The Transition from ICD-9-CM to ICD-10-CM

Guidance for Analysis and Reporting of Injuries by Mechanism and Intent

December 2016

A report of the Injury Surveillance Workgroup 9

SAFE STATES

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**THE TRANSITION FROM ICD-9-CM TO ICD-10-CM:
GUIDANCE FOR ANALYSIS AND REPORTING OF INJURIES
BY MECHANISM AND INTENT**

DECEMBER 2016

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Methodology for generating this report:

The Injury Surveillance Workgroup 9 met via monthly conference calls from September 2015 to October 2016. A list of the Workgroup members and others who participated in various aspects of this project is found on page 39.

Disclaimer:

The findings and conclusions in this report are those of the Workgroup and do not necessarily represent the official position of the Safe States Alliance or the Centers for Disease Control and Prevention.

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EXECUTIVE SUMMARY

Impetus for this report: On October 1, 2015 in the United States, ICD-10-CM replaced ICD-9-CM for coding information in hospital discharge, emergency department, and outpatient records for administrative and financial transactions. This change will impact national and state-based injury and violence surveillance activities that use these records.

Overview of ICD-10-CM for injury diagnosis and external cause

- ICD-10-CM is substantially different from ICD-9-CM. ICD-10-CM codes for nature of injury (diagnosis) and external cause of injury capture greater detail than ICD-9-CM codes.

- ICD-10-CM contains approximately 43,000 injury diagnosis codes, compared to 2,600 injury diagnosis codes in ICD-9-CM.

- ICD-10-CM contains approximately 7,500 external cause of injury codes, compared to 1,300 external cause codes in ICD-9-CM.

The purpose of this report is to provide guidance to epidemiologists and others as they begin to use ICD-10-CM coded data for injury and violence surveillance.

The report provides guidance for:

- conducting initial analyses using ICD-10-CM coded data;

- using the proposed ICD-10-CM external cause of injury matrix to analyze and report injury data by mechanism and intent of injury; and

- presenting injury trend data that span the transition from ICD-9-CM to ICD-10-CM.

Who can benefit from this report:

- epidemiologists and staff in injury and violence prevention programs; and

- researchers and others who use ICD-10-CM coded data.

As public health professionals gain experience and share findings and insights from working with injury-related ICD-10-CM coded data, this new knowledge will inform future national recommendations for injury and violence surveillance case definitions, methodologies and reporting frameworks based on ICD-10-CM.

INTRODUCTION

Effective October 1, 2015, the U.S. Department of Health and Human Services required health care organizations and providers covered by the Health Insurance Portability and Accountability Act to use the International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) to report medical information when submitting electronic claims for administrative and financial transactions. Prior to October 1, 2015, the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) was used for coding medical encounters in the hospital setting, emergency department or outpatient offices. This major transition from ICD-9-CM to ICD-10-CM for coding medical information impacts local, state, and national activities that use electronic claims files from emergency department visits and hospitalizations to conduct injury and violence surveillance.

Because of the significant differences between ICD-9-CM and ICD-10-CM, the Safe States Alliance convened the Injury Surveillance Workgroup 9 (ISW9) to develop guidance that injury and violence prevention programs can use to transition their surveillance activities to ICD-10-CM coded data. Safe States Alliance is a non-profit organization and professional association whose mission is to strengthen the practice of injury and violence prevention. Representation on the ISW9 included individuals from the National Center for Injury Prevention and Control, the National Center for Health Statistics, and the National Institute for Occupational Safety and Health of the Centers for Disease Control and Prevention (CDC); the Council of State and Territorial Epidemiologists; state health departments; an academic center; and a private research organization. The group met regularly from September 2015 through October 2016 to develop the contents of this report. A list of the ISW9 members and other contributors is found on page 39.

The aim of this report is to provide guidance to epidemiologists and others as they begin to use ICD-10-CM coded data for injury and violence surveillance. The report includes an overview of ICD-10-CM related to nature of injury (diagnoses) and external causes of injury; initial analyses helpful in understanding ICD-10-CM coded data; instructions on applying the proposed ICD-10-CM matrix for reporting external cause of injury by mechanism and intent; and examples that illustrate options for displaying injury counts or rates over time.

Injury and violence prevention programs can use this report:

- as a common starting point for understanding ICD-10-CM as it pertains to injuries;

- to analyze and present injury and violence data using standard methods and figures;

- to enable comparisons of results with other jurisdictions that also use the guidance in this report; and

- to design studies involving medical record reviews that can help distinguish changes attributable to the implementation of ICD-10-CM from differences in health care practices, medical record documentation or injury patterns.

The intended users of this report are epidemiologists in state or local health departments who conduct injury and violence surveillance. The broader audience includes researchers, data analysts or statisticians in other organizations who analyze ICD-10-CM coded data related to injuries. Solely for simplicity, this report uses "epidemiologist" to describe all potential users.

In contrast to other ISW reports, this report does not include specific recommendations or surveillance standards. Rather, the report provides guidance on transitioning from the use of ICD-9-CM coded data to ICD-10-CM coded data for injury and violence surveillance. Future work, including detailed analysis and testing of definitions and methodologies using ICD-10-CM coded data, is needed before the Safe States Alliance or other national organizations can make final recommendations regarding standard definitions and use of ICD-10-CM for injury and violence surveillance. This future work is briefly described after Chapter 4.

CHAPTER 1: OVERVIEW OF ICD-10-CM FOR INJURY

Because ICD-10-CM is substantially different from ICD-9-CM, a basic understanding of the ICD-10-CM codes, their structure and meaning is essential before analyzing ICD-10-CM coded data. This chapter provides a brief overview of the ICD-10-CM codes for injury diagnosis and for external cause.

Prior to working with ICD-10-CM coded data, injury epidemiologists should become familiar with the ICD-10-CM code set. The latest version of the ICD-10-CM code set is available on-line from both the National Center for Health Statistics [1] and the Centers for Medicare and Medicaid Services. [2] Several times a year, the ICD-10 Coordination and Maintenance committee [3] reviews proposals for changes to the codes. The ICD-10-CM code set is updated annually, with changes announced in June and implementation of the updated code set on October 1. Because the code set is dynamic, it is important to check for changes to the codes each year and to update case definitions and analytic programs as needed.

As in ICD-9-CM, ICD-10-CM includes codes for: 1) injury diagnosis, which categorize injuries and poisonings by body region and nature of injury (sometimes referred to as nature of injury codes), 2) external cause, which categorize injuries by the mechanism and intent of injury, 3) place of occurrence, 4) activity, or what the person was doing at the time the injury occurred, and 5) external cause status, which identifies whether the injury resulted from civilian, military, volunteer or other activity. The focus in this report is on the ICD-10-CM injury diagnosis codes and external cause codes.

ICD-10-CM injury diagnosis codes

Table 1 on page 8 summarizes key differences between ICD-9-CM and ICD-10-CM for injury diagnosis codes. These differences are described in greater detail below.

Structure: The code structure in ICD-10-CM is alphanumeric. Injury diagnosis codes begin with the letter "S" or "T" followed by 3 to 6 additional characters. Most injury codes have a 7th character to indicate the type of care encounter when the diagnosis was made (described on page 7). A decimal is placed between the 3rd and 4th character of the code.

- An example of a basic ICD-10-CM injury diagnosis code is S52.244A, Nondisplaced spiral

fracture of shaft of ulna, right arm, initial encounter for closed fracture.

- A new feature of ICD-10-CM codes is the use of one or more "dummy" characters ("X") embedded in the code. These characters are placeholders that will be assigned defined values in the future as needed to accommodate new codes for specific diagnoses. An example of an injury diagnosis code with an embedded "X" character is S06.4X0A, Epidural hemorrhage without loss of consciousness, initial encounter. If the code includes an "X" as one of its characters, the "X" must be present for the code to convey accurate information in electronic files.

Organization and primary axis: In ICD-9-CM, codes were grouped first by the type of injury (e.g. fractures, sprains, injuries to blood vessels), and then within the type of injury, by body region (e.g. head, neck, torso, upper extremity). In ICD-10-CM, the codes are grouped by the body region first and then within the body region, by injury type.

Detailed injury type: Compared to ICD-9-CM, ICD-10-CM codes often capture greater detail on the type of injury. For example, codes include characters that indicate:

- whether a fracture was left, right, or bilateral;

- the type of fracture involved (e.g. displaced, non-displaced, greenstick, comminuted, torus);

- whether a foreign body was present in a laceration; and

- the type of superficial injury involved (e.g. abrasion, contusion, insect bite).

New concept of underdosing: ICD-10-CM includes codes to indicate conditions that result from underdosing of drugs. Although these codes are listed in the nature of injury chapter of ICD-10-CM, they are not included in the proposed injury surveillance case definition described in Chapter 3 of this report.

Poisoning and adverse effect: In ICD-9-CM, two codes were required to describe each poisoning event—a diagnosis code (960–979 and 980–989) to describe the type of drug or toxic substance involved and an external cause code (E850–E858, E860–E869, E930–E949, E950–E952, E961–E962, and E980–E982) to describe the intent of the poisoning (e.g. accidental (unintentional), intentional self-harm, homicide, or undetermined) or adverse effect. In ICD-10-CM, the information about both the drug or substance involved and the intent are captured in a single code (T36-T50 for Drugs, medicaments and biological substances, and T51-65 for Toxic effects of substances chiefly non-medicinal as to source). These T codes contain a character to specify the intent of the poisoning (i.e. accidental (unintentional), intentional self-harm, assault, undetermined, adverse effect, and underdosing). The location of the intent character within the poisoning code can vary. For most codes in the T36-T50 and T51-T65 ranges, the 6th character of the code indicates intent. However, for T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, T49.9, T51.9, T52.9, T53.9, T54.9, T56.9, T57.9, T58.0, T58.1, T58.9, T59.9, T60.9, T61.0, T61.1, T61.9, T62.9, T63.9, T64.0, T64.8, and T65.9, the 5th character indicates intent.

The character values for each intent category are:

> 1 = Accidental (unintentional);
>
> 2 = Intentional self-harm;
>
> 3 = Assault;
>
> 4 = Undetermined;
>
> 5 = Adverse effect; and
>
> 6 = Underdosing.

A few codes describe non-drug poisonings that result from terrorism (Y38.6 and Y38.7), legal intervention (Y35.2) or operations of war (Y36.6 and Y36.7). These poisonings are coded using external cause codes rather than nature of injury codes.

Asphyxiation: ICD-10-CM contains more than 40 diagnosis codes for asphyxiation or strangulation by different mechanisms (T71), compared to a single diagnosis code in ICD-9-CM (994.7). Most T71 codes include a 6th character to specify the intent of injury (exceptions are T71.20, T71.21, T71.29 and T71.9). The character values for each intent category for the T71 codes are:

> 1 = Accidental (unintentional);
>
> 2 = Intentional self-harm;
>
> 3 = Assault; and
>
> 4 = Undetermined

Adult and child abuse: Codes in ICD-10-CM distinguish between suspected or confirmed child and adult abuse (T76 and T74, respectively). No distinction between suspected and confirmed abuse was made in ICD-9-CM.

New concept of type of encounter: Most injury diagnosis codes in ICD-10-CM include a 7th character (a letter) that provides information on the type of medical care encounter. The type of encounter character specifies whether the injury diagnosis is related to the initial encounter ("A," "B," or "C"), a subsequent encounter ("D" to "R"), or sequelae ("S") of the injury event. The specific letter assigned varies by code. For example, in general the 7th character for initial encounter is "A" but for codes that reflect an open fracture, the letter "B" or "C" is assigned (e.g., S02.102B Fracture of base of skull, left side, initial encounter for open fracture; S52.001C Unspecified fracture of upper end of right ulna, initial encounter for open fracture Type IIIA, IIIB or IIIC). The 7th character is required for all S codes and all T codes except T07, T14 and T30-T32.

- The 7th character A, B, or C for initial encounter is used while the patient is receiving active treatment for the condition.

- The 7th character D to R indicates subsequent encounter, defined as encounters of routine care during the healing or recovery phase after the active treatment phase has ended. Examples of subsequent care include: cast change or removal, removal of external or internal fixation device, medication adjustment, and other aftercare and follow-up visits after treatment of the injury or condition.

- The 7th character S indicates sequelae, defined as complications or conditions that arise as a direct result of an injury, such as scar formation after a burn. The scars are sequelae of the burn. The ICD-10-CM sequelae designation is equivalent to "late effect" codes in ICD-9-CM.

