

A RESPONSE TO THE SAFE STATES ALLIANCE INJURY SURVEILLANCE WORKGROUP (ISW)-7 ICD-9-CM POISONING MATRIX

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Introduction:

The North Carolina Division of Public Health (NC DPH) is currently participating in a CDC funded project to improve the quality of injury surveillance data in North Carolina and other states. This project is tasked with improving the quality of external cause of injury coding (E-coding) in emergency department (ED) data. In addition to state-specific projects, NC DPH is collaborating with other CDC funded states (Massachusetts, Colorado, and Utah) on consensus multi-state projects. In Year One of the Surveillance Quality Improvement (SQI) Project, a template was created for states to generate a childhood injury report to use in conjunction with the Health Resources and Services Administration's (HRSA's) Early Childhood Home Visitation Program. For Year Two, the focus of the multi-state project will be poisoning. Scott Proescholdbell of NC DPH will lead the SQI Project in developing recommendations for state poisoning surveillance. The SQI project plans to build on the work already accomplished by the Safe States Alliance Injury Surveillance Workgroup 7 (ISW-7) and the Council of State and Territorial Epidemiologists (CSTE) Overdose Subcommittee. One of the first tasks undertaken by NC SQI, as part of the Year Two multi-state project, was the application of the ISW-7 ICD-9-CM Poisoning Matrix to NC ED data.

Methods:

The NC SQI Project used ED data captured by the North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT) from January 1, 2011 through December 31, 2011. The collection of state ED data is stipulated under NC General Statute § 130A-480. In 2011, 115 out of 116 24/7 acute care civilian hospital-affiliated EDs submitted data to NC DETECT, capturing an estimated 99.5% of all eligible ED visits in the state. Data are reported as individual visits rather than individual patients. NC DETECT is only able to track repeat visits to the same ED or healthcare system. If the same patient visited two or more EDs in different healthcare systems he/she would be counted as two or more individuals. The NC DETECT ED visit data include a number of variables that are useful for poisoning surveillance, including: age, sex, state of residence, county of residence, date, time, diagnosis codes (up to 11), E-codes (up to 5), procedure codes (up to 20), chief complaint, triage notes (for select hospital systems), mode of transport, disposition, and expected source of payment.

The NC SQI Project applied the SAS Program designed for the Poisoning Matrix for ICD-9-CM Coded Morbidity Data presented in Appendix C of the *ISW-7 Consensus Recommendations for National and State Poisoning Surveillance* to the 2011 NC ED data. All analyses were performed using SAS software version 9.2 (SAS Institute Inc., Cary, NC). In NC, the first-listed code is not necessarily the primary reason for the ED visit, and so NC SQI performed separate analyses for both the first-listed code as well as for all listed codes. The NC SQI Project focused for the most part on drug poisonings, and so the authors collapsed a few of the non-drug poisoning categories. For example, ethanol poisonings were incorporated into the broader alcohol poisoning category due to the relatively small number of poisonings containing the ethanol-specific codes.

Results:

Results of the NC SQI analyses are presented in Tables 1-6. Tables 1-2 display counts of poisonings based on external cause codes (E-codes), Tables 3-4 display counts by nature (or diagnostic categories), and Tables 5-6 display counts based on all listed E-codes and diagnostic codes. The first table in each series contains counts based only on the first-listed code. The second table in each series contains counts based on codes listed in any position. As an individual ED visit may have more than one poisoning code per visit, Tables 2, 4, 5, and 6 do not add up to 100 percent.

In 2011, there were 84,488 ED visits for poisonings listed in the first position (Table 1). When analyses were extended to all listed E-codes, the number of poisonings increased to 90,677 ED visits (Table 2). Among ED visits that contained an E-code for a poisoning, there were more ED visits due to drug poisonings than ED visits due to non-drug poisonings. The subcategory containing the greatest number of visits was the category for other specified and unspecified drugs with 45,945 ED visits.

