

**Injury Indicators and COVID-19: Guidance on Analysis,
Interpretation, and Communication**

**INJURY INDICATORS AND
COVID-19: GUIDANCE ON
ANALYSIS, INTERPRETATION,
AND COMMUNICATION**

Developed by the CSTE Injury Surveillance Workgroup

Table of Contents

Acknowledgements	2
Introduction	2
Objective and scope.....	2
Background	3
Guidance for using injury data through the COVID-19 pandemic and future pandemics	4
Recommended Process	4
1. Research current context of injury trends and patterns for outcome of interest.....	4
2. Define the data question(s).....	5
3. Determine potential factors that may affect the data.....	6
4. Identify jurisdictional injury data sources to be used and considerations for each data source	8
5. Define injury indicator or event to be evaluated	11
6. Plan the approach to be used for analyzing and reviewing the data	14
7. Interpret, communicate, and disseminate the data	15
Additional Resources	17
References	18

Acknowledgements

This document was prepared by Kristen Allen, MPH and Kristina Lai, MPH (Allen & Lai Consulting, LLC). Special acknowledgement is also extended to the following contributors for their expertise and assistance in moving this work forward:

- Pamela Imm (Wisconsin Department of Health Services)
- Mia Israel (CSTE)
- Dagan Wright (Oregon Health Authority)
- David Zane
- Lauren Yerkes (Virginia Department of Health)
- Katherine McDaniel (Florida Department of Health)
- Beth Hume (Massachusetts Department of Public Health)
- Samantha Riley (Massachusetts Department of Public Health)

This guidance was developed with support from Centers for Disease Control and Prevention (CDC) Cooperative Agreement 1 NU38OT00297.

Introduction

Coronavirus Disease 2019 (COVID-19), caused by the SARS-CoV-2 virus, was discovered in Wuhan, China in December 2019¹ and was declared a global pandemic on March 11, 2020.² Local, state, and federal authorities across the United States (U.S.) enforced various public health measures in an effort to curb the spread of COVID-19.³ The virus itself has had many impacts on all aspects of society, including factors related to fatal and non-fatal injuries.⁴ Researchers are examining the potential changes in the pattern and magnitude of injuries in affected communities.

Analyzing, interpreting, and disseminating injury surveillance data, largely based on ICD-10 or ICD-10-CM coded datasets, from this period are critical to understanding the impact of the COVID-19 pandemic on injuries in the U.S. Such data are invaluable for state and local health departments and community organizations to develop and support public health policy, programs, and interventions focused on understanding and reducing the burden of injuries in communities. Guidance for handling data during the COVID-19 pandemic – and future pandemics and natural disasters – is needed for applied injury epidemiologists.

Objective and scope

The objective of this document is to provide guidance to injury epidemiologists in examining patterns and trends, interpretation, and dissemination of data (internally and to partners) related to COVID-19 and future pandemics.

The scope of this guidance document includes recommendations for U.S. public health jurisdictions using injury-related emergency department (ED), hospital discharge, and mortality datasets.

This document provides a way for epidemiologists to assess trends prior to and after the COVID-19 pandemic. It is not intended as guidance on how to use and analyze specific data sources to track disease during an ongoing pandemic.

Background

During the early stages of the pandemic, the number of individuals seeking medical care through ED visits and hospitalizations dropped dramatically. This decrease in overall visits caused changes in rates that may not reflect true injury outcomes across populations, but are, instead, an artifact of the pandemic. COVID-19 and future pandemics should be analyzed with caution and special attention paid to broader societal contexts. A 2021 literature review found nearly 500 articles published in 2020 that describe trends for 17 injury categories across six continents during the COVID-19 pandemic.⁴ Furthermore, an updated version of the review found 1,756 publications in 2021 and 2022 for the 17 injury categories.⁵ This demonstrates the breadth of interest and information that can be gleaned from injury data during similar disruptions, and the need for clear guidance for interpreting these data. The COVID-19 pandemic also shed light on the highly localized impacts felt by specific communities that may not be understood without input from community members and partners providing additional context.

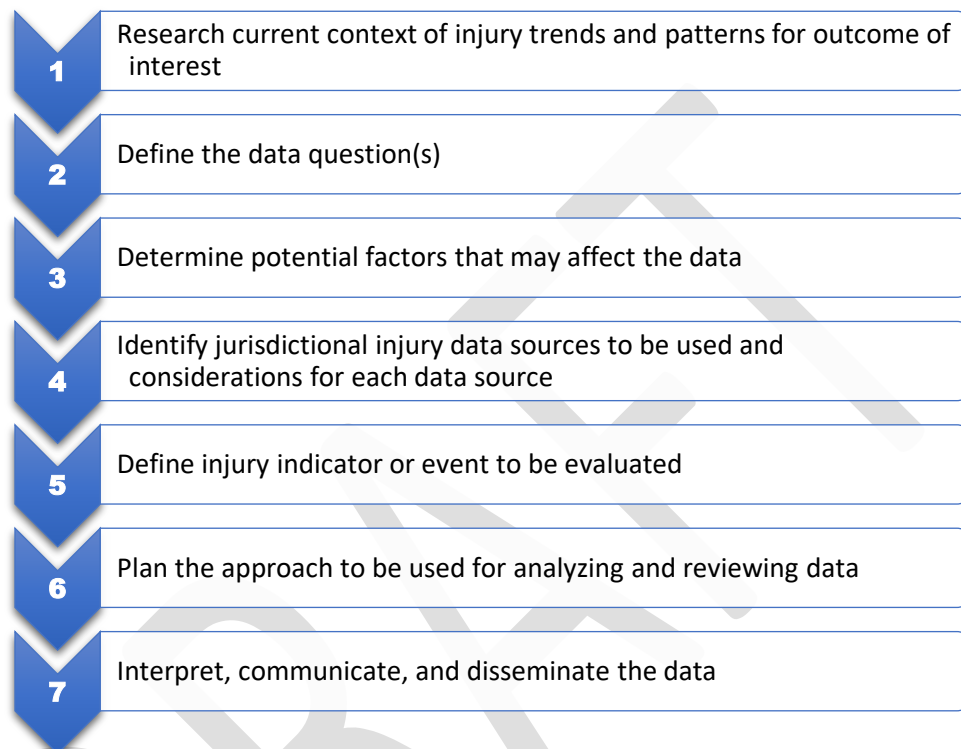
This document was born out of discussions between members of the Council of State and Territorial Epidemiologists' (CSTE) Injury Surveillance Workgroup. In Fall 2021, a small group of state and local injury epidemiologists began comparing their jurisdictional data. They found that each jurisdiction had its own unique patterns of injuries during COVID-19, depending on their geography and community characteristics, so it was not possible to develop a "one-size-fits-all" interpretation of the impact of COVID-19 on injury outcomes. Thus, this document was created in recognition that jurisdictions experience different outcomes, and there is a broader need to provide a framework for injury epidemiologists to approach, analyze, interpret, and communicate data that may be unexpectedly affected by the COVID-19 pandemic, as well as to glean lessons for other large-scale public health emergencies.