Table 1. Key differences between ICD-9-CM and ICD-10-CM codes for injury diagnosis

ICD-9-CM	ICD-10-CM
2,600 codes	43,000 codes
Code range 800-995	"S" and "T" codes
Codes consist of 3-5 characters	Codes consist of 3-7 characters; some codes have an "X" placeholder character to accommodate new codes in the future
Primary axis is nature of injury	Primary axis is body region
No character to indicate laterality	Characters within the code indicate left, right, bilateral, unspecified laterality
Limited detail on type of fracture	Detailed information on type of fracture
Laceration codes do not specify presence/absence of a foreign body	Laceration codes specify presence/absence of a foreign body
Limited information on superficial injuries	Detailed information on superficial injuries
Codes for poisoning and adverse effects of drugs	Codes for poisoning, adverse effects and underdosing of drugs
Poisoning: coded using both diagnosis codes and external cause codes	Poisoning: coded using a diagnosis code only (T code); a character in the code identifies the intent of the poisoning (unintentional, intentional self-harm, assault, or undetermined)
Asphyxiation: 994.7	40 diagnosis codes for asphyxiation or strangulation by different mechanisms and intents
No distinction between suspected and confirmed child/adult abuse	New codes to distinguish between suspected and confirmed child/adult abuse
No distinction between initial and subsequent encounter for care	Most codes have a 7th character to distinguish between initial and subsequent encounter for care
Limited late effect codes	Most codes have a 7th character indicating sequelae (late effects)

1. **ICD-10-CM codes for external cause of injury**

Like ICD-9-CM, ICD-10-CM also contains codes for external causes of injury, which reflect both the mechanism and intent of the injury. Table 2 on page 10 summarizes key differences between the ICD-9-CM and ICD-10-CM for external cause of injury.

Structure: ICD-10-CM codes for external causes of injury:

- begin with the letter "V," "W," "X" or "Y" followed by 3 to 6 additional characters;

- include a decimal between the 3rd and 4th character of the code; and

- have a 7th character to indicate the type of care encounter, as described previously for the injury diagnosis codes. For external cause codes, the 7th character for an initial encounter is "A," for a subsequent encounter is "D" and for sequelae is "S."

Change in terminology: In ICD-10-CM, the label "Suicide/self-inflicted injury" is now "Intentional self-harm" and the label "Homicide and injury purposely inflicted by other persons" is now "Assault."

Change from external cause codes in ICD-9-CM to diagnosis codes in ICD-10-CM: Several mechanisms of injury assigned an external cause code in ICD-9-CM are now assigned an injury diagnosis (nature of injury) code in ICD-10-CM. These are summarized in Table 3 on page 11.

Codes included as external causes for the purposes of injury surveillance: For comparability with historical definitions developed in ICD-9-CM, the codes that are considered as describing an external cause include:

- all V, W, and X codes;

- some Y codes (Y00-Y38 only)[a]; and

- specific T codes (diagnosis codes) that convey mechanism or intent information. These codes are shown in Table 3 on page 11.

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[a] *Y codes not considered for injury surveillance purposes include Y62-Y84 (Complications of medical and surgical care) and Y90-Y99 (Supplementary factors related to causes of morbidity classified elsewhere).*

Table 2. Key differences between ICD-9-CM and ICD-10-CM codes for external cause of injury

ICD-9-CM	ICD-10-CM
1,300 codes	7,500 codes
External cause codes begin with "E" and are commonly referred to as "E-codes"	External cause codes begin with "V," "W," "X" or "Y"
Codes contains 3-5 characters	Code contains 3-7 characters; some codes have an "X" placeholder character to accommodate new codes in the future
No distinction between initial or subsequent encounters	7th character to designate initial or subsequent encounter
Limited external cause codes for late effect	7th character indicates sequelae (late effects)
External cause codes for intentional self-inflicted injuries are referred to as Suicide/self-inflicted	External cause codes for intentional self-inflicted injuries are referred to as Intentional self-harm
External cause codes for intentional harm by other persons are referred to as Homicide and injury purposely inflicted by other persons	External cause codes for intentional harm by other persons are referred to as Assault
Includes specific external cause codes for: • poisoning and toxic effects of substances; • asphyxiation; • effects of foreign bodies; • deprivation and neglect; • lightning; and • vibration.	Includes specific diagnosis (nature of injury) codes for: • poisoning and toxic effects of substances; • asphyxiation; • effects of foreign bodies; • deprivation and neglect; • lightning; and • vibration.
Includes external cause codes for perpetrator of child and adult abuse (E967.0-.9); includes diagnosis codes for child maltreatment and abuse (995.50-995.59) and adult maltreatment and abuse (995.80-.85)	External cause codes for perpetrator of assault, maltreatment and neglect (Y07) are expanded; includes diagnosis codes to specify adult and child abuse, neglect, and other maltreatment, confirmed (T74) and suspected (T76)

Table 3. T codes in ICD-10-CM that convey external cause (mechanism and/or intent of injury) information

ICD-10-CM code	Type of External Cause
T14.91	Suicide attempt
T15-T19	Effects of foreign body entering through natural orifice
T36-T50 with a 6th character of 1, 2, 3, or 4 (Exceptions: T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with a 5th character of 1, 2, 3, or 4)	Poisoning by drugs, medicaments, and biological substances
T51-T65	Toxic effects of substances chiefly non-medicinal as to source
T71	Asphyxiation
T73	Effects of deprivation
T74, T76	Adult and child abuse, neglect, and other maltreatment, confirmed or suspected
T75.0, T75.2, T75.3	Effects of lightning, Effects of vibration, Motion sickness

GETTING TO KNOW YOUR DATA

Understanding the structure and organization of the ICD-10-CM codes in electronic files is critical for appropriately analyzing emergency department and hospitalization data for injury and violence surveillance. Here are some suggestions for initial analyses that may help you understand your data file and prepare you for more complicated analyses of data coded in ICD-10-CM.

Check the structure of the ICD-10-CM codes

- *Are there embedded blanks or spaces within the ICD-10-CM codes?* The ICD-10-CM codes should not include leading blanks, embedded blanks or embedded spaces.

- *Do the ICD-10-CM codes in the electronic file have a decimal between the 3rd and 4th characters?* The standard structure of an ICD-10-CM code includes a decimal between the 3rd and 4th characters. In some data files, however, the decimal might be implied and therefore absent. Knowing whether the decimal is present will help you adjust your analytic programs accordingly to correctly read and use the ICD-10-CM codes.

- *Do the injury diagnosis and external cause codes include 7 characters?* Most, but not all, of the codes are structured with 7 characters, with the 7th character indicating the type of encounter. Some data files have been processed to add "filler X's" to each code so that the 7th character for type of encounter is in the correct position (these "filler X's" are different than the "X" placeholders that are required characters in some codes). In order to select cases or to conduct analyses based on the 7th character, you need to know whether the codes include "filler X's" and adjust your analytic programs accordingly.

  o The Centers for Medicare and Medicaid Services require health care organizations to submit the entire ICD-10-CM code – including the 7th character for type of encounter – in the administrative claims database in order to receive reimbursement. However, if you are using an electronic file collected for some other purpose (e.g. a trauma registry), the full 7 character code might not be required and therefore, a shortened version of the ICD-10-CM code might be acceptable.

  o Some case definitions include only certain types of encounters. To determine the percent of injury records that meet the case definition, consider examining the distribution of the types of encounters for injury diagnosis codes (particularly when the code is listed as the principal diagnosis) and for external cause codes.

GETTING TO KNOW YOUR DATA

- ***Have you updated your analytic programs to appropriately identify intent of injury from the characters in codes for poisoning from drugs (T36-T50) and toxic substances (T51-T65)?*** Most of the poisoning codes include a 6th character to specify the intent of injury, but there are many exceptions where the information on the intent of injury is found in the 5th character. (See list on page 6) Check your analytic program to address these exceptions when doing analyses that involve identifying intent of injury. Consider examining the distribution of intent for poisonings.

Check the content of the electronic file

- ***Does the electronic file have a dedicated field(s) for external cause codes?*** Some T codes in ICD-10-CM also convey information on the mechanism or intent of injury. These codes are listed in Table 3. Check whether the dedicated field(s) for external cause of injury includes ICD-10-CM T codes. If the dedicated fields do not contain any T codes, you will need to search the diagnosis fields in your file for the T codes that also provide external cause information in order to identify the appropriate external cause for every record in an injury analysis.

- ***In the electronic file for data analysis, did all hospitals contribute ICD-10-CM coded records for emergency department visits and hospitalizations that occurred between October 1, 2015 through December 31, 2015?*** Healthcare organizations covered by the Health Insurance Portability and Accountability Act (HIPAA) were required to begin using ICD-10-CM for all Medicare and Medicaid claims for reimbursement beginning October 1, 2015. Determine whether all hospitals submitted ICD-10-CM coded data in your electronic files for discharges from October 1, 2015 forward.

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CHAPTER 2: THE PROPOSED ICD-10-CM EXTERNAL CAUSE MATRIX FOR REPORTING INJURY MORBIDITY

To describe the leading causes of injury morbidity, injury epidemiologists frequently report numbers and rates of injury hospitalizations and emergency department visits by cause of injury. A standard tool or framework for such reporting is the external cause matrix, which groups ICD codes into major mechanism of injury (e.g. motor vehicle-traffic, cut/pierce, drowning, falls) by intent of injury (i.e. unintentional, self-harm, assault, legal intervention/war, undetermined intent) categories. External cause matrices developed for morbidity data (based on codes from ICD-9-CM) and for mortality data (based on codes from ICD-10) have been routinely used for nearly two decades. [4]

With the transition from ICD-9-CM to ICD-10-CM, an external cause matrix for ICD-10-CM was needed. In 2013, injury epidemiologists and coding experts from the National Center for Injury Prevention and Control and the National Center for Health Statistics at the CDC collaborated to develop a proposed framework (matrix) for presenting injury and violence data using ICD-10-CM external cause of injury codes. The proposed matrix and the steps in its development are described in a comprehensive report published by the CDC in 2014. [4] The CDC report outlines the issues, decisions and processes that resulted in the general structure of the matrix (i.e. the rows and columns) as well as the guiding principles that determined the placement of the codes in the individual cells of the matrix. For a comprehensive understanding of the matrix and the implications of its use, epidemiologists are encouraged to read the full CDC report.

A brief overview of the proposed ICD-10-CM matrix for reporting external causes by mechanism and intent of injury is provided in this Chapter 3.

Basic framework for the proposed ICD-10-CM external cause matrix

The basic framework of the proposed ICD-10-CM external cause matrix is shown in Table 4. Compared to the ICD-9-CM external cause matrix, the ICD-10-CM external cause matrix has ten additional mechanism categories (rows). The new mechanism categories are highlighted with an asterisk (*) in Table 4. Although not shown in the table, each ICD-10-CM external cause code and select injury diagnosis T codes that convey mechanism or intent information (see Chapter 1) are assigned to the appropriate cell in the matrix based on the mechanism and intent of injury.[b] [5] Not all the cells of the matrix have relevant codes. These cells are noted with a dash (–) in Table 4.

[b] *Excel spreadsheets showing each code and its assignment to a specific mechanism and intent category are available on the CDC Website [5].*

Table 4. Basic structure of the proposed ICD-10-CM external cause matrix for reporting mechanism by intent of injury

Mechanism	Intent of Injury				
	Unintentional	Self-Harm	Assault	Undetermined	Legal Intervention/War
Cut/Pierce	X	X	X	X	X
Drowning/Submersion	X	X	X	X	–
Fall	X	X	X	X	–
Fire/Burn	X	X	X	X	X
Fire/Flame	X	X	X	X	X
Hot Object/Substance	X	X	X	X	–
Firearm	X	X	X	X	X
Machinery	X	–	–	–	–
All Transportation*	X	X	X	X	X
Motor Vehicle-Traffic (MVT)	X	X	X	X	–
MVT-Occupant	X	X	X	–	–
MVT-Motorcyclist	X	–	–	–	–
MVT-Pedal cyclist	X	–	–	–	–
MVT-Pedestrian	X	–	X	–	–
*MVT-Other**	X	–	–	–	–
MVT-Unspecified	X	–	–	X	–
MV – Non-traffic*	X	–	–	–	–
Pedal cyclist, Other	X	–	–	–	–
Pedestrian, Other	X	–	–	–	–
Other Land Transport*	X	X	X	–	–
Other Transport	X	X	X	–	X
Natural/Environmental	X	X	X	X	–
Bites/Stings – nonvenomous*	X	–	X	–	–
Bites/Stings – venomous*	X	X	X	X	–
Other Natural/Environmental	X	X	X	X	–
Overexertion	X	–	–	–	–
Poisoning	X	X	X	X	X
Drug*	X	X	X	X	–
Non-Drug*	X	X	X	X	X
Struck by/against	X	X	X	–	X
Suffocation	X	X	X	X	X
Other Specified	X	X	X	X	X
Other Specified – Child/Adult Abuse*	–	–	X	–	–
Other Specified – Foreign Body*	X	–	–	–	–
Other Specified, Classifiable	X	X	X	X	X
Other Specified, NEC	–	X	X	X	X
Unspecified	X	X	X	–	X

* This is a new mechanism category in the ICD-10-CM External Cause Matrix.
"X" indicates relevant ICD-10-CM codes exist for this cell.
"–" indicates there are no relevant ICD-10-CM codes that exist for this cell.

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Possible effects on cell counts due to changes in coding guidelines and external cause matrices

Changes in the ICD-10-CM coding guidelines as well as decisions regarding the structure and placement of codes in the proposed ICD-10-CM external cause matrix could result in substantial differences in cell counts when comparing results from application of the ICD-10-CM matrix to results from application of the ICD-9-CM matrix. Understanding these changes is vital to interpreting and comparing results from analysis of data using the different coding and reporting schemas.

