EMS AND TRAUMA REGISTRIES

LINKING 2022 CRASH DATA WITH EMSTR RECORDS

TEXAS Health and Human Services
Texas Department of State Health Services

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Report Finalized July 30, 2023.

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INTRODUCTION

Background and Significance

Motor vehicle traffic fatalities in Texas remain a major public health concern. However, in 2022, Texas experienced a slight decrease in motor vehicle fatalities. The 2022 death toll of 4,481, was a 0.36% decrease from the 4,497 deaths recorded in 2021. In addition, there were 15,299 serious injury crashes in 2022 with 18,880 people sustaining a serious injury, which was a decrease from 15,764 serious injury crashes with 19,448 people sustaining a serious injury in 2021.[1] Unintentional crash deaths also cost Texas each year. In a review of CDC Web-based Injury Statistics Query and Reporting System (WISQARS) cause of injury, the 2020 unintentional motor vehicle traffic deaths cost Texas a total of $49.93 Billion dollars ($44.35 million in medical costs and $42.89 billion in value of statistical life).

This report linked three databases from two different state agencies to better understand motor vehicle crash causes and outcomes. Linking data allows EMSTR to include information from multiple sources (some maintained independently) and provides a more robust study of the public health issue. By understanding the nature of the problem, motor vehicle traffic crash injuries can be prevented, and hospitals and EMS agencies can be better equipped to respond to motor vehicle injuries. Success in reducing crash-related deaths and injuries depends largely on a surveillance system that allows better monitoring of occurrence, causes, and impacts on society.

The Texas Department of State Health Services (DSHS) Injury Prevention Unit Emergency Medical Services and Trauma Registries (EMSTR) linked the Texas Department of Transportation (TxDOT) Crash Records Information System (CRIS) data with EMS and trauma reported records to create a linked dataset. For this report, EMSTR used 2022 data for all three datasets.

Project Objective

To link crash data with statutorily reportable injury and event data.

- Crash data used – TxDOT CRIS.

[1] Texas Department of Transportation, 2022; **ftp.txdot.gov/pub/txdot-info/trf/crash_statistics/2022/01.pdf and ftp.txdot.gov/pub/txdot-info/trf/crash_statistics/2021/01.pdf.**

- EMS data used – DSHS EMS records.
- Trauma hospital data used – DSHS Trauma records.

Methodology

Inclusion Criteria

The 2022 inclusion criteria were updated for both EMS and trauma. For trauma, cases were based on cause of injury encompassing Unintentional Motor Vehicle Traffic injuries as established by the Centers for Disease Control and Prevention for the annual State Injury Indicators Report.[2] For EMS, inclusions were based on 911 calls with patient contacts and crash-related calls to dispatch.

DSHS Trauma Data

Cause of Injury with International Classification of Diseases—Tenth Revision—Clinical Modification (ICD-10-CM) coded for Unintentional Motor Vehicle Traffic (MVT).

ICD-10-CM codes	Description
V02–V04 (.1, .9), V09.2, V09.3	MVT Pedestrian
V12-V14 (.3–.9), V19.4-V19.6, V19.9	MVT Pedal cycle
V20-V28 (.3-.9), V29.4-V29.9	MVT Motorcycle
V30–V79 (.4–.9), V83–V86 (.0-.3), V87.0–V87.8, V89.2	MVT Occupant
V80.3-V80.5, V81.1, V82.1	MVT Other

Included cases if the 7th character of the code was A or missing (reflects initial encounter, active treatment)

[2] Thomas KE, Johnson RL. State Injury Indicators Report: Instructions for Preparing 2021 Data. Atlanta (GA): Centers for Disease Control and Prevention (CDC), National Center for Injury Prevention and Control; 2023.

DSHS EMS Data

- Type Service Requested: 911 calls
- Incident Patient Disposition: Patient Contact

1	Patient Dead at Scene-No Resuscitation Attempted (With Transport)
2	Patient Dead at Scene-No Resuscitation Attempted (Without Transport)
3	Patient Dead at Scene-Resuscitation Attempted (With Transport)
4	Patient Dead at Scene-Resuscitation Attempted (Without Transport)
5	Patient Evaluated, No Treatment/Transport Required
6	Patient Refused Evaluation/Care (With Transport)
7	Patient Refused Evaluation/Care (Without Transport)
8	Patient Treated, Released (Against Medical Advice/AMA)
9	Patient Treated, Released (per protocol)
10	Patient Treated, Transferred Care to Another EMS Unit
11	Patient Treated, Transported by this EMS Unit
12	Patient Treated, Transported by Law Enforcement
13	Patient Treated, Transported by Private Vehicle

- Complaint Reported to Dispatch: Traffic Transportation Incident or Automated Crash Notification.

