

Consensus Recommendations for Using Hospital Discharge Data for Injury Surveillance

STIPDA

**A Report from the Injury Surveillance Workgroup of the
State and Territorial Injury Prevention Directors Association**

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USING HOSPITAL DISCHARGE DATA FOR INJURY SURVEILLANCE**

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EXECUTIVE SUMMARY

State health agencies rely on injury surveillance to assess specific needs for injury prevention programs and policies and to monitor their effectiveness. Injury surveillance is the ongoing process of tracking and monitoring incidence rates, causes, circumstances and resulting in fatal and non-fatal injuries and disseminating this data in order to prevent these injuries from occurring. Death certificates and other sources are useful for surveillance of fatal injuries. To monitor nonfatal injuries, however, other sources of data are required. One common and important source for monitoring nonfatal injuries is hospital discharge data.

Over 40 states collect data on hospital discharges. State hospital discharge data systems collect data on injuries considered serious enough to warrant hospitalization and are, therefore, priority targets for prevention. Another advantage is that hospital discharge data, unlike some national surveillance data sets, may be stratified at state, county, city, and even community levels of analysis, making these data useful for monitoring the effects of injury interventions, where the interventions are implemented.

However, hospital discharge data also have limitations for injury surveillance. State hospital discharge data systems were originally established for hospital administration and management purposes and are based on a uniform hospital discharge billing form. Therefore, hospital discharge data elements are not always specified or classified in such a way as to be informative for purposes of injury surveillance. Moreover, hospital discharge data are not collected uniformly for all states, or even within states from year to year. Standardization of data analysis and reporting methods may facilitate comparison of hospital discharge rates, but differences in rates should be interpreted with caution, due to the inherent dissimilarities of state hospital discharge data systems. In addition, they are incomplete as they include federal facilities (e.g., Indian health, military).

To assess the strengths and limitations of hospital discharge data for injury surveillance and to recommend standard methods for analyzing and reporting such data, an Injury Surveillance Workgroup was convened by STIPDA in 2001, with representatives from the State and Territorial Injury Prevention Directors Association (STIPDA); the Council of State and Territorial Epidemiologists; the National Center for Injury Prevention and Control and the National Center for Health Statistics, Centers for Disease Control and Prevention; and the National Association of Injury Control Research Centers. The Workgroup recommended standard processes for analyzing and reporting hospital discharge data by state injury prevention programs and others to facilitate comparisons of state hospital discharge rates for injury surveillance.

The ultimate goal of these recommendations is to improve state injury surveillance to support injury prevention programs and policies. By helping to standardize injury surveillance at the state level, the Workgroup also hopes to enable further collaboration between state injury prevention programs as well as integration of injury prevention within traditional public health activities. To that end, this report recommends a minimum set of state surveillance standards for hospital discharge data. However, these recommendations are not intended to limit individual states in setting and achieving their own specific objectives for injury surveillance.

BACKGROUND

Public health practitioners rely on surveillance data to assess the need for new policies and programs and to evaluate the effectiveness of existing policies and programs. Injury surveillance data are also important for monitoring state progress toward achieving the *Healthy People 2010* injury-related objectives for the nation (1).

Improving the performance of state injury surveillance systems could enhance support for state injury prevention programs and policies. Standardizing the specification of injury surveillance data elements and procedures for analyzing and reporting those data could enable injury prevention programs to compare and combine injury surveillance data from two or more states. Moreover, if these standards are compatible with standards set for state surveillance of other public health problems, injury surveillance could be integrated more easily with traditional public health surveillance. Consequently, injury prevention programs and policies could become integral components of state public health departments.

The National Public Health Surveillance System (NPHSS), for example, provides an opportunity for injury prevention to become better integrated within state public health departments. NPHSS is a conceptual framework (2) for all public health surveillance activities. It proposes that public health professionals at the state, national, and local levels reach consensus on the diseases, injuries, risk factors, services, and outcomes to be placed under surveillance and the standards and methods that should be used to collect, manage, and analyze those data. NPHSS has been envisioned and promoted by the Council of State and Territorial Epidemiologists (CSTE), with support from the Centers for Disease Control and Prevention (CDC).

Obstacles to the inclusion of injury data in NPHSS include insufficient standardization of case definitions, data collection, data analysis, and reporting methods. These issues make it difficult to link, compare, or integrate data from different systems within and among states. In 1999, a working group composed of representatives of the State and Territorial Injury Prevention Directors Association (STIPDA), CSTE, CDC, and the National Association of Injury Control Research Centers (NAICRC) recommended that injury prevention programs acquire specific surveillance capacities and track and monitor 14 injuries and injury risk factors using 11 injury data sets (3). The following year, a subsequent working group issued specific recommendations for injury surveillance using 2 of the 11 recommended data sets: the Behavioral Risk Factor Surveillance System and the Youth Risk Behavior Surveillance System.