This guidance document breaks down the steps put forth by the CSTE Injury Surveillance Workgroup and suggests a process for approaching injury data in individual jurisdictions. This document is not intended to address every type of injury or every situation that may be important on a local scale. Instead, it provides recommendations and a process that may be tailored to specific contexts and interests.

Guidance for using injury data through the COVID-19 pandemic and future pandemics

Recommended Process

The recommended process for using injury data in the context of the COVID-19 pandemic includes the following overarching steps:



These steps are described in detail below. While this document focuses on COVID-19 and future pandemics, it can also be used as a template for other major public health emergencies or national disasters.

1. Research current context of injury trends and patterns for outcome of interest

During the early stages of the pandemic, the number of individuals seeking medical care from EDs dropped dramatically. A drop was observed in the number of hospitalizations as well. This decrease in overall visits caused changes in rates that may not reflect true outcomes. With this in mind, trends and patterns during these global disruptions should be analyzed with caution.

During 2020 and 2021, increases have been observed for certain injuries in specific populations – such as overall drug poisonings and non-fatal self-harm among youth.^{6,7} It is important to work with local communities when assessing injury trends to assess and understand possible contributing factors. Community partners could include local public health departments, school nurses and counselors, local health providers, local civic leaders, leaders in the faith community, the community members, and others. When increases (and decreases) are observed, informing community partners can turn data into action by assisting in the promotion of focused prevention activities.

2. Define the data question(s)

When considering analyses or program planning and development focused on injury and COVID-19 impacts, the first step is to define the data question(s). What question(s) are you or your team trying to answer? The following items focus on intended data use, which can help frame the data question and guide your work.

- a. **What do partners see as the most important questions?** Community members, partners, focus group participants, or other members of the public can be crucial in defining the most important questions to ask using your data. Partners could include local public health departments, school nurses and counselors, local health providers, local civic leaders, leaders in the faith community, and others. COVID-19 Community-based Impact surveys may also be helpful when developing your questions. Input from these groups should be incorporated early and often, and it can help guide jurisdictional understanding of any trends or patterns in the data.
- b. **How will these data be used?** Sometimes, data questions are more research-based and may be used for reports and journal publications. Others may be solely for program planning, evaluation, or policy development. When you are developing your data questions, it is important to consider how the data will be used as this will also influence how you communicate your analyses/results. Partner and/or funder feedback on how data will be used is critical.
- c. **Who is the audience?** Understanding your potential audience also impacts how data will be used. Is your audience the general public? Other public health professionals? Community-based organizations? Healthcare systems? Policymakers? Or is your audience a mix of different people from various backgrounds and foundational knowledge? If your data are geared more towards the general public, it is important to consider language and communication methods used to talk about the data. This is discussed further in the section titled “Interpret, communicate, and disseminate the data” (Step 7).
- d. **Identify health equity considerations.** When you define data questions for analyses, it is important to consider health equity. Are there items, like demographic or geographic variables, in your data that you want to look at when you are exploring your data? Do these reveal health inequities? If health inequities exist, are you making prevention or intervention recommendations for those groups as well as getting feedback from the groups that are most impacted? How do you plan to communicate inequities? What are the best ways to effectively communicate with community groups/members? It is also important to consider the language used for your data questions, including reading level and up-to-date, culturally responsive and appropriate, equity-focused, and person-first terminology.
- e. **How can the data help programs and response activities?** When you are developing data questions and analyses, consider how the data questions may help your agency or other organizations work to prevent injuries during the COVID-19 or other future pandemics. Try to set realistic expectations for what these data can or cannot be used for.

3. Determine potential factors that may affect the data

There are a wide variety of factors that could influence injury outcomes, direction of trends and/or populations experiencing the greatest burden during and after a pandemic, epidemic, natural disaster, or societal movement. These factors should be considered and addressed when analyzing injury and violence data, describing burden, and/or discussing prevention and intervention possibilities.

The following list should not be considered all-inclusive. Instead, it provides examples of issues to consider when assessing health outcomes. When increases (and decreases) are observed, informing communities and community partners can turn data into action by assisting in the promotion of targeted prevention activities.

- a. **Underlying data quality:** Your data may be influenced by underlying factors related to data quality and reporting that may affect trends. Some data may appear to show a decreasing trend; however, this could be due to changes in data collection methodology and/or timing. Working with your data managers and understanding how the pandemic has impacted their datasets is important when assessing changes in outcomes. For instance, if data collection is halted for a month or two, this can impact timing of information. Or, if medical examiners do not have the time to complete full autopsies, for example, this could affect the quality and completeness of data and/or timing of data. It is important to be aware of any changes with data collection, completeness, and timeliness when analyzing and communicating injury outcomes.



