed overlap in work-related motor vehicle crash (MVC) injury cases in different MA CRISS data sources through data linkage.



**5.** Assessed the sensitivity of the new surveillance system through data linkage with previously identified work-related MVC fatalities and nonfatalities.



**6.** Evaluated the strengths and limitations of each MA CRISS data source to identify work-related MVC injury cases.

# Methods: Step 1



## Step 1. Identified potential work indicators in variables and codes in each data source.

- National guidelines exist for collecting crash reports, EMS, and Trauma Registry data (see notes for websites), but states may collect varying variables.
  - Variables within a data source may also change from year to year due to guideline changes.<sup>1</sup>
- Years of data used:
  - 2019 when possible as we felt it would be a more accurate indicator of total work-related crashes than pandemic era (2020) data.
  - 2020 data was the only year of MA Ambulance Trip Record Information System (MATRIS) data included in MA CRISS at the time.<sup>2</sup>
- Narratives and variables with free text fields required additional review to determine inclusion and exclusion criteria/terms.

<sup>1</sup> 2020 MATRIS data included records submitted using two versions of NEMSIS criteria (V2 and V3), which had slightly different variables and values.

<sup>2</sup> MATRIS data collection was implemented by the MA Department of Public Health (DPH) in 2013.

# Methods: Step 1

- We also linked each MA CRISS data source to work-related MVC fatalities identified by the MA DPH Occupational Health Surveillance Program (OHSP) using Fatality Assessment and Control Evaluation (FACE)<sup>1</sup> program criteria to double-check for potential work indicators.
  - Deterministic linkage was done using the date of birth and crash/admission date.
  - The accuracy of linked cases was confirmed using the city/town of the crash site and the city/town of residence.
- FACE fatalities were identified using the following data sources:
  - Media sources
  - Death Certificates
  - Police Crash Reports, including state police fatal crash investigation summaries
  - Workers' Compensation data
- The only additional work indicators identified in this process were three vehicle ownership variables in the Police Crash Report data.

<sup>1</sup> FACE (Fatality Assessment and Control Evaluation) is the NIOSH cooperative agreement under which MA DPH monitors and documents workplace deaths.

# Methods: Step 2



**Step 2.** Assessed data quality of potential work indicators within cases involving motor vehicle crash (MVC) injuries.

We used the following criteria to select MVC injury cases from each data source:

- **Police Crash Report data** – Motorists and non-motorists with an injury severity code indicating fatal, nonfatal, or possible injuries.<sup>1</sup>
- **MATRIS data** – The dispatch complaint, cause of injury, vehicle and pedestrian risk factors, and narrative fields were used to identify MVC cases in 911 calls.<sup>2</sup>
- **Acute Care Hospital Record & Trauma Registry data** – Cases with specified ICD-10-CM V-codes for traffic or non-traffic MVC injuries in any diagnosis field.<sup>3</sup>

<sup>1</sup> The inclusion of “possible injury” cases may have led to the inclusion of some cases without injuries. The City of Boston was also not submitting crash reports to the state data system in 2019 or 2020, which would have contributed to an underestimate of work-related MVC injuries.

<sup>2</sup> It was difficult to identify MVC injury cases in this version of MATRIS data. Our broad search criteria may have resulted in the inclusion of some non-MVC injury cases.

<sup>3</sup> We searched all diagnosis fields for specified V-codes between V02 – V89 with a 7<sup>th</sup> character of “A” or blank, indicating active treatment.

# Results: Potential Work Indicator Data Quality

## Completeness of the General Work Indicator Variables by MA CRISS Data Source

Work Indicator Variable or Category	2019 MA Police Crash Reports	2020 MA Ambulance Trip Records (MATRIS)	2019 MA Acute Care Hospital Records	2019 MA Trauma Registry
Vehicle Type & Weight Variables	✓			
Vehicle Registration Type Code & Vehicle Owner Name Variables	✓			
Work Zone-Relation & Road Contributing Circumstance Code	✓			
Non-Motorist Activity Code	✓			
Payer Source/Type			✓	
Work-Related Injury/Illness		✓		✓
Narrative	✓	✓		

Green = 75%+ completion

Yellow = 50-74% completion

Red = <50% completion

# Results: Potential Work Indicator Data Quality

## Completeness of the ICD-10-CM<sup>1</sup> Work Indicator Variables by MA CRISS Data Source

Work Indicator Variable or Category	2019 MA Police Crash Reports	2020 MA Ambulance Trip Records (MATRIS)	2019 MA Acute Care Hospital Records	2019 MA Trauma Registry
External Cause of Morbidity (V) Code Variables		✓	✓	✓
Place of Occurrence (Y92) Code Variables			✓	✓
Activity (Y93) Code Variables			✓	✓
Injury (Work) Status (Y99) Code Variables			✓	✓
Injury Exam (Z) Code Variables			✓	✓

Green = 75%+ completion

Yellow = 50-74% completion

Red = <50% completion

<sup>1</sup> [International Classification of Diseases, 10<sup>th</sup> Revision, Clinical Modification](#), Centers for Disease Control and Prevention, National Center for Health Statistics.

