RESEARCH BRIEF

Improving Roadside Responder Crash Data: Outcomes from an Expert Roundtable Discussion

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Incident response and emergency services personnel, including police, firefighters, emergency medical services, and towing operators, are at risk of being struck by passing motorists while they are working at the roadside. Stakeholders such as AAA and others strive to reduce these professionals' risk of being injured or killed on the job through advocacy, education, and implementation of other safety measures. However, at present, such efforts are greatly limited by a lack of comprehensive, high-quality data on the incidence, as well as the details, of crashes involving this population and the associated injuries and deaths. Such data are fundamental to the design, tracking, and appraisal of national, state, or regional countermeasures to enhance the safety of these workers. This Research Brief describes highlights from a roundtable discussion hosted by the AAA Foundation for Traffic Safety that sought to identify ways to improve data about the safety of incident response and emergency services personnel.

Current sources do not offer clear or convergent data concerning the number nor the details of crashes in which incident response or emergency services personnel are struck by passing vehicles on the roadside. For example, two data sources that nominally include on-duty deaths of incident responders are (i) the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS), which comprises detailed records of all motor vehicle crashes that occur on public roads and result in a death within 720 hours, and (ii) the Bureau of Labor Statistics' Census of Fatal Occupational Injuries (CFOI), which contains records of deaths of workers due to injuries sustained at work. Unfortunately, despite having recently implemented several changes to enable identification of incident response personnel, the most recent year of FARS data identifies fewer than half as many towing operators killed as pedestrians than the CFOI does. However, identifying all towing operators killed at the roadside is challenging in the CFOI due to variation in the coding of workers' industries and occupations. Thus, while useful in their own right, these data sources do not provide detailed information, which is critical to shed insight into what happens in these incidents and to improve our understanding of how these tragedies could best be prevented. It is also noteworthy to consider non-fatal injuries; we are unaware of any publicly available data pertaining to non-fatal injuries of roadside responders. Thus, despite some positive steps, there is still room for improvement in data quality concerning roadside responders.

With these issues and concerns as a backdrop, a panel of experts was convened to discuss issues and efforts surrounding data on crashes involving roadside responders. The overarching aim was to help improve the overall accounting of roadside service providers killed and injured each year while assisting other motorists in order to learn more about the circumstances of these tragic incidents. Toward these ends, the panel was asked to reflect on two main questions:

1. What are the limitations or barriers in current crash data involving roadside responders?
2. What solutions, techniques, or approaches can be used to improve and augment existing data?

Roundtable Discussion

Two 2-hour discussions were held virtually in June 2021. As shown in the table below, a diverse group of nine experts participated in the discussion, representing a mixture of different backgrounds and job roles, including academic researchers, epidemiologists, a crash investigator, a federal program manager, a research statistician, a program analyst, and an insurance risk control professional. Collectively, this group

had experience and knowledge of safety and health surveillance programs, work-related injuries, on-site investigations, service providers, EMS and first responder safety, towing safety, worker's compensation, national- and state-level data, operational strategies for databases, and occupational injury and illness.

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In the following sections, the main points of the conversation are distilled into different categories, following from the overarching aims/questions. Additionally, a collection of resources shared during the discussion is provided in Appendix A. While the motivation and focus of the panel was on towing operations, other types of responders were naturally implicated in much of the discussion.

Barriers and Challenges

Data Sources, Variables, and Purpose

A number of important challenges and limitations were noted with respect to the information captured by the variables in the relevant databases. In many cases, the variables related to job role and activity do not offer sufficient resolution to identify crashes or injuries arising during roadside incident response. For example, in the CFOI, the focus of which is workplace injuries (not transportation injuries) workers are grouped by industry and occupation. Tow truck operators may fall into the motor vehicle towing industry or the automobile repair industry, depending on the classification of their employer. (Note, however, that most workers in the automobile repair industry are not tow truck operators.) For this reason, not all tow truck operators are readily identifiable in the CFOI, thus statistics derived from the CFOI likely underestimate the number of tow truck operators fatally injured while working. It was also noted that data on injuries to tow truck drivers is further complicated by the diverse array of workers classified under the motor vehicle towing industry. For example, in addition to roadside service providers, the motor vehicle towing industry also includes parking enforcement and repossession operations, who may be more vulnerable to intentional acts of violence. Aggregation of all fatalities of towing operators within the motor vehicle towing industry has important implications for parsing underlying factors related to roadside crashes.