Changes to coding guidelines: The official coding guidelines for ICD-10-CM state that if the intent (e.g. accident, self-harm, assault) of the cause of an injury or other condition is unknown or unspecified, the intent should be coded as accidental intent. [6] External causes should only be coded to undetermined intent if the documentation in the record specified that the intent cannot be determined. In ICD-10-CM, all transport accident categories are assumed to be accidental intent. This is a change from the coding guidelines for ICD-9-CM where the guidance was to code cases where the intent was unknown as undetermined intent. [7]

Differences in the basic structure of the matrix: As mentioned previously, several new mechanism of injury categories (rows) not found in the ICD-9-CM matrix have been added to the proposed ICD-10-CM matrix. The addition of these new mechanism categories provides better comparability with the ICD-10 external cause matrix for mortality. The differences are summarized below:

- In the ICD-9-CM external cause matrix, the Transportation subcategories include "Motor Vehicle – Traffic"; "Pedal Cyclist, Other"; "Pedestrian, Other"; and "Transport, Other." In the proposed ICD-10-CM matrix, two additional subcategories, "Motor Vehicle – Nontraffic" and "Other Land Transport" have been added.

- In the ICD-9-CM external cause matrix, the Motor Vehicle – Traffic (MVT) subcategory includes five subheadings: "MVT-Occupant," "MVT-Motorcyclist," "MVT-Pedal cyclist," "MVT-Pedestrian," and "MVT-Unspecified." In the proposed ICD-10-CM matrix, a sixth subheading, "MVT-Other," has been added.

- In the ICD-9-CM external cause matrix, bites and stings were included in the major category of "Natural/Environmental." In the proposed ICD-10-CM matrix, these mechanisms are still included in "Natural/Environmental," but are also listed as specific subcategories, "Bite/Stings – nonvenomous" and "Bite/Stings – venomous."

- In the proposed ICD-10-CM matrix, the major category of "Poisoning" includes two subcategories, "Drug" and "Non-drug."

- In the ICD-9-CM matrix, the external cause codes related to child and adult abuse and effects due to foreign body were included in the major category of "Other specified." In the proposed ICD-10-CM matrix, these mechanisms are still included in "Other specified" but are also listed

as specific subcategories, "Other specified – Child/adult abuse" and "Other specified – Foreign body."

Differences in placement of external cause codes to specific cells in the matrix: In addition to differences in the overall structure of the ICD-9-CM and proposed ICD-10-CM matrices, there are also a few differences in placement of individual external cause codes in the cells. These differences could possibly result in differences in the cell counts when comparing results from the ICD-9-CM matrix and the ICD-10-CM matrix. The major differences in code placement are summarized below:

- In the ICD-9-CM matrix, water transportation-related drowning codes (E830 and E832) were included in the mechanism category of "Drowning/submersion." In the proposed ICD-10-CM matrix, comparable codes for water transportation-related drowning (V90 and V92) are placed in the mechanism category of "Other Transportation." This change allows for greater comparability with the ICD-10 external cause matrix for injury mortality. However, this means that not all drownings will be captured in the "Drowning/submersion" row of the matrix. For complete enumeration of drowning/submersion cases, include records with an external cause code of V90 and V92 in addition to those identified in the "Drowning/submersion" row of the proposed matrix.[c]

- In the ICD-10-CM matrix, other and unspecified transportation codes (V90 and V99) have been placed in the mechanism category of "Other transport." This change was made for consistency with the ICD-10 mortality matrix. In the ICD-9-CM matrix, codes for "Vehicle Accidents – Not elsewhere classifiable" (E846 – E848) were categorized into the mechanism category of "Other specified and classifiable."

New or more detailed codes in ICD-10-CM: As mentioned in Chapter 1, ICD-10-CM includes more than 5 times the number of external cause codes found in ICD-9-CM. The greater specificity of the ICD-10-CM codes provides detail that can be used for more precise placement of the codes in the cells of the proposed matrix. Some examples include:

- In ICD-10-CM, W16 includes multiple codes for falling, jumping or diving into a swimming pool or other body of water. A subset of these codes indicates that the injury involved drowning/submersion. The codes that describe involvement of drowning/submersion include W16.011, W16.021, W16.031, W16.111, W16.121, W16.131, W16.211, W16.221, W16.311, W16.321, W16.331, W16.41, W16.511, W16.521, W16.531, W16.611, W16.621, W16.711, W16.721, W16.811, W16.821, W16.831, and W16.91. Thus, while most of the W16 codes are placed in the mechanism category of "Fall," the subset of codes that involves drowning/submersion is included in the mechanism category of "Drowning/submersion."

- In ICD-10-CM, W22 includes multiple codes for striking against or struck by other objects,

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[c] *A nature of injury code T75.1 Unspecified effects of drowning and non-fatal submersion can also be used to identify drowning cases however this code does not identify the intent of injury.*

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including a code specific to striking against the wall of a swimming pool causing drowning and submersion (W22.041). This code (W22.041) is placed in the mechanism category of "Drowning/ submersion" rather than in the category of "Struck by/Against."

- Transportation codes involving "pedestrian conveyance" (V00) are new to ICD-10-CM. These codes were designed to identify sports- and recreation-related (e.g. roller skates, skateboard, scooter, heelies, ice skates, sled, snowboard, snow-ski) and other conveyance-related (e.g. wheelchair, baby stroller, motorized mobility scooter) injuries. The descriptions of these codes do not indicate collisions with traditional transportation vehicles, but instead, involve injuries resulting from a fall, collision, or other event. Rather than including them in the mechanism category of "Transportation," individual V00 codes are placed in the "Fall," "Struck by/against" or "Other specified, classifiable" mechanism categories in the ICD-10-CM external cause matrix as appropriate. This is similar to how comparable codes were placed in the ICD-9-CM matrix.

Other considerations: Other changes resulting from the increased specificity of ICD-10-CM codes might also impact cell counts. A few to consider include:

- As described in Chapter 1, the 7th character in the ICD-10-CM code indicates the type of medical care encounter involved when the code was assigned. A 7th character of "A" indicates an initial encounter and a 7th character of "D" indicates a subsequent encounter. This distinction was not made in ICD-9-CM. The impact of including/excluding records based on the type of encounter is unknown at this time.

- In the ICD-9-CM external cause matrix, the few non-specific late effects codes (E929.0 – E929.5, E929.8, and E929.9) were placed in the "Other specified, classifiable," "Other specified, Not Elsewhere Classifiable," and "Unspecified" mechanism categories. In ICD-10-CM, the sequelae (late effects) codes are numerous since most ICD-10-CM external cause codes can have an associated sequela code (identified by an "S" in the 7th character of the code). Currently the ICD-10-CM codes indicating sequelae from an injury are not included in the proposed ICD-10-CM matrix. The impact of this decision is unknown at this time.

Injury Surveillance Workgroup 9

CHAPTER 3: INSTRUCTIONS FOR IMPLEMENTING THE PROPOSED ICD-10-CM EXTERNAL CAUSE MATRIX

This chapter provides instructions for applying the proposed ICD-10-CM external cause matrix to administrative data for injury hospitalizations and emergency department visits.

These instructions are based on the CDC's proposed ICD-10-CM injury surveillance case definition described in the NCHS National Health Statistics Report "Proposed ICD-10-CM Surveillance Case Definitions for Injury Hospitalizations and Emergency Department Visits". [8] Conceptually, the process can be adapted for use with any ICD-10-CM coded data set, case selection criteria, or time frame. Also, these instructions assume the epidemiologist is familiar with the datasets he/she will use in the analysis and understands where and how to identify the diagnosis and external cause codes for each record. Suggestions for preliminary analyses for "getting to know your data" were provided on page 12. Epidemiologists should consider conducting these preliminary analyses prior to implementing the matrix to better understand the structure and completeness of the ICD-10-CM codes in the data file.

Instructions for implementing the external cause matrix using hospital discharge data (HDD)

1. ***SELECT*** HDD records with a <u>date of discharge </u>within a specified time frame (e.g. January 1, 2016 to December 31, 2016).

2. ***CREATE*** the injury case subset.

    a. ***IDENTIFY*** injury records by searching the <u>principal diagnosis</u> field for any of the ICD-10-CM codes in the CDC case selection criteria for injury hospitalizations (Table 5):

i. All S codes

ii. T codes from T07-T79 excluding T78

1. For T36-50, the intent of the drug poisoning is generally captured in the 6th character of the code, however for T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9, the intent is captured in the 5th character of the code. Include drug poisoning codes for which the 5th or 6th character (as appropriate) is 1, 2, 3, or 4 (for accidental, intentional self-harm, assault and undetermined intent, respectively). Exclude codes for which the 5th or 6th character (as appropriate) is 5 (for adverse effect) or 6 (for effects due to underdosing).

Selection Based on Principal Diagnosis

The surveillance definition for injury hospitalization is generally applied to hospital discharge data, which is often based on billing information collected using the Uniform Billing Form (UB-04). Datasets based on the UB-04 include fields containing ICD codes for the principal diagnosis (i.e., the condition identified by the attending physician or nurse as the reason the patient is being admitted) as well as other secondary diagnoses, complications and co-morbidities.

*Datasets can vary in the number of diagnosis fields included. However, for fields other than the **principal diagnosis** field, there are no national standards for the order in which the codes are assigned. Therefore, the presence of an injury diagnosis code in subsequent fields does not necessarily reflect an injury of sufficient severity that it would have led to hospitalization on its own. For this reason, the case definition is based on the principal diagnosis field, the one diagnostic field for which there is a generally accepted coding rule.*

For the purpose of standard comparisons, the surveillance definition is limited to the inclusion of a principal diagnosis of one of the included ICD-10-CM codes as shown in Table 5.

For further discussion, see the reports from ISW3 [9] and ISW6 [10].

Table 5. Inclusion criteria using ICD-10-CM nature of injury codes in the principal diagnosis field

ICD-10-CM codes*	Types of Injury Diagnoses
All S codes	Anatomic injuries
T07-T34	Foreign bodies, burns, corrosions, frostbite
T36-T50 with a <u>6th character</u> of 1, 2, 3, or 4 (Exceptions: T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with a <u>5th character</u> of 1, 2, 3, or 4)	Drug poisoning (excludes adverse effects and underdosing)
T51-T65	Toxic effects of substances nonmedicinal as to source
T66-T77	Other and unspecified effects of external causes (radiation, heat, light, hypo/hyperthermia, asphyxiation, child/adult abuse, lightning, drowning, motion sickness, etc.)
T79	Certain early complications of trauma, not elsewhere classified

* Principal diagnosis only. Any 7th character except "S" (sequela from previous injury). T07, T14, and T30-T32 do not have a 7th character.

b. From the injury records, identify the subset of records that indicate an initial or subsequent encounter for treatment of an injury.

   i.   Most injury diagnosis codes in ICD-10-CM include a 7th character indicating whether the visit was an initial encounter (7th character of A, B, or C), a subsequent encounter (D to R) or sequelae from a previous injury (S). All S codes and most T codes are required to have a 7th character; T codes that are not required to have a 7th character include T07, T14 and T30-T32.

Types of encounters as defined in ICD-10-CM

An **initial encounter** is one in which the patient receives active treatment for an acute condition. The initial encounter is NOT synonymous with an incident case.

Subsequent encounters refer to encounters after the patient has received active treatment for the acute condition and is receiving routine care during the healing or recovery phase. Subsequent encounters can reflect care received by the same provider or different providers.

Sequelae refers to complications or conditions that arise as a direct result of an injury, such as scar formation after a burn.

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   ii. The codes in ICD-9-CM did not make the distinction between initial encounters and subsequent encounters. **The proposed CDC ICD-10-CM surveillance definition for injury hospitalizations and ED visit recommends including both initial encounters and subsequent encounters in order for case counts to be more in alignment with the counts from the ICD-9-CM surveillance case definition.**

The concepts of initial encounter, subsequent encounter and sequelae were not included in ICD-9-CM. If a substantial change in the total case count is observed when comparing data coded in ICD-9-CM to data coded in ICD-10-CM, one explanation could be differences in the types of encounters captured in the different data sets. Understanding the frequency of 7th characters for the principal injury diagnosis might provide some insight as to why differences in case counts occurred.

   iii. **To CREATE the final injury case subset**, select only those injury records from Step "a" that have a 7th character of A through R or for which the 7th character is missing (i.e. include all records where the injury principal diagnosis code indicates an initial encounter, a subsequent encounter or the type of encounter is unknown).