Exclusion Criteria

Transfer records were excluded from the trauma data.

Data Linkage Process

Overview

DSHS conducted a probabilistic data linkage using Match*Pro software, version 2.4.

The **National Cancer Institute** developed Match*Pro and it is available for free. Match*Pro conducts probabilistic linkages based on the Fellegi Sunter model. The Fellegi Sunter Model uses a decision-theoretic approach establishing the validity of principles. The model's goal is to estimate a 'match probability' for each dataset comparison, which quantifies the likelihood the two records represent the same entity.

DSHS first linked CRIS data to the EMS registry database, then linked CRIS data to the Trauma registry. These datasets were then combined to create the final linked CRIS-EMS-Trauma dataset.

Matching Variables Used for Probabilistic Data Linkage:

	Matching Variables*
Crash to Trauma	First Name, Last Name, Middle Name, Birth Date, Incident County, Incident Date, Age
Crash to EMS	First Name, Last Name, Middle Name, Birth Date, Incident County, Incident Date, Age
Crash to EMS to Trauma	Unique ID (created by linking crash_ID, unit_nbr, and prsn_nbr)

*Matching variables are variables EMSTR used as criteria for data linkage.

2022 Data Linkage Summary

Dataset	N total (in full dataset before linkage)	N total (transportation related injuries subset)	N linked pairs (based on the data linking algorithm)
CRIS	1,612,181	1,504,625	-
EMS	4,603,934	289,097	149,438
Trauma	162,409	24,047	13,169
CRIS to EMS to Trauma	-	-	9,239

Number of pairs (records) in linking data sets, by year								
Dataset	**2014**	**2015**	**2016**	**2018**	**2019**	**2020**	**2021**	**2022***
Crash to EMS	28,806	63,179	72,304	118,029	175,896	99,618	110,191	149,438
Crash to Trauma	11,886	16,262	17,829	15,283	16,587	17,379	16,071	13,169
Crash to EMS to Trauma	3,119	5,075	6,367	6,667	10,418	12,047	10,501	9,239

*Note: 2022 inclusion criteria were updated for both the EMS and Trauma data to match the CDC State Injury Indicators Report.

Missing Records in Datasets Before and After Linkage

	Before Linking (Crash-EMS-Trauma)					
	Trauma Linking Subset (N=24, 047)		EMS Linking Subset (N=289,097)		Crash Linking Subset (N= 1,504,625)	
Matching Variable	**Count**	**%**	**Count**	**%**	**Count**	**%**
Last Name	0	0	0	0	5,527	0.37
First Name	0	0	0	0	4,608	0.31
Birth Date	6	0.02	27,577	9.54	452,953*	30.00*
Incident Date	11	0.05	45,059	15.59	0	0

*Birth date among passengers in the crash data was not captured.

	After Linking (Crash-EMS-Trauma) (N=9,239)					
	Trauma		EMS		Crash	
Matching Variable	**Count**	**%**	**Count**	**%**	**Count**	**%**
Last Name	0	0	0	0	0	0
First Name	0	0	0	0	0	0
Birth Date	0	0	0	0	0	0
Incident Date	0	0	1,700	18.40	0	0

Linked Dataset Descriptive Statistics (Crash-EMSTR)

Percentages in some tables may not equal 100% due to rounding. Values less than 5 were suppressed to reduce the likelihood of a confidentiality breach and noted by an asterisk (*). The totals below contain information from successfully linked pairs only.