This report addresses another of the 11 recommended data sets: hospital discharge data. Hospital discharge data systems are maintained by many states using data generated from uniform hospital billing forms (4), which are used in many states to bill payers such as Medicare for hospital services. The Medicare uniform hospital billing form (UB-92) has a dedicated field for recording an external cause of injury code (E code), but completing this field is not mandatory for hospitals to be paid. As of October 1997, 42 states and the District of Columbia were collecting and managing statewide hospital discharge data sets. Of these, 36 were routinely collecting E codes, and 23 were mandating that E codes be submitted for all injury hospitalizations.

Several features of hospital discharge data make them useful for injury surveillance. First, these data capture injuries that are considered by physicians to be serious enough to warrant hospitalization, and are, therefore, priority targets for prevention. Second, hospital discharge data systems that collect data from all or nearly all of the hospitals within a state are population-based. Population-based surveillance is the preferred method of monitoring the occurrence of injuries (5), because rates of injuries and injury risk factors can be calculated and generalized to the population at risk for being injured. Finally, hospital discharge data can be reported not only by state, but also by county and city, so that community-based injury risk factors and prevention methods may be monitored at the community level. In fact, hospital discharge data may be more useful than vital records for surveillance in less-populated areas for particular types of injuries that seldom result in death but do result in hospitalizations.

Hospital discharge data do, however, have some limitations for injury surveillance. First, most states do not collect information from all of the hospitals within the state. In some states, submission of data by hospitals to the state hospital discharge data system is voluntary. Additionally, discharge data from Veterans Affairs and Indian Health Service hospitals often are not captured in state hospital discharge data systems, even in states with relatively large Native American populations. In other states, E coding of hospital discharge data is not required; thus, data reported by these states is incomplete and may not be population-based with respect to injury causes.

A second limitation of hospital discharge data is the lack of information about risk factors, such as seatbelt use. Such information is not recorded on hospital billing forms. Thus, hospital discharge data cannot be used to directly track changes in risk behaviors, nor do they offer insight into what risk behaviors might have contributed to the injury. Third, incidence rates may be inaccurate because unique identifiers are rarely present in the hospital discharge data analyzed by health departments. For example, if an injured person is treated at more than one hospital, the injury may be counted more than once. Finally, changes in hospital admissions and coding practices affect hospital discharge data and may compromise the utility of these data for monitoring trends in injury morbidity.

Some of these limitations cannot be addressed merely by standardizing methods for injury surveillance using hospital discharge data. For example, as long as the uniform billing form is used to collect hospital discharge data in most states, risk factor information is unlikely to be collected because this information is not of primary interest to the hospitals and payers. Therefore, this report will focus on those limitations that can be addressed by standardizing surveillance methods. It recommends standard methods for injury surveillance using hospital discharge data to ensure that injury prevention programs and policies that rely on hospital discharge data may have access to data that is as complete, accurate, and representative as possible, while still maintaining consistency among states.

SPECIFIC LIMITATIONS OF HOSPITAL DISCHARGE DATA WITH RECOMMENDATIONS FOR IMPROVING DATA QUALITY

This report discusses limitations of hospital discharge data systems for injury surveillance as they relate to data management authority and capacity, quality assurance, and data analysis. It also provides in-depth recommendations to address each limitation, with the goal of improving data quality.

Data Management Authority

Injury surveillance may not be a top priority for the agency responsible for managing hospital discharge data within a state (the “source agency”). For example, as of 1997, only 16 of the 42 (38.1%) statewide hospital discharge data systems were managed within state health departments (4), which may be more likely to analyze and report hospital discharge data in a way that is useful for injury surveillance. But even within state health departments, the need for improving hospital discharge data systems for conducting injury surveillance (i.e., complete E coding) may not be well recognized. Therefore, in the majority of states, injury prevention programs must work closely with colleagues who may be unfamiliar or even unsympathetic to the need for improving hospital discharge data systems for injury surveillance.

Recommendation: If it does not have primary authority for the collection, management, analysis and reporting of hospital discharge data, the state injury prevention program should establish an effective working relationship with the source agency. If the injury prevention program is not the source agency for hospital discharge data, it almost certainly will not have the authority to mandate the recommendations in this report. Therefore, the injury prevention program should request that the source agency follow the recommendations of this report and offer assistance in carrying them out. The injury prevention program should request a copy of the state hospital discharge data set each year and implement the recommendations of this report, to the extent possible, with its own resources.

Data Management Capacity

Some state injury prevention programs are just beginning injury surveillance activities (Phase 1), others have targeted but not comprehensive injury prevention activities (Phase 2), and a few have developed all five components of a model state injury prevention program, including data collection and analysis (Phase 3) (6).

Recommendation: To implement all of the recommendations of this report, states will need Phase 3 surveillance capacity. State injury prevention programs with such capacity should be able to do the following:

- Access hospital discharge data
- Assess the data's completeness and validity
- Evaluate the system that collects and manages the data
- Ensure that each injury event is counted only once
- Conduct special analyses as needed
- Use the data to monitor program outcomes and support applied research
- Produce useful and accurate surveillance reports (3).

