Implementing the International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) External Cause of Injury Matrix

Background

Due to the number and complexity of ICD-10-CM external cause codes, it would be challenging and inefficient to use SAS "IF-THEN" statements to assign the more than 3,500 ICD-10-CM external cause codes to cells in the external cause matrix. Instead, predefined SAS format libraries are provided to reflect the different pieces of information captured in the ICD-10-CM codes. One format file assigns a description of the injury, a second format file assigns the mechanism of injury and a third format file assigns the injury intent. After injury cases are identified by an analyst, these formats can be used to classify injuries within the external cause matrix. Excel spreadsheets are also provided to convey this information for reference purposes and use outside of SAS. The SAS formats are created by the National Center for Health Statistics (NCHS) based on the information contained within the spreadsheets. Both the Excel spreadsheets and the SAS formats contain the same information, and may be used together.

The Excel spreadsheets and SAS formats will be updated yearly to reflect injury-related code changes introduced by the ICD-10-CM Coordination and Maintenance Committee. These yearly changes are noted in the Excel spreadsheets. In the spreadsheets, codes that have been deleted are indicated in red, codes that have been added are indicated in green and codes that have been moved to a different cell within the matrix are indicated in blue. These modifications are also recorded in the change log. Generally, any changes made to the ICD-10-CM go into effect at the beginning of the federal fiscal year, or October 1st. The year the code became active is noted in the field labeled 'CODE WAS ACTIVATED IN ICD-10-CM ON OCT 1 OF (YR)' and can be used to search for newly implemented codes each year. Additionally, codes that have since been deleted by the Coordination and Maintenance Committee will be left in both the Excel spreadsheets and the SAS formats, but the deletion will be noted under the "NOTES" column in the spreadsheets. This means that analysts may use the same formats and spreadsheets for multiple years of data – eliminating the need to match specific years of data with specific formats and spreadsheets. Importantly, multiple years of data should be analyzed with the same (most current) formats and spreadsheets for consistent code categorization, and to mitigate any changes made to the external cause matrix.

Table 1. National Center for Health Statistics files for implementing the ICD-10-CM external cause of injury matrix (Flies available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/injury/tools/)

File name	File description
FINAL 2020 ICD-10-CM_Poisoning_Matrix ALL codes 102020.xlsx	Spreadsheets with the full list of poisoning-related codes and associated descriptions, mechanism, and intentionality information.
FINAL 2020 ICD-10-CM_Non-Poisoning_Matrix ALL codes 102020.xlsx	Spreadsheets with the full list of non-poisoning-related codes and associated descriptions, mechanism, and intentionality information.
Descript_fmt64b.sas7bcat	SAS format (64-bit) file that provides injury code descriptions.
Mechanism_fmt64b.sas7bcat	SAS format (64-bit) file that provides injury mechanism information.
Intent_fmt64b.sas7bcat	SAS format (64-bit) file that provides injury intentionality information.
Descript_fmt64b.sas7bcat	SAS format (32-bit) file that provides injury code descriptions.
Mechanism_fmt64b.sas7bcat	SAS format (32-bit) file that provides injury mechanism information.
Intent_fmt64b.sas7bcat	SAS format (32-bit) file that provides injury intentionality information.
Tech Notes - Changes to the matrix 102020	A spreadsheet that documents changes to the external cause matrix including codes that were added, deleted, or moved.

Use of the SAS Formats

The formats are intended for use with cleaned administrative medical data, and after cases have been selected as injuries for classification within the matrix. The formats are designed for the first six characters of the ICD-10-CM code, or codes that are missing the 7th character for type of encounter. Codes should be left justified, without decimals or spaces, and all letters should be upper case. The direct output of the intentionality and mechanism variable formats, as well as the possible injury matrix classifications, are shown in Table 2.