Key Question: What are some potential underlying factors that could affect data quality and how will these be communicated in your analyses?

- b. **Jurisdiction-specific interventions and policies:** During the pandemic, most jurisdictions issued stay-at-home orders (at least for a brief period). These measures restricted movement and social interactions which altered peoples' risk for injury, sometimes decreasing risk for certain injuries while increasing the risk for others. For instance, stay-at-home orders led to changes in traffic patterns and motor vehicle-related injuries (decreasing these for some time in many jurisdictions). On the other hand, restriction to the home environment may have led to increases in intimate partner violence and/or child abuse with families and household members who may have been less likely to be able to separate during conflict.



Key Question: What measures/policies are taking place in your jurisdiction that could impact injury outcomes and how?

- c. **Changes in healthcare access:** Early in the pandemic, there were time periods where care was not available or severely limited. The influx of COVID-19 patients in these settings also meant that fewer services were available for other conditions/emergencies. Additionally, stay-at-home orders emphasized the importance of limiting social interactions, and media messaging encouraged people to refrain from use of healthcare services except for the most urgent/severe situations. This led to changes in use of EDs, urgent care clinics, and other health services.



Key Question: What shifts in healthcare usage are occurring in your area as a result of the public health emergency (pandemic, natural disaster or similar emergency) and how does this impact specific injury indicators?

- d. **Other life circumstances:** With a shift to remote work and school, injuries also shifted from commuting-related injuries to home-related injuries. For instance, kitchen burns may have increased as people spent more time cooking at home. This may have been especially impactful on children and youth attending school remotely and preparing their own meals.



Key Question: What life circumstances have been occurring in your area and how will these impact specific injury outcomes?



Key Question: Are the media or community organizations knowledgeable of life circumstance changes and therefore a good source of information?

- e. **Major events:** Societal stress during a pandemic or a widespread public health emergency can coincide with or spark other disrupting events. For instance, during COVID-19, the U.S. and many jurisdictions around the country, experienced significant political transitions. Some of these transitions resulted in political unrest, which may have included violence and mental health distress. Such responses may have influenced injury outcomes including self-harm, suicide, and firearm assaults not directly related to COVID-19.



Key Question: What major events are occurring in your region that could influence or exacerbate injury outcomes?

- f. **Health equity, institutional racism, and Social Determinants of Health (SDoH):** All of these factors impact health outcomes, regardless of pandemic, natural disaster, or social unrest. However, the impact may be greater for specific populations and more detrimental when coupled with a disruptive influence such as COVID-19.



Key Question: Which populations are more at-risk during a pandemic or similar public health emergency due to unequal and/or unjust conditions or structures?



Key Question: What data are available, what is missing or not available (such as primary language spoken, disabilities, sexual orientation, gender identity)? How might a lack of data impact interpretation of findings?



Key Question: What was known about these populations, SDoH disparities, inequities, racism, and biases before the pandemic, and how have these changed?



Key Question: Are the inequities exacerbated during the pandemic compared to other populations?

- g. Cost of healthcare and changes to primary payers:** During a pandemic or other major public health emergency, economic influences often co-occur (such as inflationary increases and unemployment). These changes have ripple effects on the cost of healthcare services and health insurance coverage, and in turn, impact health-seeking behaviors and the availability/accessibility of services for individuals.



Key Question: What changes have you noted in your region associated with healthcare costs and insurance coverage and how might these impact injury outcomes?

4. Identify jurisdictional injury data sources to be used and considerations for each data source

A key revelation related to the pandemic was the discovery that specific injury indicators measured by different data sources did not always reveal the same patterns, trends, or disruptions. For instance, for motor vehicle crashes, some areas reported decreases in ED visits and increases in deaths. This is an important example and reminder for epidemiologists to review and analyze an indicator from multiple perspectives (using multiple data sources such as those listed below) to gain a broader picture of overall burden and impact.

Standard databases available to most states and territories that can be used to assess the impact of COVID-19 (or another pandemic or natural disaster) on injuries include, but are not limited to, the following:

- Billing/Administrative data:
 - Inpatient Hospital Discharge Data
 - ED Discharge Data
- Death certificate data
- Additional data sources:
 - ED Syndromic Surveillance (SyS)
 - Emergency Medical Services (EMS)/ambulance data
 - Trauma Registries
 - National Violent Death Reporting System
 - COVID-19 Community-based Impact surveys
 - Outpatient Observation Stay Database

As with any data source, these have their limitations. The most salient limitation of most of these data is the timeliness of release. Some data sources, such as ED SyS, are trackable in real-time, but others are restricted by the official release by healthcare organizations and state vital records offices. Additionally,

most jurisdictions will find that these sources do not include data on sexual orientation, gender identification, or socioeconomic and disability information, which may limit some analyses. Accuracy of race and ethnicity data may be limited by how this information is collected and reported. For example, race and ethnicity might be determined by the medical professional or coroner and not how the patient/decedent identifies him/her/themselves. Jurisdictions may also need to consider other limitations of their own data sources.

Billing/Administrative Data:

Billing and administrative data files are population-based data that may be gathered and maintained by a state health agency or other organization. These data sources are typically considered the gold standard because of their overall accuracy based on final discharge codes. Still, even these billing and administrative data can be improved regarding external cause of injury codes, especially in regards to intent. ED discharge data and inpatient hospital discharge data may be separate datasets, or they may be combined in some jurisdictions. Some states and territories remove ED cases that require an observational stay or hospitalization from their ED discharge database. Refer to your agencies' documentation to determine the inclusion guidelines in your jurisdiction. The submission and release of ED discharge data and inpatient hospital discharge data may vary; while some states, localities, and territories receive files quarterly, biannually, or after the close of the calendar or fiscal year, other states may have lag-times up to 18 months. These data are typically based on the date of discharge, so this field should be used for most analytic purposes rather than "date of admission" or "date of ED visit." This may vary by jurisdiction, so you are encouraged to reach out to the state health organization or other agency maintaining the data to understand data quality and structure.