However, state injury prevention programs do not need Phase 3 capacity for all five components of a model state injury prevention program to implement the recommendations of this report. For example, a state may have Phase 1 capacity for public policy and other components of a model program, but have Phase 3 capacity for data collection and analysis, which includes surveillance. Such a state might be considered to have limited capacity overall for injury prevention, and yet have sufficient capacity to follow the recommendations of this report.

Quality Assurance: System Analysis

The quality of hospital discharge data systems varies by state for several reasons. First, hospital participation rates differ from state to state, and hospital participation rates within states may change from year to year, as hospitals merge or close and new hospitals open. Second, requirements for reporting the data elements, including the reporting of external cause of injury codes (E codes), also vary from state to state. The proportion of injury diagnoses coded by tissue or organ damage (N codes) that are also coded by cause of injury may range from 31% to 100% (4). Third, when patients are transferred between hospitals for the same injury or transferred to other services, such as rehabilitation or long term swing beds within the same facility, the same injury may generate two or more hospital billing forms. Ideally, each injury should be counted by the surveillance system only once so that an *incident rate* can be calculated, but some states lack the ability to exclude duplicate records.

Finally, unlike with the system for death certificates, states have no standard means to forward hospitalization data on nonresidents to their states of residence. This is particularly problematic when trauma centers or other referral centers are near state borders; injured residents may be hospitalized in the neighboring state without any record of their injuries entering the hospital discharge data of their state of residence. Thus, hospital discharge rates in some states may not include residents treated in neighboring states.

Deficiencies of hospital discharge data systems may be addressed systematically by quality assurance practices and procedures. However, just as the quality of hospital discharge data systems varies from state to state, quality assurance practices for hospital discharge data also vary from state to state. Most state injury prevention programs do not have the authority to evaluate the accuracy and completeness of their states' hospital discharge data systems. Moreover, the source agency for the hospital discharge data may use criteria for data quality that differ from the recommendations of this report, because the mission of the source agency may differ from the mission of the injury prevention program. Thus, there may be inherent barriers to achieving hospital discharge data quality for injury surveillance purposes.

Recommendation: State injury prevention programs that are not the source agency for hospital discharge data should try to work closely with the source agency to evaluate its data quality and data management procedures. An outline for evaluating hospital discharge data systems is presented in Appendix A.

Quality Assurance: Data Quality Assessment

Surveillance data sets that are obtained by the injury prevention program may have duplicate entries and inaccurate, incomplete or invalid codes. Additionally, hospitals reporting to the discharge data system may not have reported data for a full year.

Recommendation: Before analysis is conducted for injury surveillance purposes, hospital discharge data should first be assessed for data quality, including completeness and accuracy. A procedure for assessing data quality follows.

Step 1. Describe basic characteristics of the data, as listed in Table 1.

Table 1. Data characteristics

Number of fields dedicated to external cause codes	#
Percentage of unintentional injury records with location codes	###%
Percentage of intentional injury records with perpetrator codes	###%
Percentage of external cause codes that are invalid	###%
Percentage of external cause codes that are nonspecific; the codes are valid to 3 digits but have missing, extra, or invalid subsequent digits	###%

Step 2. Determine what percentage of hospitals that should be reporting discharges are annually submitting a full year's data. This might require consulting with the state hospital association or other agency each year to determine the number of hospitals in the state for any given year. Consider a hospital to have submitted a full year of data if there are records present for every month of the year, and no other evidence for missing records.

Step 3. Determine the percentage of all hospital discharges with an injury principal diagnosis (as defined in case definition below) that have an external cause of injury code (E code).

Percentage of injury hospitalizations with E codes = [(# records with principal diagnosis of ICD-9 CM 800 – 994, 995.5 and 995.80 – 995.85, excluding ICD-9 CM 909.3 and 909.5, that have a valid E code other than E849, E967, E869.4, E870 – 879, or E930 – 949) / (# records with principal diagnosis of ICD-9 CM 800 – 994, 995.5 and 995.80 – 995.85, excluding ICD-9 CM 909.3 and 909.5)] X 100.

Data Analysis

Even if the quality of hospital discharge data systems and data sets is optimal for injury surveillance purposes, they will need to be analyzed and presented in a standard format to facilitate interpretation and comparison within states for different surveillance periods and among other states as well. In practice, hospital discharge data often are not optimal; reporting of sub-optimal data is at the discretion of the state injury prevention program. The Workgroup considered the perspective that data may not improve if they are not used.

Recommendation: If possible, the injury prevention program should acquire the complete hospital discharge data set from the source agency to analyze the data, according to the recommendations that follow for routine surveillance and maintain the original data set for more detailed analyses and special studies. Irrespective of data quality, limitations exist for all data sets and data analyses, and they should always be reported. Once the data set is received and assessed for data quality, the 10 steps below should be followed to analyze hospital discharge data in a standard format to facilitate comparison. A state injury prevention program may also choose to perform additional analyses of special interest to its state.