When poisonings were classified by nature (or diagnostic category), the number of poisonings increased from 84,888 ED visits based on the external cause categories to 116,668 ED visits due to poisonings based on the diagnosis code listed in the first position (Table 3). When analyses included all listed diagnoses, the number of poisonings increased substantially to 633,672 ED visits (Table 4). This number is striking because there were only 4,594,346 ED visits in total for the year of 2011 and so based on the coding provided by the ICD-9-CM Poisoning Matrix, poisonings accounted for 13.8% of all ED visits in the state. Unlike Tables 1-2 -in which the number of ED visits due to drug poisonings exceeded the number of visits due to non-drug poisonings- the number of non-drug related poisonings surpassed the number of drug related poisonings in Tables 3-4. Among the drug-related poisonings, the category with the greatest number of ED visits was the category for other specified and unspecified drugs. The number of ED visits in this category varied considerably when analyses were limited to the first-listed diagnosis code (N=20,322) compared to analyses that included all applicable diagnosis codes (N=68,317).

When external cause codes and diagnosis codes were combined into a single category, the total number of poisonings was 178,706 poisonings based on the first-listed E-code and/or the first-listed diagnosis code and 689,392 ED visits based on all listed E-codes and/or all listed diagnosis codes (Tables 5 and 6). Based on the ICD-9-CM Poisoning Framework, the number of ED visits due to poisonings (N=689,392) exceeds the number of ED visits due to chest pain/ischemic heart disease (N=516,972) based on all listed diagnosis codes and accounts for 15.0% of all ED visits in 2011.

Discussion and Recommendations:

The Safe States Alliance ISW-7 *Consensus Recommendations for National and State Poisoning Surveillance* ICD-9-CM Poisoning Matrix and accompanying SAS code was successfully applied to the NC 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 Program supplied by Safe States. NC SQI discovered a handful of possible inaccuracies present in the published SAS Program available through the Safe States web portal.

- 1) For poisonings classified by external cause categories, under the section for undetermined poisonings, line 118 is missing a less than sign. The current code reads "if ("980"<=Cause13D="982") then AllC5=1," but it should read ("980"<=Cause13D<="982") then AllC5=1."

2) For poisonings classified by external cause categories, the code E934.0 is not assigned a cell under the column for adverse drug effects.

3) For poisonings classified by the nature (or diagnostic category) of the poisoning, the codes 244 (.2, .3), 275.02, 288.03, 289.84, 292, 332.1, 333.85, 336.5, 357.6, 357.24, 648.3, 655.5, 692.3, 693.0, and 779.4-779.5 are not assigned to a subcategory under the category for drug and alcohol induced diseases. These codes likely belong under the subcategory for other and unspecified drugs. Some of these codes appear missing entirely from the SAS Program.

4) For poisonings classified by the nature (or diagnostic category) of the poisoning, the columns for non-drug poisonings are not exclusive. For example, the codes for non-venom, non-foodborne poisonings (980-989) contains the code for envenomation (989.5) and some of the codes for foodborne illness and intoxications (988 and 989.7).

5) For poisonings classified by the nature (or diagnostic category) of the poisoning, the codes 909 (.0, .5) and 995 (.2, .4, .86, .89) are not included in the last row of the table for all types of poisons under the column for non-venom, non-foodborne poisonings. The cell for all types of poisons/non-venom, non-foodborne poisoning also includes codes for envenomation and foodborne illness and intoxication.

In addition to the minor errors in the ICD-9-CM Matrix and the SAS Program, NC SQI has the following general recommendations regarding the organization and application of the ICD-9-CM Matrix.

