INJURY UPDATE

*A Report to Oklahoma Injury Surveillance Participants**

January 5, 2009

Importance, Accuracy, and Completeness of External Cause of Injury Coding (E coding) in a Sample of Oklahoma Traumatic Brain Injury Hospitalizations

Injury prevention programs nationwide are dependent upon data coded for external causes of injury, and Oklahoma is no exception. Data are the foundation for identifying leading causes of morbidity and mortality, for allocating resources, and for justifying the need for particular prevention measures or policies. Whether it is "E codes" from the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM; currently used for morbidity data) or the "U, V, W, X, Y codes" from the Tenth Revision of the ICD (currently used for mortality data), these external cause of injury codes can provide a significant amount of information, if assigned correctly. E codes were mandated in 1998 to be included in Oklahoma's inpatient hospital discharge database. This report examines the issue of E coding in Oklahoma hospitals, using recent traumatic brain injury surveillance as an example of how these codes are used and why they are so important.

Traumatic brain injuries are a major public health problem and a frequent result of motor vehicle crashes, falls, and firearm-related injuries. The Injury Prevention Service (IPS) has been conducting active surveillance on traumatic brain injuries since 1992. Through medical record abstraction, IPS staff gathers detailed information on how the injury occurred and other injury characteristics. From these data, trends and high-risk populations can be identified, and prevention programs can be designed and implemented to reduce the number of injuries and/or the sequelae they produce.

In 2005, the IPS was awarded a grant from the Centers for Disease Control and Prevention (CDC) to conduct surveillance on traumatic brain injuries using a different methodology than the IPS had used in prior years. Oklahoma and three other states currently participate in this project and have collected data through 2006. Beginning with 2004 data collection, the IPS used Oklahoma's inpatient hospital discharge database to select a random sample of patients with a traumatic brain injury discharge code. Medical records were abstracted only on this sample, rather than on all head injured patients. This methodology has advantages, including being less labor intensive for hospitals and IPS staff. However, there are disadvantages, including the reliance on the hospital discharge data as the sole source of information (i.e., fewer details on patients) and the challenges of analyzing sampled data and presenting it in a meaningful and accurate way.

For prevention purposes, knowing that an individual sustained a head injury is only helpful if it is known how it happened. Prevention strategies for a fall are significantly different than those for assaults or car crashes. Even within a particular mechanism of injury, the prevention messages vary. Strategies to prevent falls can be better targeted if the leading types of falls are known (e.g., falls from ladders or other heights, slipping/tripping, etc.). By relying on the hospital discharge database as the source of information for patients not selected in the abstraction sample, the only clues for describing the incident are the ICD-9-CM codes (more specifically, the E codes).

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The first key element, then, is to have an E code (for differentiation between mechanisms of injury); the second key is to have a valid, specific E code (for differentiation within a mechanism of injury). Of course, the assignment of specific, valid E codes relies on thorough documentation in the medical record, which is not always a reality.

For the sampled records, that is, those discharges randomly selected to have a medical record review, there was an opportunity to capture more details, as well as assess the accuracy and completeness of E codes. Using the 2006 hospital discharge database, a sample of 1,050 records was selected from a total of 3,889 eligible discharges (i.e., inpatients discharged with a primary or associated diagnosis code of 800.0-801.9, 803.0-804.9, 850.0-854.1, 950.1-950.3, 959.01, or 995.55). These acute care discharges included stays from 84 hospitals across the state and were selected in a way so as to be representative of all traumatic brain injury discharges.

Of the 1,050 records selected, 59 (6%) did not have a valid primary E code listed in the hospital discharge database. Sixteen of the 59 records (27%) had a place of occurrence code only (i.e., those beginning with E849), of which, three were "unspecified place." The remaining 43 records were blank for any type of E code. Of those records with a valid primary E code listed, almost 30% were an unspecified E code, meaning that, at most, they indicated only the general mechanism of injury (e.g., motor vehicle crash, fall, assault); other times it was only the very generic "unspecified accident" category (i.e., E928.9). Injuries with the highest proportions of unspecified E codes included homicides/assaults, falls, motor vehicle crashes, and other accidents (Table 1). In these instances, the codes could have been assigned incorrectly or the coder was left no choice but to assign an unspecified E code, due to a lack of detail in the medical record.