Step 1. Review the principal diagnosis field of the hospital discharge data set using the principal diagnosis field to determine inclusion in the injury surveillance subset, as described in the following case definition.

Case Definition for Injury Hospitalization in Hospital Discharge Data

An injury hospitalization is defined as a patient record that lists the principal reason for admission to a non-federal, acute-care, inpatient facility as an injury, including the late effects of injury. Injuries are identified by the nature of injury codes listed in Table 2. Re-admissions, transfers and deaths in the hospital are included in this definition. Excluded from the definition are adverse effects of therapeutic use of drugs, of medical/surgical care and the late effects of those adverse effects. Also excluded are patients discharged from emergency departments or observation beds; however, state injury prevention programs may wish to analyze these discharges to supplement the recommended analyses.

Table 2. Inclusion/exclusion criteria* using ICD-9 CM nature of injury codes in the principal diagnosis field

Include	
800 – 909.2, 909.4, 909.9	Fractures; dislocations; sprains and strains; intracranial injury; internal injury of thorax, abdomen, and pelvis; open wound of the head, neck, trunk, upper limb, and lower limb; injury to blood vessels; late effects of injury, poisoning, toxic effects, and other external causes, excluding those of complications of surgical and medical care and drugs, medicinal or biological substances.
910 – 994.9	Superficial injury; contusion; crushing injury; effects of foreign body entering through orifice; burns; injury to nerves and spinal cord; traumatic complications and unspecified injuries; poisoning and toxic effects of substances; other and unspecified effects of external causes.
995.5 – 995.59	Child maltreatment syndrome.
995.80 – 995.85	Adult maltreatment, unspecified; adult physical abuse; adult emotional/psychological abuse; adult sexual abuse; adult neglect (nutritional); other adult abuse and neglect.
Exclude	
< 800	
909.3, 909.5	Late effects of complications of surgical and medical care; late effects of adverse effects of drug, medicinal, or biological substance.
995.0 – 995.4, 995.6 – 995.7, 995.86, 995.89	Other anaphylactic shock; angioneurotic edema; unspecified adverse effect of drug, medicinal and biological substance; allergy, unspecified; shock due to anesthesia; anaphylactic shock due to adverse food reaction; malignant hyperpyrexia or hypothermia due to anesthesia.
996 – 999	Complications due to certain specified procedures; complications affecting specified body systems, not elsewhere classified; other complications of procedures, NEC; complications of medical care, NEC.
<p>* Codes used in this definition may need to be updated annually as new codes are introduced, and following the adoption of ICD-10 CM. Although some injuries, such as poisonings, near-drownings, and medical injuries, may be incompletely captured by excluding codes <800, the Workgroup recommends excluding codes <800 until consensus is reached about case definitions and analytic procedures. In the meantime, individual states may choose to conduct supplementary analyses using “excluded” codes.</p>	

The Workgroup arrived at this case definition after extensive discussion. Its goal was to recommend a case definition that is simple, applicable in all states, and based on the one diagnostic field for which there is a generally accepted coding rule (the principal diagnosis field). This rule states that the principal diagnosis field is reserved for the code corresponding to “the reason for which, after study by the attending physician or nurse, the patient was admitted.” For the other diagnostic fields, there are no national standards for the order in which codes are assigned. Therefore, the presence of an injury diagnosis code in subsequent fields does not necessarily reflect an injury of sufficient severity that it would have led to hospitalization on its own.

In practice, the rule for the principal diagnosis field may not be followed scrupulously. In fact, there may be a financial incentive to disregard this rule and use the principal diagnosis field to enter the code for the diagnosis with the greatest reimbursement rate. Regulations exist to deter these types of coding abuses, but the Workgroup is unaware of any current research that assesses the validity of principal diagnosis codes in hospital discharge records. To overcome the problem of inconsistent ranking of diagnoses by relevance to patients' reasons for hospital admission, state injury prevention programs could analyze all diagnostic codes for each patient. However, because many state injury prevention programs lack the capacity to perform these more sophisticated analyses, the Workgroup recommends that only the principal diagnosis field be used to define injury hospitalizations at this time. This practice will achieve data uniformity necessary for comparison by state.

Step 2. Report frequencies of diagnoses in the principal diagnosis field according to the Barell Matrix, a two-dimensional array of three-, four- and five-digit ICD-9 CM injury codes grouped by the body region of the injury and the nature of the injury. The Barell Matrix assigns all ICD-9 CM codes between 800 and 999, excluding adverse effects (other than adult and child maltreatment) and complications of surgical and medical care. This matrix and the SAS codes for constructing it can be found at www.cdc.gov/nchs/about/otheract/ice/barellmatrix.htm and is included in Appendix B of this report.