3. **IDENTIFY** the first valid external cause code for each case in the final injury case subset. For the purposes of implementing the proposed ICD-10-CM external cause matrix, the first valid external cause code is defined as "the first mention of one of the V, W, X, Y or T codes listed in Table 6".[d]

Table 6. ICD-10-CM codes with external cause information that are included in the proposed ICD-10-CM external cause matrix

ICD-10-CM codes*	Types of External Causes of Injury
V00-V99	Transport accidents
W00-X58	Other external causes of accidental injury
X71-X83	Intentional self-harm
X92-Y09	Assault
Y21-Y33	Event of undetermined intent
Y35-Y38	Legal intervention, operations of war, military operations and terrorism
T14.91	Suicide attempt
T15-T19	Effects of foreign body entering through natural orifice
T36-T50 with a 6th character of 1, 2, 3, or 4 (Exceptions: T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with a 5th character of 1, 2, 3, or 4)	Poisoning by drugs, medicaments, and biological substances
T51-T65	Toxic effects of substances chiefly non-medicinal as to source
T71	Asphyxiation
T73	Effects of deprivation
T74, T76	Adult and child abuse, neglect, and other maltreatment, confirmed or suspected
T75.0, T75.2, T75.3	Effects of lightning, Effects of vibration, Motion sickness

7th character of "A," "D" or 7th character missing

CONSIDERATIONS when identifying the first valid external cause code:

a. As with injury diagnosis codes, external cause codes in ICD-10-CM also include a 7th character indicating whether the visit was an initial encounter (A), a subsequent encounter (D) or sequelae from a previous injury (S). When identifying the first valid external cause code, include codes with a 7th character of A or D or for which the 7th character is missing (i.e. include all initial encounters, subsequent encounters and cases where the type of encounter is unknown).

b. If the dataset has a dedicated field(s) for external cause codes, look there first for a valid external cause code.

[d] The T codes listed in Table 6 are injury diagnosis codes rather than external cause codes. However, because they convey external cause information (mechanism and intent of injury), they are included in the proposed ICD-10-CM external cause matrix and are considered conceptually as external causes.

     i.   Some of the valid external cause codes in Table 6 are diagnosis codes (T codes). Therefore, it might be necessary to search diagnosis fields to identify the external cause code for each injury case.

     ii.   A case could possibly have BOTH a valid external cause code in the dedicated field AND a principal diagnosis that contains external cause information (i.e. the principal diagnosis is T14.91, T15-T19, T36-T50, T51-T65, T71, T73, T74, T76, T75.0, T75.2, T75.3). In these situations, if the external cause information from the dedicated field does not match the external cause information from the principal diagnosis (i.e. the mechanism and intent from the external cause code in the dedicated field would map to a different cell in the matrix than would be indicated from the principal diagnosis), the principal diagnosis code takes priority (i.e. assign the case to the mechanism and intent identified by the principal diagnosis code).

  c. If the dataset does not have a dedicated field for external cause codes, search all diagnosis fields to identify the first valid external cause code as summarized in Table 6.

  d. If a case has multiple valid external cause of injury codes, only the first listed should be used in the analysis.

4. **ASSESS** the completeness of external cause coding by calculating the percent of injury cases in the final injury case subset from Step 2 that have a valid external cause code as identified in Step 3. If this percentage is low[e], use of the matrix might not be appropriate as most cases will not be represented in the final table or there could be differential coding which could result in biased results (e.g. if certain causes are more likely to be coded than others). The number and percentage of injury cases with a valid external cause code should be reported whenever presenting analysis results.

5. **CATEGORIZE** each injury case that has a valid external cause code to the appropriate cell of the ICD-10-CM external cause matrix. Excel spreadsheets showing the assignment of each external cause code to a given cell in the matrix can be found on the CDC website [5] (under Injury Coding and Data Systems, find the two Excel spreadsheets: ICD-10-CM External Cause Matrix for Poisoning and ICD-10-CM External Cause Matrix for Causes other than Poisoning). Sample SAS programming code to assist in creating the matrix can be found on the CDC website. [11]

6. **SUMMARIZE** the results by creating a table similar to Table 7 on page 24, showing the counts for each cell. Note that some of the cells will be blank by definition because there are no valid external cause codes for certain categories in the matrix. The number of injury cases that did not have a valid external cause code should also be noted. A footnote to the table should be used to indicate the percentage of injury cases with a valid external cause code.

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[e] *"Low" is a relative term defined by the user based on historical trends and past experience with the data set. The underlying concept is that counts of injuries by specific mechanisms or intents might be significantly underestimated if a high proportion of injury cases are not assigned an external cause. Providers and users of data sets should strive to improve the completeness of external cause coding. Ideally, all injury records in a data set should have an external cause assigned.*

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Table 7. Example of a table to report the results from the proposed ICD-10-CM external cause matrix: injury hospitalizations by mechanism and intent of injury

Mechanism	Intent of Injury					
	Unintentional	Self-Harm	Assault	Undetermined	Legal Intervention/War	Total
Cut/Pierce	975	264	820	21	0	2,080
Drowning/Submersion†	101	*	0	*	–	111
Fall	42,428	51	20	48	–	42,547
Fire/Burn	1,339	27	*	27	0	1,410
Fire/Flame	1,009	*	*	*	0	1,039
Hot Object/Substance	330	*	*	*	–	371
Firearm	254	65	671	94	*	1,091
Machinery	606	–	–	–	–	606
All Transportation	15,140	*	23	21	*	15,201
Motor Vehicle-Traffic (MVT)	12,108	*	23	21	–	12,157
MVT-Occupant	8,362	0	*	–	–	8,369
MVT-Motorcyclist	1,513	–	–	–	–	1,513
MVT-Pedal cyclist	340	–	–	–	–	340
MVT-Pedestrian	1,380	–	21	–	–	1,401
MVT-Other	413	–	–	–	–	413
MVT-Unspecified	100	–	–	21	–	121
MV – Non-traffic	436	–	–	–	–	436
Pedal cyclist, Other	931	–	–	–	–	931
Pedestrian, Other	143	–	–	–	–	143
Other Land Transport	1,309	0	0	–	–	1,309
Other Transport	213	0	0	–	*	225
Natural/Environmental	840	*	*	*	–	867
Bites/Stings – nonvenomous	204	–	*	–	–	206
Bites/Stings – venomous	63	0	*	*	–	71
Other Natural/Environmental	573	*	*	*	–	590
Overexertion	1,677	–	–	–	–	1,677
Poisoning	3,447	5,482	*	927	0	9,868
Drug	3,171	5,208	*	882	–	9,272
Non-Drug	276	274	*	45	0	596
Struck by/against	2,144	0	1,176	–	49	3,369
Suffocation	313	65	*	*	0	390
Other Specified – Child/Adult Abuse	–	–	113	–	–	113
Other Specified – Foreign Body	123	–	–	–	–	123
Other Specified, Classifiable	57	*	*	*	*	71
Other Specified, NEC	–	*	*	*	*	23
Unspecified	200	*	*	–	*	224
Cases with a valid external cause code	69,644	5,976	2,877	1,189	85	79,771**
Cases lacking a valid external cause code						1,595
TOTAL INJURY HOSPITALIZATIONS						81,366

†This category does not include drowning/submersion involving watercraft. For a complete enumeration of all drowning/submersion cases, include V90 and V92.
 "–" indicates no relevant ICD-10-CM external cause codes exist for this cell
"*" indicates the cell count is below that needed to maintain confidentiality or statistical reliability; users should follow the reporting requirements of their organization
** 98.0% of injury cases had a valid external cause code

Instructions for implementing the external cause matrix using emergency department data (EDD)

The instructions for implementing the matrix using emergency department data (EDD) are the same as those for hospital discharge data **except for Step 2** – identifying the injury records. For EDD, records are selected based on having either a specified principal diagnosis or a valid external cause code. These selection criteria are consistent with the recommendations of previous injury surveillance workgroups [10, 12] and the instructions for the CDC injury indicators. [13] For additional explanation and detail, please read the instructions for implementing the matrix using hospital discharge data (HDD) first; this will provide useful information to better understand the instructions on pages 19-23 for implementing the external cause matrix using EDD.

1. **SELECT EDD** records with a date of discharge within a specified time frame (e.g. January 1, 2016 to December 31, 2016).

2. **IDENTIFY** injury records in EDD by selecting those records that have either a principal diagnosis of any of the ICD-10-CM codes listed in Table 5 on page 20 (with a 7th character of A to R or missing) or records that have a valid external cause code listed in Table 6 on page 22 (with a 7th character of A, D or missing).

3. **IDENTIFY** the first listed external cause of injury code for each case in the injury subset. Table 6 on page 22 lists the valid ICD-10-CM external cause codes for inclusion in the matrix. Note that some of the valid external cause codes are also injury diagnosis codes (T codes).

   A few considerations should be taken into account when identifying the first valid external cause code:

   a. As with injury diagnosis codes, external cause codes in ICD-10-CM also include a 7th character indicating whether the visit was an initial encounter (A), a subsequent encounter (D) or sequelae from a previous injury (S). When identifying the first valid external cause code, include codes with a 7th character of A, D or for which the 7th character is missing (i.e. include all initial encounters, subsequent encounters and cases where the type of encounter is unknown).

   b. If the dataset has a dedicated field(s) for external cause codes, look there first.

      i. Some of the valid external cause codes in Table 6 are also diagnosis codes (T codes). Therefore, it might be necessary to search diagnosis fields to identify the external cause code for each injury case.

      ii. A case could possibly have BOTH a valid external cause code in the dedicated field AND a principal diagnosis that also contains external cause information (i.e. the principal diagnosis is T14.91, T15-T19, T36-T50, T51-T65, T71, T73, T74, T76, T75.0, T75.2, T75.3). In these situations, if the external cause information from the dedicated field does not match the external cause information from the principal diagnosis (i.e. the mechanism

and intent from the external cause code in the dedicated field would map to a different cell than would be indicated from the principal diagnosis), the principal diagnosis code takes priority (i.e. assign the case to the mechanism and intent identified by the principal diagnosis code).

   c. If the dataset does not have a dedicated field for external cause codes, search all diagnosis fields to identify the first valid external cause code as summarized in Table 6 on page 22.

   d. If a case has multiple valid external cause of injury codes, only the first listed should be used in the analysis.

4. **ASSESS** the completeness of external cause coding by calculating the percent of injury cases in the final injury case subset from Step 2 that have a valid external cause code (identified in Step 3). If this percentage is low[f], use of the matrix might not be appropriate as most cases will not be represented in the final table or there could be differential coding which could result in biased results (e.g. if certain causes are more likely to be coded than others). The number and percentage of injury cases with a valid external cause code should be reported whenever reporting analysis results or presenting the final matrix.

5. **CATEGORIZE** each injury case that has a valid external cause code to the appropriate cell of the ICD-10-CM external cause matrix. Excel spreadsheets with the assignment of each external cause code to a given cell in the matrix can be found on the CDC website [5] (under Injury Coding and Data Systems, find the two Excel spreadsheets: ICD-10-CM External Cause Matrix for Poisoning and ICD-10-CM External Cause Matrix for Causes other than Poisoning). Sample SAS programming code to assist in creating the matrix can be found on the CDC website. [11]

6. **SUMMARIZE** the results by creating a table similar to Table 7 on page 24, which shows the counts for each cell. Note that some of the cells will be blank by definition because there are no valid external cause codes for certain categories in the matrix. The number of injury cases that did not have a valid external cause code should also be listed. A footnote to the table should be used to indicate the percentage of injury cases with a valid external cause code.

Comparing counts between ICD-9-CM and ICD-10-CM external cause matrices

With the transition to a new coding schema and external cause matrix, it is important to determine whether the results from the new ICD-10-CM matrix are comparable to historical results from the ICD-9-CM matrix. If substantial differences are seen (i.e. the counts for a given mechanism/intent cell are substantially higher or lower than historical trends), additional exploration should be conducted to better understand whether differences are "true" increases or decreases or "artifactual" changes resulting from the transition to the new coding system or the new matrix.

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[f] *"Low" is a relative term defined by the user based on historical trends and past experience with the data set. The underlying concept is that counts of injuries by specific mechanisms or intents might be significantly underestimated if a high proportion of injury cases are not assigned an external cause. Providers and users of data sets should strive to improve the completeness of external cause coding. Ideally, all injury records in a data set should have an external cause assigned.*

A stepwise approach to identify possible reasons for the observed differences should be considered.

1. Compare the total injury case counts across ICD versions. The total count of injury cases may be impacted by coding differences across ICD versions. If there are substantial differences in the total number of injury cases between ICD-9-CM and ICD-10-CM, this will likely affect the numbers in the individual cells of the external cause matrix as well.

2. Examine the completeness of external cause coding across ICD versions. If substantial changes have occurred in the proportion of injuries that have an external cause code, this will impact comparability. Awareness of such changes can help when interpreting the findings.

3. When interpreting the counts in individual cells, rows or columns, consider known changes that have occurred across versions of the matrix. (See Chapter 2.)

4. If just one category of the matrix was analyzed, consider running the full matrix. If substantial changes in a row or column total have occurred, determine whether the difference is confined to a single cell or whether there are differences across the entire column or row. In addition, determine if there are related changes to other areas of the matrix. As you conduct this review, keep in mind that cells with small counts (e.g. less than 20 cases) may be unstable, making inter-pretation of differences more difficult.

5. When comparing counts within a single cell (e.g. unintentional fall injuries) across versions of the matrix, consider comparing counts for each individual ICD-9-CM or ICD-10-CM code included in the cell (e.g. unintentional fall from height) to identify whether the differences in cell counts are the result of increases or decreases to counts for a few individual codes.