1) *Reconsider the classification of codes E855.2 and E938.5 as cocaine poisonings:* The codes E855.2 and E938.5 designate poisonings due to the effects of local anesthetics. These codes include poisonings due to such topical anesthetics as cocaine hydrochloride; however, these codes are not limited to cocaine. Although these codes are marked with an asterisk in the ICD-9-CM Matrix to signify their lack of exclusivity, it is unlikely that many (if any) of the NC ED visits assigned these codes were actually due to cocaine poisonings. While cocaine hydrochloride is used for select medical procedures in the United States, its use is rare in comparison to many other topical anesthetics. E855.2 is not especially problematic because there were few visits to the ED that received this code. E938.5 is slightly more problematic because 53 ED visits were assigned this code in 2011 (ED visits with a code of E938.5 accounted for 11% of all “cocaine poisonings” classified by external cause category). None of the chief complaints or triage notes for the 53 ED visits that received a code of E938.5 mentioned cocaine, although common anesthetics such as lidocaine, benzocaine, and over-the-counter anesthetics (i.e Oragel) were mentioned.

NC SQI recommends that Safe States consider the reclassification of codes E855.2 and E938.5 in the future.

2) *Reclassify ED visits that receive a code of 305.1 for tobacco use disorder:* In NC ED visit data, the diagnosis code 305.1 is used to document a current or past history of tobacco use by the patient and not a suspected poisoning or overdose. In NC, use of the code 305.1 varies considerably by facility with a range of 0-44% of all ED visits receiving this code by hospital. In 2011, a total of 522,478 ED visits (11% of all ED visits) received this code in at least one of the 11 available diagnosis fields. The majority of the 572,036 ED visits for non-drug related poisonings was due to ED visits that received a code of 305.1. (In addition, 50,836 ED visits received a code of 305.0 for alcohol use disorder and 18,583 visits received a code of 305.2 for cannabis use disorder.) Many of these ED visits were due to causes unrelated to poisonings or even injuries. The code specific to an acute tobacco or nicotine poisoning is 989.4. Although limiting analyses to the first-listed diagnosis code mitigates the influence that tobacco use disorder has on the total number of drug-related poisonings, the number of ED visits due to tobacco use disorder is still considerable with 48,290 ED visits over the course of a year. This number is greater than many of the other poisoning categories. A drawback of limiting analyses to the first-listed diagnosis code is the possibility of undercounting the true number of poisonings. In NC DETECT data, the first-listed code is not necessarily the primary code. Another option is to limit analyses to the first two diagnosis codes. ***NC SQI recommends that Safe States consider the reclassification of codes 305.0, 305.1, and 305.2, into a category for “alcohol, tobacco and cannabis use disorder” in the future.***

3) *Separate “other specified” and “unspecified” drugs (where applicable):* The central goal of the SQI Project is the improvement of injury surveillance data. NC SQI is tackling this objective by improving the usage, specificity, and accuracy of coding and, in particular, coding of poisonings. Part of this process involves comparing cases in which a patient receives a code for a specific type of poison, such as the code of 962.3 for insulin and anti-diabetic agents, and cases in which a patient receives a code for an unspecified drug or medicinal substance (977.9). The NC SQI is aware that some codes lump other and unspecified poisons into the same category, which complicates things. ***NC SQI recommends that Safe States consider separating “other specified” and “unspecified” drug categories in future editions of the ICD-9-CM Matrix, wherever possible.***

Conclusion:

The Safe States Alliance ISW-7 *Consensus Recommendations for National and State Poisoning Surveillance* ICD-9-CM Poisoning Matrix and SAS Program are useful tools for categorizing poisonings and drug and alcohol induced diseases. These tools will be useful for states that regularly use hospital discharge and ED data for injury and poisoning surveillance. The ICD-9-CM Poisoning Matrix will help standardize poisoning definitions across states and facilitate the comparability of counts and rates between states.