The rows of the matrix are based on principal body regions:

- head and neck including brain, skull, face, and front of the neck
- spinal cord
- vertebral column
- torso which includes the abdomen, thorax, pelvic region, trunk, back, and buttock
- upper extremities
- lower extremities
- other and unspecified including injuries such as foreign bodies, early complications, poisoning and toxic effects, and other and unspecified effects of external causes that cannot be classified into any specific body region

Each principal body region is further divided into subcategories yielding a total of 35 possible categories.

The columns of the matrix are the 11 nature-of-injury categories:

- fractures
- dislocations
- sprains and strains
- internal injuries
- open wounds including lacerations and amputations
- injuries to blood vessels
- injuries to nerves
- contusions, abrasions and other superficial injuries excluding minor lacerations
- crushing injuries
- burns
- injuries of other and unspecified nature

Step 3. Report frequencies of valid external cause codes according to the recommended Framework of E-code Groupings for Presenting Injury Mortality and Morbidity Data (Table 3). If more than one external cause code is listed for a given record, report only the first valid E code listed in the designated E code field. If nothing is listed there, report only the first valid E code listed in the diagnostic code fields. If the first E-code is invalid, or it is E849, E967, E869.4, E870 – 879 or E930 – 949, use the next valid E-code listed in designated E code fields or other diagnostic code fields. If there are no other E codes listed, report E967, E869.4, E870-879, or E930-949, but not E849. Records with no valid E codes in any of the diagnostic code fields are treated the same way as records having no E codes at all; they are excluded from tabulation.

Table 3. Recommended framework of E-code groupings for presenting injury mortality and morbidity data

Mechanism/Cause	Manner				
	Unintentional	Self-inflicted	Assault	Undetermined	Other*
Cut/pierce	E920.0 –.9	E956	E966	E986	E974
Drowning/ submersion	E830.0 –.9, E832.0–.9, E910.0 –.9	E954	E964	E984	
Fall	E880.0 – E886.9, E888	E957.0 –.9	E968.1	E987.0 –.9	
Fire/burn	E890.0 – E899, E924.0 –.9	E958.1,.2,.7	E961, E968.0,.3	E988.1,.2,.7	
Fire/flame	E890.0 – E899	E958.1	E968.0	E988.1	
Hot object/ substance	E924.0 –.9	E958.2,.7	E961, E968.3	E988.2,.7	
Firearm	E922.0 –.3,.8, .9	E955.0 – .4	E965.0 –.4	E985.0 –.4	E970
Machinery	E919.0 –.9				
Motor vehicle traffic**, ***	E810 – E819 (.0 –.9)	E958.5	E968.5	E988.5	
Occupant	E810 – E819 (.0,.1)				
Motorcyclist	E810 – E819 (.2,.3)				
Pedal cyclist	E810 – E819 (.6)				
Pedestrian	E810 – E819 (.7)				
Unspecified	E810 – E819 (.9)				
Pedal cyclist, other	E800 – E807 (.3), E820 – E825 (.6), E826.1, .9, E827 – E829 (.1)				
Pedestrian, other	E800 – E807 (.2) E820 – E825 (.7) E826 – E829(.0)				
Transport, other	E800 – E807 (.0,.1,.8,.9) E820 – E825 (.0–.5,.8,.9) E826.2 –.8 E827 – E829 (.2 –.9) E831.0 –.9, E833.0 – E845.9	E958.6		E988.6	

Table 3. Recommended framework of E-code groupings for presenting injury mortality and morbidity data (continued)

Manner					
Mechanism/Cause	Unintentional	Self-inflicted	Assault	Undetermined	Other*
Natural/ environmental	E900.0 – E909, E928.0 –.2	E958.3		E988.3	
Bites and stings****	E905.0 –.6,.9, E906.0 –.4,.5,.9				
Overexertion	E927				
Poisoning	E850.0 – E869.9	E950.0 – E952.9	E962.0-.9	E980.0 – E982.9	E972
Struck by, against	E916 – E917.9		E960.0, E968.2		E973, E975
Suffocation	E911 – E913.9	E953.0 –.9	E963	E983.0 –.9	
Other specified and classifiable****	E846 – E848, E914 – E915 E918, E921.0 –.9, E922.4 E923.0 –.9, E925.0 – E926.9 E928.3, E929.0 –.5	E955.5,.6,.9 E958.0,.4	E960.1, E965.5 –.9 E967.0 –.9, E968.4,.6,.7	E985.5, .6 E988.0,.4	E971, E978 E990 – E994, E996 E997.0 –.2
Other specified, not elsewhere classifiable	E928.8, E929.8	E958.8, E959	E968.8, E969	E988.8, E989	E977, E995, E997.8 E998, E999
Unspecified	E887, E928.9, E929.9	E958.9	E968.9	E988.9	E976, E997.9
All injury	E800 – E869, E880 – E929	E950 – E959	E960 – E969	E980 – E989	E970 – E978, E990 – E999
Adverse effects					E870 – E879, E930.0 – E949.9
Medical care					E870 – E879
Drugs					E930.0 – E949.9
All external causes					E800 – E999

*Includes legal intervention (E970 – E978) and operations of war (E990 – E999).

