IMPLEMENTING THE EXTERNAL CAUSE MATRIX FOR INJURY MORBIDITY – NORTH CAROLINA EMERGENCY DEPARTMENT DATA – JANUARY 2015 – MAY 2015/JANUARY 2016 – MAY 2016

A Report on the Transition to ICD-10-CM

Prepared by

Katherine Harmon[1,2], MPH
Clifton Barnett Barnett[1], MSIS
Stephen Marshall1Marshall[2], PhD
Anna Waller[1,2], ScD

Submitted
July 27, 2016

[1]Carolina Center for Health Informatics, University of North Carolina at Chapel Hill
[2]Injury Prevention Research Center, University of North Carolina at Chapel Hill

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

INTRODUCTION

The North Carolina Division of Public Health (NC DPH) is currently participating in a Centers for Disease Control and Prevention (CDC) funded project to improve the quality of injury surveillance data in North Carolina (NC) and other states. This project is tasked with improving the quality of injury coding in emergency department (ED) data for the purposes of better statewide injury surveillance. In addition to state-specific projects, NC DPH has collaborated with other CDC funded states (Massachusetts, Colorado, and Utah) on consensus multi-state projects. In past years, the NC SQI project has tackled such disparate projects as child maltreatment, opioid overdoses, and unintentional falls among others. In the fifth, and final, year of the NC SQI Project, the focus has been on the transition on October 1, 2015, from the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) to the *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM).[1,2]

Beginning in 1979, ICD-9-CM has been used to code morbidity data for the primary purpose of hospital billing and administration. In addition to their primary purpose, these codes have served an important role in public health surveillance, including injury surveillance.[3] The Injury Control and Emergency Health Services section of the American Public Health Association and the International Collaborative Effort (ICE) on Injury Statistics developed an External Cause of Injury Matrix to organize injury morbidity and mortality data according to injury intent (unintentional, intentional, undetermined, etc.) and injury mechanism (motor vehicle crash, fall, poisoning, etc.) using ICD-9 (mortality) and ICD-9-CM (morbidity) codes. The External Cause of Injury Matrix was used extensively by state and national organizations for injury surveillance. In 1999, the United States adopted ICD-10 for classifying mortality data and the External Cause of Injury Matrix was updated to accommodate ICD-10 codes; however, the United States continued to use the ICD-9-CM External Cause of Injury Matrix for injury morbidity data until October 1, 2015.[4,5]

The transition from ICD-9-CM to ICD-10-CM on October 1, 2015, constituted a major change in the way that injuries are classified in hospital administration data. These changes may have a considerable impact on injury surveillance in ways that were not originally foreseen. Some of the differences in ICD-9-CM versus ICD-10-CM that may impact injury counts as well as comparability are listed below:

- Increase in the number of codes from 14,000 (ICD-9-CM) to 70,000 (ICD-10-CM).
- Increase in injury detail and specificity (ICD-10-CM).
- Addition of a 7th character that indicates whether a visit is an initial encounter, a subsequent encounter, or due to sequela (ICD-10-CM).
- The external cause of injury (intent/mechanism) is captured by codes that begin with the letter "E" (ICD-9-CM) versus codes that begin with the letter "V", "W", "X", and select "Y" and "T" codes (ICD-10-CM).
- Increase in the length of codes from 3-5 digits/characters (ICD-9-CM) to 3-7 digits/characters (ICD-10-CM).
- The addition of "X's" as placeholders in select codes (ICD-10-CM).
- In ICD-9-CM, poisonings/toxic effects of substances and suffocation/asphyxiation are coded with both a diagnosis code and an external cause of injury code. In ICD-10-CM, these injuries are coded with a single code that combines nature and intent/mechanism of injury.
- Decrease in the number of codes describing overexertion (ICD-10-CM).
- Increase in the number and specificity of codes describing child and adult abuse (ICD-10-CM).[3]

The National Center for Injury Prevention and Control (NCIPC) and the National Center for Health Statistics (NCHS) are in the process of finalizing the External Cause of Injury Matrix for Injury Morbidity for use with ICD-10-CM data. Due to the substantial changes in coding from ICD-9-CM to ICD-10-CM, it is important that CDC partners with end users, such as state health departments, to test this new matrix.[6]

North Carolina is unique in that it collects near real-time ED visit data from all 24/7 acute-care hospital affiliated civilian EDs as part of its syndromic surveillance system the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT). Although elements tied to hospital billing, such as ICD-10-CM diagnosis codes, may take longer to enter the NC DETECT system, most ED visits are assigned at least one diagnosis code within two weeks' post-visit. Therefore, the NC SQI project was able to obtain 2016 data for the months January-May, apply the ICD-10-CM External Cause Matrix for Injury Morbidity, and compare these data to 2015 ED visit data from the same calendar period.

Whenever possible, the NC SQI Project team followed the instructions for both the *ICD-9-CM* and *ICD-10-CM External Cause of Injury Matrices* and applied the accompanying SAS code as described; however, some methodologic changes were made due to the structure of the NC DETECT ED visit data.[5-8] All methodologic changes are documented in the Methods and Results section.

All results presented in this document are preliminary and reflect the April 24, 2016 draft for *Implementing the ICD-10-CM External Cause Matrix for Injury Morbidity*.   In addition, NC DETECT continues to update ED visits with diagnosis codes as these codes enter the system; therefore, the ED visit counts reported in this document may not reflect the counts reported upon the release of the static 2016 NC DETECT ED visit database in June 2017. Lastly, NC SQI researchers used the Practice Management Information Corporation (PMIC) ICD-9-CM and ICD-10-CM coding manuals as well as the Centers for Medicare and Medicaid Services (CMS) and the NCHS *ICD-10-CM Official Guidelines for Coding and Reporting* for assistance.[1,2,9]

METHODS AND RESULTS

1. Select emergency department records during a specified time frame for state residents.
    a. Selected all NC DETECT ED records during the period January 1, 2015 – May 31, 2015 for patients with a state residency listed as 'NC'.
        i. The total number of ED visits was 1,980,079.
    b. Selected all NC DETECT ED records during the period January 1, 2016 – May 31, 2016 for patients with a state residency listed as 'NC'.
        i. The total number of ED visits was 2,019,058.
    c. Figure 1 displays the total number of ED visits for the selected period (January – May) by month for the years 2015 and 2016.