# Methods: Step 3



**Step 3.** Created an algorithm, including text searches, to find potential work-related MVC injury cases using the identified work indicators.

- Flags were created for each work indicator to count how many work indicators were present per case.
- The results of text searches for gig workers and other types of workers were reviewed and refined as needed to capture work-related cases and exclude false positives.
  - Narrative searches in Police Crash Report data included terms for rideshare and delivery workers only.
  - Narrative searches in MATRIS data included terms for rideshare and delivery workers, “working” as an activity, and work vehicles (given the limited number of other work indicators in MATRIS data).

# Results: Potential Cases Identified in 2019-2020

## Potential Work-Related Fatal and Nonfatal Motor Vehicle Crash Injury Cases Identified in 2019 and 2020 MA CRISS Data Sources

Data Source	Data Year	Total Injured Motorists and Non-Motorists <sup>1</sup> #	Total Injured in Potential Work-Related Crashes # (%)	Injured Gig Workers <sup>2</sup> in Work-Related Crashes # (%)
MA Police Crash Reports <sup>3</sup>	2019	43,106	<b>3,350 (7.8%)</b>	32 (1.0%)
	2020	33,139	<b>1,926 (5.8%)</b>	36 (1.9%)
MA Acute Care Hospital Records <sup>4</sup>	2019	73,016	<b>2,712 (3.7%)</b>	N/A <sup>5</sup>
	2020	49,531	<b>1,686 (3.4%)</b>	N/A <sup>5</sup>
MA Trauma Registry <sup>6</sup>	2019	5,777	<b>143 (2.5%)</b>	N/A <sup>5</sup>
MA Ambulance Trip Record Information System (MATRIS) <sup>6</sup>	2020	28,403	<b>546 (1.9%)</b>	11 (2.0%)

<sup>1</sup> Motorists = car and truck occupants and motorcyclists. Motorist injuries relating to buses, taxis, and ridesharing services were limited to drivers only; Non-Motorists = cyclists and pedestrians.

<sup>2</sup> Gig workers include rideshare drivers, app-based food delivery persons, and some private company package delivery persons. Gig workers may include motorists or non-motorists. These cases were identified through text searching and manual review to exclude false positives, such as non-gig workers injured in the same crash event.

<sup>3</sup> Collected by the MassDOT Registry of Motor Vehicles.

<sup>4</sup> Collected by the Center for Health Information and Analysis (CHIA).

<sup>5</sup> Acute Care Hospital Record and Trauma Registry data do not have narratives to search for terms or other variables that identify gig workers. Both datasets were deduplicated to the individual level as some people had multiple hospital visits for the same incident.

<sup>6</sup> Collected by the MA DPH Bureau of Health Care Safety and Quality.