**Three fourth-digit codes (.4 [occupant of streetcar], .5 [rider of animal], .8 [other specified person]) are not presented separately because of small numbers. However, because they are included in the overall motor vehicle traffic category, the sum of these categories can be derived by subtraction.

***E968.5 (assault by transport vehicle), E906.5 (bite from unspecified animal), E922.4 (unintentional injury [gunshot wound] with BB/pellet), E955.6 (suicide attempt/intentionality self-inflicted injury [gunshot wound] with BB/pellet gun), E986.6 (assault [gunshot wound] with BB/pellet gun), E985.6 (undetermined intent injury [gunshot wound] with BB/pellet gun), E928.3 (unintentional human bite), and E968.7 (assault by human bite), are specific to the *ICD-9 CM* and, therefore, only apply to morbidity coding.

Table 3. Recommended framework of E-code groupings for presenting injury mortality and morbidity data (continued)

**** E849 (place of occurrence) has been excluded from the matrix. For mortality coding, an ICD-9 E849 code does not exist. For morbidity coding, an ICD-9-CM E849 code should never be first-listed E code and should only appear as an additional code to specify the place of occurrence of the injury incident.

SAS coding information can be found at <http://www.cdc.gov/nchs/data/ice/9sascodes.txt>. Note that there is a limitation to this program: it recognizes only the first-listed E code. If the first-listed E code in a record is invalid, the record is treated as having no E code and is excluded from the Recommended Framework of E code Groupings. The Workgroup recommends that individual states modify the SAS program themselves so that records with valid E codes in subsequent fields are not excluded.

Step 4. Calculate *crude unadjusted injury discharge rates* using state residents only in the numerator and state populations obtained from either the U.S. Census or state demographics center/agency in the denominator. Calculate these rates for the Barell matrix and the Recommended Framework of E-code Groupings for Presenting Injury Mortality and Morbidity Data. For ease of analysis, part-time state residents should be excluded.

Step 5. Calculate *sex-specific age-adjusted rates*, and the total state population for the Barell matrix and the Recommended Framework of E-code Groupings for Presenting Injury Mortality and Morbidity Data. When calculating state rates for comparison with other states, perform age-adjustment to the 2000 standard population using NCHS age distribution #1 (Table 4).

Age adjustment — the application of age-specific rates to a standard age distribution — eliminates differences in crude rates that may result from different age distributions of populations. An age-adjusted rate has no meaning in isolation; it can only be used to compare with another rate standardized in the same way.

Table 4. Standard age groups with age adjustment template using National Center for Health Statistics age distribution #1

Age	State Population	Number of cases in State	State Age-Specific Rate	Weight	Weighted State Age-Specific Rate
<1	pop ₁	n ₁	n ₁ /pop ₁	0.013818	(n ₁ /pop ₁) * 0.013818
1-4	pop ₂	n ₂	n ₂ / pop ₂	0.055317	(n ₂ / pop ₂) * 0.055317
5-14	pop ₃	n ₃	n ₃ /pop ₃	0.145565	(n ₃ /pop ₃) * 0.145565
15-24	pop ₄	n ₄	n ₄ /pop ₄	0.138646	(n ₄ /pop ₄) * 0.138646
25-34	pop ₅	n ₅	n ₅ / pop ₅	0.135573	(n ₅ / pop ₅) * 0.135573
35-44	pop ₆	n ₆	n ₆ /pop ₆	0.162613	(n ₆ /pop ₆) * 0.162613
45-54	pop ₇	n ₇	n ₇ / pop ₇	0.134834	(n ₇ / pop ₇) * 0.134834
55-64	pop ₈	n ₈	n ₈ / pop ₈	0.087247	(n ₈ / pop ₈) * 0.087247
65-74	pop ₉	n ₉	n ₉ / pop ₉	0.066037	(n ₉ / pop ₉) * 0.066037
75-84	pop ₁₀	n ₁₀	n ₁₀ / pop ₁₀	0.044842	(n ₁₀ / pop ₁₀) * 0.044842
85+	pop ₁₁	n ₁₁	n ₁₁ / pop ₁₁	0.015508	(n ₁₁ / pop ₁₁) * 0.015508
Total	pop ₁₂	n ₁₂	————	1	SUM of column = State Age Adjusted Rate

Step 6. Report *age-specific rates* for the Barell matrix and the Recommended Framework of E-code Groupings for Presenting Injury Mortality and Morbidity Data, calculated in Step 5 (fourth column of Table 4).

State injury prevention programs also may wish to report rates in injury-specific age groupings that differ from the recommended standard age groupings. For example, they may wish to report rates of swimming pool near-drowning injury among toddlers or motor vehicle injury rates for 16- and 17-year-olds.

