

**ID: 76758550**

## **Injury - Host Site Description**

### **Montana Department of Public Health and Human Services**

**Assignment Location:** Helena, US-MT  
Montana Department of Public Health and Human Services  
EMS, Trauma Systems, & Injury Prevention Section

**Primary Mentor:** Hannah Yang, MSPH in Global Disease Epidemiology and Control  
Epidemiologist Supervisor  
Montana Department of Public Health and Human Services (DPHHS)

**Secondary Mentor:** Cedar Mitchell, PhD and MSPH in Epidemiology  
Career Epidemiology Field Officer  
Montana Department of Public Health and Human Services (DPHHS)

### **Work Environment**

Hybrid

### **Assignment Description**

The Fellow will join the EMS, Trauma Systems, and Injury Prevention Section (EMSTS) epidemiology/data team and will focus on traumatic brain injury related projects. In addition to a primary mentor within EMSTS, the fellow will also receive mentorship from our Career Epidemiology Field Officer with CDC who serves as an epidemiologist with the Epidemiology and Scientific Support Bureau and will provide epidemiologic expertise and facilitate connections with subject matter experts at CDC as needed. The fellow will also have access to the many other experienced epidemiologists across the Public Health and Safety Division. Our cross-functional supervisory model is designed to provide robust program-based and technical support, foster professional growth and subject matter expertise, and ensure that epidemiologists are never isolated as the sole "data person" in a program-focused environment.

The fellow's role will focus on leveraging data systems to enhance TBI surveillance and improve quality of care and patient outcomes. Daily activities will include:

- Staying up-to-date on relevant TBI research
- Linkage of multiple state-wide datasets (EMS, trauma registry, death certificates)
- Data analysis in SAS or R using individual and linked datasets
- Preparing written reports to summarize findings and translate to various audiences
- Presenting findings in internal meetings and public health forums
- Participating in relevant meetings, events, and trainings to deepen subject matter and technical expertise and relationships with partners

This assignment offers the opportunity to directly contribute to critical public health initiatives, while gaining valuable data analysis skills, expanding subject matter expertise in TBI, and receiving high-level mentorship and support from experienced epidemiologists at Montana DPHHS.

### **Describe Statistical and Data Analysis Support, Such as Databases, Software, and Surveillance Systems Available to the Fellow**

The Fellow will be provided access to statistical analysis tools (SAS and/or R), as well as other tools as necessary to support assigned activities (ie- Microsoft Office, MatchPro, Python, GitLab). Training/support on the use of these tools can be provided by mentors. The Fellow will be provided access to all relevant surveillance systems including the state EMS registry, state trauma registry, death certificate data, and all other necessary systems needed to complete assigned activities.

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**Projects**

**Surveillance Activity Title: Data linkage of trauma registry TBI data with EMS data and death certificate data for surveillance of trauma registry TBI case fatality rate**

*Surveillance Activity Description:*

This project will focus on developing a linked dataset that includes TBI cases from the trauma registry, linked with any related EMS records (including scene response and interfacility transports) and death certificates. The objective is to improve our surveillance of case fatality rate for trauma registry TBI cases. This indicator is used in evaluation of several EMSTS programs. We focus specifically on trauma registry TBI cases because this is a subset of TBI that can potentially be impacted by improvements in patient care and trauma system efficiency.

The first step will be to create a linked trauma/EMS dataset that represents unique cases seen in the trauma registry. Because interfacility transport plays a significant role in Montana's healthcare system, trauma registry data must first be de-duplicated (over 20% of records in the trauma registry indicate that the patient was transferred from another facility, and many patients are transferred two or more times). Subsequently, linkage with EMS scene response and/or interfacility transport records will help to create a full picture of care provided to the patient. A linkage algorithm for this step already exists. The linked dataset can then be filtered to TBI cases.

The second step will be to link the trauma/EMS TBI dataset with death certificate data. This step will serve to augment the outcome data available in the trauma registry. We are interested in ascertaining deaths related to TBI that may not have been captured in the trauma registry. Some of the common reasons why the trauma registry may lack outcome data are transfers out-of-state or data quality issues. Additionally, some patients may pass away after discharge from the hospital due to complications, which is not captured in the trauma registry. Montana Vital Statistics receives death certificates for residents who die out-of-state.