# Methods: Step 4

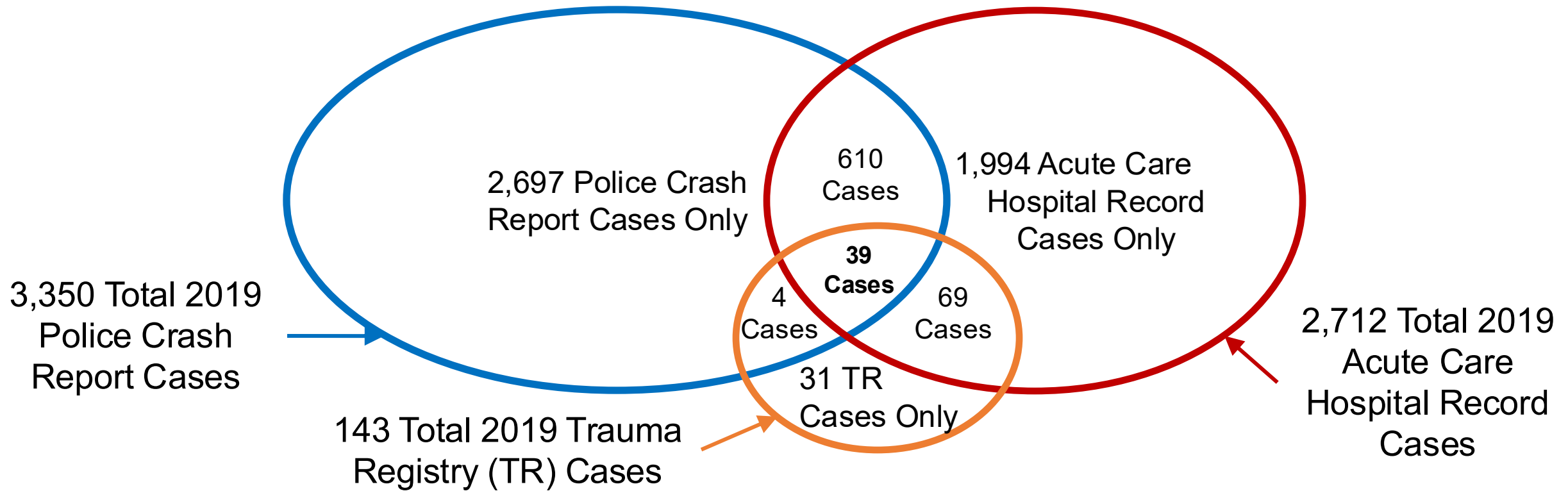


## Step 4. Assessed overlap in work-related MVC injury cases in different MA CRISS data sources through data linkage.

- We deterministically linked each data source's potential work-related MVC injury cases by data year using the date of birth and crash/admission date. The accuracy of linked cases was confirmed using other fields, including names, city/town of residence, city/town of crash site/hospital, sex/gender, person type, ICD-10-CM codes, and narratives.
- Cases were deduplicated, prioritizing cases with higher injury treatment levels and a greater number of work indicators, using the following unique identifiers in each data source:
  - State-unique crash ID and person number<sup>1</sup> from Police Crash Report data;
  - Billing number from Acute Care Hospital Record data;
  - Record ID from Trauma Registry data; and
  - Incident ID from MATRIS data.

<sup>1</sup> According to the [MMUCC](#) from the National Highway Traffic Safety Administration (NHTSA), person number indicates the “number for the motor vehicle occupant in the motor vehicle they occupied, or for each non-motorist, in consecutive order”.

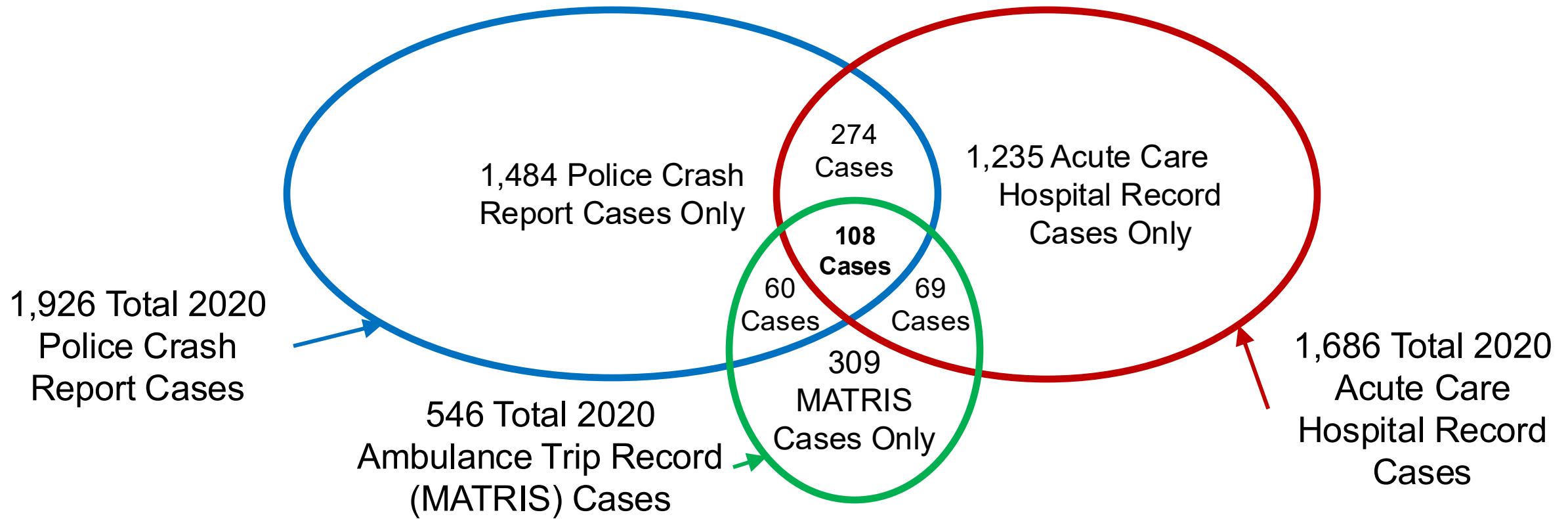
# Results: 2019 Work-Related MVC Injury Case Overlap