Step 7. Report *sex-specific injury rates* for the Barell matrix and the Recommended Framework of E-code Groupings for Presenting Injury Mortality and Morbidity Data. Rates for many causes of injury differ by sex. For example, hospitalizations resulting from falls are more common among older women, and homicide is more common among men.

Step 8. Report injury rates, for the Barell matrix as well as the Recommended Framework of E-code Groupings for Presenting Injury Mortality and Morbidity Data *by level of urbanization*, using the following categories:

- Large central metropolitan
- Large fringe metropolitan
- Small metropolitan
- Non-metropolitan with a city of 10,000 or more population
- Non-metropolitan without a city of 10,000 or more population

These designations were developed for use in the *Urban and Rural Health Chartbook of Health, United States, 2001(7)* and are available on the NCHS web site at ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/Health_US/hus01/. For county codes, click on countyfile.txt (ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/Health_US/hus01/countyfile.txt). For documentation of the file layout, see www.cdc.gov/nchs/products/pubs/pubd/hus/docurban.pdf. Assignment of the 3,142 counties and county equivalents to the five urbanization levels was based on their classification in the Urban Influence code system (December 1996 Revision) developed by the Economic Research Service, U.S. Department of Agriculture. The categorization of counties as metropolitan or non-metropolitan in the Urban Influence code system is based on the June 1993 Office of Management and Budget definition of metropolitan areas.

Step 9. Report *median hospital charges* for each classification of injury in the Barell matrix and the Recommended Framework of E-code Groupings for Presenting Injury Mortality and Morbidity Data. Note, however, that hospital charges usually do not portray the actual cost of treatment. Listed charges are usually based on what the least price-sensitive payer is willing to pay, and most payers do not pay full charges. Consequently, listed charges usually overestimate the actual cost burden of the hospital stay (8). Reports of hospital discharge data for injury surveillance purposes should include a footnote about potential overestimation. In addition, because large outliers are often found in charge data, reporting median charges may be more informative than reporting mean charges.

Step 10. Report *payer source* as government, self-pay, workers compensation, commercial insurance companies, or health maintenance organization for the Barell matrix and the Recommended Framework of E-code Groupings for Presenting Injury Mortality and Morbidity Data. Since most statewide hospital discharge data sets were originally created as a management and reimbursement tool for non-federally funded acute care facilities, data sets often allow for the coding of various types of expected reimbursement. Categories for expected reimbursement may include Medicaid, Medicare, self-pay, workers' compensation, commercial insurance companies, Corrections, and HMOs. In the interest of simplifying an analysis, these categories usually can be collapsed. For example, it is recommended

that all government payers, including Medicaid and Medicare, be combined to form one category. In addition, it is often useful to separate commercial insurance payers and self-pay categories. This allows for calculating hospital charges stratified according to the burden of charges, such as an individual, the government or the private sector.

The payer sources recommended here correspond roughly to those recommended in *Data Elements for Emergency Department Systems (DEEDS)* (9), a set of specifications recommended for data collection by 24-hour, hospital-based emergency departments: insurance company, Medicare, Medicaid, workers' compensation, other government payments, self-pay, no charge, other, and unknown. DEEDS also recommends that more than one source may be reported for patients who have more than one type of insurance coverage.

Analyses Not Recommended at This Time

Race and Ethnicity. Data collection on race and ethnicity is a complex topic. Pending evaluation of states' methods for collecting information about race and ethnicity in hospital discharge data, the reporting of such information is not recommended.

Injury Severity. Ideally, an injury surveillance system should include an indicator of injury severity. However, the decision to hospitalize an injured patient may not be based solely on injury severity. For example, a child with a spiral fracture of the forearm — an injury often associated with abuse — may be hospitalized if the treating physician is concerned that the child may not be safe in her home environment. Hospitalization decisions may vary by age, sex, injury types, payer sources, or hospitals within a state or across states. Admission to a hospital is influenced by many socioeconomic factors, co-morbidity and morbidities, by the general physical health of each individual, and by variations in clinical practice. Therefore injury severity scoring systems have been developed so that injury rates may be compared by severity according to standard methods designed to be independent of these characteristics.

One widely accepted injury severity scoring system is the Abbreviated Injury Scale (10). It uses a standard dictionary to enable experts to assign numeric scores based upon body region and type of injury. The Abbreviated Injury Scale has been revised several times and although it continues to have several important shortcomings for practice and research (11), it is still widely used. One problem with the Abbreviated Injury Scale is that the calculated score has a weak correlation with injury mortality. To improve this correlation, the Injury Severity Score was developed (12). The Injury Severity Score is calculated as the sum of the squares of the scores assigned by the Abbreviated Injury Scale for the three most severely injured body regions.