In transportation-oriented data sources such as FARS, incident response personnel were indistinguishable from other vehicle occupants or pedestrians prior to 2019. For example, a person standing on the side of the road would simply be coded as a pedestrian; a person coded as working on a vehicle could be the vehicle owner or a tow operator. In 2019, NHTSA added several new data elements to FARS intended to identify incident responders; however, the information ultimately entered into FARS is limited to the information collected by on-scene investigators at the site of a crash, which itself is dictated by the contents of each respective state's police crash report form. NHTSA's Model Minimum Uniform Crash Criteria (MMUCC) recommends that states include a variable to indicate whether each person involved in a crash is an incident responder, and if so, what type (e.g., police, fire, EMS, tow operator, transportation, or other); however, not all states include all of the information recommended by MMUCC in the current version of their police crash report form.

Other points arose concerning the coding of information in a dataset:

- In some data sources, the narrative description of the incident is critical for understanding the circumstances of an injury or fatality. This highlights the usefulness of including a section for narrative description. However, not all narratives are created equally, and thus critical information can be lost, compared with data elements that are fixed or more clearly delineated. There is also concern that the narrative may include Protected Health Information (PHI) or Personally Identifiable Information (PII).
- Along these lines, some panelists suggested that coding of occupation on police crash report forms would be of great value such that this detail was not reliant on the narrative; even an indicator that a crash was "work-related" or that an injured person was "working" would be valuable to differentiate between a tow operator vs. a person working on their own vehicle.
- Within NHTSA databases, other nuances in classification of vehicles were noted, including that towing classifications can also conflate cases where trailers are being towed (e.g., landscaping) with the towing of a motor vehicle. Including categories for special uses could better delineate the vehicle type/purpose.
- Another special difficulty in the context of identifying towing workers struck as pedestrians is the tow truck may not be a contact vehicle in the crash and thus may not be coded at all, in which case the towing operator may appear in the data simply as a pedestrian or as a person working on a disabled vehicle.
- In one panelist's recent work, they noted inconsistent coding in the North American Industry Classification System (NAICS), including 32% where occupation was not reported in the death certificate, as well as substantial miscoding. It was noted that there are already standard codes for occupation, industry, and work relatedness; however, many current data sources rely on information from coroners, physicians, medical examiners, etc. for certification of the death certificate and who may not complete the death certificate with the accurate industry and occupation information.

In some situations, the constraints are not necessarily due to the underlying data elements themselves, but rather the intended purpose of the dataset, which oftentimes is not directly related. For example, because it is intended as a resource concerning patient care, the National Emergency Medical Services Information System (NEMSIS) contains no means of coding that a crash victim was a roadside service provider. Similarly, by design, neither FARS nor CFOI offers insight into injury-only crashes.

Related to the purpose of a given database, the panel raised some important questions. It was emphasized that some databases are ill-equipped to consider the full complement of factors that contribute to crashes; for example, organizational safety culture is an important upstream factor for safety yet does not lend itself to capture in a crash report being administered for a roadside incident. A consideration of such factors would be especially useful for those looking to develop or evaluate a full complement of safety countermeasures.

Many of the current databases are related to fatalities and injuries; however, the panelists identified near-misses in towing and other roadside rescues as an area where more knowledge is needed. More specifically, a broader understanding of near misses would allow for a consideration of factors that help avoid an incident. Particularly, the collection of near-miss data to identify "good saves" helps to inform efforts to prevent crashes in the first place. One needs to be cautious though in extrapolating to different levels of severity. For example, it is not clear from currently available data whether the factors that contribute to fatal injuries have the same impact as with less severe injuries, near misses and other outcomes. More broadly, the data systems that are feeding into these different outcome categories need to be consistent.

