

EMS AND TRAUMA REGISTRIES (EMSTR)

**LINKING 2023 CRASH DATA
WITH EMSTR RECORDS**



TEXAS
Health and Human
Services

Texas Department of State
Health Services

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INTRODUCTION

Background and Significance

Motor vehicle traffic fatalities in Texas remain a major public health concern. However, Texas experienced a decrease in the number of motor vehicle traffic fatalities. The 2023 death toll of 4,291 was a decrease of 2.70% from the 4,410 deaths recorded in 2022.

In addition, there were 15,227 serious injury crashes in Texas in 2023 with 18,765 people sustaining a serious injury. This was similar to 2022 data (15,299 serious injury crashes with 18,880 people sustaining a serious injury).

Unintentional crash deaths also cost Texas each year. In a review of CDC Web-based Injury Statistics Query And Reporting System (WISQARS) Cost of Fatal Injury Report, the 2023 unintentional motor vehicle traffic occupant deaths cost Texas a total of \$31.51 billion dollars (\$32.70 million in medical costs and \$31.48 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 Texas Department of State Health Services (DSHS) Emergency Medical Services and Trauma Registries (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 occurrences, causes, and impacts on society.

The DSHS Injury Prevention Unit EMSTR program 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 2023 data for all three datasets.

Project Objective

To link crash data with statutorily reportable injury data.

- Crash data used – TxDOT CRIS.

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

Methodology

Inclusion Criteria

EMSTR updated the 2022 and 2023 inclusion criteria for both EMS and trauma from previous reports. For trauma, cases were coded for “Fatal” and “Nonfatal”, and “Motor Vehicle Traffic (MVT) all Intentions”, as established by the National Center for Health Statistics (NCHS).¹ Codes used were selected from the International Classification of Diseases—Tenth Revision—Clinical Modification (ICD-10-CM).

For EMS, patient records included in the linked dataset were:

- 911 calls.
- Patient contact made.
- The call to dispatch was crash related.

Exclusion Criteria

EMSTR staff excluded transfer records from the trauma data. This means, if a patient arrived at a patient by a transfer, they were not included in the analysis.

¹ Hedegaard H, Johnson RL, Garnett MF, Thomas KE. The International Classification of Diseases, 10th Revision, Clinical Modification (ICD–10–CM) external cause-of-injury framework for categorizing mechanism and intent of injury. National Health Statistics Reports; no 136. Hyattsville, MD: National Center for Health Statistics. 2019.

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	Last Name, First Name, Middle Name, Birth Date, Incident Date, Incident County, Age
Crash to EMS	Last Name, First Name, Middle Name, Birth Date, Incident Date, Incident County, 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.

2023 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	1,627,726	1,521,454	-
EMS	4,839,749	269,394	139,988
Trauma	183,759	24,151	15,603
CRIS to EMS	-	-	139,202
CRIS to EMS to Trauma	-	-	8,297

Number of Pairs (Records) in Linking Datasets by Year

Dataset	2014	2015	2016	2018	2019	2020	2021	2022*	2023*
Crash to EMS	28,806	63,179	72,304	118,029	175,896	99,618	110,191	149,438	139,988
Crash to Trauma	11,886	16,262	17,829	15,283	16,587	17,379	16,071	13,169	15,603
Crash to EMS to Trauma	3,119	5,075	6,367	6,667	10,418	12,047	10,501	9,239	8,297

*Note: EMSTR updated the 2022 and 2023 inclusion criteria for both the EMS and trauma data to match the Motor Vehicle Traffic criteria of NCHS.²

² Hedegaard H, Johnson RL, Garnett MF, Thomas KE. The International Classification of Diseases, 10th Revision, Clinical Modification (ICD–10–CM) external cause-of-injury framework for categorizing mechanism and intent of injury. National Health Statistics Reports; no 136. Hyattsville, MD: National Center for Health Statistics. 2019.

Missing Records in Datasets Before and After Linkage

2023	Before Linking (Crash-EMS-Trauma)					
	Trauma Linking Subset (N= 24,151)		EMS Linking Subset (N=269,394)		Crash Linking Subset (N=1,521,454)	
Matching Variable	Count	%	Count	%	Count	%
Last Name	0	0	15	0	5,630	0.37
First Name	0	0	14	0	4,840	0.32
Birth Date	*	*	27,930	10.36	457,363**	30.06**
Incident Date	33	0.14	42,311	15.70	0	0

*Suppressed due to low case numbers.

