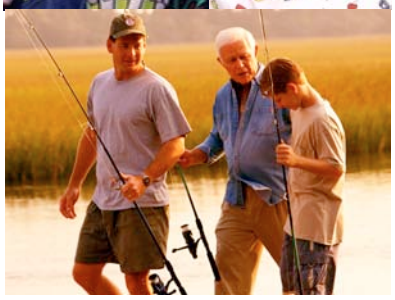
Traumatic Brain Injury Surveillance Summary Report

Tracy Wendling, M.P.H.
Director of Surveillance
Injury Prevention Service
Oklahoma State Department of Health

Pam Archer, M.P.H.
Chief
Injury Prevention Service
Oklahoma State Department of Health

For more information, please contact:
Injury Prevention Service
Oklahoma State Department of Health
1000 N.E. 10th Street
Oklahoma City, Oklahoma 73117-1299
(405) 271-3430
http://ips.health.ok.gov



October 2009

Table of Contents

Background 1
TBI Data Collection in Oklahoma 1
TBI Surveillance Methodology for 2004-2007 Data 2
Lessons Learned: Surveillance Procedures 5
Lessons Learned/Recommendations: Data Elements 7
Highlights of 2007 Data Collection 12
References 13

Traumatic Brain Injury Surveillance Summary Report

Background

United States. Traumatic brain injuries (TBIs) are a leading cause of death and disability in the U.S.[1] Approximately 1.4 million people sustain a TBI each year, resulting in 50,000 deaths, over one million emergency department visits, 235,000 hospitalizations, and 80,000-90,000 permanent severe neurological disabilities.[1-3] Brain injuries are complex and only rarely are consequences limited to a single deficit. Many survivors with serious injuries experience a constellation of symptoms and impairments, such as physical, emotional, cognitive, and behavioral problems that may require months or years of rehabilitation.[1] Injuries do not have to be serious, however. Even mild TBIs can result in long-term cognitive problems, which impair an individual's ability to perform activities of daily living.[1,4] In this country, 5.3 million individuals are living with long-term or lifelong TBI-associated disabilities; although, this estimate is suspected to underrepresent the true number.[1] Lifetime costs have been estimated at $60 billion annually.[3]

Oklahoma. From 2004-2007, a total of 17,890 TBIs occurred among Oklahoma residents that were fatal or serious enough to require hospitalization. The highest rate of TBI was among persons 65 years and older, followed by persons 15-24 years of age. Males were over 1.5 times more likely to be injured than females. Falls and motor vehicle crashes were the most common causes of TBI, accounting for 35% and 25% of injuries respectively, followed by gunshot wounds (8%) and assaults (7%). Of the 17,890 TBIs in 2004-2007, 3,758 (22%) were fatal. Males had a higher case fatality rate than females (24% and 16%, respectively).

TBI Data Collection in Oklahoma

Authority. The Injury Prevention Service (IPS) has had the authority to collect and maintain TBI surveillance data since TBIs were mandated a reportable condition in April 1991 by the Oklahoma Board of Health and the Oklahoma legislature (HJR 1040).

History of TBI Data Collection. Statewide surveillance for hospitalized and fatal TBIs has been conducted in Oklahoma since 1992 using a standard morbidity and mortality code definition from the National Center for Injury Prevention and Control (NCIPC). Because a complete, consistent hospital discharge database was not available in Oklahoma until January 2005 (2002 data), TBI surveillance data were collected directly from medical records for 1992-2003. A contact person was designated at each hospital's medical records department to work with IPS staff to generate a list of TBI patients based on the TBI discharge codes and to make medical records available for review. Data elements were collected through medical record reviews by trained IPS staff at all 116 acute care hospitals (including federal facilities) in the state. From 1992-1998, approximately 100 variables, including most of the current basic and extended data elements recommended by the NCIPC, were collected on all hospitalized cases. From 1999-2000, a 50% random sample of hospital medical

records was selected and abstracted for both the basic and extended variables. For the remaining 50% of medical records, only the basic variables were abstracted. From 2001-2003, due to reduced funding, only basic variables were collected on all TBI cases. A list of medical records that were not available during each hospital site visit was maintained and records were requested until they became available. TBI deaths were identified from the Office of the Chief Medical Examiner from 1992-1999 and from Vital Statistics beginning in 2000.