Figure 1. Number of Emergency Department Visits by North Carolina Residents by Month -- North Carolina, January - May, 2015-2016
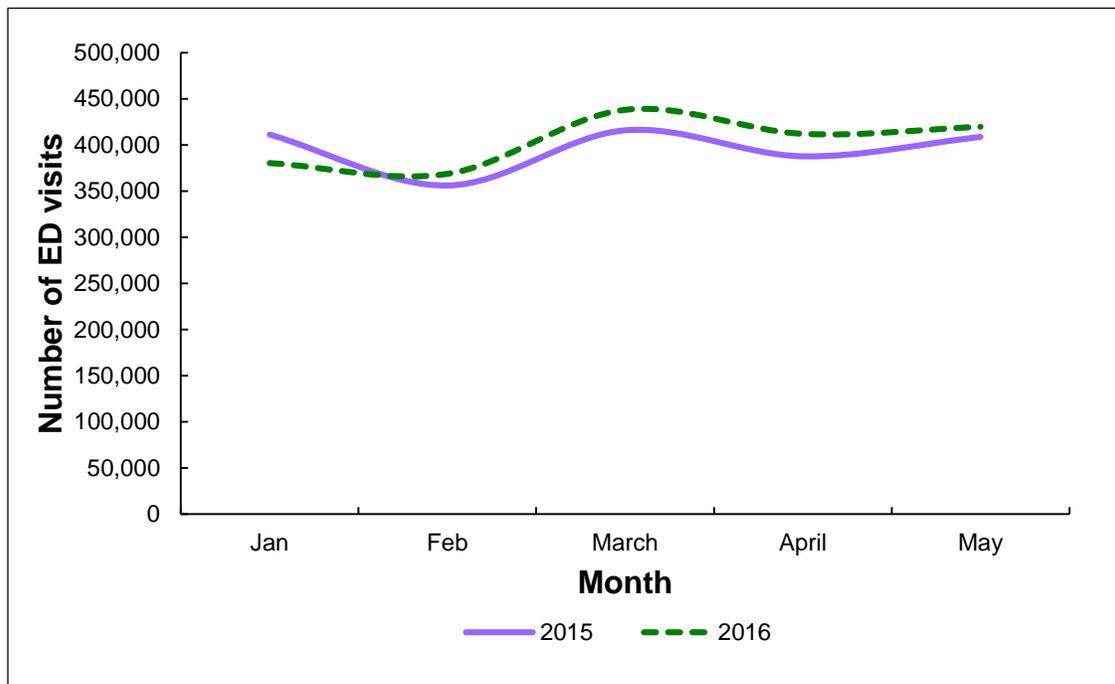
    d. There were some missing data during this period, especially for data elements tied to administration and billing.

        i. In 2015, 286,973 ED visits were missing diagnosis codes (14.5% of total visits).

        ii. In 2016, 425,211 ED visits were missing diagnosis codes (21.1% of total visits).

2. Select an injury subset from the entire emergency department data set.

    a. For 2015 data, select ED visits in which the first-listed diagnosis code is for an injury. The ICD-9-CM injury diagnosis codes are listed in Table 1.

Table 1. List of ICD-9-CM Injury and Poisoning Diagnosis Codes

ICD-9-CM Codes
800.00-909.2
909.4
909.9-994.9
995.50-995.59
995.80-995.85

    b. For 2016 data, select ED visits in which the first-listed diagnosis code is for an injury. Include all codes except codes that end in an "S" (Sequela); this includes codes that are missing a last character. The ICD-10-CM injury diagnosis codes are listed in Table 2.

Table 2. List of ICD-10-CM Injury and Poisoning Diagnosis Codes

ICD-10-CM codes*	Types of injuries
All S codes	Anatomic injuries
T07-T34	Foreign bodies, burns, corrosions, frostbite
T36-T50 with any 6th character except 5 or 6	Drug poisoning, except adverse effects and under-dosing
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
*First-listed diagnosis only. Any 7th character except "S" (sequela from previous injury).	

    c. Before final case selection (2016 data only), determine the frequency with which the various 7th characters appear in the first-listed diagnosis field for records in the injury subset.

        i. The final case selection includes all ED visits with injury diagnosis codes in the first position except for codes ending in "S". The "S" code indicates that the injury is due to "sequela." This character is used for complications or conditions that arise as a direct result of a condition, such as treatment for scar tissue after a burn.[8] According to the American Academy of Professional Coders, the most frequent sequela is chronic pain resulting from a past injury.[9] In the 2016 NC DETECT ED visit data set, there were zero ED visits with a first-listed injury diagnosis code that ended in "S". Table 3 displays the breakdown of qualifying injury ED visits by the frequency of the last character.

Table 3. Number of Emergency Department Visits with a First-Listed Injury Diagnosis Code Stratified by Last Digit/Character of Diagnosis Code– North Carolina, January – May, 2016