According to E coding protocols, the place of occurrence code is a secondary code used to describe the location of the injury; therefore, it should never be used as a primary E code. Similarly, E967, the code specifying the perpetrator in adult and child abuse cases should not be a primary E code. Current guidelines for E coding specify not to use E849.9 if place of

Table 1. Unspecified Primary E codes Among 1,050 Sampled Traumatic Brain Injury Records as Reported in the 2006 Hospital Discharge Database

E code	Number of "Unspecified" Codes	Total E codes in Category	Percent Unspecified
Motor vehicle traffic accidents (E810-E819)	63	325	19%
Motor vehicle nontraffic accidents (E820-E825)	6	29	21%*
Other road vehicle accidents (E826-E829)	0	32	0%
Water transport accidents (E830-E838)	0	2	0%
Vehicle accidents not elsewhere classifiable (E846-E848)	0	1	0%
Accidental poisoning (E850-E869)	0	4	0%
Misadventures (E870-E876)/Adverse effects (E878-E879, E930-E949)	1	15	7%
Accidental falls (E880-E888)	156	395	39%
Accidents due to natural/environmental factors (E900-E909)	1	13	8%
Other accidents (E916-E928)	21	64	33%
Late effects of accidental injury (E929)	0	2	0%
Suicide and self-inflicted injury (E950-E959)	0	3	0%
Homicide and injury purposely inflicted by others (E960-E969)	35	96	36%*
Legal intervention (E970-E978)	1	1	100%
Undetermined manner of injury (E980-E989)	3	3	100%
TOTAL	287	985	29%
MISSING PRIMARY E CODE	59		
TOTAL UNSPECIFED AND MISSING	346	1044**	33%

*Other and unspecified nature may be included in one or more codes.

**Six additional records were included from the Vital Statistics database (all were coded with a V, W, or X ICD-10 code).

occurrence is not stated; however, it is good practice and extremely helpful for data users to include place of occurrence in at least all other situations. Seventy-three percent of records did not have a place of occurrence code; of the 284 records that reported a secondary E849 code, 29 (10%) indicated an unspecified place.

Table 2. Comparison of Place of Occurrence E codes Pre- and Post-Revision Among 1,038 Sampled 2006 Traumatic Brain Injury Records

E code	Pre-Revision Number	Pre-Revision Percent	Post-Revision Number	Post-Revision Percent
E849.0 Home	168	16%	334	32%
E849.1 Farm	6	0.5%	14	1%
E849.2 Mine/quarry	0	0%	0	0%
E849.3 Industrial place	10	1%	17	2%
E849.4 Recreation place	13	1%	35	3%
E849.5 Street	156	15%	368	35%
E849.6 Public building	17	2%	44	4%
E849.7 Residential institution	44	4%	73	7%
E849.8 Other specified place	32	3%	33	3%
E849.9 Unspecified place	64	6%	120	12%
Missing	528	51%	0	0%

Part of the surveillance project involves reviewing and revising E codes, as necessary, after the sampled medical record reviews have been completed. The final database, therefore, includes the E codes reported by the hospital and the revised E codes reported by IPS staff trained in E coding. Ideally, there should be few, if any, revised E codes. Upon completing the 1,050 medical record reviews, IPS staff determined that 1,038 records met the traumatic brain injury case definition and were eligible for inclusion in the final surveillance database. Twelve records were excluded for various reasons, including that the patient was an out-of-state resident or was admitted for follow-up treatment of a previously counted injury.

Among the 1,038 confirmed traumatic brain injury records reviewed, E-codes were missing in 27 (3%), down from the initial 6% missing. These additional E codes were found documented in the record during abstraction, but, for unknown reasons, were not reported to the hospital discharge database. Two additional records had no primary E code, only a place of occurrence code. Ultimately, 647 records (62%) had one or more E codes revised or added. Revisions did improve the completeness of injury location reporting (Table 2). Had only the original coding been used, 57% of the sample would have had missing or unspecified locations. After revising, this percentage decreased to 12%. The percentage of records indicating a home as the place of injury occurrence doubled (16% to 32%), while street locations more than doubled (15% to 35%). Other locations, such as residential institutions, had smaller, yet still important, increases.