Demographic Variables

GENDER	COUNT	% of all Linked Records
Male	6,158	66.65
Female	3,056	33.08
Unknown (Unable to Determine)	17	0.18
Missing	8	0.09
Total	**9,239**	**100.00**

RACE/ETHNICITY	COUNT	% of all Linked Records
White – Not Hispanic	4,561	49.37
Hispanic	2,556	27.67
Black – Not Hispanic	1,507	16.31
Asian	147	1.59
Other	347	3.76
Unknown	121	1.31
Total	**9,239**	**100.00**

AGE GROUP (YEARS)	COUNT	% of all Linked Records
0-17	304	3.29
18-24	1,489	16.12
25-44	3,557	38.50
45-64	2,575	27.87
65+	1,314	14.22
Total	**9,239**	**100.00**

Trauma Variables

PRIMARY PAYMENT METHOD	COUNT	%
Private/Commercial Insurance	3,645	39.45
Self-Pay	2,380	25.76
Medicare	1,087	11.77
Medicaid	737	7.98
Other	729	7.89
Not Known/Not Recorded	396	4.29
Other Government	264	2.86
Missing	*	*
Total	**9,239**	**100.00**

HOSPITAL DISPOSITION		
Discharged to home or self-care (routine discharge)		

**Other included Discharged/Transferred to court/law enforcement, Discharged/Transferred to hospice care, Discharged/Transferred to a psychiatric hospital or psychiatric-distinct unit of a hospital, Discharged/Transferred to an Intermediate Care Facility (ICF), Discharged/Transferred to another type of institution not defined elsewhere, and Discharged/Transferred to another type of rehabilitation or long-term care facility.

***Not Applicable for hospital disposition was reported if patient's emergency department (ED) disposition was: Deceased, Discharged to home or self-care (routine discharge), Discharged/Transferred to another short-term general hospital for inpatient care, Discharged/Transferred to another type of health care institution, or Discharged/Transferred to court/law enforcement.

The Injury Severity Score (ISS) is an established medical score to assess trauma severity. It assesses the combined effects of patients with multiple injuries and is based on an anatomical injury severity classification.

LOCALLY CALCULATED INJURY SEVERITY SCORE** (ISS)	COUNT	%
Very Low (0-8)	3,928	42.52
Low (9-15)	3,106	33.62
High (16-24)	1,398	15.13
Very High (>=25)	807	8.73
Total	**9,239**	**100.00**

Decided by the **Association for the Advancement of Automotive Medicine (AAAM).

When establishing the ISS criteria, the AAAM mapped a series of anatomically defined injury descriptions according to:

i. Energy dissipation
ii. Threat to life
iii. Treatment period
iv. Incidence
v. Permanent impairment

EMS Variables

COMPLAINT REPORTED TO DISPATCH	COUNT	%
Traffic transportation incident	9,216	99.75
Automated Crash Notification	23	0.25
Total	**9,239**	**100.00**

CHIEF COMPLAINT LOCATION	COUNT	%
General/Global**	2,739	29.65
Extremity-Lower	1,078	11.67
Head	739	8.00
Extremity-Upper	598	6.47
Back	475	5.14
Chest	378	4.09
Neck	151	1.63
Abdomen	144	1.56
Genitalia	10	0.11
Not Recorded	2,896	31.35
Not Applicable	29	0.31
Missing	*	*
Total	**9,239**	**100.00**

**Note: General/Global included instances where multiple injuries were recorded and/or where the patient's complaints indicated an impact to multiple body systems. Other General/Global responses included generalized weakness, difficulty breathing, not feeling right, etc.

EMS TRANSPORT METHOD		

INCIDENT PATIENT DISPOSITION	COUNT	%
Patient treated, transported by this EMS Unit	8,171	88.44
Patient Treated, Transferred Care to Another EMS Unit	508	5.50
Patient Refused Evaluation/Care (Without Transport)	225	2.44
Patient Treated, Released (AMA)	176	1.90
Patient Evaluated, No Treatment/Transport Required	86	0.93
Patient Treated, Released (per protocol)	47	0.51
Patient Refused Evaluation/Care (With Transport)	8	0.09
Patient Dead at Scene-Resuscitation Attempted (With Transport)	7	0.08
Patient Treated, Transported by Law Enforcement	7	0.08
Other**	*	*
Total	**9,239**	**100.00**

**Other included Patient Treated, Transported by Private Vehicle; Patient Dead at Scene-No Resuscitation Attempted (Without Transport); and Patient Dead at Scene-Resuscitation Attempted (Without Transport).