TBI Surveillance Methodology for 2004-2007 Data

TBI Case Definition. Data were collected on men and women of all ages and racial and ethnic groups among Oklahoma's 3.5 million residents. The TBI mortality case definition codes in the *Central Nervous System Injury Surveillance Data Submission Standards—2002* (referred to as *Standards* in the rest of the summary report) were used.[5] Fatal TBI cases were identified in the Vital Statistics (VS) database by searching all 20 multiple cause of death code fields for a code indicating a TBI. Oklahomans who died out of state were included. For nonfatal injuries, the TBI morbidity case definition codes in the *Standards* were used. Hospitalized TBI cases were identified in the inpatient hospital discharge database (HDD) by searching the principal diagnosis and all 15 other diagnosis codes for a code indicating a TBI. TBI cases were limited to Oklahoma residents who died or were discharged from an acute care hospital during 2004-2006. Persons injured more than 12 months before the date of discharge or death were excluded.

Data Contributors. The Oklahoma State Department of Health (OSDH) Vital Records Division maintains death certificates on all deaths that occur in the state. Death certificates are coded to multiple causes by the National Center for Health Statistics. A real-time electronic VS file, which includes all deaths in Oklahoma and deaths of Oklahoma residents that occurred outside of the state, is made available to the IPS through the OSDH intranet and can be accessed daily. A final centralized statewide electronic database of deaths for the year, including multiple cause coding and personal identifiers such as name, date of birth, and date of death is obtained by the IPS annually.

Data for the centralized statewide HDD are collected and maintained by the Health Care Information Division of the OSDH. The HDD includes all state licensed general and specialized hospitals; federal government facilities are excluded. Discharge data records are submitted for persons discharged within a calendar year from all hospital beds. A separate record is submitted for each discharge, including information on the patient, provider, service, diagnosis and treatment, payer, and charges/bill type. A comprehensive data quality program is run on the database, including checks to ensure that all required fields are completed, ages are appropriate (0-115 years), date fields have the correct year of discharge and proper date sequences, there are not duplicate records, E codes are present for injury-related discharges, etc. Letters regarding missing and inappropriate data are sent to hospitals to obtain updated information and/or clarification. The IPS receives a finalized HDD each year.

Personal identifiers, including name, date of birth, last four digits of the social security number, and medical record number are obtained by the IPS for all reportable injuries, including TBIs.

Data Elements. During 2004 TBI data collection, the IPS collected data for all TBI cases from the HDD on all available basic variables as described in the *Standards*. In addition, all available extended variables were obtained during medical record reviews of a sample of 1,200 cases; these variables were updated in the TBI database. In 2006, numerous conference calls were held with TBI funded states and the NCIPC to enhance and update the *Standards*. In a document used by funded states, but yet to be formally published and released, basic and extended data elements were clarified and updated. In addition, 44 new variables were added. These revised and new elements were used in the collection of 2005-2007 sampled TBI data. The creation of new variables was part of the original grant proposal guidelines, which charged grantees with identifying a topic of emerging public health importance and collecting additional information on that topic during regular TBI surveillance. Funded states selected falls among individuals aged 65 years and older as the emerging public health topic and 37 of the 44 new variables related to this module. The remaining seven new variables were to be collected on all TBI sampled cases.

Data Linkage and Sampling Methodology. Deaths in the 2004-2007 centralized electronic HDD and VS database were linked using the probabilistic linking software SAS LinkPro. For persons with multiple hospitalizations for the same event, back-to-back stays were combined and the definitive care hospital was documented. Patients transferred from one hospital to another were identified using the source of admission and personal identifiers. Protocols were established to determine if non-consecutive stays were for the same injury (deleted second stay from the database) or for a second injury (included second stay in the database). Discharges for the same person that occurred 2-10 days after the initial stay were removed from the database unless the external cause of injury code (E code) indicated a different type of injury (e.g., fall and motor vehicle crash). If subsequent discharges occurred 11 or more days later, the stays were considered to be related to separate injuries and were included in the database. Without a comprehensive review of all medical records, it was unknown exactly how many of the discharges were for follow-up care of a previous injury. Persons in the VS database were also compared to patients in the HDD using personal identifiers to identify and combine duplicates.