Table 1. Poisoning Matrix for ICD-9-CM Coded Morbidity Data - Poisonings Based on the First Listed External Cause of Injury Code: North Carolina Emergency Department Visit Data, 2011

TYPE OF POISON†	Assigned Intent Based on External Cause of Injury Code							TOTAL
	Unintentional	Self-Harm	Assault	Legal Intervention	Undetermined	Envenomation	Adverse Event	
DRUG	8,430	6,923	16	--	2,463	--	49,204	67,036
Nonopioid Analgesics, Antipyretics, and Antirheumatics	809	--	--	--	--	--	1,530	2,339
<i>4-Aminophenol Derivatives</i>	463	--	--	--	--	--	257	720
Opioids	1,302	--	--	--	--	--	2,105	3,407
<i>Heroin</i>	197	--	--	--	--	--	69	266
<i>Pharmaceutical Opioids**</i>	1,105	--	--	--	--	--	2,036	3,141
<i>Methadone</i>	146	--	--	--	--	--	74	220
Cocaine	331*	--	--	--	--	--	46*	377*
Antidepressants, Sedative-Hypnotics, and Other Psychotropic Drugs	2,593	3,090	--	--	738	--	5,107	11,528
<i>Benzodiazepines</i>	932	--	--	--	--	--	631	1,563
<i>Psychostimulants</i>	182	--	--	--	--	--	148	330
Anticoagulants	--	--	--	--	--	--	3,440	3,440
Other Specified and Unspecified Drugs	3,395	3,833	16	--	1,725	--	36,976	45,945
NON-DRUG	5,230	140	20	<10	85	11,301	--	16,777
Alcohol	167	--	--	--	--	--	--	167
Carbon Monoxide	154	55	--	--	39	--	--	248
Petroleum Products and Other Solvents and Vapors	107	--	--	--	<10	--	--	110
Other and Unspecified Non-drugs	4,802	85	20	<10	43	11,301	--	16,252
UNSPECIFIED POISON	--	260	0	--	415	--	--	675
TOTAL	13,660	7,323	36	<10	2,963	11,301	49,204	84,488

Footnotes:

*Not the only poison in this category

**The term pharmaceutical is used to denote the availability of these agents through prescription and does not necessarily reflect the actual source of these agents for any given poisoning.

†Only selected classes of drugs and non-drugs are shown in the table. Classes were chosen based on a combination of their public health importance and the availability of a specific ICD code range.

Table 2. Poisoning Matrix for ICD-9-CM Coded Morbidity Data - Poisonings Based on the All Listed External Cause of Injury Codes: North Carolina Emergency Department Visit Data, 2011

TYPE OF POISON†	Assigned Intent Based on External Cause of Injury Code							TOTAL††
	Unintentional	Self-Harm	Assault	Legal Intervention	Undetermined	Envenomation	Adverse Event	
DRUG	9,106	7,429	17	--	2,661	--	53,095	72,074
Nonopioid Analgesics, Antipyretics, and Antirheumatics	971	--	--	--	--	--	1,889	2,856
<i>4-Aminophenol Derivatives</i>	559	--	--	--	--	--	335	893
Opioids	1,625	--	--	--	--	--	2,672	4,293
<i>Heroin</i>	219	--	--	--	--	--	77	296
<i>Pharmaceutical Opioids**</i>	1,410	--	--	--	--	--	2,595	4,001
<i>Methadone</i>	193	--	--	--	--	--	101	294
Cocaine	419*	--	--	--	--	--	53*	472*
Antidepressants, Sedative-Hypnotics, and Other Psychotropic Drugs	3,179	3,861	--	--	925	--	6,062	13,979
<i>Benzodiazepines</i>	1,330	--	--	--	--	--	916	2,244
<i>Psychostimulants</i>	233	--	--	--	--	--	164	397
Anticoagulants	--	--	--	--	--	--	3,975	3,975
Other Specified and Unspecified Drugs	3,842	4,680	17	--	1,938	--	40,176	50,573
NON-DRUG	5,844	162	22	<10	97	12,140	--	18,259
Alcohol	298	--	--	--	--	--	--	298
Carbon Monoxide	172	61	--	--	44	--	--	276
Petroleum Products and Other Solvents and Vapors	119	--	--	--	<10	--	--	122
Other and Unspecified Non-drugs	5,262	101	22	<10	50	12,140	--	17,570
UNSPECIFIED POISON	--	549	0	--	499	--	--	1,048
TOTAL	14,767	7,779	39	<10	3,188	12,140	53,095	90,677

Footnotes:

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†Only selected classes of drugs and non-drugs are shown in the table. Classes were chosen based on a combination of their public health importance and the availability of a specific ICD code range.