Annually, we see around 120 fatalities from a total of around 1300 unique TBI cases in the trauma registry. We currently use this information to calculate the case fatality rate for TBI (around 9%). By adding death certificates to the analysis we hope to be able to calculate a more accurate case fatality rate.

*Surveillance Activity Objectives:*

Objectives:

- Optimize an existing probabilistic record linkage process that deduplicates trauma registry data to unique trauma cases, and links any related scene and/or interfacility EMS records
- Develop a new linkage algorithm between the trauma/EMS TBI data and death certificate data
- Calculate case fatality rate for trauma registry TBI cases

Deliverables:

- Linked trauma/EMS dataset
- Linked trauma/EMS/death certificate TBI dataset
- Report outlining linkage process & impact of linkage to death certificates on case fatality rate

*Surveillance Activity Impact:*

This project will strengthen Montana's data infrastructure and enhance the accuracy of TBI surveillance, specifically providing a more comprehensive understanding of TBI case fatality rates and patient outcomes. Accurate patient outcome data will serve as the foundation for other projects/research and continuous improvement in TBI care. This work will also help inform TBI-related topics identified in our current Legislative session (that will be addressed in the next couple years), thereby bolstering state government support for EMS and Trauma systems.

**Surveillance System Evaluation Title: Evaluation of EMS documentation versus hospital TBI diagnoses**

*Surveillance System Evaluation Description:*

EMS data is one of the timeliest data sources available for public health surveillance, and therefore evaluation of its role as part of a TBI surveillance system is crucial. The current TBI surveillance definition that EMSTS uses with EMS data includes any record with a provider primary or secondary impression (eSituation.11/eSituation.12) of ICD-10-CM codes S09.90, S02.0, S02.1, S02.8, S02.91, S04.02, S04.03, S04.04, S06, S07.1, T74.4 (all sub-codes included). The use of ICD-10-CM codes within EMS data has nuanced differences from their use within hospital discharge data, and therefore this surveillance definition warrants further evaluation.

This project will utilize the linked trauma/EMS TBI dataset produced from step 1 of the proposed "surveillance activity", allowing for EMS documentation to be compared against definitive TBI diagnoses from the trauma registry. The project will also involve exploration of other facets of EMS documentation (such as GCS, head assessment, trauma triage criteria, narratives, adverse events).

This evaluation will reveal the current performance of EMS documentation, highlight any discrepancies, and help pinpoint opportunities for additional training.

*Surveillance System Objectives:*

**Objectives:**

- Utilize linked trauma/EMS TBI dataset produced from step 1 of the Surveillance Activity to compare EMS impressions to trauma registry diagnoses
- Explore additional facets of EMS documentation and how they relate to data captured in the trauma registry

**Deliverables**

- Report outlining the evaluation findings
- Recommendations for or against revising the current EMS TBI surveillance definition

*Surveillance System Impact:*

This evaluation will pinpoint potential weaknesses in EMS field recognition of TBI, EMS documentation, and EMSTS current surveillance practices, and offer actionable insights to improve in these areas. Ultimately, enhanced field triage and early identification of TBI can facilitate faster, targeted treatments, leading to better patient outcomes.

**Major Project Title: Association of pre-hospital and in-hospital adverse events with outcomes after traumatic brain injury**

*Major Project Description:*

The EPIC-TBI guidelines recommend avoidance of hypoxia, hypotension, and hypocarbia in prehospital care of TBI. Montana is unique in that the EPIC-TBI treatment protocols are implemented not only in the prehospital setting but also within hospital emergency and inpatient care.

This project will assess how the occurrence of adverse physiologic events—including hypoxia ( $\text{SaO}_2 < 90\%$ ), hypotension ( $\text{SBP} < 90 \text{ mm Hg}$ ), and hypocarbia (end-tidal  $\text{CO}_2 < 35 \text{ mm Hg}$  due to hyperventilation)—in both the prehospital and hospital phases are associated with key TBI outcomes such as death in the ED, hospital mortality, and unfavorable discharge disposition. The analysis will mimic that done by Maiga et al (<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2829777>), however, the Maiga study excluded interfacility transfers and did not look at the role of in-hospital adverse events, which we hope to address with this project.