Data Access and Linkage

Another discussion theme centered on access to data and the challenges associated with linking data from different sources. With respect to data access, some panelists cited restrictions on what kinds of data they have been able to access related to fatal and non-fatal injuries. These constraints can lead to underreporting. For example, in some cases, panelists have only been able to investigate when their research team was granted authorization from companies involved due to limitations of legal authority.

While coded aggregate data is readily available from a number of sources, it is less clear how and if individual case records or other "raw" data is accessible.

The panel also noted that many current data sources are "disparate and fragmented," often because data systems are built in isolation and, as discussed previously, suited for different purposes. Some databases are less stringent for roadway incidents; OSHA, for example, is not required to investigate transportation-related injuries and deaths that occur on public roadways unless they occur in work zones, and employers are exempt from reporting such fatalities and injuries to OSHA. As a result of the differences in purpose, processing, and content of disparate databases, it is common to find generally low concordance regarding the number of fatalities that occur involving roadside responders. Data from various databases must be pieced together to arrive at a more comprehensive understanding of fatal crashes involving roadside responders.

With respect to linkage, it was noted that no one data source alone is sufficient for identifying all roadside injuries. For example, one panelist described research that involved combining data from OSHA, CFOI, National Crime Information Center (NCIC), motor vehicle crash reports, media outlet reports, medical examiner and coroner reports, and worker's compensation reports. All of these data sources were found to have various strengths and weaknesses; none of them individually included all relevant information. Moreover, because of insufficient information common to each source, there is a need for probabilistic linkage (a method for combining information from different sources based on the probability of belonging to the same person or event; contrasted with deterministic (or exact) linkage).

Data Collection and Coding

The issues with the data variables notwithstanding, data collection and coding also were identified as significant challenges with current data systems. Most pointedly, the difficulties in getting information were noted, in no small part, because of the workload of law enforcement and/or first and second responders in the field. In many or most cases, personnel are busy with other important job functions (e.g., setting up traffic control, attending to the injured); data entry is a secondary priority for these workers. The panel also noted that situational factors can impact the collection of data; for example, in some cases, first or early responses come from off-duty personnel stopping to assist. Another factor noted was the scale or scope of the incident (e.g., multi-vehicle crash site versus lone vehicle). Thus, irrespective of the comprehensiveness of a data collection form, there are practical limits to the quantity and quality of on-scene data that researchers can realistically expect first and second responders to collect.

Other barriers relate to the complexity of the codes, labels, or definitions of different data elements. In some cases, there is a disconnect between different stakeholders concerning data collection (e.g., planners and coders). In some cases, this disconnect is manifest in a lack of understanding by the field personnel regarding the true intention of the database planners. This can lead them to use a data field (e.g., a checkbox) in a manner inconsistent with its intended meaning. Naturally, this can lead to inaccuracies in the final dataset or misinterpretation of the resulting data. The panel also raised the broader consideration of how much information is "good enough" or what level of detail is appropriate or necessary for the given purpose? Considering the other roles and responsibilities of personnel in the field, this needs to be balanced and realistic.

Summary

The first part of the panel discussion brought to light numerous and interrelated limitations and barriers respecting current data systems. These barriers relate to the purpose of different datasets and the corresponding data variables that they comprise, access to data and challenges associated with linking data from disparate sources, as well as data collection and coding issues stemming from difficulties in gathering data in the field or in the context of an investigation. With a broader understanding of some of the deficits, the discussion turned to potential solutions.

Towards Improvements and Solutions

The expert discussion generated a number of potential inroads for improving the quality of existing data sources or developing new resources aimed at addressing the underlying questions of roadside safety. As for the summary of the discussions surrounding barriers and challenges above, substantive comments from the experts' conversation have been organized according to a few overarching threads.