**CRIS does not capture the birth date among passengers.

2023	After Linking (Crash-EMS-Trauma) (N=8,297)					
	Trauma		EMS		Crash	
Matching Variable	Count	%	Count	%	Count	%
Last Name	0	0	0	0	0	0
First Name	0	0	0	0	1	0
Birth Date	0	0	0	0	291	3.50
Incident Date	0	0	13	0	0	0

Linked Dataset Descriptive Statistics (Crash-EMSTR)

Some of the total percentages were rounded to 100%. Values less than 5 were suppressed to reduce the likelihood of identifying an individual and noted by an asterisk (*). The totals below contain information from successfully linked pairs only.

Demographic Variables

CRIS-EMS-TR

Sex	COUNT	% of all Linked Records
Male	5,168	62.29
Female	3,120	37.60
Unknown (Unable to Determine)	*	*
Missing	7	0.08
Total	8,297	100.00

In the 2023 linked crash, EMS, and trauma dataset; 62% of matched records were male and 38% were female.

RACE/ETHNICITY	COUNT	% of all Linked Records
White – Non Hispanic	3,500	42.18
Hispanic	2,891	34.84
Black – Non Hispanic	1,242	14.97
Asian	141	1.70
Other	425	5.12
Unknown	97	1.17
Missing	*	*
Total	8,297	100.00

In 2023, White – Non-Hispanic people accounted for the highest percent of crashes at 42.18%, followed closely by Hispanic with 34.84%. Black – Non-Hispanic and Asian had a lower percentage of crashes with 14.97% and 1.70% respectively.

Trauma Variables

AGE GROUP (YEARS)	COUNT	% of all Linked Records
0-17	609	7.34
18-24	1,321	15.92
25-44	2,951	35.57
45-64	1,981	23.88
65+	1,422	17.14
Missing	13	0.16
Total	8,297	100.00

Individuals between the ages of 25 to 44 (35.57%) and 45 to 64 (23.88%) were involved in the highest percent of linked car crashes in 2023.

PRIMARY PAYMENT METHOD	COUNT	%
Private/Commercial Insurance	3,157	38.05
Self-Pay	1,946	23.45
Medicare	1,138	13.72
Medicaid	847	10.21
Other	633	7.63
Not Known/Not Recorded	340	4.10
Other Government	232	2.80
Not Billed (for any reason)	*	*
Missing	*	*
Total	8,297	100.00

The majority (38.05%) of patients in the linked crash dataset used private health insurance to pay their medical bills. Self-pay (23.45%) and Medicare (13.72%) were the next most common method of payments used by patients.

Emergency Department (ED) DISPOSITION	Frequency	Percent
Floor bed (general admission, non-specialty unit bed)	2,518	30.35
Intensive Care Unit (ICU)	1,573	18.96
Transferred to Another Hospital	1,192	14.37
Operating Room	977	11.78
Telemetry/step-down unit (less acuity than ICU)	721	8.69
Home without services	670	8.08
Observation unit (unit that provides < 24 hour stays)	308	3.71
Deceased/expired	234	2.82
Other (jail, institutional care, mental health, etc.)	26	0.31
Left against medical advice	24	0.29
Home with services	*	*
Not Applicable (NA)	48	0.58
Missing	*	*
Total	8,297	100.00

Emergency Department (ED) disposition pertains to where the patient went after they were discharged from the ED.

Close to one third (30.35%) of patients went from the ED to the hospital floor bed (general admission, non-specialty unit bed). The next three ED dispositions were Intensive Care Unit (18.96%), transferred to another hospital (14.37%), and operating room (11.78%).