Last Digit/Character	No. of ED visits	Percent of ED visits	Description
A	169,702	93.5%	An 'A' indicates that the injury diagnosis code was assigned for an initial encounter in which the patient received "active" treatment for the condition[2]. Example: S61.316A - 'Laceration without foreign body of right little finger with damage to nail - initial encounter.'[2,9]
D	5,849	3.2%	A 'D' indicates that the injury diagnosis code was assigned for a subsequent encounter in which the patient has already received treatment for the acute injury and is presenting at the ED for routine or follow-up care. Example: S46.112D - 'Strain of muscle, fascia, and tendon of long head of biceps, left arm - subsequent encounter.'[2,9]
8	2,434	1.3%	All ED visits with codes ending in '8' belonged to the code T14.8 - 'Other injury of unspecified body region.' According to coding guidelines, this code should contain place-holders and a character in the last position.[2]
B	1,780	1.0%	A 'B' indicates that the injury diagnosis code was assigned for an initial encounter for an open fracture. Example: S62.639B - 'Displaced fracture of distal phalanx of unspecified finger - initial encounter for open fracture.'[2]
0	1,099	0.6%	Most ED visits with a code ending in '0' belonged to the code T149.0 - "Injury, unspecified', T30.0, 'Burn of unspecified body region, unspecified degree', and T31.0 - 'Burn involving less than 10% of body surface'. According to coding guidelines, these should contain place-holders and a character in the last position. In addition, some ED visits contained codes that were missing characters/digits to be considered a valid code. Example: S06.0.[2]
G	219	0.1%	A 'G' indicates that the injury diagnosis code was assigned for a subsequent encounter for a fracture with delayed healing. Example: S22.41XG - 'Multiple fractures of ribs, right side - subsequent encounter for fracture with delayed healing.'[2]
7	115	0.1%	Most ED visits with a code ending in a '7" belonged to the code T07 - "Unspecified multiple injuries'. This code is reportable as a three-digit code.
1	110	0.1%	Most ED visits with a code ending in a '1" belonged to the code T149.1 - "Suicide attempt' or T31.11 - 'Burns involving 10-19% of body surface with 10-19% third degree burns'. According to coding guidelines, these visits should contain place-holders and a character in the last position. In addition, some ED visits contained codes that were missing characters/digits to be considered a valid code. Example: S72.1.[2]
9	63	<0.1%	All ED visits with a code ending in '9' were missing characters/digits to be considered a valid code. Example: T50.9.[2]
P	39	<0.1%	A 'P' indicates that the injury diagnosis code was assigned for a subsequent encounter for a fracture with malunion. Example: S62.637P - 'Displaced fracture of distal phalanx of left little finger - subsequent encounter for fracture with malunion.'[2]
4	36	<0.1%	The most common code ending in a '4' was T30.4 - "Corrosion of unspecified body region, unspecified degree'. According to coding guidelines, this code should contain place-holders and a character in the last position. In addition, some ED visits contained codes that were missing characters/digits to be considered a valid code. Example: S22.4.[2]

E	24	<0.1%	A code ending in 'E' indicates that it was assigned for a subsequent encounter for open fracture type I or II with routine healing. Example: S82.832E - 'Other fracture of upper and lower end of left fibular - subsequent encounter for open fracture type I or II with routine healing.'[2]
C	23	<0.1%	A code ending in 'C' indicates that it was assigned for an initial encounter for open fracture type IIA, IIIB, or IIIC. Example: S82.851C - 'Displaced trimalleolar fracture of right lower leg - initial encounter for open fracture type IIA, IIIB, or IIIC.'[2]
3	21	<0.1%	All ED visits with a code ending in '3' were missing characters/digits to be considered a valid code. Example: S62.3.[2]
K	18	<0.1%	A 'K' indicates that the injury diagnosis code was assigned for a subsequent encounter for a fracture with nonunion. Example: S02.609K - 'Fracture of mandible, unspecified - subsequent encounter for fracture with nonunion.'[2]
2	17	<0.1%	All ED visits with a code ending in '2' were missing characters/digits to be considered a valid code. Example: S60.2.[2]
6	13	<0.1%	All ED visits with a code ending in '6' were missing characters/digits to be considered a valid code. Example: S62.6.[2]
M	4	<0.1%	A code ending in 'M' indicates that it was assigned for a subsequent encounter for open fracture type I or II with nonunion. Example: S72.002M - 'Fracture of unspecified part of neck of left femur - subsequent encounter for open fracture type I or II with nonunion.'[2]
5	2	<0.1%	All ED visits with a code ending in '5' were missing characters/digits to be considered a valid code. Example: S63.5.[2]
F	2	<0.1%	A code ending in 'F' indicates that it was assigned for a subsequent encounter for open fracture type IIIA, IIIB, or IIIC with routine healing. Example: S72.92XF - 'Unspecified fracture of left femur - subsequent encounter for open fracture type IIIA, IIIB, or IIIC with routine healing.'[2]
N	1	<0.1%	A code ending in 'N' indicates that it was assigned for a subsequent encounter for open fracture type IIIA, IIIB, or IIIC with nonunion. Example: S82.111N - 'Displaced fracture of right tibial spine- subsequent encounter for open fracture type IIIA, IIIB, or IIIC with nonunion.'[2]
Total	**181,571**	**--**	

d. For 2015 and 2016, there were 237,801 (12.0% of total visits) and 181,571 (9.0% of total visits) that contained a qualifying injury diagnosis code in the first position. Figure 2 displays the number of injury-related ED visits captured by NC DETECT for the months of January through May during 2015 and 2016.

Figure 2. Number of Emergency Department Visits with a First-Listed Injury Diagnosis Code by Month -- North Carolina, January - May, 2015-2016
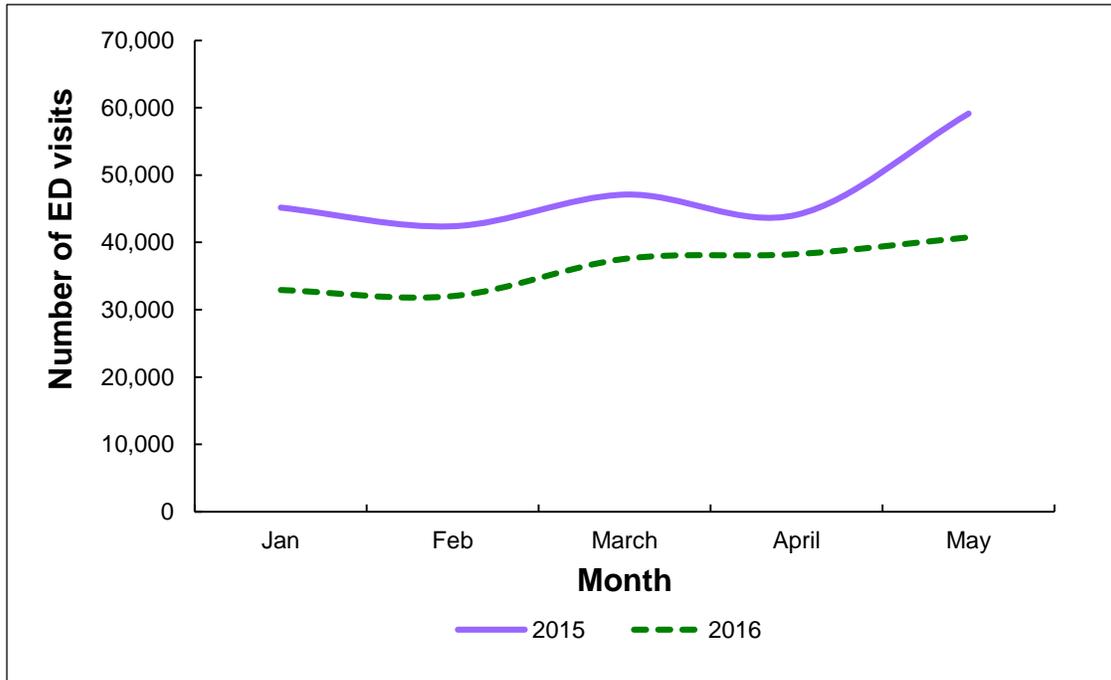
e. NC DETECT does not have a designated "primary" diagnosis field; therefore, it is important to identify the number of injuries that would be captured if the injury data set included ED visits in which an injury diagnosis code was present in *any* position. NC DETECT captured up to 11 diagnosis codes in 2015 and 37 in 2016 (although only 11 diagnosis fields were included in the 2016 data set used for analyses).