Inpatient Hospital Discharge Database

Most states maintain statewide, centralized, electronic databases of hospitalizations.⁸ The information collected varies from state to state, and although many states use the standard uniform billing form (UB-04) as the basis for their hospital file, others use a subset of UB-04 variables, while some collect additional variables.⁸ It is important to review your jurisdiction's dataset to assess the relevant variables for your surveillance/analyses. Most states and localities will have several diagnosis variables and often more than one external cause code. Discharge dates, patient demographics, and billing information are other commonly analyzed data elements.

Hospital billing files include patients admitted to all acute care hospitals for medical treatment (specialty hospitals, Veterans Affairs (VA) medical centers, and federal hospitals are not included). Some states and territories include cases in their hospital billing data that were transferred from an observation unit or the ED, while others do not.

ED Discharge Database

ED datasets include patients seen and treated within the ED. Some states and territories only include "treated and released" cases within their file, while others may include cases subsequently admitted to an observation unit or the hospital for further treatment. Many, but not all, states and territories have access to ED data.

Death certificate data

Death certificate data are typically maintained within a state health department. The file captures all resident deaths (whether or not they died in-state) and deaths that occur within the state or territory.

Most states include the variables listed on the [U.S. Standard Certificate of Death](#), and many states include additional variables. When conducting surveillance for your jurisdiction, first limit death data to injury as the underlying cause, then, if desired, restrict the data to residents within your jurisdiction.

Additional data sources

The following data sources may also be used for assessing the impact of COVID-19 or other natural disaster or public health emergency. Each jurisdiction's data may differ, so the respective jurisdictional data teams should be able to provide guidance for the best analytical approach.

ED Syndromic Surveillance (SyS)

While some jurisdictions access their ED visit data through their ED discharge database, many also have, or only have, access to ED visit data via ED SyS from acute care hospitals, urgent care centers, and/or other facility types. SyS data may include discharge data coded in ICD-10-CM; however, many data systems may also contain text fields such as chief complaint and triage notes.⁹ There are multiple standard injury indicator definitions available for analysis. A benefit of using SyS data is that it is often available in near real-time for detection of trends and major changes in ED use. For example, a sudden reduction in ED visits on SyS data for a certain injury may signal an intervention impact in real-time whereas ED discharge data would not be available until much later. However, jurisdictions should exercise caution when interpreting SyS data as data quality differs by jurisdiction, and the final discharge data may show significant differences.

Emergency Medical Services (EMS)/ambulance data

Most jurisdictions maintain an EMS/ambulance trip data file based on a universal standard established by the National Emergency Medical Services Information System (NEMSIS) for collecting patient care information resulting from prehospital EMS activations.¹¹ NEMSIS includes over 500 national data elements including ICD-10-CM codes and may contain additional data elements based on state and local needs.¹¹

National Violent Death Reporting System (NVDRS)

NVDRS collects information from death certificates, coroner/medical examiner reports, law enforcement documents, and toxicology results into one anonymous database.¹⁰ Data elements collected provide valuable context about violent deaths, such as relationship problems; mental health conditions and treatment; toxicology results; and life stressors, including recent money- or work-related or physical health problems.

Trauma Registry

A trauma registry is a data collection tool used by designated hospitals to report traumatic injury (meeting specific inclusion criteria) data to the jurisdiction. This can be a rich and high-quality data source for injury epidemiologists. Information included in the trauma registry include: injury type; cause of injury; injury location; time of incident; type of location; use of safety equipment such as helmets, seat belts; injury severity indicators; functional status at discharge; narratives; alcohol use and toxicology findings; and other informative indicators.

COVID-19 Community-based Impact Survey data

During the COVID-19 pandemic, many jurisdictions conducted community-based surveys to assess the impact of COVID-19 on their populations. Questions vary by state and territory, so

each jurisdiction's COVID-19 survey team should be able to help determine which variables may be useful for analyses.

Outpatient Observation Stay Database

Outpatient observation stay data includes patients requiring some form of extended medical oversight, but not necessarily a hospital admission. Observation services may include monitoring, assessment, and short-term treatment before determining whether a patient requires further hospital inpatient treatment or step-down monitoring of a patient discharged from inpatient care.⁹ Some states and territories include observation stays within the hospital inpatient discharge data while others maintain a separate file.

5. Define injury indicator or event to be evaluated

Before defining and reviewing the injury indicator of interest, we recommend a review of the *CSTE Injury Surveillance Toolkit*¹¹ which provides guidance on creating separate hospitalization and ED injury data subsets. In addition to this, we recommend a review of the document titled *State Injury Indicators Report: Instructions for Preparing 2020 Data*⁹ developed by CDC for creation of a mortality injury subset. The injury indicators detailed in the CSTE Injury Surveillance Toolkit are suggested as priorities for review, however, other indicators may be more relevant for individual jurisdictions. We recommend exploring recent or relevant peer-reviewed publications and/or seeking guidance from community members and partners on indicators most relevant for the population or jurisdiction of interest. For example, in some Western states, extreme heat and wildfire-related events coincided with the COVID-19 pandemic, forcing people to evacuate their homes and sometimes seek shelter in congregate settings. This had relevant context regarding COVID-19 as there were injuries, emergency response needs, increased hospitalizations, as well as increased risk for COVID-19 transmission.