Defining Data Needs, Data Sharing, and Coalitions

In terms of application, the panel rightly noted one needs to carefully consider their purpose or end goal when using such data. This understanding is critical in determining whether the key information is available or sufficient to support decision-making or other outcomes. Examples include whether one wants to include all injuries to roadside responders (i.e., including non-crash injuries sustained while operating equipment, falls, etc.) or just crash injuries; whether to consider all levels of severity (injuries, fatalities, near misses; i.e., looking at the entire injury pyramid/Heinrich's triangle); and whether aggregate data (e.g., total number of injuries) is sufficient or whether record-level data (detailed information about each individual injured person and the injury-producing event) are required. Along these lines, questions about the nature of the crashes of interest are relevant, as they could inform different countermeasures (e.g., crashes occurring during transport to or from the incident scene versus those during the roadside rescue). Depending on user needs, one can identify what data are available in relation to what data is desired and then determine the mechanism to close the gap(s) (e.g., through expansion of resources, advocacy, etc.).

It follows that depending on policy or stakeholder needs, different approaches, solutions, or priorities will be appropriate, given (likely) limited resources. For example, promoting enhancements to particular datasets or establishing effective linkages between different sources might be sufficient for some purposes, while others might call for the development of new sources of data. Some of these specific avenues are discussed further below. Part of the mapping out of data needs also includes more fundamental questions, each of which has implications for resources:

- Who is the steward of such data?
- By whom/how should the data be collected?
- Is the data planned as a single study or part of a surveillance system?

Some of these issues will inform the development of coalitions to facilitate data sharing agreements and possible mechanisms for improving harmonization across data systems (note, although related, this is distinct from data linkage strategies, discussed subsequently). Collaboration and dialogue are fundamental to this sort of effort. Coordinating with other stakeholders such as unions or advocacy groups might be another means of generating interest and, by extension, reporting at different levels.

Improving Data Granularity and Coding

It was noted that the immediate- and longer-term goals and competing concerns of those responsible for collecting the data of interest will impact the collection and completeness of data. Often, there are mismatched expectations of people with different roles in data collection, leading to tradeoffs for increasingly complex variables and coding.

One important improvement is already underway at NHTSA regarding the coding and classifications of different crash elements that will occur over the next few reporting cycles. These include an expansion of data attributes to enable identification of roadside responders in the FARS database, such as whether the crash was emergency vehicle related; whether the vehicle was in special use at the time of the crash (including towing, safety service patrol, and others); and whether each involved person was working as an incident responder (including EMS personnel, fire, tow operator, and others). As noted previously, however, these data cannot be entered into FARS if they are not first recorded at the state level, thus gaps will remain over time until all states consistently collect the information needed to populate these new attributes.

The panel highlighted the key role of the person filling out the report, including their respective training and the equipment or materials used to gather data. In addition to clearly identifying different information and underlying codes/classifications, the data entry process needs to be easy, yet comprehensive. Drop-down or fixed options

(e.g., checkboxes) are important for consistency; to the extent possible, moving critical elements out of narrative descriptions and into fixed data fields would improve the consistency of reporting. That said, this was not intended to supplant the narrative fields, which have been proven highly useful for more rigorous data/text mining approaches.

Standardization in reporting was also raised as an important part of the puzzle. Historically, in some databases, occupation was derived from a crash narrative, which would be subject to widespread variability in reporting standards. A standardized reporting box for occupation was deemed necessary (and underscored the move by NHTSA to enhance certain data elements). Panelists noted several existing standards that are useful for occupational or injury classification or entities charged with such standardization, including National Uniform Billing Committee, Standard Occupational Classification (SOC) System, North American Industry Classification System (NAICS), and NIOSH Industry and Occupation Computerized Coding System (NIOCCS).