   i. In 2015, the number of ED visits which contained an injury diagnosis code in *any* position was 330,015 ED visits (16.7% of total visits).

   ii. In 2016, the number of ED visits which contained an injury diagnosis code in *any* position was 287,373 ED visits (14.2% of total visits).

3. Identify the first-listed external cause mechanism for each ED visit. For ICD-10-CM data, some injury diagnosis codes are also external cause codes.
   a. For 2015 data, select the first-listed external cause for ED visits that received an injury diagnosis code. The ICD-9-CM external cause codes are listed in Table 4.

Table 4. List of ICD-9-CM External Cause of Injury Codes

ICD-9-CM codes	Types of External Causes
E800-E848	Transport accidents
E850-E858	Accidental poisonings by drugs, medications, and biological substances
E860-E869	Accidental poisonings by other solid and liquid substances, gases, and vapors
E880-E888	Accidental falls
E890-E899	Accidents caused by fire and flames
E900-E909	Accidents due to natural and environmental factors
E910-E915	Accidents caused by submersion, suffocation, and foreign bodies
E916-E928	Other accidents
E950-E959	Suicide and self-inflicted injuries
E960-E969	Homicide and injuries purposely inflicted by other persons
E970-E978	Legal intervention
E979	Terrorism
E980-E989	Injuries undetermined whether accidentally or purposely inflicted
E990-E999	Injuries resulting from operations of war

   b. For 2016 data, select the first-listed external cause for ED visits that received an injury diagnosis code. Include all codes except codes that end in an "S" (Sequela); this includes codes that are missing a last character. The ICD-10-CM external cause codes are listed in Table 5.

Table 5. List of ICD-10-CM External Cause of Injury Codes

ICD-10-CM codes*	Types of External Causes
V00-V99	Transport accidents
W00-X58	Other external causes of accidental injury
X71-X83	Intentional self-harm
X92-Y08	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 any 6th character except 5 or 6	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, and motion sickness
*7th character of "A", "D" or 7th character missing.	

c. Although coding guidelines state that all ED visits with an injury diagnosis code should receive a corresponding external cause of injury code (except for ICD-10-CM T-codes which serve as both an injury diagnosis and external cause of injury code), valid external cause of injury codes were missing from some ED visits with a first-listed injury diagnosis code.

  i. In 2015, the number of ED visits with a first-listed diagnosis code missing an external cause of injury code was 73,310 (30.8% of injury-related visits).

  ii. In 2016, the number of ED visits with a first-listed diagnosis code missing an external cause of injury code was 78,270 (43.1% of injury-related visits).

  iii. The percent of ED visits with a first-listed injury diagnosis code varied somewhat by month. Figure 3 displays percent missingness by month for the years 2015-2016.

  iv. The percent of ED visits with an injury diagnosis code missing an external cause of injury code varied by facility. Figure 4 displays percent missingness by facility for 2016. The range in percent missingness by facility was 0%-100%. Missingness by facility was also a problem in 2015; some, but not all, facilities that had high percent missingness in 2015 also had high missingness in 2016 (data are not displayed).