In 2019, MA CRISS identified 5,444 unique, potentially work-related motor vehicle crash (MVC) injury cases.

- 86.7% (4,722) were identified in only 1 of the 3 data sources, mainly in Crash Report and Hospital Record data.
- 12.5% (683) were identified in 2 of the 3 data sources.
- 0.7% (39) were identified in all 3 data sources.

# Results: 2020 Work-Related MVC Injury Case Overlap



In 2020, MA CRISS identified 3,539 unique, potentially work-related motor vehicle crash (MVC) injury cases.

- 85.6% (3,028) were identified in only 1 of the 3 data sources, mainly in Crash Report and Hospital Record data.
- 11.4% (403) were identified in 2 of the 3 data sources.
- 3.1% (108) were identified in all 3 data sources.

# Methods: Step 5



**Step 5.** Assessed the sensitivity of the new surveillance system through data linkage with previously identified work-related MVC fatalities and nonfatalities.

- The sensitivity of identifying fatal work-related motor MVC injury cases was assessed by linking our fatal injury cases with the FACE<sup>1</sup> motor vehicle fatalities identified by the MA DPH Occupational Health Surveillance Program (OHSP).
- A second sensitivity assessment regarding nonfatal injury cases was attempted using a previously created dataset of 2019 and 2020 nonfatal work-related MVC injuries identified by MA DPH OHSP.
  - These OHSP-identified nonfatal injuries were found through media reports and weekly police crash report summaries of fatal and near-fatal crashes.
  - This assessment was inconclusive as there were insufficient personal identifiers common to the OHSP-identified injuries and MA CRISS cases to allow for data linkage.

<sup>1</sup> FACE (Fatality Assessment and Control Evaluation) is the NIOSH cooperative agreement under which DPH monitors and documents workplace deaths. These cases are identified through media sources, death certificates, police crash reports (including state police fatal crash investigation summaries), and Workers' Compensation data.

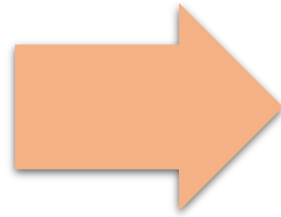
# Methods: Step 6



**Step 6.** Evaluated the strengths and limitations of each MA CRISS data source to identify work-related MVC injury cases.

## Study Purpose

Improve statewide surveillance of fatal and nonfatal work-related motor vehicle crash injuries among motorists and non-motorists using data sources in the Massachusetts Crash-Related Injury Surveillance System (MA CRISS).



## Evaluation Question

How useful is each MA CRISS data source in identifying work-related motor vehicle crash injury cases?

# Results: Strengths and Limitations

## MA Police Crash Reports

### Strengths

Captures many potentially work-related MVC injury cases based on vehicle type and range of injury severity, including fatalities.

Commercial vehicles and work zone-related crashes can be identified through several variables.

Gig workers can be identified through narrative text searches. Appears to capture more gig workers than MATRIS narratives.

### Limitations

May include false-positive cases due to the use of commercial vehicles outside of work and the inclusion of “possible injury” cases.

Contains a limited number of variables to identify non-motorists working at the time of the crash.

Some variables have inconsistent completion; Open text fields for vehicle owner names are difficult to use.

Narrative text-searching is complicated and requires manual review to remove false positives.

Gig workers cannot always be differentiated from delivery persons working for wages in the narratives.

# Results: Strengths and Limitations

## MA Ambulance Trip Record Information System (MATRIS)

### Strengths

Likely to include serious injury cases and some fatalities.<sup>1</sup>

There is a yes/no variable indicating if the injury/illness was work-related.

Gig workers can be identified through narrative text searches.

### Limitations

It is difficult to identify MVC injury cases in general, which may contribute to false positive cases.