6. When analyzing cell, row, or column totals, consider comparing results to trend data from multiple years of historic data, not just a single year. Use trend information from other (non-ICD-10-CM coded) data sources as well as information on prevention efforts, policy implementation, and modifications to data coding/processing/programming to understand any identified changes in trends.

   a. Consider creating trend lines for counts/rates by quarter for several years to see if the results for the fourth quarter of 2015 (when data are coded in ICD-10-CM rather than ICD-9-CM) are anomalous.

CHAPTER 4: PRESENTING INJURY TRENDS THAT SPAN THE TRANSITION FROM ICD-9-CM TO ICD-10-CM

This chapter provides a range of options for presenting injury trends that span the transition from ICD-9-CM to ICD-10-CM. The intent of this chapter is to encourage further thinking about the analysis and display of such data; the options presented here should not be viewed as recommendations nor as an exhaustive list of possibilities.

Issues with trend data and ICD-10-CM

Differences between ICD-9-CM and ICD-10-CM codes, coding guidelines, or external cause matrix structure could alter the classification of certain injury cases with respect to mechanism or intent. These differences might even affect whether a record in the hospital or emergency department data file is classified as an injury. At this time, the effect of these differences on injury and violence surveillance is largely unknown. Presenting injury counts or rates over time periods that span the transition from ICD-9-CM to ICD-10-CM naturally leads to interpretation of whether or not a change in the counts or rates occurred. However, there is **potential for misinterpretation**, given the unknown effect of the change in coding from ICD-9-CM to ICD-10-CM. Changes in the magnitude of a count or rate might be partly or wholly attributable to the change in the coding schema or reporting matrix used rather than a "true" increase or decrease due to changes in underlying risk or protective factors.

As discussed in Chapter 2, the implementation of ICD-10-CM could affect counts for several reasons. For example, changes in coding guidelines for intent, as described on page 16, might decrease counts of injuries with undetermined intent and increase counts of unintentional injuries. Differences between ICD-9-CM and ICD-10-CM external cause codes and changes in the external cause matrix could also affect counts and rates. Additionally, some health care providers have noted that coding a record in ICD-10-CM can take longer to complete. [14, 15, 16] The increased burden of coding in ICD-10-CM could results in decreased coding of external cause of injury, because external cause codes are not required for hospital reimbursement. States that mandate reporting of external cause of injury, however, should not see a decrease in external cause codes, especially if there is a designated field for external cause in the electronic file.

To minimize the potential for misinterpretation, when showing trend results that span the transition from ICD-9-CM to ICD-10-CM, injury epidemiologists should:

1. clearly show the point in time at which the change in coding systems occurred (October 1, 2015); and

2. include language that cautions against comparing results from analysis of ICD-10-CM coded data to those from ICD-9-CM coded data.

Options for displaying injury trends

The following examples are offered as options – not recommendations – for presenting injury trends that span the transition from ICD-9-CM to ICD-10-CM. Injury epidemiologists will need to use their knowledge about the quality and completeness of the data and other relevant issues to decide which option to consider or whether to display injury trends at all. Consultation with other epidemiologists using ICD-10-CM coded data may be helpful. When providing results, organizational policies regarding how to handle release of estimated or provisional results to the media or the public should be followed.

Figures 1 through 9 are based on actual data from a state that had access to two quarters of ICD-10-CM coded data for hospitalizations and that had a population of 4 million in 2015. Injury hospital discharges occurring before October 1, 2015 were classified by mechanism and intent according to the ICD-9-CM external cause matrix. [17] Injury hospital discharges occurring between October 1, 2015 and March 31, 2016 were classified according to the proposed ICD-10-CM matrix in Chapter 3. Counts for the remainder of 2016 were projected from the observed data to allow for the inclusion of a full year of 2016 in the example plots that follow.[9] For readability and illustration only, the figures with quarterly results show data from 2013 to 2016. The figures with annual results show data from 2010 to 2016.

[9] *The projected data are for illustration only. The projected data were calculated by taking the average of the counts for the two quarters of ICD-10-CM data (2015 Q4 and 2016 Q1) divided by the average of the most recent three quarters of ICD-9-CM coded data (2015 Q1 – 2015 Q3). This ratio is denoted as M in the next statement. The count for 2016 Q2 was projected by multiplying the count for 2015 Q2 by M. Similarly, the count for 2016 Q3 was projected by multiplying the count for 2015 Q3 by M. The projection for 2016 Q4 was set to equal to the actual value for 2015 Q4 because it was coded in ICD-10-CM.*

SAFE STATES

Option 1: Plot the unadjusted data by quarter

One approach is to visualize trends using quarterly data, so that each data point represents cases coded entirely in either ICD-9-CM or ICD-10-CM. The example bar-line chart in Figure 1 represents pre- and post-transition counts of all injury-related hospital discharges using different fill colors for counts derived from ICD-9-CM- and ICD-10-CM-coded data. The addition of trend lines helps highlight trends pre- and post-transition. The break in the trend line between the third and fourth quarters of 2015 further reinforces the timing of the transition. The quarterly line chart in Figure 2 displays the same data as shown in Figure 1 with the broken trend line only; the bars are removed.

Figure 1. Quarterly bar-line chart
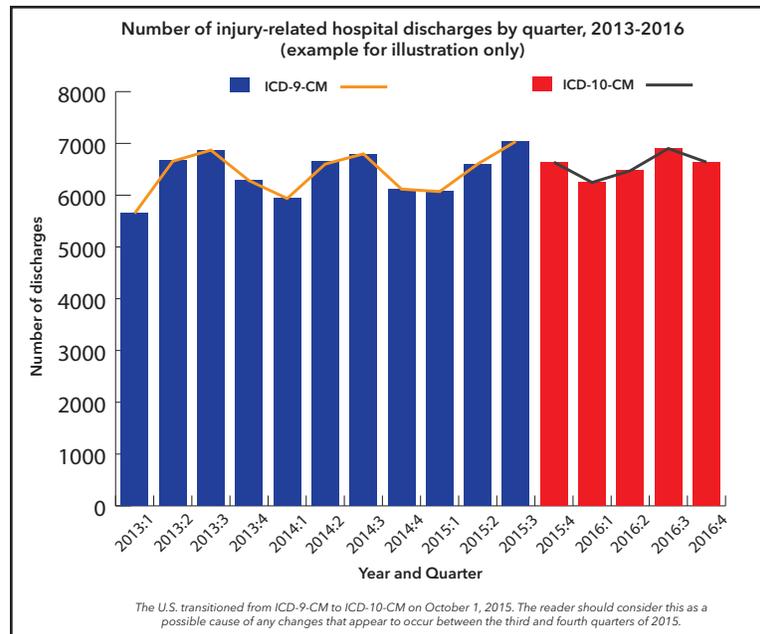
Figure 2. Quarterly line chart
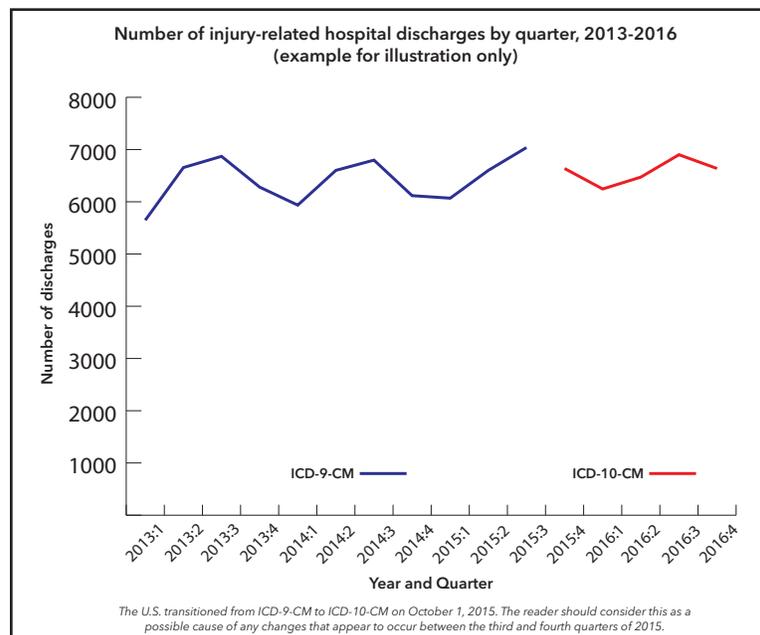
The scatterplot in Figure 3 below includes trend lines estimated by linear regression, overlaid on the same hospital discharge counts from Figure 1 and Figure 2 on page 30. The regression lines further aid the assessment of pre- and post-transition trends, as well as any immediate change in the counts that may have occurred as a result of the transition. In Figure 4 below, the trend curves were estimated using local regression (LOESS).

Figure 3. Quarterly scatter plot with trend lines estimated by linear regression

Number of injury-related hospital discharges by quarter, 2013-2016
(example for illustration only)

The U.S. transitioned from ICD-9-CM to ICD-10-CM on October 1, 2015. The reader should consider this as a possible cause of any changes that appear to occur between the third and fourth quarters of 2015.
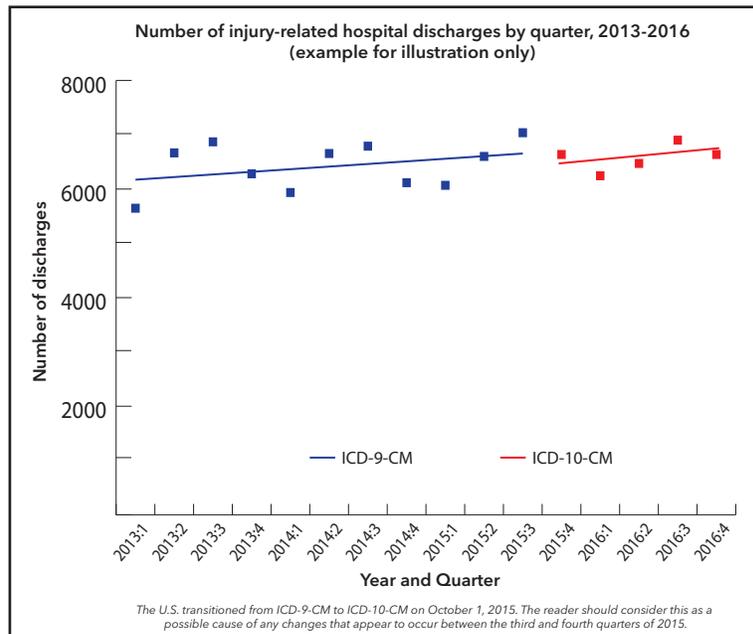
Figure 4. Quarterly scatter plot with trend lines estimated by local regression (LOESS)

Number of injury-related hospital discharges by quarter, 2013-2016
(example for illustration only)

The U.S. transitioned from ICD-9-CM to ICD-10-CM on October 1, 2015. The reader should consider this as a possible cause of any changes that appear to occur between the third and fourth quarters of 2015.
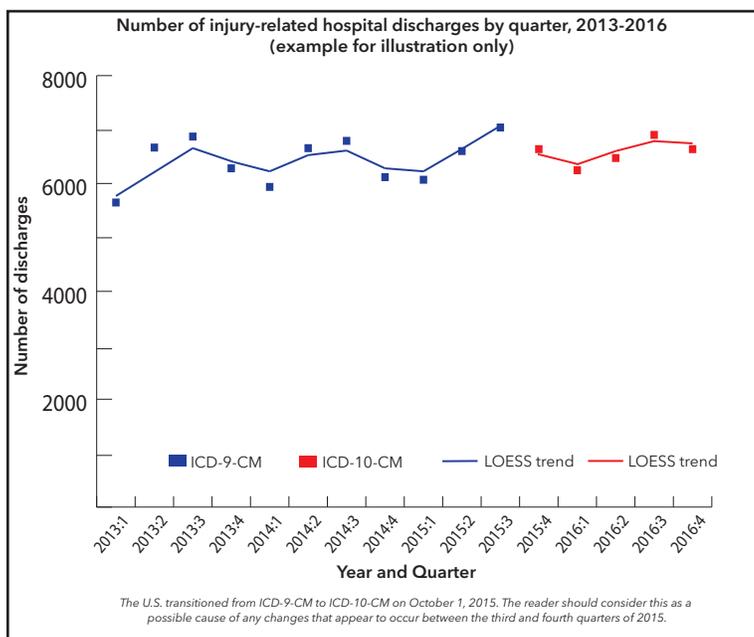
LOESS Curve Fitting (Local Regression)

LOESS is a technique for fitting a curve through a set of data points, such as a sequence of counts or rates observed over time, without requiring the analyst to pre-specify a functional form for the curve. This is accomplished by building a global regression curve from multiple, locally fitted curves. The fits of the local curves are influenced only by nearby data points. LOESS regression requires the specification of a smoothing parameter value that determines how much or how little smoothing of the fitted regression line will occur. Most common statistical analysis packages include procedures to perform LOESS regression. [18]

Option 2: Plot the unadjusted data by year

When presenting annual results, an epidemiologist must first decide how to calculate an annual value for 2015, the year that the transition from ICD-9-CM to ICD-10-CM occurred. One option shown in Figure 5 below is to avoid the problem by presenting values for all years except for 2015 and explaining the reason for the suppression in a footnote to the figure. This approach might be appropriate when data quality for the fourth quarter 2015 is problematic. For example, issues may have occurred if a large hospital system did not submit data or if there were problems with general data submission. This approach might be appropriate for rush requests, for results that are intended for wide dissemination to a diverse audience or when there is no time or staffing to fully assess other options.