Figure 3. Percent of Emergency Department Visits with a First-Listed Injury Diagnosis Code Missing a Valid External Mechanism Code by Month -- North Carolina, January - May, 2015-2016
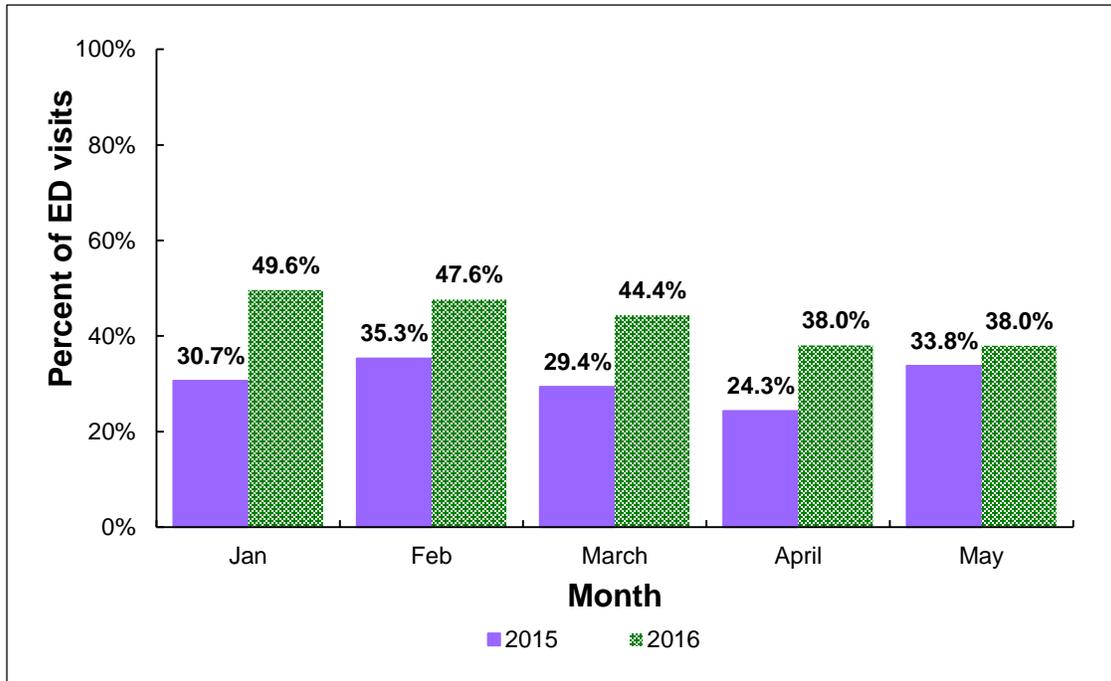
Figure 4. Percent of Emergency Department Visits with a First-Listed Injury Diagnosis Code Missing a Valid External Mechanism Code by Facility -- North Carolina, January - May, 2015-2016
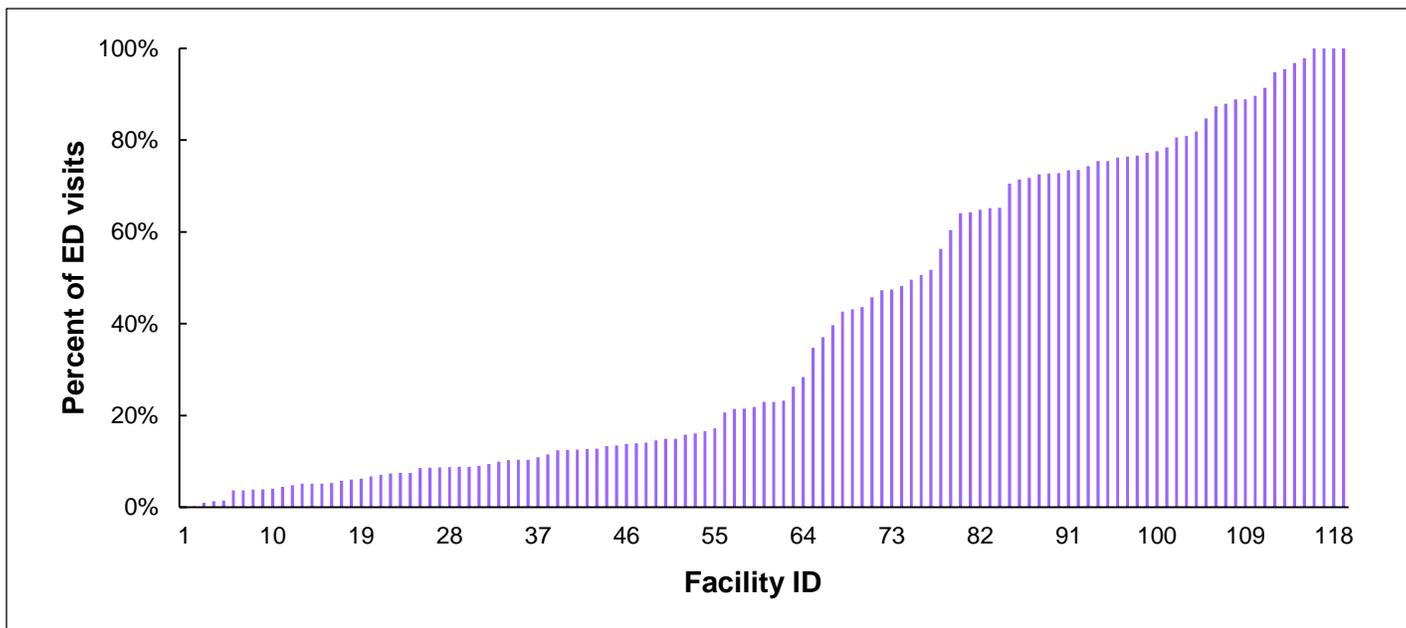
d. Summarize the results by creating a table similar to Table 5 in the CDC document *Implementing the ICD-10-CM External Cause Matrix for Injury Morbidity*. The results of applying the ICD-9-CM and ICD-10-CM External Cause Matrix to 2015 and 2016 NC DETECT ED visit data are displayed in Table 6.

e. Figures 5-7 displays three common injury mechanisms by month of visit.
   i. Figure 5 displays an injury mechanism in which counts were considerably higher in 2015 (unintentional - falls).
   ii. Figure 6 displays an injury mechanism in which counts were considerably higher in 2016 (unintentional - natural and environmental injuries).
   iii. Figure 7 displays an injury mechanism in which counts were similar across both years of the study (unintentional - injuries caused by machinery).

Table 6. External Cause Matrix: Injury Emergency Department Visits by Mechanism and Intent of Injury -- North Carolina, January - May, 2015-2016

Mechanism	January - May 2015 (ICD-9-CM)						January - May 2016 (ICD-10-CM)					
	Intent of Injury						Intent of Injury					
	Unintentional	Self-Harm	Assault	Undetermined	Other/Legal Intervention/ War	Total	Unintentional	Self-Harm	Assault	Undetermined	Other/Legal Intervention/ War	Total
Cut/Pierce	10,171	282	498	15	8	10,974	5,847	141	329	244	0	6,561
Drowning/Submersion	44	0	0	1	0	45	7	0	0	1	…	8
Fall	53,047	9	18	18	0	53,092	31,471	0	3	5	…	31,479
Fire/Burn	2,585	1	15	18	0	2,619	1,504	5	7	47	0	1,563
Fire/Flame	529	1	3	13	0	546	375	0	2	0	0	377
Hot Object/Substance	2,060	0	12	5	0	2,077	1,129	5	5	47	…	1,186
Firearm	537	22	220	35	1	815	481	7	141	13	2	644
Machinery	738	0	0	0	0	738	642	…	…	…	…	642
All Transportation*							20,809	5	7	2	…	20,823
Motor Vehicle Traffic (MVT)	23,732	2	19	4	…	23,757	18,023	5	7	2	…	18,037
MVT-Occupant	15,937	…	…	…	…	15,935	7,824	0	2	…	…	7,826
MVT-Motorcyclist	954	…	…	…	…	954	606	0	0	…	…	606
MVT - Pedal Cyclist	102	…	…	…	…	102	186	0	0	…	…	186
MVT - Pedestrian	554	…	0	…	…	553	186	0	5	…	…	191
MVT- Other	119	…	…	…	…	119	2	5	0	…	…	7
MVT - Unspecified	6,072	2	19	4	…	6,094	9,219	0	0	2	…	9,221
Motor Vehicle - Non-Traffic*							907	0	0	…	…	907
Pedal Cyclist, Other	1,251	…	…	…	…	1,251	708	0	0	…	…	708
Pedestrian, Other	102	…	…	…	…	102	220	0	0	…	…	220
Other Land Transport							889	0	0	…	…	889
Other Transport	1,924	0	0	…	0	1,924	62	0	0	…	0	62
Natural/Environmental	7,180	…	…	6	…	7,186	17,091	0	7	73	…	17,171