As specified in the *Standards*, a representative sample of at least 1,000 TBI cases (preadmission deaths not included) needed to be successfully abstracted using a stratified sampling approach. An initial sample of 1,200 cases was selected using 2004 data to allow for false positive cases and missing records. Hospitalized cases were divided into strata based on hospital size (<100 beds and ≥100 beds). The proportion of cases in each of the hospital stratum was calculated and the sample followed the same proportions. The sample was formed by

selecting the predetermined number of cases in each stratum from a randomized, stratified database of TBI cases. After 2004 data produced a very low number of false positives, the sample size was reduced to 1,050 for subsequent years.

Extended Medical Records Surveillance. The IPS abstracted all basic and extended variables for all sampled cases. On average, one abstraction took 15-20 minutes for an experienced abstractor. Cases requiring the completion of the additional fall variables involved at least five more minutes per record. Data were recorded on site at the selected hospitals on a hard copy abstraction form. Data for 2004-2005 were obtained by telephone from a medical records employee for hospitals that had only one or two randomly selected cases. Beginning with 2006 data, hospitals with less than 10 cases submitted copies of the records by mail. The IPS determined and documented if the case met the NCIPC's clinical case definition for a TBI as defined in the *Standards*. Quality assurance measures included double-checking forms for missing or inconsistent information and periodic double reviews to assess inter-rater reliability. In addition, a document was produced with definitions for most variables and notes about unusual/confusing issues, which was readily available during all abstractions. A list of sampled records was maintained and information on the basic and extended variables from the abstraction forms was entered under security into an Access 2000 file. The file was combined with a database of non-sampled cases. Abstraction forms were kept in locked cabinets in a locked room.

As outlined in the *Standards*, TBI cases found to be false positives during abstraction were included in the data set submitted to the NCIPC; false positive cases were flagged by the "abstract" variable.

Usefulness of the Data. The need for standardized TBI data is well documented.[6] In Oklahoma, TBI data are needed for describing the problem and demand for services and for funding treatment, prevention, and research. Standardized data on TBI allow the identification of high-risk populations and risk factors and the development of targeted prevention programs and evaluations. Data also enable policymakers and the public to put various health conditions in perspective. It is also important to frame the costs of treating injuries versus expenditures for prevention.

Limitations of the Data. The Oklahoma TBI surveillance system excluded individuals with less severe TBIs who were treated in an emergency department and released home and individuals treated in a physician's office. TBI data for hospitalized cases were obtained from the hospital discharge database. The HDD did not obtain data from federal hospitals (military and Native American facilities) nor did it include Oklahoma residents who were hospitalized out of state.

Persons with two consecutive hospital stays were likely transferred from one facility to another for additional care for the same injury and the two stays were combined. If there was a gap between stays, it was difficult to determine if the person was readmitted for the same injury or suffered a second injury.

Without a date of injury variable in the HDD, standardized methods were used to classify cases as one injury or two separate injuries; however, all cases may not have been correctly classified.

The TBI database was evaluated prior to being sent to the NCIPC to ensure complete and quality data. All cases were reviewed to verify that they had a TBI code, were discharged or died in the surveillance year, were residents of Oklahoma, and were not duplicate records. Date fields were checked for improper sequences and conflicts. Frequencies were run on all variables to ensure completeness of the data and to verify that they were in the proper format required by the NCIPC. Checks were made to ensure that false positive cases were included and identified in the database and that all available ICD-9-CM, ICD-10, and E codes were submitted in the proper position. The crude death and hospitalization incidence rates were calculated and compared to previous years. Predictive value positive was calculated based on medical records reviews to determine the probability that persons with a TBI code actually experienced a TBI. A marker for sensitivity was also calculated based on cases of hospitalized TBI deaths.

Lessons Learned: Surveillance Procedures

Background Work

- Establish a primary and secondary contact person at all medical records departments in the state.
  - The medical records director may not be the best contact person due to a busy schedule.
  - Create a list of all hospitals including the official name of the medical records department, the address, and the contact people's names, phone numbers, fax numbers, and e-mail addresses.
  - Periodically, send out a form to have the information updated.
- Maintain a file folder for each hospital with copies of all correspondence and notes on all telephone calls.
  - Keep a map/directions to each out-of-town hospital in the folder.
  - Keep race codes/other specific hospital information in the folder.
- Send a preliminary letter to the medical records primary contact person to explain the TBI surveillance process before making any telephone calls to set up reviews.
- Consider having an injury prevention office support staff worker schedule hospital visits and send letters.
  - Provide the support staff worker with the abstractors' schedules of dates available for reviews.
  - Send a confirmation letter and/or place a reminder call prior to the scheduled visit. The confirmation letter should include the date of the visit, the approximate time of arrival, and the number of abstractors to be expecting.