††Categories are based on all available external cause of injury codes (E-codes); ED visits are not mutually exclusive by category.

Table 3. Poisoning Matrix for ICD-9-CM Coded Morbidity Data - Poisonings Based on the First Listed Diagnosis Code: North Carolina Emergency Department Visit Data, 2011

TYPE OF POISON†	Classified by Nature (or Diagnostic Category) of the Poisoning				TOTAL
	Drug and Alcohol Induced Diseases	Non-venom, Non-foodborne Poisoning	Envenomation	Foodborne Illness and Intoxication	
DRUG	18,941	15,279	--	--	34,220
Nonopioid Analgesics, Antipyretics, and Antirheumatics	--	1,509	--	--	1,509
<i>4-Aminophenol Derivatives</i>	--	943	--	--	943
Opioids	3,036*	1,361	--	--	4,397*
<i>Heroin</i>	--	190	--	--	190
<i>Pharmaceutical Opioids**</i>	--	1,171	--	--	1,171
<i>Methadone</i>	--	122	--	--	122
Cocaine	2,676	330*	--	--	3,006*
Antidepressants, Sedative-Hypnotics, and Other Psychotropic Drugs	634	4,209	--	--	4,843
<i>Benzodiazepines</i>	--	1,714	--	--	1,714
<i>Psychostimulants</i>	233	191	--	--	424
Anticoagulants	--	143	--	--	143
Other Specified and Unspecified Drugs	12,595	7,727	--	--	20,322
NON-DRUG	72,487	2,249	7,605	107	82,448
Alcohol	24,197	160	--	--	24,357
Carbon Monoxide	--	188	--	--	188
Petroleum Products and Other Solvents and Vapors	--	100	--	--	100
Other and Unspecified Non-drugs	48,290	1,801	7,605	107	57,803
UNSPECIFIED POISON	0	--	--	--	0
TOTAL	91,428	17,528	7,605	107	116,668

Footnotes:

*Not the only poison in this category

**The term pharmaceutical is used to denote the availability of these agents through prescription and does not necessarily reflect the actual source of these agents for any given poisoning.

†Only selected classes of drugs and non-drugs are shown in the table. Classes were chosen based on a combination of their public health importance and the availability of a specific ICD code range.

Table 4. Poisoning Matrix for ICD-9-CM Coded Morbidity Data - Poisonings Based on the All Listed Diagnosis Codes: North Carolina Emergency Department Visit Data, 2011

TYPE OF POISON†	Classified by Nature (or Diagnostic Category) of the Poisoning				TOTAL††
	Drug and Alcohol Induced Diseases	Non-venom, Non-foodborne Poisoning	Envenomation	Foodborne Illness and Intoxication	
DRUG	77,904	25,396	--	--	98,585
Nonopioid Analgesics, Antipyretics, and Antirheumatics	--	2,930	--	--	2,930
<i>4-Aminophenol Derivatives</i>	--	1,781	--	--	1,781
Opioids	12,782*	3,039	--	--	15,375*
<i>Heroin</i>	--	312	--	--	312
<i>Pharmaceutical Opioids**</i>	--	2,739	--	--	2,739
<i>Methadone</i>	--	312	--	--	312
Cocaine	18,804	898*	--	--	19,189*
Antidepressants, Sedative-Hypnotics, and Other Psychotropic Drugs	5,141	8,611	--	--	13,413
<i>Benzodiazepines</i>	--	4,080	--	--	4,080
<i>Psychostimulants</i>	1,187	455	--	--	1,616
Anticoagulants	--	242	--	--	242
Other Specified and Unspecified Drugs	56,390	13,164	--	--	68,317
NON-DRUG	573,378	5,189	10,268	175	586,674
Alcohol	78,468	872	--	--	78,928
Carbon Monoxide	--	352	--	--	352
Petroleum Products and Other Solvents and Vapors	--	172	--	--	172
Other and Unspecified Non-drugs	522,478	3,841	10,268	175	535,141
UNSPECIFIED POISON	<10	--	--	175	<10
TOTAL	613,995	29,771	10,268	175	633,672