Bites/Stings – Nonvenomous*							3,774	0	0	0	…	3,774
Bites/Stings – Venomous*							681	0	7	73	…	761
Other Natural/Environmental	7,180	0	0	6	…	7,186	12,636	0	0	0	…	12,636
Overexertion	12,826	…	…	…	…	12,826	304	…	…	…	…	304
Poisoning	2,400	1,409	5	735	0	4,549	2,687	801	10	320	0	3,818
Drug*							2,028	764	6	260	…	3,058
Non-drug*							659	37	4	60	0	760
Struck By/Against	17,221	0	3,174	0	74	20,469	10,860	9	2,234	21	24	13,148
Suffocation	102	26	18	4	0	150	115	12	0	6	0	133
Other Specified	8,931	117	1,890	47	1	10,986	5,943	43	914	88	11	6,999
Child Abuse*							…	…	595	…	…	595
Foreign Body*							4,027	…	…	…	…	4,027
Classifiable	6,293	12	682	5	1	6,993	1,916	0	10	2	1	1,929
Not Elsewhere Classifiable	2,638	105	1,208	42	0	3,993	…	43	309	86	10	448
Unspecified	9,689	101	1,219	129	5	11,143	…	0	0	…	8	8
ED visits with a valid external cause code	152,480	1,969	7,076	1,012	89	162,626	97,761	1,023	3,652	820	45	103,301
ED visits without a valid external cause code						75,175						78,270
Total Injury ED visits						*237,801*						*181,571*

*Indicates a new mechanism category in the ICD-10-CM External Cause Matrix.
…Indicates that there are no relevant external cause codes for this cell.

Figure 5. Number of Emergency Department Visits Due to Unintentional Falls by Month -- North Carolina, January - May, 2015-2016
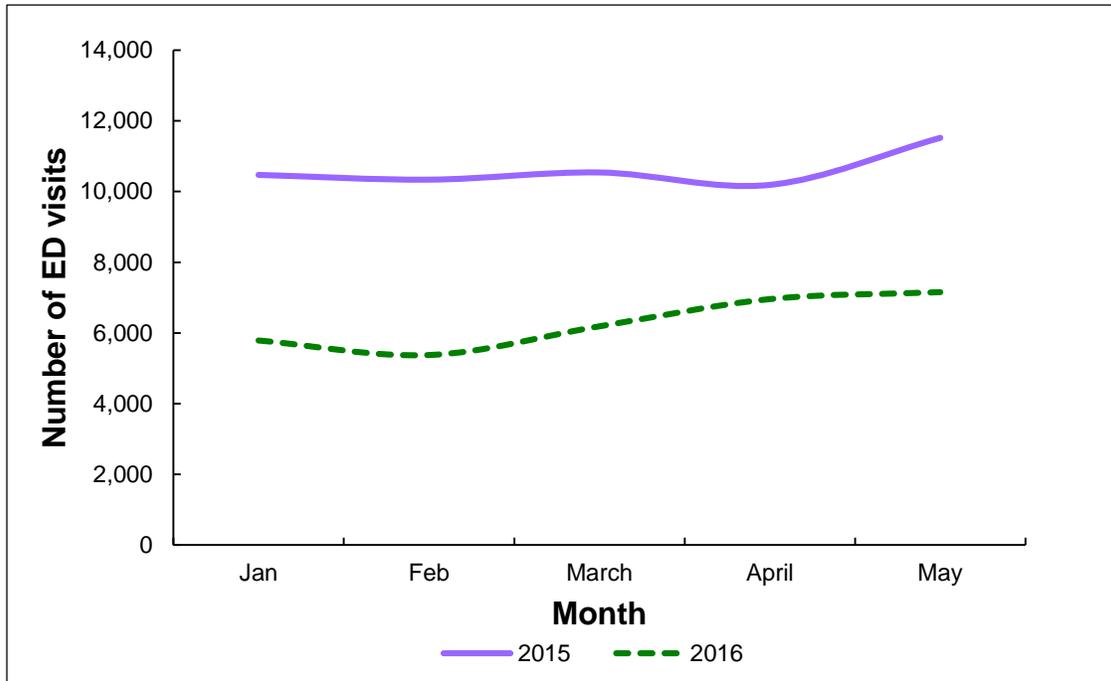