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*Major Project Objectives:*

Objectives:

- Utilize linked trauma/EMS/death certificate dataset produced from step 2 of the Surveillance Activity to assess the associations of pre-hospital and in-hospital hypoxia, hypotension, and hypocarbia with TBI outcomes

Deliverables:

- Detailed report or manuscript that compares the outcomes in patients experiencing these adverse events versus those receiving optimal care, highlighting any additional benefits from hospital-level interventions.
- Presentation of results at State Trauma Care Committee

*Major Project Impact:*

This project will provide critical evidence on how combined prehospital and hospital interventions may impact outcomes in TBI patients. By validating these associations in Montana, the findings can guide further refinement of both EMS and hospital protocols, ultimately leading to improved survival and functional outcomes.

**Additional Project #1 Title: Assessment of BIG criteria for mild TBI interfacility transport decision making in Montana**  
**Project #1 Type: Major Project**

*Project #1 Description:*

This joint initiative with Montana's two Level I trauma centers will assess the feasibility and effectiveness of utilizing the Brain Injury Guidelines (BIG) to guide interfacility transport decisions for BIG 1 criteria mild TBI patients in Montana. BIG provides a risk stratification algorithm that differentiates mild TBI patients into three categories and does not mandate hospital admission, repeat head CT, or neurosurgical consult for all patients, which is a departure from most standard care protocols.

BIG has not been validated in the context of interfacility transfers in Montana. We want to do an analysis similar to this study

([https://journals.lww.com/jtrauma/fulltext/2024/06000/reducing\\_low\\_value\\_interhospital\\_transfers\\_for.14.aspx](https://journals.lww.com/jtrauma/fulltext/2024/06000/reducing_low_value_interhospital_transfers_for.14.aspx)). The trauma medical directors of Montana's two Level I trauma facilities are interested in collaborating with EMSTS to conduct research around this topic using statewide trauma registry data.

*Project #1 Objectives and Expected Deliverables:*

Objectives:

- Utilize deduplicated Trauma Registry dataset to examine interfacility transport patterns among TBI patients
- Retrospective application of BIG criteria to trauma registry data to assess whether it would have reduced interfacility transfer rates

Deliverables:

- Detailed report or manuscript that identifies the percentage of interfacility transfers for minor TBI that may have been low value and could have potentially safely been treated at the initial facility.
- Presentation of results to State Trauma Care Committee

*Project #1 Impact:*

Montana's health system is under strain due to its large, rural nature, mainly volunteer EMS workforce, and lack of access to high-level trauma care. Minimizing unnecessary interfacility transfers would relieve pressure on EMS, improve bed availability at larger trauma centers, and keep patients closer to home when safe to do so.

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**Please Describe the Fellow's Anticipated Role in Preparedness and Response Efforts – Include Activities and Time Allocation (Required Competency of Fellowship)**

The Fellow will have ample opportunities for engagement in preparedness and response efforts. Opportunities include, but are not limited to, participation in preparedness tabletop and functional exercises, supporting PHSD with drafting or analyzing health alert network and other emergency notifications, and engagement with response activities as opportunities arise. The secondary mentor, Dr. Mitchell, works directly with the preparedness and response sections at PHSD and the CDC and will facilitate engagement opportunities for the Fellow based on their interests. Time allocation will depend on the type of activity and can range from 1 day a week for functional exercises to a few hours per month for emergency notification communications. Based on the interest of the Fellow and status of other fellowship activities, preparedness and response efforts will be balanced with the Fellow's workload.

**Please Describe the Fellow's Anticipated Role in Cluster and Outbreak Investigations – Include Activities and Time Allocation (Required Competency of Fellowship)**

The Fellow will be integrated into cluster and outbreak investigations related to non-infectious (e.g., overdose, injury) and infectious disease events based on the interest of the Fellow. Both the primary and secondary site mentors will facilitate integration of the Fellow with appropriate PHSD epidemiology sections responding to outbreak investigations as they arise and based on the availability of the Fellow. As a division, PHSD responds to about 200 outbreak investigations a year and works closely with local and tribal health jurisdictions to support local field investigations. Time will be allocated to support engagement of the Fellow in at least one outbreak investigation, with additional time allocated based on the interest of the Fellow and their workload.