Training

- Conduct refresher training for all abstractors to enhance their knowledge of TBI and TBI data collection before beginning a new surveillance year.
  - Go over every variable on the forms; spend extra time on new questions and challenging

questions (e.g., Glasgow Outcome Scale or clinical case definition).
  - Invite a neurosurgeon to give a general presentation on TBIs, including medical treatment, imaging, terminology, etc.
  - Conduct training on what information to document to allow accurate assignment of E codes and Abbreviated Injury Scale (AIS) scores.
  - Look for opportunities to have formal training on E coding and AIS scoring.

Preparing for Site Visits/Telephone Reviews

- Obtain the HDD, select the sample, and review medical records as soon as possible.
  - If data collection is delayed, medical records may have to be requested from off-site storage or retrieved from microfiche.
  - Depending on the hospital, records may only be available electronically (scanned or directly inputted). Be aware of the hospital's limitations on computer accessibility and how this may impact the number of abstractors that can review on site (e.g., fewer numbers go more often).
- Design a TBI data collection form and have all abstractors and data entry personnel review the form.
  - Allow ample white space between questions on the TBI form to help prevent missed questions, make data entry easier, etc.
  - Include unknown/not applicable choices, so that every question requires an answer.
- Prepare a document or "cheat sheet" with definitions for variables and notes about unusual/confusing issues; continually update the document as additional issues arise.
  - Bring copies on all site visits.
- Find travel routes to visit more than one small to medium size hospital in a day, if possible.
  - Work longer hours some days to finish as many hospitals/medical records in the area as is feasible.

Collecting Data from Hospitals

- Call each hospital the day before the site visit to remind them of the medical records review.
- Fill out all known information ahead of time on the TBI forms; verify the information while at the hospital.
  - Consider using functions, like Microsoft's mail merge, to import information from the database of records directly onto forms.
- Keep multi-volume medical records together by turning them sideways in the stack of medical records.
- Have abstractors share tips with each other at individual hospitals on where difficult to find information is located in the medical record.
- Before leaving each hospital, review all TBI forms for missing data and cross-check TBI forms with the hospital list to verify that all requested medical records were obtained.
  - Request and review missing medical records before leaving the hospital.
- For hospitals with small numbers of randomly selected cases, conduct

medical record reviews by telephone or request copies by mail.
  - Fax an abstraction form to the medical records department before calling. They will usually look for information ahead of time, which speeds up review time on the phone.
  - Fill out known information before calling and confirm the information on the call.
  - Mail a letter to hospitals with 10 or fewer selected records requesting copies. Include in the letter the authority to receive such information (e.g., statutes or regulations) and a postage-paid envelope.
  - Mailed records save time and resources.
- Consider not "mixing" TBI surveillance with other surveillance or abstraction activities (i.e., other injuries).
  - Abstractors stay focused and it is less confusing for hospital staff.

After the Visit/Telephone Review/Submission of Copies

- Send a thank you letter promptly after conducting medical records reviews.
  - Hospital personnel appreciate being thanked.
  - For hospitals that submit records by mail, a letter serves as a confirmation of receipt and that reviews have been completed.
  - Document that all TBI surveillance is complete for the year or include a list of missing medical records on the letter to keep track of what has been done and what is still needed.
- Give completed forms to the data entry specialist promptly after each visit to facilitate ongoing data entry.
- Have an experienced person assess and assign correct E codes and record AIS scores.

Lessons Learned/Recommendations: Data Elements

(not a comprehensive listing of variables)

Core Variables

<u>County of Injury:</u> In situations where the record had no information on where the injury occurred, the county of injury was assumed to be the county of residence *if* the hospital's county and the county of residence were the same. Based on prior studies of Oklahoma TBI medical record reviews, 90% of injuries occurred in the patient's county of residence.