Once the data are prepared and the formats are applied, the mechanism and the intent of the injury can be reported to cross tabulate cells of the matrix. The formats can be hard coded into the dataset, removing the need to reference them with each data import. Additionally, the formats include a numbering schema that allows for the substringing of the first 5 characters of the mechanism and the first 2 characters of the intentionality to create numeric fields. In large datasets file size may be an issue, and therefore working with smaller numeric fields that can be formatted may be more desirable and efficient. The optional code to facilitate this is listed below.

Table 2. External cause of injury matrix formats reflecting Intentionality and Mechanism

Mechanism (Format=*Mechf.*)	Intentionality (Format=*Intentf.*)				
	01.Unintentional	02.Intentional Self-Harm	03.Assault	04.Undetermined	05.Legal intervention/War
1.00.Cut/Pierce	X	X	X	X	X
2.00.Drowning/ Submersion	X	X	X	X	…
3.00.Fall	X	X	X	X	…
4.10.Fire/Flame	X	X	X	X	X
4.20.Hot object/ substance	X	X	X	X	…
5.00.Firearm	X	X	X	X	X
6.00.Machinery	X	…	…	…	…
7.11.MVT-Occupant	X	X	X	…	…
7.12.MVT-Motorcyclist	X	…	…	…	…
7.13.MVT-Pedal cyclist	X	…	…	…	…
7.14.MVT-Pedestrian	X	…	X	…	…
7.15.MVT-Other	X	X	…	…	…
7.16.MVT-Unspecified	…	…	…	X	…
7.20.MV-Non-traffic	X	X	…	…	…
7.30.Pedal cyclist, other	X	…	…	…	…
7.40.Pedestrian, other	X	…	…	…	…
7.50.Other Land Transport	X	X	X	…	…
7.60.Other Transport	X	X	X	…	X
8.10.Bites and Stings, nonvenomous	X	…	…	…	…
8.20.Bites and Stings, venomous	X	X	X	X	…
8.30.Natural/ Environmental, other	X	X	X	X	…
9.00.Overexertion	X	…	…	…	…
10.10.Poisoning, Drug	X	X	X	X	…
10.20.Poisoning, Non-drug	X	X	X	X	X
11.00.Struck by/against	X	X	X	X	X

12.00.Suffocation	X	X	X	X	X
13.00.Other Specified, Child/Adult Abuse	...	...	X	...	...
14.00.Other Specified, Foreign Body	X	...	...	...	...
15.00.Other Specified, Classifiable	X	X	X	X	X
16.00.Other Specified, Not Elsewhere Classifiable	...	X	X	X	X
17.00.Unspecified	X	X	X	...	X

'X' Indicates that valid codes exist for classification into this cell.

'...' Indicates that valid codes do not currently exist for classification into this cell.

Instructions for using the formats

This sample code assumes that: the operating system is a 32-bit system (for a 64-bit system please use the provided formats that end in ('_FMT64B'), a working dataset named 'ICD10_Injury_Clean' already exists, that a field with a valid external cause of injury code named 'EX_CAUSE' has been created, that this field contains an external cause code ready for classification within the matrix, and that the code in the EX_CAUSE field meets the conditions described above (left justified, with no spaces/decimals, all letters upper case, and with only the first six digits).

Step 1: Lookup and import the formats

```
** Create a library for the SAS format files, and place the files in that folder;
Libname Myfmtlib "Z:\ ICD10CM Formats (file path) ";

** Read in the SAS format files for injury description, mechanism, and intent;
Options Fmtsearch=( Myfmtlib.DESCRIPT_FMT32B, Myfmtlib.MECHANISM_FMT32B, Myfmtlib.INTENT_FMT32B); Run;
```

Step 2: Applying the formats

```
Data ICD10_Injury_Classified_Cases;
        Set ICD10_Injury_Clean;

        Intent=PUT((EX_CAUSE), $INTENTF.);           ** Apply format for the intentionality;
        Mechanism=PUT((EX_CAUSE), $MECHANISMF.);      ** Apply format for the mechanism;
        Descript=PUT((EX_CAUSE), $DESCF.);            ** Apply format for a description of the code;
Run;
```