Figure 5. Bar chart of annual counts, with count for 2015 suppressed
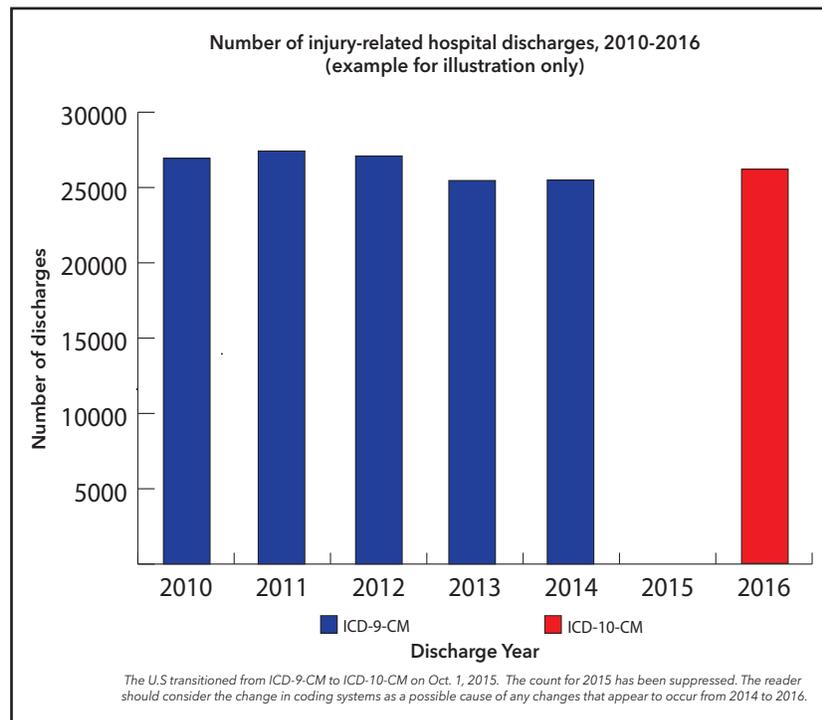
If the goal is to include data for 2015, the epidemiologist can adjust the 2015 data to account for the transition to ICD-10-CM, but only after reviewing medical records (Appendix C) to recode injury cases from the fourth quarter of 2015 into ICD-9-CM or to validate recoding done by applying a tool based on the General Equivalence Mappings between ICD-9-CM and ICD-10-CM. However these approaches could introduce other problems that might limit comparability of results [19].

Resource and time constraints may dictate that ICD-9-CM and ICD-10-CM injury counts for 2015 be calculated separately and combined without adjustment. In considering whether and how to present results, the epidemiologist must use personal knowledge of policy changes, local data quality, and other factors that can influence injury counts and rates. Also helpful is knowledge of changes in coding practices resulting from the transition to ICD-10-CM. The following two examples illustrate issues that might arise.

Example #1: All injury hospitalizations

Figure 1 on page 30 shows the quarterly counts for all injury-related hospital discharges plotted from 2013 through 2016. In this figure, the effect of the ICD-10-CM transition on the total count of injury discharges does not seem large. Figure 6 shows the same data from Figure 1 but now aggregated into annual counts. The bar representing the count of discharges in 2015 is highlighted in gray to distinguish the 2015 count from the values for other years. Using a third color for the 2015 bar allows the legend to indicate that the count includes cases coded in both ICD-9-CM and ICD-10-CM. Again, a footnote to Figure 6 explains the change in coding systems and suggests caution in interpreting apparent trends around the transition date.

Figure 6. Bar chart of annual counts, with count for 2015 included

Number of injury-related hospital discharges, 2010-2016
(example for illustration only)

The U.S transitioned from ICD-9-CM to ICD-10-CM on Oct. 1, 2015. The reader should consider the change in coding systems as a possible cause of any changes that appear to occur from 2014 to 2016.
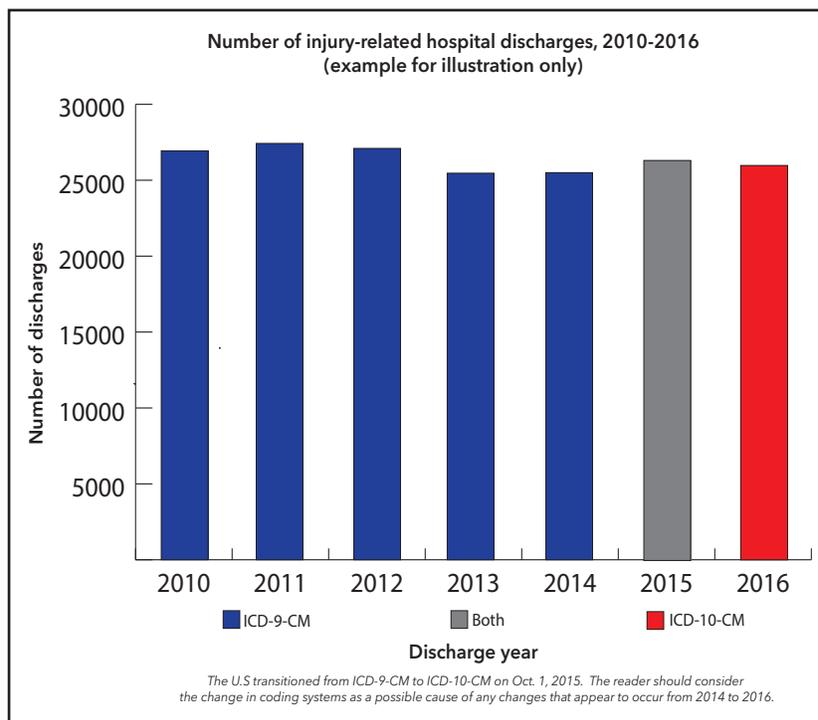
Example #2: Hospitalizations for unintentional poisoning

As mentioned on page 16, the ICD-10-CM coding guidelines differ from the ICD-9-CM coding guidelines when the intent of a cause of injury is unknown or unspecified. The ICD-10-CM coding guidance is that these cases should be coded as unintentional (accidental), while the ICD-9-CM coding guidance is to code these cases as undetermined intent. This change in coding guidance might have a noticeable effect on the injury count (and on any rates calculated from the count) for unintentional injuries. To illustrate this potential effect, this second example considers hospital discharges for unintentional poisoning.

Figure 7 shows an exploratory scatter plot of the yearly counts from 2010 to 2016. In the state that produced these data, major legislation went into effect in 2012 that was anticipated to reduce the number of discharges for unintentional drug overdose in 2013 and 2014. Injury discharges before October 1, 2015 were categorized according to the ICD-9-CM external cause matrix and injury discharges occurring on or after October 1, 2015 were categorized according to the ICD-10-CM external cause matrix. For 2015 the ICD-9-CM and ICD-10-CM counts were added to obtain a total count of unintentional poisoning for the year. In 2015, the counts of hospital discharges for unintentional poisoning increased back to the level observed in 2012, while the count for 2016 is projected to be the highest for the entire period.

Figure 7. Exploratory scatter plot of annual counts of hospital discharges for unintentional poisoning from 2010 to 2016

The U.S. transitioned from ICD-9-CM to ICD-10-CM on October 1, 2015. The reader should consider this as a possible cause of any changes that appear to occur between the third and fourth quarters of 2015.
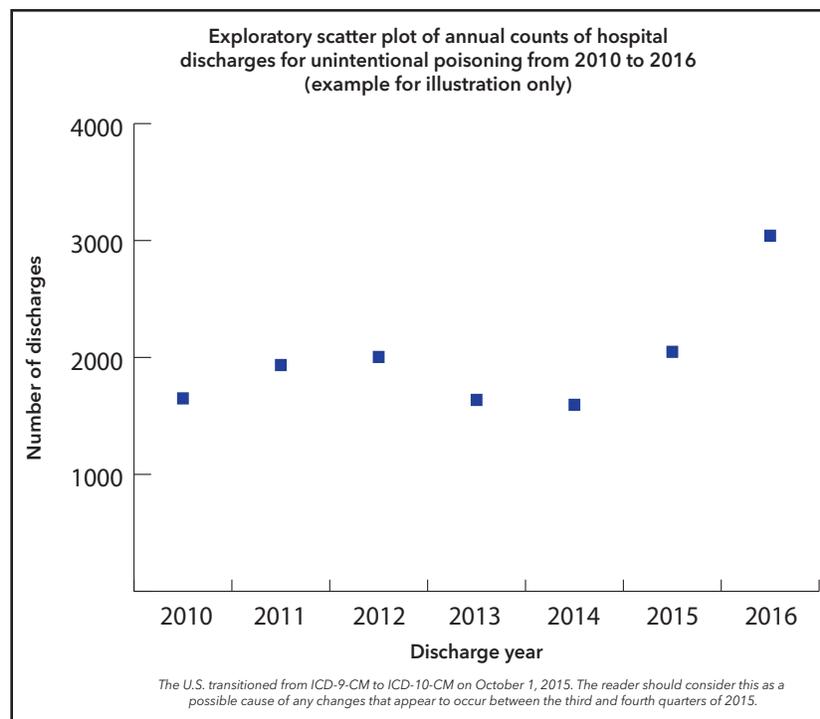
To further explore this increase, Figure 8 shows an exploratory plot of the same data by quarter for 2013 to 2016. While the number of hospital discharges for unintentional poisoning began increasing in the second and third quarters of 2015 (before the transition to ICD-10-CM occurred), the counts of hospital discharges for unintentional poisoning jumped up in the fourth quarter of 2015 (the first quarter after the transition). This increase in the fourth quarter of 2015 is much larger than any previous quarterly increase since 2013. The count for the first quarter of 2016 was similar to that for the fourth quarter of 2015. These two facts suggest the influence of a coding artifact.

Figure 8. Exploratory scatter plot of annual counts of hospital discharges for unintentional poisoning by quarter from 2013 to 2016

Exploratory scatter plot of annual counts of hospital discharges for unintentional poisoning by quarter from 2013 to 2016 (example for illustration only)

The U.S. transitioned from ICD-9-CM to ICD-10-CM on October 1, 2015. The reader should consider this as a possible cause of any changes that appear to occur between the third and fourth quarters of 2015.
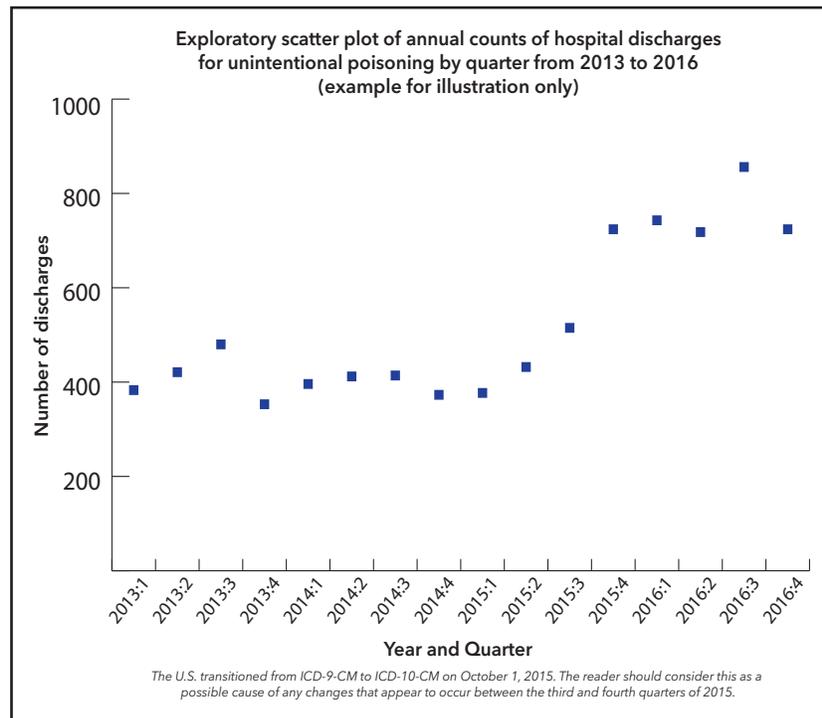
The results from the exploratory analysis displayed in Figure 8 on page 35 suggest that the increase from 2014 to 2015 could at least partially be an artifact of the transition to ICD-10-CM. Moreover, because only one quarter of 2015 hospital data was coded in ICD-10-CM, the full effect of any artifact that may exist will not be observed until 2016. Ultimately, the epidemiologist must make the decision whether to release this type of data and, if so, in what form. Figure 9 below demonstrates one possibility, using a stacked bar chart and colors to visually indicate the timing of the transition and the ICD-10-CM coded data. The stacked bar of results for 2015 clearly shows that the total count combines data coded in ICD-9-CM and in ICD-10-CM.