The revision of primary E codes did not yield such dramatic changes as seen in the place of occurrence revisions (Table 3). There were 3% with missing codes and these were assigned during the revision. The proportion of accidental falls increased 4% (38 records) after the changes and 10 more homicides/ assaults were added to that particular category. For the most part, records were coded to the appropriate large category (e.g., motor vehicle crashes, homicides/assaults). Within categories, though, the specificity of codes increased. Taking motor vehicle traffic crashes as an example, E code revisions decreased the number of crashes coded as "unspecified nature" from 15% to 4% (Table 4). Fifty-seven records (5% of the total sampled records) had a revised third E code.

After completing the medical record abstractions, revising the E codes, and analyzing the resultant data set, a report was prepared. This report, *Traumatic Brain Injury Data Report, 2004-2006,* is available on the IPS website (ips.health.ok.gov). In it, traumatic brain injuries in Oklahoma are described in detail—by demographics, etiology, place of occurrence, severity, and outcome, among other ways. In conclusion, E codes are an integral part of injury data analysis. E codes are frequently the means of identifying injuries within a data set and are crucial pieces of information to explain how an injury occurred and whether it was caused intentionally or unintentionally. Oklahoma's

hospital discharge database has seen steady improvement in the accuracy and completeness of E code reporting. For 2006, approximately 93% of injury hospitalizations had at least one E code reported. To keep the momentum going and further improve the validity and accuracy of E codes, there needs to be continued discussion between users and providers. Data users who analyze and appreciate the value of E codes should continue to be vocal on how the codes are used and what improvements need to be made, and should recognize the efforts of providers. Coders, physicians, and others who make the codes a reality should continue to pursue training opportunities and consider ways to improve documentation in the records and applicable hospital and coding policies.

Table 3. Comparison of Primary E codes Pre- and Post-Revision Among 1,038 Sampled 2006 Traumatic Brain Injury Records

E code	Pre-Revision Number	Pre-Revision Percent	Post-Revision Number	Post-Revision Percent
Motor vehicle traffic accidents (E810-E819)	331	32%	335	32%
Motor vehicle nontraffic accidents (E820-E825)	29	3%	35	3%
Other road vehicle accidents (E826-E829)	32	3%	32	3%
Water transport accidents (E830-E838)	2	0.1%	3	0.3%
Vehicle accidents not elsewhere classifiable (E846-E848)	2	0.1%	1	0.1%
Accidental poisoning (E850-E869)	4	0.4%	1	0.1%
Misadventures (E870-E876)/ Adverse effects (E878-E879,E930-E949)	14	1%	0	0%
Accidental falls (E880-E888)	410	39%	448	43%
Accidents due to natural/environmental factors (E900-E909)	15	1%	16	2%
Other accidents (E916-E928)	62	6%	47	5%
Late effects of accidental injury (E929)	3	0.3%	3	0.3%
Suicide and self-inflicted injury (E950-E959)	3	0.3%	4	0.4%
Homicide and injury purposely inflicted by others (E960-E969)	96	9%	106	10%
Legal intervention (E970-E978)	1	0.1%	2	0.2%
Undetermined manner of injury (E980-E989)	2	0.1%	5	0.5%
Missing	32	3%	0	0%

Table 4. Comparison of Motor Vehicle Traffic Primary E codes Pre- and Post-Revision Among 335 Sampled 2006 Traumatic Brain Injury Records

Motor vehicle traffic accident involving…	Pre-Revision Number	Pre-Revision Percent	Post-Revision Number	Post-Revision Percent
E810 Collision with train	3	1%	4	1%
E811 Re-entrant collision with another vehicle	1	0.3%	6	2%
E812 Collision with motor vehicle	128	39%	133	40%
E813 Collision with other vehicle	5	2%	4	1%
E814 Collision with pedestrian	20	6%	25	7%
E815 Collision on the highway	37	11%	41	12%
E816 Loss of control without highway collision	72	22%	94	28%
E817 Boarding or alighting	4	1%	2	1%
E818 Other noncollision accident	10	3%	12	4%
E819 Unspecified nature	51	15%	14	4%
Total	331*		335**	

*During revision, 16 of these records were changed to codes outside of the E810-E819 range.

**Twenty of these records originally had a missing E code or a code outside of the E810-E819 range.

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