Recommendation: Like date of injury, which is assumed to be the date of admission in instances where it is missing, county of injury could be assumed to be the county of residence IF the county of residence and county of first hospital admission are the same.

<u>Discharge Disposition:</u> Outpatient rehabilitation was added to the option "returned home—with home health services (including home IV) or outpatient rehabilitation; includes home hospice." While hospitals do code a discharge with home health care differently than a discharge to home, that differentiation is not the case for outpatient rehabilitation. Many TBI patients have such services (e.g., physical, speech, and occupational therapy), so it was important to look at all documentation (particularly the discharge summary and discharge

planning notes) to determine if rehabilitation was applicable.

Race (7 variables): Through 2007 data surveillance, hospitals collected just one race, which made these variables slightly burdensome. However, they were useful for death certificate data, which already incorporated multiple race selections (in addition to a "bridged-race" variable). Oklahoma has a large Native American population and it has been suspected that, depending on how race is determined in the hospital, this group can be underreported. As a result, if the patient had Indian Health Service as the payment source, race was marked as American Indian/Alaska Native, unless the patient was a pregnant female.

Recommendation: Multiple races can be cumbersome to analyze. If hospitals only report one race and death data have a "bridged-race" variable, it may be more feasible to use that in analysis.

Extended Variables

Abbreviated Injury Scale (AIS) Score—Head: This variable is described to be the most severe score for the head region, which may be coded using either the 1998 or the 2005 version of the AIS. The most recent AIS version (2005), however, has more detailed and discriminating injury descriptions, many with several severity levels for injuries that previously had only one. Depending on the version used, data years within and between states may not be comparable, or may require mapping ("crosswalking") between versions. In addition, depending on the inclusion/exclusion criteria for skull fractures, the "Face" chapter of the AIS may be relevant in coding.

Recommendation: With changes to the injury descriptors in the "Head" chapter of the AIS 2005, it could be inaccurate to compare the variable AISHEAD between years within a state or between states unless there is some indication of the version used, or a single version is selected for coding this variable.

Blood Alcohol Level: On occasion, a medical record will have documentation of alcohol use by the patient prior to injury, but also document negative blood alcohol concentration test results (perhaps due to a lag time between drinking/injury and official laboratory test). In order not to lose the information of likely alcohol use, Oklahoma abstractors coded the option "BAC not tested or results not found, clinical or other evidence of alcohol use" in such cases.

Glasgow Outcome Scale (GOS) Score: This scale is rather subjective and requires enough training among abstractors to ensure consistency. Coding GOS must be based on more than where patients are discharged (e.g., home does not automatically equate to a good outcome). Occasionally, untrained abstractors may make such assumptions. It may be helpful to have abstractors all code some practice cases to ensure consistent assignment of values.

Intracranial Lesion: Without a definite time frame on when imaging is performed and given the varying degrees of interpretation inherent in reading imaging scans, documented intracranial lesions, in actuality, may be

acute or subacute (i.e., lesions in between acute and chronic in age; results labeled as chronic are excluded).

Recommendation: Guidance should indicate that intracranial lesions can be defined broadly as any acute, or subacute, trauma-related abnormality in the cranium.

Length of Time Unconscious: One coding option on this variable is "not applicable (e.g., use of sedative or paralytic drugs)." It is unclear when this value should be coded. According to the variable definition, the length of time unconscious begins at the time of injury and ends the first moment the individual regains consciousness. It is certainly possible for an individual to have certain drugs administered prior to regaining consciousness, but it does not seem that such administration should make the variable not applicable. The drugs do interrupt the patient's state of unconsciousness (perhaps making it medically induced) such that the length of time cannot be clearly determined, but they do not negate the fact that the individual lost consciousness as a result of their injury. In such instances, Oklahoma abstractors have coded "loss of consciousness of unknown duration" and have not made use of the "not applicable" option.

Recommendation: Guidance should be clarified on the use of "not applicable" for this variable.

Personal Protective Equipment: One issue related to this variable involves the use of child safety seats. Occasionally, medical records have stated that the child (patient) was in a child safety seat during a motor vehicle crash, but that the seat was installed improperly, or not at all, in the vehicle or that the child was not buckled properly in the seat. Such factors could negate the protectiveness of the equipment.

Recommendation: If this issue is deemed to be important, it could be feasible to revise the variable options to include a selection for "child safety seat—improperly restrained."