There are a limited number of work indicators, i.e., narratives, ICD-10-CM external cause of morbidity codes, and the work-related injury/illness variable.

Narrative text-searching is complicated and requires manual review.

Gig workers cannot always be differentiated from delivery persons working for wages in the narratives.

<sup>1</sup> Persons transported by the medical examiner to the morgue would not be included, but persons transported to the hospital by EMS who subsequently died would be included in MATRIS data.

# Results: Strengths and Limitations

## MA Acute Care Hospital Records

(Hospital Discharge, Observation Stay, and ED Discharge data)

### Strengths

Captures a broad range of injury severity, including serious injuries and some fatalities.<sup>1</sup>

Workers' compensation can be identified in payer source and type variables, and work status can be identified in the ICD-10-CM Y99-codes.

Likely to capture fewer false positives than Crash Report data given the specificity of the work indicators.

### Limitations

ICD-10-CM external cause of morbidity codes only capture a few types of work vehicles.

ICD-10-CM codes for place of occurrence, activity, work status, and injury exam are often missing.

Gig workers cannot be identified due to the absence of narratives or other relevant variables.

<sup>1</sup> Includes persons who are dead on arrival or who die after being admitted to the ED/hospital.

# Results: Strengths and Limitations

## MA Trauma Registry

### Strengths

Captures serious injuries and some fatalities.<sup>1</sup>

There is a yes/no variable indicating if the injury/illness was work-related.

Likely to capture fewer false positives than Crash Report data given the specificity of the work indicators.

### Limitations

Identifies fewer additional potentially work-related MVC injury cases beyond those identified in the Hospital Record or Crash Report data compared to MATRIS data.

The primary payment method variable in the MA data does not include Workers' Compensation.

ICD-10-CM V-codes only capture a few types of work vehicles.

ICD-10-CM codes for place of occurrence, activity, work status, and injury exam are often missing.

Gig workers cannot be identified due to the absence of narratives or other relevant variables.

<sup>1</sup> Includes persons who are dead on arrival or who die after being admitted to the ED/hospital.

# Key Findings

It is important to use multiple data sources to identify potential work-related motor vehicle crash (MVC) injuries, as we found relatively low overlap between cases identified by different data sources.

MA CRISS data sources identified approximately 5,400 potential work-related MVC injury cases in 2019 and approximately 3,500 cases in 2020 (pandemic era). Linked datasets of potential cases led to more deduplicated cases identified overall in 2019 and 2020 than any single data source.

Acute Care Hospital Record and Police Crash Report data identified the most potential work-related MVC injury cases. However, Crash Report data may include more false-positive cases than Hospital Record data.

Crash Report and Ambulance Trip Record (MATRIS) data were the most helpful data sources for identifying gig workers due to the presence of narratives. Crash Report data, however, identified about 3x as many gig workers as MATRIS data.

The identification of gig workers in narratives requires complicated text searches and manual review to exclude false-positive cases.

# Conclusions and Recommendations



While each MA Crash-Related Injury Surveillance System (MA CRISS) data source was independently useful in identifying potential work-related MVC injuries, the linked 2019 and 2020 MA CRISS datasets of potential cases resulted in many more cases being identified overall for each year examined than by any single data source and allowed for deduplication.

## Recommendations:



- Conduct outreach to data owners to advocate for the inclusion of nominal<sup>1</sup> variables indicating if an injury/illness is work-related, including options for self-employed and gig workers.
- Conduct outreach to those documenting information in the data sources, i.e., law enforcement officers, EMS professionals, health information management staff, and trauma registrars, to highlight the value of the information provided by the work indicators, including work-related details provided in the narratives and, therefore, improve case identification.



<sup>1</sup> Nominal variables are categorical variables in which the categories are in no particular order. They include dichotomous (2-category) variables, e.g., the work-related illness/injury variables in the Ambulance Trip Record (MATRIS) and Trauma Registry data sources have yes/no categories.

# Acknowledgments and Contacts

This study/report was supported in part by an appointment to the Applied Epidemiology Fellowship Program administered by the Council of State and Territorial Epidemiologists (CSTE) and funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Number 1NU38OT000297-03-00.

For further information, please contact:

[Jeanne.Hathaway@mass.gov](mailto:Jeanne.Hathaway@mass.gov) or

[James.Laing@mass.gov](mailto:James.Laing@mass.gov)

# Connect with DPH



@MassDPH



Massachusetts Department of Public Health



[mass.gov/dph](https://mass.gov/dph)