HOSPITAL DISPOSITION	COUNT	%
Discharged to home or self-care (routine discharge)	4,319	52.05
Discharged/Transferred to inpatient rehab or designated unit	726	8.75
Discharged/Transferred to home under care of organized home health service	289	3.48
Discharged/Transferred to Skilled Nursing Facility	263	3.17
Deceased/Expired	182	2.19
Left against medical advice or discontinued care	96	1.16
Discharged/Transferred to a short-term general hospital for inpatient care	86	1.04
Discharged/Transferred to Long Term Care Hospital (LTCH)	74	0.89
**Other	111	1.33
***Not Applicable	2,147	25.88
Missing	*	*
Total	8,297	100.00

**Other includes 'Discharged/Transferred to a psychiatric hospital or psychiatric distinct part unit of a hospital/', 'Discharged/Transferred to an Intermediate Care Facility (ICF)/', 'Discharged/Transferred to another type of institution not defined elsewhere/', 'Discharged/Transferred to court/law enforcement/', and 'Discharged/Transferred to hospice care'.

***Not Applicable for hospital disposition was reported if patient's 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'.

Hospital disposition is the outcome of the patient when they leave the hospital. Over half of the patients (52.05%) were discharged home and 8.75% of patients were discharged or transferred to an inpatient rehab facility. A little more than 2% of patients died in the hospital.

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.

When establishing the ISS criteria, the Association for the Advancement of Automotive Medicine (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

LOCALLY CALCULATED INJURY SEVERITY SCORE (ISS)	COUNT	%
1-8 (minor)	3,371	40.63
9-15 (moderate)	2,623	31.61
16-24 (severe)	1,261	15.20
25+ (profound)	865	10.43
Not Applicable / Not Recorded	164	1.98
Missing	13	0.16
Total	8,297	100.00

In 2023, 72.24% of the injured crash patients were assigned an ISS less than 15. The same trend was observed in 2022.

EMS Variables

The variables in this report are found in the National Emergency Medical Services Information System (NEMSIS) 3.4.0 and 3.5.0 data dictionaries.

COMPLAINT REPORTED TO DISPATCH (eDispatch.01)	COUNT	%
Traffic transportation incident	8,278	99.77
Automated Crash Notification	19	0.23
Total	8,297	100.00

To be included in this analysis, patients must have had a complaint reported to dispatch as traffic related, which included traffic transportation incident and automated crash notification.

An Automatic Crash Notification (ACN) system is a type of technology integrated into vehicles.³ This system detects a vehicle collision and automatically alerts emergency services, providing crucial details like location and crash severity to speed up response times and improve patient outcomes. The operator can communicate with occupants and relay information to first responders, enhancing safety by decreasing the time between a crash and receiving necessary medical attention.

³ [ite.org/technical-resources/topics/transportation-system-management-and-operations/transportation-safety-advancement-group/products/advanced-automatic-collision-notification-aacn-white-paper/#:~:text=Overview,quickly%20with%20the%20appropriate%20equipment.](https://www.nhtsa.gov/technical-resources/topics/transportation-system-management-and-operations/transportation-safety-advancement-group/products/advanced-automatic-collision-notification-aacn-white-paper/#:~:text=Overview,quickly%20with%20the%20appropriate%20equipment.)

CHIEF COMPLAINT LOCATION (eSituation.07)	COUNT	%
General/Global**	2,057	24.79
Extremity-Lower	817	9.85
Head	676	8.15
Extremity-Upper	559	6.74
Back	420	5.06
Chest	361	4.35
Neck	210	2.53
Abdomen	116	1.40
Genitalia	*	*
Missing	3,077	37.09
Total	8,297	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.

The table above provides information about the primary anatomic location of the chief complaint as identified by EMS personnel. The three top patient anatomical complaints were general/global (24.79%), lower extremities (9.85%), and the head (8.15%). Over one third of records did not have a chief complaint location entered. This could be due to activations where EMS personnel make no patient contact, patients who have no complaints of illness or injury but are seen by EMS for observation, or the lack of consistency with reporting between EMS agencies.

EMS TRANSPORT METHOD (eDisposition.16)	COUNT	%
Ground-Ambulance	6,197	74.69
Air Medical-Rotor Craft	189	2.28
Ground-Other Not Listed	10	0.12
**Other	*	*
Missing	1,897	22.86
Total	8,297	100.00

**Other included 'Air Medical-Fixed Wing', 'Ground-ATV', or 'Rescue Vehicle and Ground-Bariatric'.

Close to 75% of patients were transported by ground ambulance.