Assigning these scores by individual chart review is labor-intensive. Automated systems for assigning scores have been developed to convert ICD-9 CM diagnosis codes in hospital discharge databases. Unfortunately, variations in state hospital discharge data systems, such as the number of fields on hospital billing forms for reporting diagnostic codes, may influence their reliability.

At this time, the Workgroup does not recommend a specific injury severity scoring system, because further evaluation and comparison of published injury severity scoring systems remains to be done.

CONCLUSION

Hospital discharge data represents an important and useful data source for the surveillance of non-fatal injuries. This report has presented a minimum set of recommendations analyzing and reporting hospital discharge data. These recommendations are not intended to limit individual states in setting and achieving their own objectives for injury surveillance. The ultimate goal of these recommendations is to improve injury surveillance to support injury prevention programs and policies. The Workgroup hopes that this report will enhance your use of hospital discharge data for injury surveillance. By helping to standardize injury surveillance at the state level, the Workgroup also hopes to further enable collaboration among state injury prevention programs as well as integration of injury prevention within traditional public health activities.

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ABOUT STIPDA

The State and Territorial Injury Prevention Directors Association (STIPDA) is a national non-profit organization of professionals committed to protecting the health of the public by sustaining, enhancing and promoting the ability of state, territorial and local health departments to reduce death and disability associated with injuries. To advance this mission, STIPDA engages in activities to increase awareness of injury as a public health problem; provide injury prevention and control education and training; enhance the capacity of public health agencies to conduct injury prevention and control programs; and support public health policies designed to advance injury prevention and control.

For more information about STIPDA or the Injury Surveillance Workgroup, please visit the STIPDA website at www.stipda.org.

Assessment of State Hospital Discharge Data Systems

The following is a listing of information to be sought in a thorough evaluation of the hospital discharge data system. The Workgroup acknowledges that many of these assessments may be subjective; for example, terms such as “recent” and “well documented” are not defined.

After each topic, recommendations are made for improving the hospital discharge data system.

1. Have the data quality and completeness been evaluated by the source agency?

If yes,

- How recent was the evaluation?
- Were the results well documented?
- Was sufficient information gathered to assess injury aspects?
- How often is evaluation performed?

If no,

- Is the source agency planning an evaluation or have a desire or willingness to do so?
- If no,
 - What are the barriers?
 - Is the injury prevention program able to assist in overcoming barriers?

2. Determine hospital participation rates

- Determine the number of hospitals that should be reporting (state licensing body)
 - Describe by various characteristics, e. g., bed size, trauma center status, children’s hospitals, geographic distribution
 - Is a monitoring system in place to keep denominator of hospitals up to date?
- Determine the number of hospitals that are reporting
 - Describe by various characteristics
- Calculate the percentage of hospitals reporting
 - Describe by various characteristics
- Other data to collect
 - Completeness of reporting — what percent of hospitals report by the deadline established by the source agency?
 - Consistency by hospital — do hospitals drop in/out of the numerator of reporting?

3. How to improve hospital reporting rates

- Provide reporting rate information to providers and users
- Encourage source agency to increase participation rates, e.g., provide incentives
- Engage other interested parties:
 - Leadership of agency where injury prevention program resides
 - Local agencies that may become users of hospital discharge data system for injury prevention
- Offer assistance as appropriate

4. Assess management and supervisory practices
 - What quality control procedures are advocated centrally, at hospitals?
 - How are coders supervised?
 - What is the turnover rate among coders? Variations by geographic areas?
 - Are coders well trained?
 - How are training needs identified?
 - How are training needs met? Timeliness?
 - What is the content of the training?
 - What is the quality of training? Has it been evaluated?
 - Are the current NCHS guidelines being used for instruction?
 - Are there standards for performance?
 - Do coders receive feedback about their performance?
 - How timely is the reporting of data? Are hospitals monitored by deadlines for reporting?
 - Who is responsible for the above activities?

5. How to improve management and supervisory practices
 - As appropriate, offer to assist the source agency to improve practices by:
 - Establishing systems and procedures to correct deficiencies identified, e.g., developing quality control manuals, methods for identifying training needs, creating feedback mechanisms
 - Identifying successful approaches in other states
 - Setting specific goals for improving performance
 - Providing resource assistance as appropriate

6. Assess out-of-state hospitalizations among your state's residents
 - Contact neighboring state(s) (injury control director) to determine if hospital discharge data is collected and ask for a count of the number of your state's residents in their data set
 - If hospital discharge data are not collected, contact county health department(s) along the border and determine if there is a pattern of local residents using out-of- state hospitals

7. How to improve the identification of out-of-state hospitalizations
 - Establish a routine reciprocal reporting mechanism with other state(s).
 - If hospital discharge data are not collected in an adjacent state(s), and this appears to be a significant issue, consider developing a retrospective hospital(s) chart review in the adjacent state area with the cooperation of the health agency in the area.
 - These same issues may apply to states that border other countries. At this time, CDC has made no international agreements.

State and Territorial Injury Prevention Directors Association

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