INCIDENT SEASON	COUNT	%
Spring (March, April, May)	2,084	27.64
Fall (September, October, November)	2,028	26.90
Summer (June, July, August)	1,807	23.97
Winter (December, February, January)	1,620	21.49
Missing	1,700	18.40
Total	**9,239**	**100.00**

RESPONSE TIME (Minutes)	COUNT	MISSING	MEAN	MEDIAN
Traffic-related (linked crash-EMS-trauma)	9,233	6	8.71	7.0
EMS all 911 responses (EMS dataset)	4,391,696	212,238	16.15	8.0

Note: Missing indicated a run where the EMS Unit Response Time could not be calculated. There were only six linked records where response time could not be assessed.

Crash Variables

MANNER OF COLLISION	COUNT	%
One motor vehicle - going straight	3,611	39.08
Angle - both going straight	1,180	12.77
Opposite direction - one straight-one left turn	904	9.78
Same direction - both going straight-rear end	784	8.49
Opposite direction - both going straight	603	6.53
Same direction - one straight-one stopped	522	5.65
Angle - one straight – one left turn	450	4.87
Same direction - both going straight-sideswipe	418	4.52
One motor vehicle turning left	146	1.58
Other**	621	6.70
Total	**9,239**	**100.00**

**Other included Opposite direction one straight – one backing; Same direction both right turn; Angle – one right turn- one stopped, etc.

INJURY SEVERITY ID**	COUNT	%
Incapacitating injury	3,723	40.30
Non-incapacitating injury	2,582	27.95
Possible injury	1,688	18.27
Not injured	848	9.18
Killed	336	3.64
Unknown	62	0.67
Total	**9,239**	**100.00**

**ftp.dot.state.tx.us/pub/txdot-info/trf/crash_statistics/automated/standard-extract.xlsx

Definitions of injury severity groups:[3]

- Incapacitating Injury: Severe injury which prevents continuation of normal activities; includes broken or distorted limbs, internal injuries, crushed chest, etc.
- Non-Incapacitating Injury: Evident injury such as bruises, abrasions, or minor lacerations which do not incapacitate.
- Possible Injury: Injury which is claimed, reported, or indicated by behavior, but without visible wounds; includes limping or complaint of pain,
- Not Injured: The person involved in crash did not sustain an incapacitating injury, a non-incapacitating injury, or a possible injury.
- Killed: Died due to injuries sustained from the crash, within 30 days of the crash.
- Unknown: Unable to determine whether injuries exist. Some examples may include hit and run, fled scene, failure to stop and render aid, etc.

[3] KABCO Injury Classification Scale and definitions for Texas.

Conclusion

Linking CRIS, EMS, and trauma data, provides medical, traffic, and public health professionals with a more comprehensive picture of the impact of motor vehicle crashes on all sectors. The results of this report can serve as an opportunity for DSHS, TxDOT, and other professionals to identify new topics for further studies, including ways to identify motor vehicle crash causes and set priorities to reduce morbidity, injury severity, and cost arising from motor vehicle traffic crashes. This data will be useful in supporting community-based highway safety programs.

Finally, this report will provide a baseline for researchers to further explore motor vehicle traffic crash causes, prevalence, and consequences.

General Informational Page

General Information

The Emergency Medical Services and Trauma Registries (EMSTR) is comprised of four registries: the EMS Registry; the acute Traumatic Injury Registry; the Traumatic Brain Injury Registry / Spinal Cord Injury Registry; and the Submersion Registry. EMSTR is a statewide passive surveillance system that collects reportable event data from EMS providers, hospitals, justices of the peace, medical examiners, and rehabilitation facilities. Texas is home to one of the largest EMS registries in the U.S. with more than 4 million records submitted annually.

TEXAS
Health and Human Services

Texas Department of State Health Services

Our Goals

- Provide a robust registry reporting framework for recording reportable traumas;
- Reduce the burden of injury to the public resulting from preventable occurrences using trend analysis; and
- Provide data as close to real-time as possible for local, state, and national leadership use.

Our Mission

- Improve Texans' health, safety, and well-being through good stewardship of public resources with a focus on core public health functions.
- The Injury Prevention Unit works to understand how injuries impact Texans. By providing injury and violence data and education, we can help you lead the way on injury prevention in homes, workplaces, and communities.

Contact Information

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