Footnotes:

*Not the only poison in this category

**The term pharmaceutical is used to denote the availability of these agents through prescription and does not necessarily reflect the actual source of these agents for any given poisoning.

†Only selected classes of drugs and non-drugs are shown in the table. Classes were chosen based on a combination of their public health importance and the availability of a specific ICD code range.

††Categories are based on all available diagnostic codes; ED visits are not mutually exclusive by category.

Table 5. Poisoning Matrix for ICD-9-CM Coded Morbidity Data - Poisonings Based on the First Listed External Cause of Injury Code and/or the First Listed Diagnosis Code: North Carolina Emergency Department Visit Data, 2011

TYPE OF POISON†	All Poisonings††
DRUG	87,666
Nonopioid Analgesics, Antipyretics, and Antirheumatics	3,368
<i>4-Aminophenol Derivatives</i>	1,383
Opioids	7,158
<i>Heroin</i>	355
<i>Pharmaceutical Opioids**</i>	3,815*
<i>Methadone</i>	284
Cocaine	3,254*
Antidepressants, Sedative-Hypnotics, and Other Psychotropic Drugs	13,134
<i>Benzodiazepines</i>	2,835
<i>Psychostimulants</i>	669
Anticoagulants	3,567
Other Specified and Unspecified Drugs	60,529
NON-DRUG	91,592
Alcohol	24,463
Carbon Monoxide	317
Petroleum Products and Other Solvents and Vapors	150
Other and Unspecified Non-drugs	66,715
UNSPECIFIED POISON	675
TOTAL	178,706

Footnotes:

*Not the only poison in this category

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†Only selected classes of drugs and non-drugs are shown in the table. Classes were chosen based on a combination of their public health importance and the availability of a specific ICD code range.

††Categories are based on all available external cause and diagnostic codes; ED visits are not mutually exclusive by category.

Table 6. Poisoning Matrix for ICD-9-CM Coded Morbidity Data - Poisonings Based on All Listed External Cause of Injury Codes and/or All Listed Diagnosis Codes: North Carolina Emergency Department Visit Data, 2011

TYPE OF POISON†	All Poisonings††
DRUG	144,448
Nonopioid Analgesics, Antipyretics, and Antirheumatics	4,883
<i>4-Aminophenol Derivatives</i>	2,163
Opioids	18,166
<i>Heroin</i>	449
<i>Pharmaceutical Opioids**</i>	5,493*
<i>Methadone</i>	444
Cocaine	19,319*
Antidepressants, Sedative-Hypnotics, and Other Psychotropic Drugs	20,126
<i>Benzodiazepines</i>	5,125
<i>Psychostimulants</i>	1,805
Anticoagulants	4,191
Other Specified and Unspecified Drugs	105,785
NON-DRUG	592,039
Alcohol	78,954
Carbon Monoxide	380
Petroleum Products and Other Solvents and Vapors	200
Other and Unspecified Non-drugs	540,481
UNSPECIFIED POISON	1,055
TOTAL	689,392

Footnotes:

*Not the only poison in this category

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†Only selected classes of drugs and non-drugs are shown in the table. Classes were chosen based on a combination of their public health importance and the availability of a specific ICD code range.

††Categories are based on all available external cause and diagnostic codes; ED visits are not mutually exclusive by category.