Enabling Data Linkage

The concept of data linkage was a frequently occurring topic during the discussion, distinct from facilitating data sharing/access. In recognition of the need to combine data from multiple sources, it was noted that it would be ideal to have standardized unique identifiers that can link data across different databases. In the absence of such an identifier, probabilistic linkage is necessary, which requires substantial expertise and may still result in errors in the estimates of relevant incidents.

The development of a universal identifier, however, does not occur in a vacuum. It requires that relevant data sources are identified so that they can be included in the network and it requires an active and strong commitment from many stakeholders to ensure buy-in and continued compliance. With respect to specific data types, the panel noted the potential utility of connecting roadside crash data with hospital data (trauma centers, in particular), EMS data, insurance or worker's compensation data, and systems for self-report of incidents.

Given the importance of triangulating data sources, it was suggested that organizations such as the AAA Foundation for Traffic Safety could build inventories of what data is available and help build strategies to overcome barriers in sharing data, given that some data sources are restricted and data agreements are not always easily negotiated.

Expanding Data Types and Sources

Although inexorably linked to the above section regarding data needs, the panel also entertained broad discussion about alternative or non-traditional avenues to gaining more insight into the circumstances surrounding roadside crashes. These are not mutually exclusive.

Reporting and Understanding of Near Misses

Near-miss incidents were touted as a major gap in our understanding of roadside safety, which can offer good information not only about the crashes that happen, but also about the ones that do not happen. Moreover, data on near misses can be valuable in helping understand steps successfully taken to prevent the occurrence of crashes and injuries.

There are a number of different ways in which near-miss data can be gathered, whether as part of routine survey data collection or as part of a reporting system where EMS/tow operators/others can log such incidents. The discussion drew heavily upon the National Firefighter Near-Miss Reporting System (NFFNMRS) as an exemplar of such a system. The NFFNMRS is a voluntary, anonymous online reporting system (similar in some ways to the Aviation Safety Reporting System), where the respondent will not be penalized for any transgressions on their part. The reporting forms include quantitative fields as well as narratives, which can support automatic text mining efforts. The panel also used the CDC Vaccine Adverse Event Reporting System (VAERS) as a good and topical example of a monitoring system that could be modeled for towing or other roadside incidents.

Near-miss reporting can greatly enhance our understanding of the circumstances of encounters on the roads that do not result in a crash (for whatever reason). However, to implement such a system in a meaningful way requires buy-in by many stakeholders, as well as active participation from the people in the field. It follows that the incentivization or motivation of tow operators to share information would be an integral consideration.

Video Event Recorders

While the rationale is often for determining liability, cameras and video event recorders were touted as one possible means of gathering additional insight into roadside crashes as well as near misses. Several existing platforms can capture front and rear views from a vehicle. Often, these will save and/or transmit recordings surrounding a g-force trigger (e.g., crash). Others will record continuously (useful in cases where there is no contact, such as a near miss). It was noted that the practice of adding cameras to tow trucks was becoming more common.

Use of video has been integral to many large-scale studies of driver behavior (e.g., SHRP2). These efforts have also helped to highlight many of the logistical considerations that need to be addressed. For example, how and where is the data stored and for how long? Who owns the data? How will the data be coded and by whom? What other data uses exist (e.g., training)? Finally, if a private company such as a tow operator installs recorders on their vehicles, could video of near misses or crashes be made available to others to guide safety improvements without threat of liability concerns? Video data has prospects, but there are challenges in processing this data on the backend, especially at scale.

Media, Narrative, and Other Sources

In addition to general improvements in a variety of data sources as well as provisions for enhancing the prospects of linking data sets, the panel also raised some alternative approaches that can be useful for gleaning information regarding the circumstances of crashes involving roadside responders. For example, local news or media coverage of crashes may afford details of certain crashes that are not captured in other more traditional databases. One panelist described an approach that attempted to identify news stories of roadside service providers injured or killed in crashes, and then link the articles probabilistically back to traditional motor vehicle crash databases. It was also noted that for the CFOI, Google alerts are used to help gather data regarding occupational injuries and they are currently building systems to code directly from news articles. This can be difficult because of lack of consistency across internet sources; however, these can help narrow the information that the human coder needs to work with.