Inclusion criteria are also important to consider along with the indicators and will depend on the questions you want to answer. Below are a few questions to consider:

- *Do you only want to include injuries for those persons officially residing in your state, or do you want to include all injuries regardless of residency status?* For example, the burden of certain injuries on the healthcare system and in certain communities living in your jurisdiction could be greater if patients are not excluded from analysis due to residency status (such as migrant workers, people experiencing homelessness, or others who do not have official residency documentation). Additionally, overall burden and trends might be missed by limiting analysis to residents only. However, as stated in the bullet below, such restrictions might be necessary for national or multi-jurisdictional comparisons.
- *For hospitalization indicators, do you only want to include those with a physical injury as the primary reason for admission?* For example, hospitalizations with self-harm often have a principal diagnosis of a mental/behavioral/neurological code (ICD-10-CM F-code series)¹² and these would be excluded from analysis if a self-harm hospitalization indicator is restricted to principal diagnosis of injury. This restriction could also lead to under-reporting or missing important patterns that could be helpful to communities for primary prevention and intervention strategies. Expanding to all diagnosis fields may be useful for certain injuries, but note that this differs from the CSTE Injury Indicator Toolkit definitions.

Proposed Inclusion Criteria for National Comparisons

You may utilize different inclusion criteria for injury indicators to better answer or provide information specific to your communities,¹¹ however, for comparisons with national data, please use the following proposed inclusion criteria:⁹

1. Limit to residents of your jurisdiction (exclude those from out-of-state or other jurisdictions) regardless of the information source used.
2. Only include non-fatal hospitalization and ED visits (fatalities will be reported in death records).

Sample Indicators and Considerations

This document does not cover all injury indicators. Below are examples of several injury indicators that were impacted during the pandemic and some discussion on factors that influenced these indicators and data findings that may serve to guide review and analysis of other indicators.

Overdose

There were concerns for increased overdose cases during the COVID-19 pandemic because of a lack of access to risk-reduction services and emergency treatments, such as naloxone^{13,14}. To better understand this trend, a review of all overdose cases (using the CSTE [Drug Overdose Indicator](#) guidelines) will help initially frame a broad understanding of this burden. Breaking down the counts and incidents by intent can also be helpful to create a framework for intervention for those who unintentionally overdose and those intending self-harm. Regardless of the intent, it is important to include all overdoses because the intention can be arbitrary or vary by reporter. Similarly, limiting to a specific intent can undercount the true incidence.

Suicide/Self-Harm

The COVID-19 pandemic and associated social isolation and stress led to concerns of increased cases of suicide and self-harm and/or barriers to seeking care for individuals at higher risk. However, data differed by jurisdiction. Some areas noted increases, other areas decreased, and some experienced no change compared to pre-COVID-19 rates.

Firearms

There were multiple factors during COVID-19 that may have impacted assault and firearm injury rates, including the direct effects of COVID-19 on societal well-being and racial injustice across the country. There is significant evidence, across jurisdictions, that firearm injury is on the rise. The increase in intentional firearm injury and assault demonstrates a strong need for informed interventions. For example, certain jurisdictions show a higher rate of firearm injury and specific racial and socioeconomic groups are disproportionately affected as survivors.

Traumatic Brain Injury (TBI)

TBIs can have significant short- and long-term impacts, not only for the person experiencing the injury, but also on their family, community, and workplace. The incidence of TBIs can be influenced by a variety of causes including falls, motor vehicle-related crashes, assault, and others. It is also important to consider and understand that during COVID-19, those with a TBI may have been missed or reported later as many may have chosen to delay or were unable to seek immediate medical care due to constrained healthcare services and social distancing precautions. Providing overall counts and rates are important, but it also can be helpful to

assess any changes in the cause of TBI during the changing dynamics of the COVID-19 pandemic, such as increased transportation-related TBIs, increased fall related TBI's, or decreased athletic event-related TBIs among children.

Assault/Domestic Violence

During the COVID-19 pandemic, there were concerns that stay-at-home policies reduced exposure to community support systems and increased isolation which may have led to rising assault and domestic violence, especially among populations at higher risk.¹⁵⁻¹⁸ Though these justifiable concerns may mean an increase in this type of violence, the data may not reveal these trends and may actually indicate the contrary (decreasing rates). Analysis should consider other factors at play such as fear of exposure to COVID-19 and other stay-at-home policies that may have increased barriers to seeking healthcare.

Unintentional Motor Vehicle-Related Traffic Injuries

Stay-at-home policies during the early stages of the pandemic led to opposing trends in motor vehicle injuries. Some jurisdictions saw increases in severe motor vehicle injuries and deaths because less traffic led to more reckless driving. Conversely, other jurisdictions saw decreases in overall motor vehicle injuries and deaths because of the reduction in the number of vehicles on the road. Additionally, during COVID-19, many users of urban public transportation began walking, cycling, or using micro-transport, and increases in these injury categories were observed. Such shifts are often temporary, so reviewing these trends can lead to a better understanding of rebound trends once policies and behaviors adapt.

Fire or smoke-related

Some jurisdictions, like those in the Western U.S., experienced unprecedented wildfires that coincided with the COVID-19 pandemic. These wildfire events have become more common and can lead to significant impacts in the affected communities and in far-reaching areas affected by wildfire smoke. In these jurisdictions, it may be important to look at all contributing diagnosis fields and not just the principal diagnosis field. This is an example (as with self-harm hospitalizations) of when it may be important to choose an approach that differs from the suggested creation of the hospitalization injury subset as described in the [CSTE Injury Surveillance Toolkit](#).

Drowning

Closures and social distancing policies during COVID-19 may have also affected trends in drowning. For example, many communities might have closed public pools, but during warmer months the public accessed natural bodies of water or pools in private homes. Lifeguards may not always have been on duty at these locations, potentially increasing the risk of drownings, especially among children. Some natural bodies of water also experienced large differences between warm ambient air and cold-water temperatures which can pose a danger for hypothermia.

Unintentional Falls (age of 65 years old or greater)

With fewer community outings and home visitors, the COVID-19 pandemic revealed changes in trends for falls among persons aged 65 years and older in some jurisdictions. Like other persons at risk for an injury, there can be hesitancy for those aged 65 years and older to seek preventive healthcare or services that could lessen the risk of falls. Those who have fallen might not seek

care in a timely manner due to fear of exposure to COVID-19 or lack of available healthcare services due to the pandemic's stress on the system. Long periods of sedentary behavior due to pandemic restrictions may also increase the risk of fall due to lower muscle mass and fatigue. Also, a lack of social events or community gatherings might impact those seeking help or detection of warning signs noted by others that could prevent such falls.