Figure 6. Number of Emergency Department Visits Due to Unintentional Natural and Environmental Injuries by Month -- North Carolina, January - May, 2015-2016
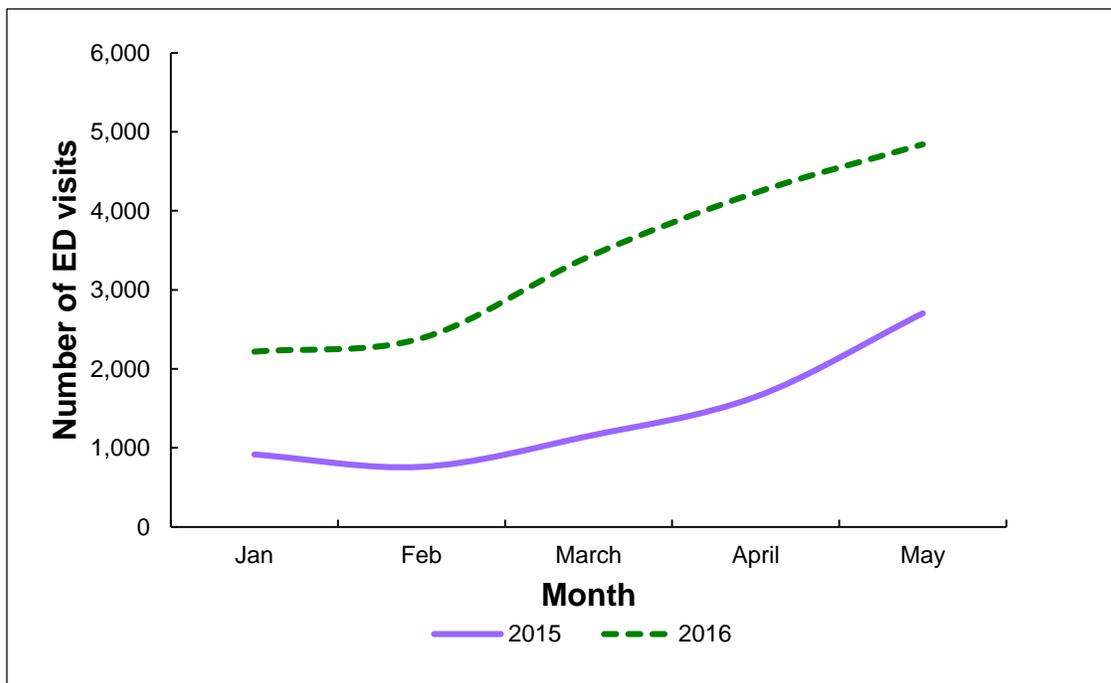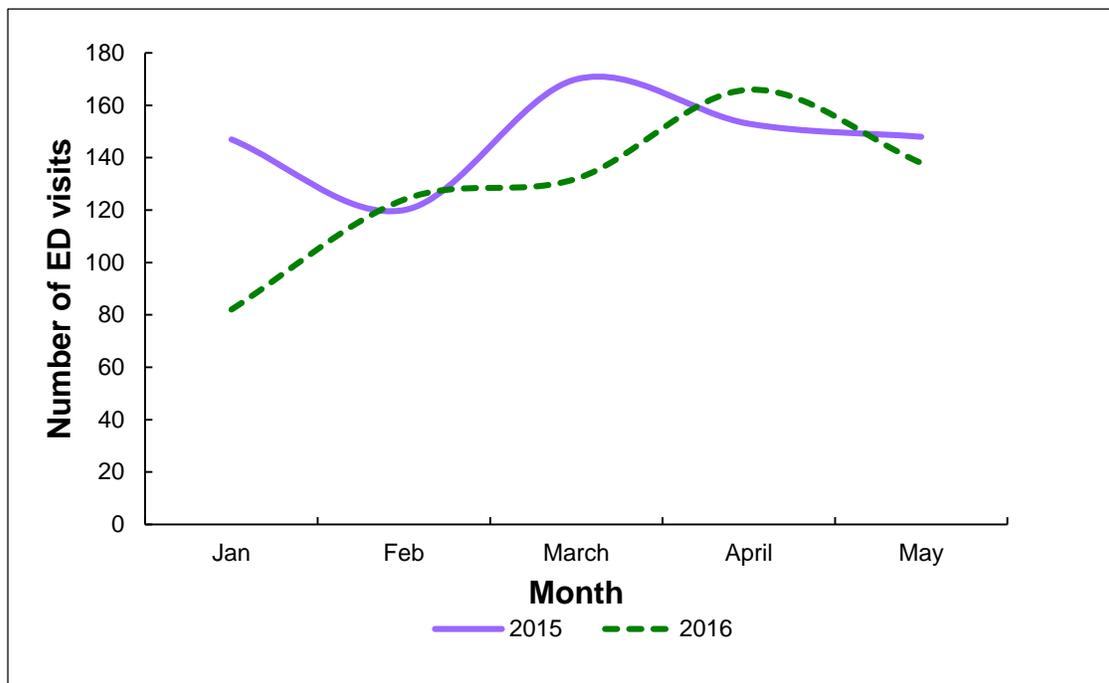
Figure 7. Number of Emergency Department Visits Due to Unintentional Injuries Caused by Machinery Incidents by Month -- North Carolina, January - May, 2015-2016

DISCUSSION

The NCIPC/NCHS *ICD-10-CM External Cause Matrix for Injury Morbidity* and accompanying SAS code was successfully applied to the NC DETECT ED data with only minor alterations. These alterations were due to the formatting of the codes collected by NC DETECT rather than problems with the SAS code supplied by the NCIPC and NCHS. NC SQI did have some concerns about the implementation of the matrix; however, it is important to reiterate that both the 2016 NC DETECT ED visit data and the methods used are preliminary. At this time, the NC SQI project team does not have an explanation for many of the aberrations observed in the NC DETECT ED visit data and additional resources are required to explore the ICD-10-CM data in greater detail. It is possible that some of the issues mentioned below may reflect NC DETECT ED visit data quality issues. These issues may resolve as hospitals update and improve their administrative software and as physicians and medical coders become more familiar with ICD-10-CM. Lastly, the NC SQI project team recommends that other end-users test the *ICD-10-CM External Cause Matrix* to determine if the issues described below are unique to NC ED visit data or common to other sources of morbidity data.

- In 2015, there were 237,801 ED visits with a first-listed diagnosis code of injury. In 2016, this number decreased to 181,571 ED visits; a percent decrease of 23.6%. At this time, it is unknown what may have caused the decrease in the number of injury-related ED visits in 2016; however, it is likely hospital data quality issues may have played a part. The transition to ICD-10-CM impacted more than just the submission of injury mechanism codes. For example, some hospitals ceased sending any ICD codes for periods during 2016.
- In 2015, the percent of ED visits with a first-listed injury diagnosis code missing an external cause of injury code was 30.8%. In 2016, percent missingness increased to 43.1%. Again, the NC SQI project team hypothesizes that this increase in percent missingness may be at least partly due to the upheaval caused by the transition. Evidence suggests that the NC DETECT ED visit data quality has improved

since January 2016 and it is likely that it will continue to improve as clinicians and hospital coders continue to become more familiar with the ICD-10-CM coding structure.