Skull Fracture: Although seemingly straightforward, identifying a diagnosed skull fracture can be difficult in the absence of specific inclusion/exclusion criteria. A physician may not explicitly state "skull fracture" in the medical record or imaging results may be highly specific, therefore requiring a need for knowledge of cranial and facial bones and other clinical descriptions. Differences between states do exist in terms of what types of fractures are included in this variable (e.g., should ethmoid, frontal, and sphenoid sinus, orbital wall, or orbit, not otherwise specified be counted?).

Recommendation: To ensure consistent and comparable data collection, guidance should include specifically what qualifies to be counted as a skull fracture (i.e., involvement of which cranial and facial bones, what processes [mastoid process, condylar process, etc.], and what signs/ symptoms [Battle's sign, etc.]).

Module Variables—All Patients

Amnesia: This variable can be somewhat subjective, particularly in determining the status of individuals with mild dementia or other neurological problems, but who appear to be high

functioning. Additionally, coding patients who asked repetitive questions regarding the injury (amnesia vs. confusion/disorientation) can be challenging.

Clinical Case Definition: This variable is very useful, but, if not guided by specific inclusion/exclusion criteria, can lead to inconsistent results within and between states. In addition, setting a level of intoxication (i.e., 0.2 mg/dL) in the "unable to determine" value, as was done with the amnesia variable, would be helpful.

Recommendation: To ensure consistent and comparable data collection, guidance should include specifically what clinical descriptions qualify to be counted as a skull fracture, intracranial lesion, decreased level of consciousness, and neurological or neuropsychological abnormality.

Drug Use: The results of this variable must be interpreted cautiously in the absence of a clarifying coding option or additional variable that could identify the false positives. Individuals who are administered certain types of medications prior to hospital admission (e.g., during ambulance or mediflight transport) may have a positive toxicology screen as a result. Sometimes, but not always, the medical record will have a disclaimer regarding the positive screen (e.g., given opiates or benzodiazepines en route). In order to differentiate between patients with true illicit drug use and patients given medical treatment, an additional value may be helpful (e.g., toxicology screen conducted and results positive due to medical treatment).

Recommendation: Evaluate the use and benefit of this variable. If the information is deemed valuable, consider adding an additional value to account for patients who were not using illicit drugs prior to injury, despite a positive toxicology screen.

Other Motor Vehicle Type: This variable contains highly specific types of motor vehicles that are rarely involved in sampled injuries in Oklahoma. The leading category, all-terrain vehicle, could easily be merged into the sports and recreation variable, as could other values, such as motorized boat, jet ski, and snowmobile. With such small numbers, this variable has essentially no value.

Recommendation: The variable M_OTHMV and its corresponding "specify" variable (M_OTHMV_SPEC) should not be incorporated in future versions of the main (extended) data elements.

Module Variables—65 Years and Older Fall Patients

The difficulty with the majority of the fall-related module variables was twofold. First, there was a significant lack of documentation in the medical records that hindered the ascertainment of specific circumstances of the fall (e.g., factors and objects involved), which left many variables with a high percentage of unknown values. Secondly, without a comparison group of older adults with similarly abstracted information, it remains challenging to interpret and draw conclusions on the TBI sample beyond what is already well documented in the literature. Of course, surveillance is not research, but it is

important in the planning of prevention initiatives to understand if/how the fall-related variables are unique to fall patients rather than being a part of aging in general. Surveillance should initiate control and prevention activities; this purpose becomes a struggle when variables are missing so many details (up to 66% unknown).

Body Position/Mechanics: Although relatively straightforward, one of this variable's values, "climbing," has sparked some discussion among abstractors. The discussion centered on when a person goes from walking to climbing. Clearly, ascending a flight of stairs or a ladder is climbing, but the distinction is somewhat unclear if a person trips over one or two steps.

Recommendation: Clarification on the "climbing" value in the guidance would be helpful.

Comorbid Conditions: Capturing the presence or absence of most comorbid conditions (Alzheimer's/dementia, arthritis, atrial fibrillation, CVA/stroke, depression, diabetes, hypertension, osteoporosis, Parkinson's, recent illness, and vision problems) was relatively easy, particularly with thorough documentation in the history and physical and admission assessments. However, what was unknown was how, if at all, these conditions contributed to the fall or severity of the subsequent injury.