Media and other text-based approaches lend themselves to different narrative text mining approaches, which can offer unique insight that is not necessarily coded in other data elements. The same is true for narratives that might be gathered in different parts of an investigation, even if this information is later excluded from coded data. Clearly, narratives should be part of the data collection process; however, they should not supplant the coding of critical data elements.

Descriptions of other lesser-known data sources, such as those stemming from the International Towing Museum's Wall of the Fallen Survivor Fund, also highlight other potential data sources that can be considered when broaching the topic of roadside safety, perhaps with the aim of expanding and linking such data to others. Panelists also noted that witness statements might be useful in capturing additional detail, although these are not typically captured in existing data systems.

Recommendations

A number of recommendations have been distilled, based on the rich information provided by the panel of experts. They are not independent of one another, nor is the list exhaustive. Collectively (and ideally), they represent areas where positive steps can be taken towards establishing better estimates of crashes involving roadside responders and gaining better insight into the circumstances surrounding such instances. In the figures below, the recommendations are grouped into three categories, however these are not mutually exclusive.

Improving Data Quality and Granularity

Enhance Current Data Systems	Improve Data Collection Process	Enhance Training of Coders	Standardize Job Codes
Advocate for continued enhancements to current data systems, including improvements to specific variables or elements. The ultimate goal is to ensure sufficient resolution in the variables that relate to personnel responding to incidents at the roadside.	Promote or advocate for enhancements in the collection of data to reduce the burden for those charged with collecting data in the field, while ensuring the capture of critical elements.	Promote or advocate for continued or enhanced training of coders. This requires a deeper assessment of needs and challenges faced by those in the field.	Promote the standardizing of critical job codes and other related data elements across data sets. In traffic crash data sets, promote, at minimum, an indicator of whether a crash-involved person was working or on-duty.

Enabling Data Sharing and Linkage

Catalogue Existing Data Sources	Determine Cost-Benefits of Linkage	Establish a Data Coalition	Develop Linkage Strategy
Develop inventories of what data sources* are available and what information each includes. This will help guide strategies for sharing and linking data. This includes record-level data that forms the basis of aggregates generated by different organizations. **Note that "data sources" should be construed broadly to include non-traditional data sources, such as media articles, in addition to traditional sources such as research or actuarial databases.*	Determine what information can be gained by linkage of existing data sources beyond that which is available in any of them individually, and how or whether those data sources can be linked.	Establish a coalition charged with facilitating data sharing and harmonizing, including a universal identifier that would be common across data sources (or, minimally, a feasibility assessment of doing so).	Determine the following: • Which existing data sources can be linked deterministically in their current form? • Which existing data sources can be linked deterministically in their current form? • What steps would need to be taken to enable deterministic linkage where it is not currently possible (e.g., creation of unique identifiers common to all relevant data sources) and what is the feasibility of doing so? • Whether probabilistic linkage is feasible until unique identifiers are created to enable deterministic linkage?

Expanding Data Sources

Explore Near-Miss Reporting System	Examine Feasibility and Utility of Video Data
If data on near misses are desired, carry out a feasibility assessment of a near-miss reporting system for roadside service providers. If promising, this could be conducted as a proof-of-concept with a one or more fleets of roadside service providers.	If in-vehicle video data are desired for risk-management operations and/or for research or educational purposes, a feasibility assessment of using truck-mounted video recorders to capture near misses can be carried out.

Conclusion

Incident response and emergency services personnel are at risk of being struck by passing motorists while they are working at the roadside. Comprehensive, detailed, high-quality data on the incidents and crashes are important in guiding effective countermeasures to better protect these workers. This Research Brief highlights a roundtable discussion with a panel of diverse experts that sought to identify ways to improve data about roadside incidents to enhance the safety of incident response and emergency services personnel. The first part of the panel discussion brought to light numerous interrelated limitations and barriers with respect to current data systems, relating to the purposes of different datasets and the corresponding data variables, access to data and challenges associated with linking data from disparate sources, as well as data collection and coding issues. The discussion also generated a number of potential inroads for improving the quality of existing data sources or developing new resources aimed at addressing the underlying questions of roadside safety. Based on the aggregate information brought to light in the discussion, a number of recommendations have been presented in the hopes that more positive steps can be taken to protect vulnerable roadside workers.