- In addition, counts of individual cells within the External Cause Matrix varied widely from 2015 to 2016. For example, the number of ED visits related to unintentional falls decreased from 53,047 in 2015 to 31,471 ED visits in 2016. On the other-hand, the number of ED visits due to natural and environmental causes increased from 7,186 ED visits in 2015 to 17,171 ED visits in 2016, and still other cell counts remained relatively constant. The preliminary NC DETECT ED visit data indicate that comparing specific external causes of injury across a period that spans both ICD-9-CM and ICD-10-CM coded data may be difficult.
- Under ICD-9-CM, all external cause of injury codes that coded venomous animal bites and stings were unintentional in nature. In 2016, medical coders had the option of assigning intent to venomous animal bites and stings and 80 ED visits (10.5% of all venomous bites/stings) were coded as "assaults" or of "undetermined" intent. After reviewing the free text fields of these ED visits, most of these visits appeared to be unintentional in nature. It is unknown at this time why these visits are being coded incorrectly.
- ED visits containing the injury mechanism code Y09 - "Assault by unspecified means" were not assigned a cell after applying the SAS code accompanying the *ICD-10-CM External Cause of Injury Matrix*.
- Lastly, NC SQI recommends that the NCIPC/NCHS consider looking beyond the first-listed injury diagnosis code as a means of identifying injuries using morbidity data. Over the course of the NC SQI project, it became apparent after years of working with injury data, and poisoning data in particular, that the first-listed diagnosis code was not always the principal diagnosis. There are a number of reasons why this could be, including 1) the first-listed diagnosis code may be the code that is the most highly reimbursable, 2) the first-listed diagnosis code may reflect the patient's primary symptoms rather than underlying condition (e.g. R11.2 – 'Nausea with vomiting, unspecified' versus T40.2X1A – 'Poisoning by other opioids, unintentional, initial encounter'), and 3) the order in which NC DETECT receives diagnosis codes may not reflect the order in which the codes were assigned at the hospital. Since NC DETECT ED visit data do not have a designated principal diagnosis code, it is likely that limiting the definition of an injury to the first-listed field is leading to an underestimation of the "true" number of injury-related ED visits; therefore, the NC SQI project team recommends that the CDC create a more expansive definition for morbidity data sets that do not include a designated principal diagnosis field.

CONCLUSIONS

The NCIPC/NCHS *ICD-10-CM External Cause Matrix for Injury Morbidity* and SAS Program are useful tools for categorizing injuries by intent and mechanism. These tools will be useful for states and other organizations that regularly use hospital discharge and ED data for injury and poisoning surveillance. The *ICD-10-CM External Cause Matrix for Injury Morbidity* will help standardize injury definitions across states and facilitate the comparability of counts and rates between states. However, our preliminary analyses indicate that ICD-9-CM and ICD-10-CM data may not be directly comparable and researchers should use caution before examining hospital administrative data that spans the period pre- and post-transition to ICD-10-CM. In addition, more work needs to be done to ensure that the *ICD-10-CM External Cause Matrix for Injury Morbidity* is ready for widespread distribution and utilization. Although the NC SQI project is in its fifth and final year, we would like to continue to assist the CDC on ICD-10-CM-related projects. Due to our familiarity and expertise in handling morbidity data, we are in strong position to work with ICD-10-CM data for the purposes of improved injury surveillance.

REFERENCES

1. Practice Management Information Corporation. *International Classification of Diseases, Ninth Revision, Clinical Modification 2010*. Sixth Edition: Hospital Edition. Los Angeles, CA: Practice Management Information Corporation; 2009. ISBN 978-1-57066-607-0.

2. Practice Management Information Corporation [PMIC]. *International Classification of Diseases, Tenth Revision, Clinical Modification Diagnosis Coding System 2014*. Hospital Edition. Los Angeles, CA: Practice Management Information Corporation; 2013. ISBN 978-1-57066-607-0. ISBN 978-1-939852-02-1.

3. Annest JL, Hedegaard H, Chen LH, Warner M, Smalls E. *Proposed Framework for Presenting Injury Data using ICD-10-CM External Cause of Injury Codes*. Atlanta, GA: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention; 2014. Retrieved July 25, 2016 from www.cdc.gov/injury/wisqars/pdf/icd-10-cm_external_cause_injury_codes-a.pdf.

4. National Center for Health Statistics. ICD Injury Matrices. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention; 2009. Retrieved July 25, 2016 from www.cdc.gov/nchs/injury/injury_matrices.htm.

5. National Center for Injury Prevention and Control. Matrix of E-code Groupings. Atlanta, GA: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention. Retrieved July 25, 2016 from www.cdc.gov/injury/wisqars/ecode_matrix.html.

6. National Center for Injury Prevention and the National Center for Health Statistics. DRAFT: *Implementing the ICD-10-CM External Cause Matrix for Injury Morbidity*. Atlanta, GA: National Center for Injury Prevention and Control, Centers for Disease Control and Prevention. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention; 2016.

7. National Center for Health Statistics. SAS Input Statements for External Cause of Injury Morbidity Matrix. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention; 2009. Retrieved July 5, 2016 from ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/injury/sascodes/icd9cm_external.sas.

8. Sheu Y. SAS Code for Implementing ICD-10-CM External Cause Matrix for Injury Morbidity. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention; 2016.

9. Centers for Medicare and Medicaid Services and the National Center for Health Statistics. *ICD-10-CM Official Guidelines for Coding and Reporting*. Baltimore, MD: Centers for Medicare and Medicaid Services. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention; FY 2016. Retrieved July 24, 2016 from www.cms.gov/medicare/coding/icd10/downloads/2016-icd-10-cm-guidelines.pdf.

10. Mitchell D. Take the patient's perspective when appending the seventh character in ICD-10-CM. *AAPC News*. April 1, 2014. Retrieved July 23, 2016 from www.aapc.com/blog/27096-initial-subsequent-sequela-encounter/.