Factors Involved with the Fall: Again, the problem of missing/not documented details resulted in nearly one-half of the records being coded to "no mention of factor involvement" (Oklahoma's default for unknown). The most common "other" entries were dizziness, lightheadedness, near syncope, lost balance, weakness, and orthostatic hypotension. While not commonly used in Oklahoma, the "ice/snow" option may more appropriately fit under the variable "objects involved with fall."

Recommendation: An assessment of the "other specified" entries may identify areas for refining existing categories (e.g., add near syncope to syncope) or creating new options and removing less frequently used ones.

Location at the Time of the Fall: Although relatively straightforward, this variable is another element where the "other specified" values could be used to indicate a need for additional categories. In Oklahoma's experience, a number of falls occurred in the hospital, so an option under "public locations" would be useful.

Recommendation: Creating a "public location—hospital" value in the guidance would be helpful.

Objects Involved with the Fall: With two-thirds of the sampled cases having unknown information on this variable, certainly the usefulness is called into question. However, there was also some confusion regarding the incorporation of assistive devices. The variable description, "objects involved with the fall, including assistive devices," begs the question of whether to include all assistive devices in use by the patient or only those documented to be involved with the fall. In addition, situations where there was documentation of the patient "usually" using an assistive device, but no information as to whether or not it was

present at the time of the fall, are particularly challenging.

Recommendation: Guidance should incorporate some additional details on how to code assistive devices.

Highlights of 2007 Data Collection

- Mail merge was used to import known information onto abstraction forms prior to visiting each hospital. The information came from the database used to select the sample and included the following variables: hospital name, medical record number, patient's name, patient's address (including street, city, county, and zip code), patient's last four digits of his/her social security number, patient's date of birth and age, patient's race, Hispanic ethnicity, all diagnosis and E codes, and discharge disposition. It was much quicker to verify these data in the medical record, than to abstract them on site.

- Out of the 81 hospitals that had at least one sampled TBI record, 65 facilities had 10 or fewer records. All of these facilities were willing to mail copies of the selected records. IPS staff then had several "in-office" surveillance days where a conference room was reserved and abstractors worked as if they were reviewing records at a hospital. Not only did this option save time and travel for IPS staff, but hospitals seemed to prefer it over having to dedicate personnel to conduct telephone reviews or cater to a site visit.

- The number of abstractors available for 2007 data collection was essentially cut in half over previous years' numbers. While this lack of personnel could have been problematic, it actually improved data quality by limiting the number of reviewers and boosting consistency. In combination with the other efficiency measures above, the IPS was not hindered by a reduced number of abstractors.

- Beginning with 2005 data collection, 44 new variables were added to the *Standards*. The IPS tested all new variables for that year's data, except for one (the optional variable on antihypertensive use among older falls). For 2006 data collection, the NCIPC made several more of these variables optional. Using what was learned during 2005 data collection and afterwards assessing the value of each optional variable, the IPS decided to drop several more optional variables that had exceptionally large rates of missing information or were infrequently positive (i.e., AVPU, frailty, incontinence, multiple sclerosis, peripheral neuropathy, seizures/epilepsy, syncope, hip fracture, and wrist fracture). This decision improved efficiency without affecting data quality or scope.

References

1. Langlois JA, Rutland-Brown W, Wald MM. The epidemiology and impact of traumatic brain injury: A brief overview. *J Head Trauma Rehabil.* 2006;21(5):375-378.

2. Langlois JA, Rutland-Brown W, Thomas KE. *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths*. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2004.

3. Finkelstein E, Corso P, Miller T. *The Incidence and Economic Burden of Injuries in the United States*. New York: Oxford University Press; 2006.

4. National Center for Injury Prevention and Control. *Report to Congress on Mild Traumatic Brain Injury in the United States: Steps to Prevent a Serious Health Problem*. Atlanta, GA: Centers for Disease Control and Prevention; 2003.

5. Marr A, Coronado V, Eds. *Central Nervous System Injury Surveillance Data Submission Standards -- 2002*. Atlanta, GA: Centers for Disease Control and Prevention; 2004.

6. National Center for Injury Prevention and Control. *Traumatic Brain Injury in the United States--A Report to Congress*. Atlanta, GA: Centers for Disease Control and Prevention; 1999.