Step 3 (*Optional*): Creating numeric variables for mechanism and intent:

```
** Substring the Intent and Mechanism variables;
Data ICD10_Injury_Classified_Cases_Numeric;
        Set ICD10_Injury_Classified_Cases;

        Intentn=Input(Substr(Intent,1,2),2.0);
        Mechn= Input (Substr (Mechanism,1,5),5.2);
Run;

** Temporary Formats For use with Variables "Intentn" And "Mechanism";
Proc Format;
Value Intf        1='Unintentional'
                  2='Self-Harm'
                       3='Assault'
                       4='Undetermined'
                       5='Legal/War';
Value Mechf        1.0= 'Cut/Pierce'
                   2.0= 'Drowning/Submersion'
                        3.0= 'Fall'
```

```
                    4.1= 'Fire/Flame'
                    4.2= 'Hot Object/Substance'
                    5.0= 'Firearm'
                    6.0= 'Machinery'
                    7.11='MVT-Occupant'
                    7.12='MVT-Motorcyclist'
                    7.13='MVT-Pedal cyclist'
                    7.14='MVT-Pedestrian'
                    7.15='MVT-Other'
                    7.16='MVT-Unspecified'
                    7.2= 'Mv Non-Traffic'
                    7.3= 'Pedalcyclist, Other'
                    7.4= 'Pedestrian, Other'
                    7.5= 'Other Land Transport'
                    7.6= 'Other Transport'
                    8.1= 'Bite And Stings-Nonvenomous'
                    8.2= 'Bite And Stings-Venomous'
                    8.3= 'Natural/Environmental, Other'
                    9.0= 'Overexertion'
                    10.1='Poisoning: Drug'
                    10.2='Poisoning: Non-Drug'
                    11.0='Struck By/Against'
                    12.0='Suffocation'
                    13.0='Other Specified, Child/Adult Abuse'
                    14.0='Other Specified, Foreign Body'
                    15.0='Other Specified, Classifiable'
                    16.0='Other Specified, Not Elsewhere Classifiable'
                    17.0='Unspecified';
Run;

Proc Freq;
Table Intentn Mechn;
Format Intentn Intf. Mechn Mechf.;
Run;
```

Additional technical notes

There are two sets of formats that are provided, one for systems operating 64-bit versions of SAS, and others operating 32-bit versions. These are identified in the names of the formats as either '_FMT32B' for 32-bit systems, or '_FMT64B' for 64-bit systems.

Additional resources

The report containing the final external cause-of-injury matrix "The International Classification of Diseases, 10th Revision, Clinical Modification (ICD–10–CM) external cause-of-injury framework for categorizing mechanism and intent of injury." Available at: https://www.cdc.gov/nchs/data/nhsr/nhsr136-508.pdf

For historical/background information, see:

The Injury Surveillance Workgroup 9 (ISW9) report "The Transition from ICD-9-CM to ICD-10-CM: Guidance for analysis and reporting of injuries." Available at: https://safestates.site-ym.com/?ISW

The report "Proposed Framework for Presenting Injury Data using ICD10-CM External Cause of Injury Codes". Available at: https://www.cdc.gov/injury/wisqars/pdf/ICD-10-CM_External_Cause_Injury_Codes-a.pdf

Contact the NCHS Injury Statistics Program

For questions, suggestions, or comments concerning this document, the excel spreadsheets, or the SAS formats please contact the Injury Statistics Program at NCHS at nchsinjury@cdc.gov.

Resource Updates and Changes

Date	Update/Change
12-31-2019	Files have been posted to reflect the revised external cause matrix.
10-01-2020	Files have been updated to reflect changes for federal fiscal year 2021.
10-20-2020	Files have been updated to correct for an improperly formatted code.
	If formats were downloaded between 10-01-2020 and 10-19-2020, there was an error that may impact functionality, please redownload the formats
11-01-2021	Files have been updated to reflect changes for federal fiscal year 2022. This includes the addition of R45.88 from outside the injury chapters.