6. Plan the approach to be used for analyzing and reviewing the data

The approach used to analyze your data relies heavily on the kind of data and questions you have. The following examples discuss some common analyses and suggested approaches.

a. **Assessing data changes across years or different time frames (e.g., quarterly rate vs yearly rate), interventions, and different pandemic waves**

It can be helpful to review one to two years (or more) of data before the pandemic (or other natural disaster or public health emergency) to establish baseline counts and rates for comparison. Continuing with the comparison for a few years after the major event is also recommended to determine if patterns/trends reestablish to pre-pandemic status. Yearly counts can be especially helpful when presenting rates. Quarterly and monthly changes in data can show seasonal or varying distribution patterns as COVID-19 has evolved and impacts injury data. Changes may also highlight the effects of lockdown actions from jurisdictions over time. If you wish to compare subpopulations and the impact of the pandemic, multiple years of data may be necessary and rolling averages may need to be considered. Analysis such as interrupted time-series or other methods, which use longitudinal data to measure the impact of an event, intervention, or policy change may be considered if deemed appropriate and sufficient data are available.^{19,20}

b. **Analyzing and reviewing data by defined jurisdiction (e.g., by county, region, etc.) or by subpopulation (e.g., age, sex, race, etc.)**

County- or region-level data can be very helpful to better assess impacts "hidden" by state-level rates. This is especially important when jurisdiction policies and the spread of COVID-19 impact certain areas and populations differently. For example, the distribution of COVID-19 and injury indicator data may vary by county and by time. Some counties implemented stronger lockdown policies compared to others. This may impact not only the spread of COVID-19, but also injury outcomes.

Presenting data by demographic variables such as sex, age group, race, and ethnicity allows assessment of disproportionate impact. For instance, youth may have suffered greater impact of self-harm compared with other populations. Another example revealed that there were higher rates of motor vehicle transportation injuries among people 35 years and younger.

c. **Assessing changes in potential injury severity indicators or proxies**

There are various measures that can be used to indicate severity. For example, mean or median length of hospital stay for falls or transportation injuries (e.g., 2018-2019 compared to 2020-2021) can be used as a proxy for injury severity (longer stays indicating greater severity). Another measure of severity is the ratio of hospitalization to ED visits by injury indicator. However, note that this ratio could be an indicator of severity changes, reflect the impact of

COVID-19 on the healthcare system, or reflect changes or restrictions based on income and insurance. These measures are proxies for severity and should be interpreted with caution based on their limitations. A clear explanation of these limitations should be given when communicating these measures.

Other more formal severity measures, such as the Elixhauser Comorbidity Index²¹ or Charlson Comorbidity Index²², have been developed using ICD-10-CM codes as injury severity indicators. Additional severity indicators specific to injury using ICD-10-CM coding, such as the ISS-TARN and ICDPIC-R²³, have been explored with some success.

7. Interpret, communicate, and disseminate the data

Once you have completed your analysis, communication and dissemination of the data will be essential in order to respond with intervention and prevention strategies and focus on communities that are most impacted. The method of communication and the way in which the data are described and shared (interpretation) is critical for appropriate use. The following considerations should be addressed to effectively use data to guide action.

a. Seek community and partner input

Ideally, communities, community-based organizations and partners should be involved early in the process, as mentioned above in Steps 1 and 2. At this step in the process, you should seek out these partners again by sharing draft reports and incorporating their feedback into the final products. Input from community partners can also help provide context and narrative when describing health outcomes for disproportionately impacted populations. Partners can include community-based organizations, diversity teams within your organization, academics, and other governmental agencies, especially those providing services and outreach for disproportionately impacted populations. For example, in one state, counts and rates of ED visits with firearm injuries were presented to a local Black, Indigenous, and people of color (BIPOC) coalition. The community-based organization provided valuable feedback, such as a preference to report counts overall using more recent data rather than rates. The community felt they could better understand and take action based on counts. This feedback was later incorporated into data products.

b. Consider language, content, and reading level

When communicating data, there are several considerations related to language, disability and content. Key considerations include use of non-stigmatizing/sensitive terminology and explanations of data; use of appropriate reading-level for your audience; and adjustment of level of detail regarding the content of your message based on your audience.

With regard to non-stigmatizing language, be aware of how people with lived experience would prefer you discuss and explain the data. For instance, is the use of “victim” appropriate or is “survivor” a most acceptable term?²⁴ How do you explain or acknowledge disparities and their potential impact on your injury outcome? Are you recognizing biases (including implicit biases) and institutional racism as having impacts on these noted disparities?²⁵

Related to language is the consideration of reading level. Generally, it is considered best to use short phrases, avoid acronyms and technical terms, and present data in easily digestible bits (possibly using visualization methods or social math). Many jurisdictions also report findings in multiple languages based on local population needs. Collaborating with participants from local communities can ensure proper language translation and provide cultural context.

In terms of disability, we suggest you work with local disability advocates and accessible communications specialists to ensure that content is reviewed and adjusted for things such as the use of visually-impaired reading software, color contrast, inclusive language, and other factors important to your community.