INCIDENT PATIENT DISPOSITION (eDisposition.12)	COUNT	%
Patient Treated, Transported by this EMS Unit	6,079	73.27
Patient Treated, Transferred Care to Another EMS Unit	274	3.3
Patient Treated, Released (AMA)	113	1.36
Patient Refused Evaluation/Care (Without Transport)	107	1.29
Patient Evaluated, No Treatment/Transport Required	41	0.49
Patient Treated, Released (per protocol)	23	0.28
Patient Dead at Scene-Resuscitation Attempted (With Transport)	12	0.14
Patient Refused Evaluation/Care (With Transport)	10	0.12
Patient Treated, Transported by Law Enforcement	*	*
Patient Treated, Transported by Private Vehicle	*	*
Patient Dead at Scene-Resuscitation Attempted (Without Transport)	*	*
Missing	1,632	19.67
Total	8,297	100.00

To be included in this analysis, EMS must have made contact with a patient. In close to 75% of records, patients were treated and transported by the EMS unit that responded to the scene.

INCIDENT SEASON (custom variable)	COUNT	%
Winter	2,012	24.25
Summer	1,986	23.94
Spring	1,962	23.65
Fall	1,885	22.72
Missing	452	5.45
Total	8,297	100.00

In 2023, an even number of crashes occurred in all four seasons.

Response Time (custom variable) is defined as the number of minutes elapsed from unit notified dispatch time to unit arrived on scene time.

RESPONSE TIME (Minutes)	COUNT	MISSING	MEAN	MEDIAN
Traffic-related (linked crash-EMS-Trauma)	8,282	15	8.16	7

Note: Missing indicated a response where the EMS Unit Response Time could not be calculated. There were 15 linked records where response time could not be assessed.

On average, approximately eight minutes elapsed from the unit notified of dispatch time to the time the EMS unit arrived on the scene of a crash.

Scene Time (custom variable) is defined as the minutes elapsed from unit arrived on scene time to unit left scene time.

SCENE TIME (Minutes)	COUNT	MISSING	MEAN	MEDIAN
Traffic-related (linked crash-EMS-Trauma)	7,437	860	18.36	16

On average, an EMS unit spent 18 minutes on the scene of a crash.

Crash Variables

MANNER OF COLLISION (FHE_Collsn_ID)	COUNT	%
One motor vehicle – going straight	3,098	37.34
Angle – both going straight	1,220	14.70
Opposite direction – one straight-one left turn	859	10.35
Same direction – both going straight-rear end	664	8.00
Opposite direction – both going straight	627	7.56
Angle – one straight – one left turn	430	5.18
Same direction – one straight – one stopped	374	4.51
Same direction – both going straight – sideswipe	351	4.23
One motor vehicle turning left	151	1.82
Other**	69	0.82
Total	8,297	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**(INJRY_SEV_ID)	COUNT	%
Incapacitating injury	3,541	42.68
Non-incapacitating injury	2,550	30.73
Possible injury	1,626	19.60
Killed	313	3.77
Not injured	237	2.86
Unknown	30	0.36
Total	8,297	100.00

**CRIS data dictionary ftp.dot.state.tx.us/pub/txdotinfo/trf/crash_statistics/automated/standard-extract.xlsx.

Injury severity records are recorded by first responders as well as law enforcement agents at the scene of a crash. Their initial impression of an injury could turn out to be a different diagnosis than what a physician identifies after close examination of a trauma patient. This could be one of the reasons why the injury severity scores in the crash report and those in the trauma dataset are different.

The KABCO injury rating system is a widely used system for police to categorize each involved person's injuries in crash reports using one of six codes. (Note that while KABCO is the term used nationally, on Texas accident reports.)

Definitions of injury severity groups:⁴

- 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.

⁴ KABCO Injury Classification Scale and definitions for Texas [kabco-system-police-reports-tx.pdf](#).

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

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 / Spinal Cord Injury Registry; and the Submersion Registry. EMSTR is a statewide 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 approximately 5 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.
- 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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prevention/ems-trauma-registries](https://dshs.texas.gov/injury-prevention/ems-trauma-registries)

Emergency Medical Services and Trauma Registries

***[dshs.texas.gov/injury-
prevention/ems-trauma-registry](https://dshs.texas.gov/injury-prevention/ems-trauma-registry)***