Figure 9. Stacked bar chart of annual counts from 2010 - 2016, showing 4th quarter split for 2015
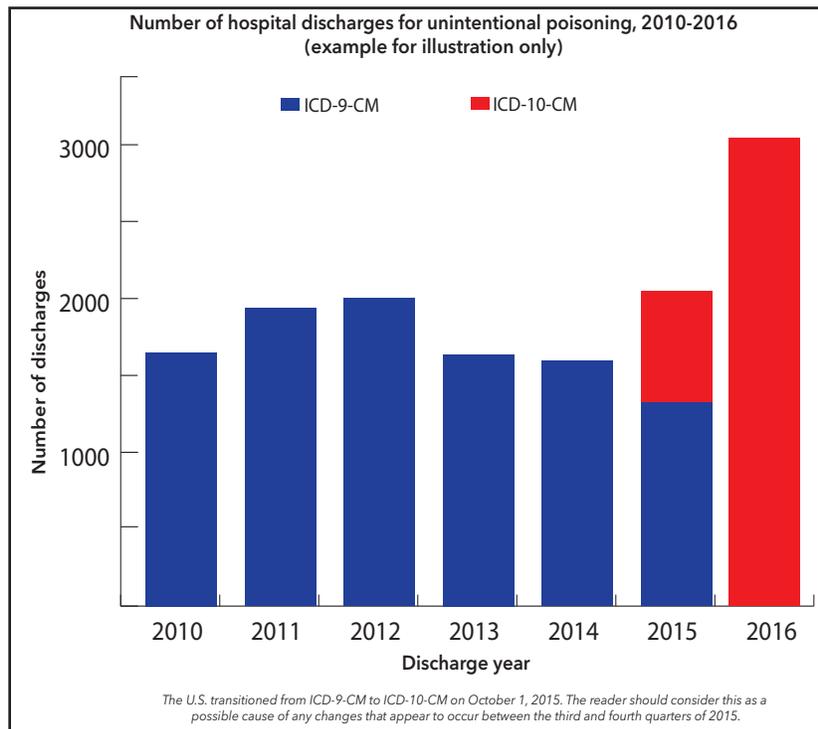
THE FUTURE AFTER ISW9

The ISW9 was charged with developing a guidance document to facilitate analyses and assessments of ICD-10-CM coded data. The guidance provided in this report is meant to provide a common starting place for epidemiologists and researchers working with ICD-10-CM coded data. Further work is needed before final recommendations can be made.

The transition from ICD-9-CM to ICD-10-CM for injury surveillance remains in its early stage. There is still much to learn about ICD-10-CM coded data and its implication for injury and violence surveillance. Local, state and national partners can contribute ongoing support and collaboration to increase the collective knowledge and to fully transition injury surveillance to ICD-10-CM. The challenge ahead is for injury epidemiologists to test the proposed CDC injury case definition and analysis frameworks along with the guidance provided in this ISW9 report. Increased knowledge of the impact of both the ICD-10-CM coding structure and the proposed CDC injury analysis tools will inform recommendations for future adjustments and finalization of case definitions and reporting frameworks. [4, 8, 20]

Staff at injury and violence prevention programs and other organizations can **conduct initial analyses**, share results, and develop best practices. Collaborative opportunities exist for further exploration by designing and executing specific multi-state analyses that test the validity or reliability of the proposed injury surveillance case definitions and specific external causes of injury. Similar to the guidance in this ISW9 report to implement the proposed matrix for external cause of injury, guidance for implementing injury diagnosis related groupings (such as traumatic brain injury, drug poisoning, and hip fracture) based on ICD-10-CM codes needs to be developed and tested.

The need to **broadly communicate** progress and findings among all partners in injury surveillance will increase as coded data based on ICD-10-CM become more widely available. Approaches to disseminate results and best practices might include:

- webinars;
- presentations at professional association annual meetings;
- presentations at meetings of state hospital associations and state health information

management associations;

- publication of results and recommendations; use of websites for communities of practice or special interest groups; and

- distribution through listservs.

Once testing and validation has been completed, **finalized recommendations** for the use of ICD-10-CM coded hospitalization and emergency department data for injury surveillance will be prepared, disseminated and implemented. Next steps after testing and validation include:

- finalizing and publishing CDC injury case definitions and the analytic frameworks (the matrices) for injury surveillance;

- updating the CDC injury indicators based on the final definitions and matrices; and

- seeking endorsement of the definitions and frameworks from professional organizations.

Intentional and comprehensive **facilitation and coordination** of this effort will be vital to ensure that injury epidemiologists have high quality surveillance tools to use well into the future. Multi-state approaches to improving surveillance and workforce capacity relative to the ICD-10-CM transition will be essential for ensuring a smooth transition.

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SPONSORING ORGANIZATIONS

About Safe States

The Safe States Alliance is a national non-profit 501(c)(3) organization and professional association whose mission is to strengthen the practice of injury and violence prevention. Our vision is to be the recognized leader and driving force in understanding and preventing injuries and violence.

To advance our mission and vision, the Safe States Alliance engages in activities that include:

- **Increasing** awareness of injury and violence throughout the lifespan as a public health problem;

- **Enhancing** the capacity of public health agencies and their partners to ensure effective injury and violence prevention programs by disseminating best practices, setting standards for surveillance, conducting program assessments, and facilitating peer-to-peer technical assistance;

- **Providing** educational opportunities, training, and professional development for those within the injury and violence prevention field;

- **Collaborating** with other national organizations and federal agencies to achieve shared goals;

- **Advocating** for public health policies designed to advance injury and violence prevention;

- **Convening** leaders and serving as the voice of injury and violence prevention programs within state health departments; and

- **Representing** the diverse professionals that make up the injury and violence prevention field.

About CDC

CDC works 24/7 to protect America from health, safety and security threats, both foreign and in the U.S. Whether diseases start at home or abroad, are chronic or acute, curable or preventable, human error or deliberate attack, CDC fights disease and supports communities and citizens to do the same. As the nation's health protection agency, CDC saves lives and protects people from health threats. To accomplish our mission, CDC conducts critical science and provides health information that protects our

nation against expensive and dangerous health threats, and responds when these arise.

The National Center for Health Statistics (NCHS) at CDC provides statistical information that will guide actions and policies to improve the health of the American people. As the nation's principal health statistics agency, NCHS leads the way with accurate, relevant, and timely data.

The National Center for Injury Prevention and Control (the Injury Center) at CDC has helped protect Americans from injuries and violence for more than 20 years. With a mission to prevent violence and injuries and to reduce their consequences, the Injury Center studies violence and injuries and the best ways to prevent them, applying science and creating real-world solutions to keep people safe, healthy, and productive. The Injury Center provides critical funding and technical assistance to states.

About CSTE

CSTE is a national non-profit organization and professional association of member states and territories representing public health epidemiologists, working to advance public health policy and epidemiologic capacity. We also provide information, education, and developmental support to practicing epidemiologists in a wide range of areas as well as expertise for program and surveillance efforts.

CSTE envisions using the power of epidemiology to improve the public's health, which we actively accomplish through our mission:

- Promote effective use of epidemiologic data to guide public health practice and improve health;

- Support effective public health surveillance and epidemiologic practice through training, capacity development, and peer consultation;

- Develop standards for practice; and

- Advocate for resources and scientifically based policy.

LIST OF COMMONLY USED ACRONYMS

CDC	Centers for Disease Control and Prevention
CSTE	Council of State and Territorial Epidemiologists
EDD	Emergency Department Data
HD	Hospital Discharge
HDD	Hospital Discharge Data
ICD	International Classification of Diseases
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification
ICD-10-CM	International Classification of Diseases, 10th Revision, Clinical Modification
ISW9	The Injury Surveillance Workgroup 9
NCHS	National Center for Health Statistics
NCIPC	National Center for Injury Prevention and Control

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SAFE STATES

APPENDICES

APPENDIX A:

ICD-10-CM RESOURCES (ARE YOU READY FACT SHEET)

Are You Ready for ICD-10-CM Injury Data?

Effective October 1, 2015, the Centers for Medicare and Medicaid Services require claims for health care in emergency departments and hospitals to be coded in ICD-10-CM. Get a head start on preparing to use ICD-10-CM coded data with these tips and resources before the release of the full ISW9 report in October 2016!

1. Identify the information you need.

- What is the basic structure of an ICD-10-CM code? What major changes occurred with ICD-10-CM codes for injury?
- Are there any implementation issues specific to injury coding?
- How will the claims database structure and variable format change? Will the availability of claims databases be delayed?
- Is there anything unique about databases for 2015, when claims were coded in ICD-9-CM for January through September and ICD-10-CM in October through December?
- When did my state workers compensation program implement ICD-10-CM ?

2. Ask relevant organizations in your state for the information.

- State trauma registry or cancer registry program
- State hospital association
- State chapter of the professional coder organization
- State Medicaid
- State Workers Compensation

3. Handle pertinent action items.

- **Update materials** that refer to ICD-9-CM to reflect ICD-10-CM. For example, update injury statutes, rules, data use agreements.
- **Update statistical programs** that analyze injury claims data.
- **Identify quarterly injury trends** based on ICD-9-CM to better understand differences identified using ICD-10-CM-coded data, when available for comparison. Generate quarterly counts and rates across multiple years using ICD-9-CM. In addition, assess seasonality and any other quarterly patterns.
- **Notify key users** of injury statistics about anticipated changes or delays.

See the links to helpful resources on the back page.

The Injury Surveillance Workgroup 9 (ISW9) Needs Your Help!

The ISW9 is preparing a guidance document on methods to analyze and report injury diagnoses and external causes coded in ICD-10-CM.

- **Volunteer to give feedback on these draft methods from March to May 2016.**
- Look for the full ISW9 report with final methods in October 2016!

To learn more about ISW or to view previous reports, click here.

SAFE STATES

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Helpful resources for transitioning to ICD-10-CM

ICD-10-CM Transition Materials	• www.cdc.gov/nchs/icd/data/CDC_ICD-10_Transition_FactSheet_12_2013.pdf • Resources: www.cdc.gov/nchs/icd/icd10cm_pcs_resources.htm • Training webinars: www.cdc.gov/nchs/icd/icd10cm_pcs_trainings.htm • Talk: www.hcup-us.ahrq.gov/datainnovations/icd10_transitioning_pres.jsp
ICD-10-CM Coding Manual & General Equivalence Mappings	• From NCHS: www.cdc.gov/nchs/icd/icd10cm.htm • From CMS: www.cms.gov/Medicare/Coding/ICD10/2016-ICD-10-CM-and-GEMs.html
Injury Matrices	• Proposed ICD-10-CM external cause matrix: http://www.cdc.gov/injury/wisqars/pdf/icd-10-cm_external_cause_injury_codes-a.pdf • Proposed ICD-10-CM injury diagnosis matrix http://www.cdc.gov/nchs/data/nhsr/nhsr089.pdf
Coding Education & Documentation	• AHIMA Clinical documentation tips for ICD-10-CM, including injuries and external causes and other resources: www.ahima.org/topics/icd10 • AHA Central Office FREE webinars: www.ahacentraloffice.org • Coding Clinic can be purchased from the American Hospital Association: http://www.ahacentraloffice.org/codes/products.shtml • Free "Code This" monthly case studies: www.optumcoding.com/Codethis/?archive=2013 • Video by CMS, AHA, and AHIMA that reviews coding basics - valid versus invalid codes, coding examples and resources, how to submit coding questions: www.youtube.com/watch?v=Mv2BiBccEcU&feature=youtu.be • "Road to 10: The Small Physician Practice's Route to ICD-10" FREE webcasts by physician/coder teams on specialty areas (obstetrics, orthopedics, internal medicine, pediatrics, etc.): http://www.roadto10.org/
Coding Issues	• ICD-10-CM coding questions can be submitted to AHA Coding Clinic online: www.codingclinicadvisor.com • Problems with the ICD-10-CM code sets can be sent to Medical Systems Administrator for National Center for Health Statistics: Nchsicd9CM@cdc.gov • Coordination and Maintenance Committee for proposals of new codes: www.cdc.gov/nchs/icd/icd9cm_maintenance.htm
General Resources	• www.cms.gov/Medicare/Coding/ICD10/ • www.cdc.gov/nchs/icd.htm

APPENDIX B: LINKS TO SAS PROGRAMS AND OTHER TOOLS

http://www.cdc.gov/nchs/injury/injury_tools.htm

APPENDIX C: CONDUCTING A MEDICAL RECORD REVIEW

After applying the proposed matrix of injury causes and displaying results, epidemiologists might identify a need to investigate the effects of the ICD-10-CM coding system on specific causes of injury. [1, 2, 3] A medical record review is one approach to investigating the effects. This type of review can provide information on the physician documentation used to assign the ICD-10-CM codes and the quality of coding. This appendix describes the common purposes of a medical record review as well as main activities, relevant knowledge areas, and skills needed. It highlights a few considerations that inform decisions about resource requirements and offers suggestions for meeting staffing needs. This information will be most useful to a program with public health authority to conduct a review and some experience in conducting a review, and when an in-depth investigation is warranted, such as assessing sensitivity of a proposed case definition based on ICD-10-CM codes for injury diagnoses or external causes of injury.