In terms of the content and detail of your analyses and messages, if your data are geared towards a professional public health audience, you may be able to ask more detailed questions or conduct more detailed analyses, and you may have more space or freedom to use technical terms. Finally, if your audience consists of policymakers, you may want to consider high-level key points in communicating your data questions and findings.

c. Anticipate common questions

When preparing to disseminate and communicate your results, there might be additional questions that you can anticipate. It may be helpful to document anticipated questions and responses so you can address these should they arise. For example, if you are researching motor vehicle crashes and the data show that there has been an interruption in trends with a decrease in injuries, consider potential follow-up questions. Partners and community members may ask questions such as:

- Are the injuries more severe (increase in hospitalizations and decrease in ED visits suggest an increase in severity)?
- Have deaths increased while non-fatal injuries have decreased?
- How does the motor vehicle injury data compare to traffic crash data (have crashes decreased during this time)?

d. Context for dissemination of data and unintended stigmatization

Data results may show higher counts or rates for disproportionately affected groups. The information that is highlighted about a disproportionately affected group in a report or data presentation can be helpful in securing additional resources and targeting appropriate prevention and intervention strategies. However, highlighting higher counts or rates can also stigmatize the very groups with a greater need. Providing additional information (in essence, context) about how the disproportionately affected population may be impacted by more systemic influences (such as implicit bias among healthcare providers, institutional racism, or residential segregation) needs to be acknowledged as possibly contributing to the health outcome under review. For instance, one county in Washington developed a report and recommendations for recognition of structural impacts and provided suggestions on how to measure these. Some of these recommendations include use of self-reported measures of race, gender and ethnicity, and development of measures to assess structural racism and its impact

(see *Equity Gaps in Injury and Violence Data Across King County, Washington State, and the Pacific Northwest Region*²⁶ for more information on this project).

There is currently no coordinated, standardized, pro-equity approach to injury and violence-related data collection at local, state, regional, or national levels. Misclassification as well as incomplete collection of race, ethnicity, language proficiency, sexual orientation, gender identity, and disability is rampant.²⁷ This lack of a standardized approach weakens our ability to hold ourselves and each other accountable for making progress in tackling the inequities in the status quo, and, if not addressed, makes us complicit in allowing perpetuation of structural racism and other forms of structural bias and marginalization. In addition, intersectionality or use of intersectionality can impact interpretation of findings, such as youth suicide risk in youth who are both Black and Native American, or disabled and gay.^{27–30} Current language used to collect injury and violence data are not community-preferred and perpetuate inequities in injury and violence risk, data collection, and prevention.

e. Suggestions for use of data and resources

Use of additional data sources is highly encouraged, especially to better understand impacts on smaller communities or disproportionately affected populations. Use of census data in measures such as the Social Deprivation Index³¹ or Social Vulnerability Index,³² can provide valuable input or understanding for small area-level analyses. Survey data such as the Behavioral Risk Factor Surveillance System (BRFSS),³³ the Youth Risk Behavior Surveillance System (YRBSS),³⁴ and even specific community surveys can be helpful to triangulate additional sources of information. Focus groups, qualitative interviews and other qualitative data can also be extremely useful. In addition to being timelier and context-aware, these data sources can help provide a ‘story’ that resonates with a different audience and provide details that may be overlooked by quantitative analysis alone.

Additional Resources

- 1) CSTE Injury Surveillance Toolkit: <https://resources.cste.org/Injury-Surveillance-Methods-Toolkit/>.
- 2) We All Count Data Equity Framework: <https://weallcount.com/the-data-process/>
- 3) Addressing Gaps in Public Health Reporting of Race and Ethnicity Data for COVID-19: Findings & Recommendations Among 45 State & Local Health Departments: https://preparedness.cste.org/wp-content/uploads/2022/04/RaceEthnicityData_FINAL.pdf
- 4) [Sample Excel templates](#) for exploring COVID-19 and injury trends across jurisdiction, time, and population

References

1. Centers for Disease Control and Prevention. Basics of COVID-19. Published November 4, 2021. Accessed June 14, 2022. [https://www.cdc.gov/coronavirus/2019-ncov/your-health/about-covid-19/basics-covid-19.html#:~:text=COVID%2D19%20\(coronavirus%20disease%202019,%2C%20a%20flu%2C%20or%20pneumonia.](https://www.cdc.gov/coronavirus/2019-ncov/your-health/about-covid-19/basics-covid-19.html#:~:text=COVID%2D19%20(coronavirus%20disease%202019,%2C%20a%20flu%2C%20or%20pneumonia.)
2. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomed.* 2020;91(1):157-160. doi:10.23750/abm.v91i1.9397
3. Ghafil C, Matsushima K, Ding L, Henry R, Inaba K. Trends in Trauma Admissions During the COVID-19 Pandemic in Los Angeles County, California. *JAMA Netw Open.* 2021;4(2):e211320. doi:10.1001/jamanetworkopen.2021.1320
4. Zane D, Roe D. COVID-19 and Injury Connections: A Literature Review. *Tex Public Health J.* 2022;74(1):14-18.
5. Zane D. *COVID - 19 + Injury Connections: A Literature Review of Articles Published in 2021 and 2022 (With a Compendium of Selected Bibliographical Information, with Hyperlinks to Nearly 2,000 Published Articles).*; 2022.
6. Holland KM, Jones C, Vivolo-Kantor AM, et al. Trends in US Emergency Department Visits for Mental Health, Overdose, and Violence Outcomes Before and During the COVID-19 Pandemic. *JAMA Psychiatry.* 2021;78(4):372-379. doi:10.1001/jamapsychiatry.2020.4402
7. Yard E, Radhakrishnan L, Ballesteros MF, et al. Emergency Department Visits for Suspected Suicide Attempts Among Persons Aged 12-25 Years Before and During the COVID-19 Pandemic - United States, January 2019-May 2021. *MMWR Morb Mortal Wkly Rep.* 2021;70(24):888-894. doi:10.15585/mmwr.mm7024e1
8. Council of State and Territorial Epidemiologists. *Nonfatal Opioid Overdose Standardized Surveillance Case Definition.*; 2018. Accessed October 14, 2022. https://cdn.ymaws.com/www.cste.org/resource/resmgr/ps/2019ps/Nonfatal_Opioid_Overdose_011.pdf
9. Thomas K, Johnson R. *State Injury Indicators Report: Instructions for Preparing 2020 Data.*; 2022. Accessed December 29, 2022. <https://stacks.cdc.gov/view/cdc/117725>
10. Centers for Disease Control and Prevention. National Violent Death Reporting System (NVDRS). Published 2021. Accessed February 19, 2023. <https://www.cdc.gov/violenceprevention/datasources/nvdrs/index.html>
11. Council of State and Territorial Epidemiologists. CSTE ICD-10-CM Injury Surveillance Toolkit. Published November 2019. Accessed December 28, 2022. <https://resources.cste.org/Injury-Surveillance-Methods-Toolkit>