Acknowledgement

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Suggestion Citation

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About the AAA Foundation for Traffic Safety

The AAA Foundation for Traffic Safety is a 501(c)(3) nonprofit, publicly supported charitable research and education organization. It was founded in 1947 by the American Automobile Association to conduct research to address growing highway safety issues. The organization's mission is to identify traffic safety problems, foster research that seeks solutions, and disseminate information and educational materials. AAA Foundation funding comes from voluntary, tax-deductible contributions from motor clubs associated with the American Automobile Association and the Canadian Automobile Association, individual AAA club members, insurance companies, and other individuals or groups.

Appendix A: Noteworthy Resources or Initiatives Shared during Roundtable

- The Kentucky Occupational Safety and Health Surveillance (KOSHS) program, funded in the last 20 years by NIOSH, tracks worker injuries (primarily non-fatal) and illnesses. https://kiprc.uky.edu/programs/kentucky-occupational-safety-and-health-surveillance-koshs-program
- The Fatality Assessment and Control Evaluation (FACE) program, one of three integrated components tracks fatal injuries and onsite investigations. https://www.cdc.gov/niosh/face/default.html
- The Center for Firefighter Injury Research & Safety Trends (FIRST) has assessed safety culture in over 600 fire departments, and can assist others in establishing connections. https://drexel.edu/dornsife/research/centers-programs-projects/FIRST
- National Fire Fighter Near-Miss Reporting System (NFFNMRS), implemented in partnership with NIOSH, is a national registry for reporting safety hazards, non-fatal injuries, and near-misses. https://drexel.edu/dornsife/research/centers-programs-projects/FIRST/our-projects/Near-Miss-Reporting/ and http://www.firefighternearmiss.com/

  Related publications:

  - Taylor, J.A., Lacovara A.V., Smith G.S., Pandian, R., & Lehto M. (2014). Near Miss Narratives from the Fire Service: A Bayesian Analysis. *Accident Analysis and Prevention.* 62, 119–129. https://doi.org/10.1016/j.aap.2013.09.012
  - Taylor, J. A., & Lacovara, A. V. (2015). From Infancy to Adolescence: The Development and Future of the National Firefighter Near-Miss Reporting System. *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*, 24(4), 555–576. https://doi.org/10.2190/NS.24.4.h
  - Taylor, J.A., Davis, A.L., Barnes, B., Lacovara, A.V., & Patel, R. (2015) Injury Risks of EMS Responders: Evidence from the National Fire Fighter Near-Miss Reporting System. *BMJ Open*, 2015;5:e007562. https://doi.org/10.1136/bmjopen-2014-007562
- NHTSA's National EMS Information System (NEMSIS) was developed as a patient care monitoring system; it is not focused on provider injury. It is close to a census (but technically not quite), with 75% of info received within 2 weeks, and 43.5 million reports collected in 2020. https://nemsis.org.
- The Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) is a census of fatalities resulting from occupational injuries. Data is gathered from approximately 25 sources including states, death certificates, coroners' reports, OSHA, and Google News Alerts. The resulting data is reported by occupations/categories/industries, etc. https://www.bls.gov/iif/oshfat1.htm
- The Towing Traffic Incident Reporting System (TTIRS) is a voluntary system for confidential reporting of near-miss and struck-by incidents involving tow operators. https://www.respondersafety.com/Near-Miss/Towing-Recovery-Near-Miss.aspx
- The Cargo Tank Risk Management Committee is an example of voluntary collaboration across an industry to improve worker safety. www.cargotanksafety.org