Purpose of a medical record review

A state or local injury and violence prevention program must first determine if there is a need for additional information to better understand injury results or to prevent misinterpretation. As described previously in the body of the ISW9 report, applying the proposed injury matrices, running quarterly and annual trend analyses for periods that span both ICD-9-CM and ICD-10-CM coding schemes, and displaying results graphically can lead to questions about the data that a medical record review is well suited to answer. [3]

Common purposes of a medical record review related to ICD-10-CM are:

1. ***To assess the accuracy of coding***
   Does the physician documentation of injuries support the ICD-10-CM code that the hospital coders assigned? In accordance with ICD-10-CM guidelines, coding professionals must assign ICD-10-CM codes based on physician documentation.

2. ***To assess a case definition***
   How accurate is the ICD-10-CM case definition? What is the sensitivity and positive predictive value of a case definition or a group of codes? If a state has a state-specific case definition that

differs from a CDC definition, the injury epidemiologist might want to assess it. A state might want to evaluate a specific injury classification (e.g. traumatic brain injury, unintentional falls) from the proposed injury diagnosis or external cause matrix. [1, 4]

3. **To understand new concepts and structural changes in ICD-10-CM**
   As mentioned previously, the ICD-10-CM coding system introduces new concepts not found in ICD-9-CM. For example, the 7th character of an ICD-10-CM code indicates the type of health care encounter: initial encounter, subsequent encounter, or sequelae. *How does using the initial encounter information impact injury rates? How accurate is this 7th character of the ICD-10-CM injury codes in an electronic file of data from emergency department visits or hospitalizations?*

4. **To create a dual-coded data set (each medical record coded in both ICD-9-CM and ICD-10-CM) to calculate comparability ratios**
   How comparable are the counts of a particular type of injury (e.g. assault injury) based on the ICD-9-CM and ICD-10-CM matrices? Is there a need to know the comparability ratios? A medical record review to create a dual-coded data set involves reviewing the same original physician medical documentation and coding the injury diagnoses and/or external causes in ICD-9-CM and ICD-10-CM. If an objective of the review is not to calculate a robust measure of sensitivity, the review to create a dual-coded data set does not need to be extensive. Additional time is needed to determine the principal diagnosis (i.e., the condition identified after study by the attending physician or nurse as the reason the patient is being admitted). After the same medical information has been coded in ICD-9-CM and ICD-10-CM, then the epidemiologist can count the causes of interest using both coding schemes and calculate the ratio by dividing the number of cases based on ICD-10-CM by the number of cases based on ICD-9-CM. This calculation can be repeated for each specific type of injury of interest. A ratio of one means that the two coding systems produced the same number of counts and therefore the net effect of the new coding system is negligible. A comparability ratio can be used to adjust statistics based on the two coding systems so that they are comparable, or an epidemiologist can simply provide the comparability ratios as a note in temporal displays of data. For more details on the calculation and application of comparability ratios, see Anderson et al. [5].

Key considerations

Use existing dual-coded data sets, if available: Instead of reviewing records to create a dual-coded data set, an epidemiologist could assess ICD-10-CM coding by analyzing existing dual-coded electronic records where a professional coder assigned both ICD-9-CM and ICD-10-CM codes based on the same physician documentation in a medical record. Hospitals might have dual-coded data from the training and testing phase of ICD-10-CM. A hospital association in a state, the state health department or state Medicaid agency might have dual-coded data. Analysis of a dual-coded data set could answer specific questions raised by the injury trend analyses described previously. [3] It could also limit the scope of a medical record review to outliers identified in the analysis of dual-coded data. Creating a dual-coded file from a random sample of all emergency department visits or hospitalizations might be cost prohibitive for an injury and violence prevention program, due to the expected small propor-

tion of the records having an injury diagnosis. For example, to create 100-150 injury records with dual codes, an injury and violence prevention program might need to review 1,000 medical records. Using a random sample of all emergency department visits or hospitalizations is necessary, if the goal is to identify records identified by one coding system but not the other. A more efficient way to create a sample of dual-coded records that can allow an epidemiologist to identify injury records unique to one coding system might be to have a professional coder assign ICD-9-CM codes (based on the physician documentation in the medical records) for a random sample of injury records identified using ICD-10-CM codes. Then the professional coder would assign ICD-10-CM codes for a random sample of injury records identified using ICD-9-CM codes.

Public health authority: The state or local health department must have the public health authority to obtain without patient consent medical record data for the investigation of injuries. If it does not, an alternative is to ask hospitals to conduct a review as part of its internal quality improvement studies or to partner on a research study and pursue review and approval from the Institutional Review Board (IRB) of the hospitals and the health department. This alternative, having hospitals review and assign codes, might be more efficient and effective, because professional coders are very experienced with ICD-9-CM and ICD-10-CM. Having hospitals assign codes might be preferable, because it replicates the usual method for assigning diagnosis codes and external causes that describe health care encounters in emergency departments and inpatient wards of hospitals.

Possible options to limit the size of the medical record review, including sampling: Though a medical record review can serve multiple purposes, **limiting the purpose** can limit the scope and size of a review. The more specific the question about the implementation of ICD-10-CM, the narrower the scope of the medical record review can be. A narrow scope can reduce the time needed for data collection, which reduces cost. Additional analyses and linking data sets can provide information to narrow the scope of the review even further and can describe the possible set of medical records from which to sample.

There is often a need to **sample medical records** related to injuries, because the total number of records is too many to afford the time and cost to review all of them. For example, in a state with a population of 5 million, there can be 25,000 to 30,000 injury-related hospitalizations and 315,000 to 350,000 emergency department visits related to injuries, depending upon whether the selection of records was based on only a principal diagnosis of injury or a secondary diagnosis of injury. A common method to ensure that the sample of medical records represents the total (the population) without distortion or bias is random sampling. Given that the medical record reviews of interest pertain to ICD-10-CM coding, the injury epidemiologist might want to consider if there are patient or hospital characteristics or some other factor that would increase or decrease the difficulty in fully documenting and coding a specific injury or cause of injury. Example characteristics solely to illustrate this point could be the age of the patient (such as the very young or old where developmental and cognitive issues make self-reporting a detailed cause of injury difficult) or the size of the hospital (which might influence in-hospital coding versus out-sourced coding or the complexity of the medical condition of

patients.) If so, the injury epidemiologist could group records by this characteristic into groups (strata) and select a stratified random sample (select records within each stratum) as a way to reduce variance and increase precision of the estimates from the sample. [6, 7] Consulting a professional coder about possible factors influencing ICD-10-CM coding related to injury and their causes is critical.

Analyzing quarterly trends by hospital, hospital system, or hospital size (which can be based on the number of licensed beds) might narrow the focus of the record review to a few hospitals or a hospital system.

Another way to limit the number of records to review is by **linking databases**. This approach requires a second data set which is known to have high quality ICD-10-CM coding. For example, an injury and violence prevention program could link injury records from the electronic file of emergency department visits or hospitalizations (administrative data) to the state or local trauma registry. Analysis of the linked data would be limited to ICD-10-CM codes for trauma diagnoses and external cause of trauma, not all injuries. For example, most trauma registries do not include cases of drug poisoning. To identify potential missed cases, an analysis could focus on four groups of records: 1) trauma "cases" found in the administrative data file using ICD-10-CM codes but not found in the trauma registry, 2) cases in the trauma registry but not found in the administrative data at all, 3) cases in the trauma registry that matched to a non-trauma record from the administrative file, and 4) cases in the trauma registry that matched to a trauma record from the administrative file. To assess inter-rater reliability among hospital coders and trauma registrars with regard to the specific trauma diagnosis or external cause of trauma, an epidemiologist could analyze the trauma cases that matched from the two sources and calculate a percent agreement between the two sources about the specific trauma diagnosis or the external cause of injury, for example, and then calculate a kappa statistic, a measure of the degree of non-random agreement, in this case, between the coders or reviewers assigning an ICD-10-CM code. Kappa indicates the reliability of the ICD-10-CM coding. [8] To provide information needed to calculate sensitivity, specificity, and/or predictive value positive, the review of the original source medical records could be limited to a stratified random sample of records where the four groups above represent each stratum. [9, 10]

After these considerations

If the epidemiologist and injury and violence prevention program identify a need and specific purpose for a medical record review, the next step is to determine the usefulness and feasibility of a review. It is helpful to outline upfront all parties who will use the findings and for what purpose. If anticipated use is limited, the injury and violence prevention program may want to reconsider undertaking the review. An understanding of the major activities involved, the knowledge and skills needed, and the resource requirements will inform a decision about feasibility.

Major activities of a medical record review

A medical record review can be a large undertaking. The entire process, including planning, can take substantial time. A full timeline and work plan for a medical record review should cover the following major activities:

- writing and approving partnership agreements that delineate roles and responsibilities, including data use agreements that govern access to and use of identified data;

- developing methods (including protection of confidential information and data security, sampling scheme, sample size calculations, data collection form, database and instruction manual for the data collection);

- requesting an IRB review and obtaining IRB approval or determination that the review is exempt;

- pilot testing or requesting expert feedback of the data collection form, manual, and database;

- revising the methods (including content to be collected), if needed;

- hiring and training medical record reviewers;

- collecting data (onsite at hospitals or by having records sent to the injury and violence prevention program);

- conducting analyses (including completing tables and graphs of results);

- interpreting results;

- summarizing findings; and

- disseminating the results to key audiences and using them.

A fixed deadline for results can affect planning, staffing level, and other resource needs. An injury and violence prevention program can extend a self-imposed deadline. However, sometimes department leadership, a state's hospital association, or a large hospital system in the jurisdiction has a specific deadline, such as an upcoming IT or electronic health record conversion. Compared to a longer time period for a review, a shorter time period requires either more staff time devoted to reviewing records or a decrease in the sample size, which in turn decreases the precision of the results. Additionally, more complex study questions generally require more information from the medical records. This additional information could increase the total time required for data collection, unless the sample size is decreased. Table 8 addresses the impact of common parameters on resource requirements associated with a medical record review.

Table 8. Impact of Common Parameters on Resource Requirements

Parameter	Level	Impact	Other Considerations
Project time period	Short	Increased staff time to meet tight deadlines; all software, approvals for remote access to electronic records, and non-staff resources must be available	Can other projects be delayed so that key staff can devote full time to the review? Are the checkpoints for quality clear to all staff?
	Long	Staff might be able to work part-time on the review, if the project starts on time	A longer time frame might allow for a pilot test, which can make the review go more efficiently.
Level of precision	Narrow	Sample size must be larger	
	Broad	Sample size can be smaller	Are precise estimates needed for specific subgroups or stratified results of the main finding?
Number of participating hospitals	Few	Might decrease time to request records and travel time; could reduce representativeness of results	
	Many	Increased time to request and re-request records; increased travel time and costs; findings may be more representative	Can increase time to obtain approvals for remote access and learn another electronic system.
Type of medical records	Paper	Can take more time to access records, if hospitals outsource medical records storage	Can be faster to navigate than electronic records; need a secured fax/email system if not reviewing onsite; need to shred copies
	Electronic	Can save travel time if the electronic record is indexed, scanned portions are readable, and navigation is clear	What effort is needed to gain access, get inside firewall, and maintain security? Training requirements? Hardware or system requirements from remote location?

Relevant knowledge and skills needed for a medical record review

Staff members need specific knowledge and skills to effectively plan and conduct a medical record review. Needed knowledge includes an understanding of:

- state statutes and rules related to accessing medical records without patient consent;

- data sources of hospital claims for inpatient care and emergency department visits;

- mechanisms to protect confidentiality and privacy;

- clinical terminology and typical documentation in medical records;

- health care systems, including health information management and contacts for release of information;

- relevant content to collect from a medical record; and

- coding guidelines related to the International Classification of Diseases (ICD-10-CM and perhaps ICD-9-CM).

Also relevant is staff experience that demonstrates strong skills in:

- project management;

- applied biostatistics (e.g. power calculations or calculating sample sizes, identifying an appropriate sample, analyzing results);

- technical writing (e.g. creating instructions for a medical record reviewer; reporting on analysis results);

- database development, data entry, and storage;

- data quality assurance; and

- engagement of stakeholders, partners, users or hospitals.

Staffing for a medical record review related to ICD-10-CM can consist of a coding professional and statistician/epidemiologist/data analyst. If a state or local injury and violence prevention program does not have existing staff with the necessary knowledge and skills or they are unavailable to work on the medical record review, then a program could consider hiring temporary staff or contractors with the requisite expertise. Specific technical expertise can be added by partnering with other groups within the agency or with local universities with public health faculty and graduate students. A local college with an associate degree in medical record technology or a bachelor degree in health information management is another source for students or recent graduates to hire. The state's hospital association and state professional coding organization might provide expertise as an engaged partner or suggest ways to find affordable, temporary staffing.

Other Costs

Consider the costs of non-staff resources, such as ICD coding manuals, database and statistical analysis software, encryption software, laptops, encrypted email services, and secured portals to access electronic records remotely. Budget for travel costs (mileage, parking, lodging for out-of-town stays overnight) and costs to reimburse hospitals for providing records.

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Additional Resources for Conducting a Medical Record Review

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