12. Imm P, Grogan B, Diallo O. Self-harm injury hospitalisations: an analysis of case selection criteria. *Inj Prev*. 2021;27(S1):i49-i55. doi:10.1136/injuryprev-2019-043514
13. Centers for Disease Control and Prevention. Overdose Deaths Accelerating During COVID-19. Published online December 18, 2020. Accessed February 19, 2023. <https://www.cdc.gov/media/releases/2020/p1218-overdose-deaths-covid-19.html>
14. Slavova S, Rock P, Bush HM, Quesinberry D, Walsh SL. Signal of increased opioid overdose during COVID-19 from emergency medical services data. *Drug Alcohol Depend*. 2020;214:108176. doi:10.1016/j.drugalcdep.2020.108176
15. Substance Abuse and Mental Health Services Administration. *Intimate Partner Violence and Child Abuse Considerations During COVID-19*. Accessed February 19, 2023. <https://www.samhsa.gov/sites/default/files/social-distancing-domestic-violence.pdf>
16. Evans ML, Lindauer M, Farrell ME. A Pandemic within a Pandemic — Intimate Partner Violence during Covid-19. *New England Journal of Medicine*. 2020;383(24):2302-2304. doi:10.1056/NEJMp2024046
17. Usher K, Bhullar N, Durkin J, Gyamfi N, Jackson D. Family violence and COVID-19: Increased vulnerability and reduced options for support. *Int J Ment Health Nurs*. 2020;29(4):549-552. doi:10.1111/inm.12735
18. Kaukinen C. When Stay-at-Home Orders Leave Victims Unsafe at Home: Exploring the Risk and Consequences of Intimate Partner Violence during the COVID-19 Pandemic. *Am J Crim Justice*. 2020;45(4):668-679. doi:10.1007/s12103-020-09533-5
19. Matthay ZA, Kornblith AE, Matthay EC, et al. The DISTANCE study: Determining the impact of social distancing on trauma epidemiology during the COVID-19 epidemic- An interrupted time-series analysis. *J Trauma Acute Care Surg*. 2021;90(4):700-707. doi:10.1097/TA.0000000000003044
20. Cho YS, Ro YS, Park JH, Moon S. Effect of social distancing on injury incidence during the COVID-19 pandemic: an interrupted time-series analysis. *BMJ Open*. 2022;12(4):e055296. doi:10.1136/bmjopen-2021-055296
21. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity Measures for Use with Administrative Data. *Med Care*. 1998;36(1):8-27. doi:10.1097/00005650-199801000-00004
22. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40(5):373-383. doi:10.1016/0021-9681(87)90171-8

23. Eskesen TO, Sillesen M, Rasmussen LS, Steinmetz J. Agreement Between Standard and ICD-10-Based Injury Severity Scores. *Clin Epidemiol*. 2022;14:201-210. doi:10.2147/CLEP.S344302
24. Centers for Disease Control and Prevention. Health Equity Guiding Principles for Inclusive Communication. Published 2022. Accessed March 19, 2023. https://www.cdc.gov/healthcommunication/Preferred_Terms.html
25. Badolato GM, Boyle MD, McCarter R, Zeoli AM, Terrill W, Goyal MK. Racial and Ethnic Disparities in Firearm-Related Pediatric Deaths Related to Legal Intervention. *Pediatrics*. 2020;146(6). doi:10.1542/peds.2020-015917
26. Harborview Injury Prevention & Research Center. *Equity Gaps in Injury and Violence Data Across Seattle, King County, Washington State, and Pacific Northwest Region.*; 2022.
27. Miles A, Tanenbaum B, Thompson-Ricci S. Transforming injury prevention for youth (TriPY): an intersectionality model for youth injury prevention. *Inj Prev*. 2022;28(6):564-569. doi:10.1136/ip-2022-044619
28. Standley CJ, Foster-Fishman P. Intersectionality, social support, and youth suicidality: A socioecological approach to prevention. *Suicide Life Threat Behav*. 2021;51(2):203-211. doi:10.1111/sltb.12695
29. Wigglesworth A, Clement DN, Wingate LR, Klimes-Dougan B. Understanding suicide risk for youth who are both Black and Native American: The role of intersectionality and multiple marginalization. *Suicide Life Threat Behav*. 2022;52(4):668-682. doi:10.1111/sltb.12851
30. Baiden P, LaBrenz CA, Asiedua-Baiden G, Muehlenkamp JJ. Examining the intersection of race/ethnicity and sexual orientation on suicidal ideation and suicide attempt among adolescents: Findings from the 2017 Youth Risk Behavior Survey. *J Psychiatr Res*. 2020;125:13-20. doi:10.1016/j.jpsychires.2020.02.029
31. Robert Graham Center - Policy Studies in Family Medicine & Primary Care. Social deprivation index (SDI). Published November 5, 2018. Accessed February 19, 2023. <https://www.graham-center.org/rgc/maps-data-tools/sdi/social-deprivation-index.html>
32. Centers for Disease Control and Prevention. CDC/ATSDR Social Vulnerability Index. Published 2022. Accessed February 19, 2023. <https://www.atsdr.cdc.gov/placeandhealth/svi/index.html>
33. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System. Published 2023. Accessed February 21, 2023. <https://www.cdc.gov/brfss/index.html>

34. Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance System (YRBSS). Published 2022. Accessed February 21, 2023.
<https://www.cdc.gov/healthyyouth/data/yrbs/index.htm>

DRAFT