

An Evaluation of External Cause-of-Injury Codes Using Hospital Records from the Indian Health Service, 1985

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Abstract: To evaluate the usefulness of International Classification of Diseases external cause-of-injury and poisoning codes (E codes) for public health surveillance of nonfatal injuries, we analyzed E codes from Indian Health Service (IHS) hospital records. E codes for unknown or unspecified causes were used for 25 percent of records. At two hospitals, 63 percent of E codes assigned by

independent coders agreed; another 18 percent matched on general cause-of-injury groups. With uniform guidelines and increased training, E coding could provide a valuable, cost-effective method of quantifying and characterizing severe, nonfatal injuries. (*Am J Public Health* 1990; 80:279-281.)

Introduction

Because external causes of injury and poisoning are routinely coded on death certificates under the International Classification of Diseases (ICD) external cause-of-injury and poisoning coding scheme (E codes),¹ we have learned a great deal about fatal injuries. We know much less, however, about the causes of the many more numerous nonfatal injuries, partially because we lack the appropriate data. Although hospital discharge records provide a potential mechanism for public health surveillance of nonfatal injuries severe enough to require hospitalization, most hospitals do not routinely E code discharge data. Recently, influential health policy and advisory groups, including the National Academy of Sciences and the Council of State and Territorial Epidemiologists, have advocated routine E coding of hospital discharge data to link injury data collection and the development and implementation of intervention strategies.²⁻⁴

Presently, population-based E coded hospital discharge data are already available in the Indian Health Service (IHS). To examine a practical application of hospital discharge data E coding as well as the strengths and limitations of using E codes for injury surveillance, we analyzed IHS records to determine the level and quality of E coding, the reliability of E codes assigned by different coders, and the feasibility of using E coded hospital discharge data as an injury surveillance tool.

Methods

Discharge records for eligible American Indians and Alaska Natives hospitalized at IHS facilities from October 1, 1984—September 30, 1985, were selected for analysis. We excluded records for medical care provided by outside contractors and at tribal facilities (27.9 percent of admissions⁵) because they are not reliably E coded.

Medical records for all hospitalizations were coded by on-site medical records personnel at each of 46 IHS hospitals using the standard ICD (ninth revision)-Clinical Modification (ICD-9-CM)⁶ codes and rules. Records were coded after discharge based on clinical assessment, diagnostic and ther-

apeutic procedures, and other health services information collected during the hospitalization and recorded on the chart. Each IHS record was coded for: 1) up to six clinical codes; and 2) one cause-of-injury code, if the hospitalization was injury-related.

The ICD hospital indexing system includes the Classification of Diseases and Injuries (often called "N codes"); two supplementary classifications: Factors Influencing Health Status and Contact with Health Service (V codes*) and External Causes of Injury and Poisoning (E codes); and four appendices (Morphology of Neoplasms, Glossary of Mental Disorders, Classification of Drugs, and Classification of Industrial Accidents). Diagnostic and therapeutic procedures are coded with yet another classification scheme, the Classification of Procedures in Medicine.

The cause-of-injury/poisoning E code has several components. All E codes have three digits following an "E." Three-digit E codes can be grouped according to general external cause or intent (e.g., E880-E888: accidental** falls, E950-E959: suicide and self-inflicted injury). Most three-digit E codes also require a fourth digit subdivision (EXXX.0-EXXX.9) to identify the role of the injured person or to provide additional cause-specific information.

For this analysis, we selected injury records by two independent methods: 1) records with injury and poisoning diagnosis and health services codes (ICD-9-CM codes 800-999 and V71.3-V71.6); and 2) records receiving cause-of-injury E codes (E800-E999). We then compared the files to measure the level of injury coding. To evaluate the reliability of IHS E codes, we reviewed E coded records for two hospitals, abstracted cause-of-injury information, and recoded the external causes of injury and poisoning. The author (SMS) who recoded records was blinded to the original codes.

Results

Of the 10,921 (13.9 percent) IHS hospital discharge records with at least one injury-related diagnosis or health services code, 99.3 percent were E coded. All records with an injury diagnosis code (800-999) had an associated E code;

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*V codes are used for occasions when a person encounters the health care system for a specific purpose other than illness or injury (e.g., immunization or pregnancy). For injuries, certain V codes may be appropriate for persons hospitalized for observation following a traumatic event.

**Although use of the term "accidental" denotes an unpreventable event and, therefore, is to be avoided, unintentional injuries are labeled "accidental" in the ICD.

52 of 128 records selected by an injury health services codes (V71.3–V71.6) were E coded.

Of the 11,063 E coded records selected independent of diagnosis codes, 10,845 (98.0 percent) had at least one injury or poisoning diagnosis or health services code. For the other 218 E-coded records, the most frequent conditions requiring hospitalization were adverse effects of medical/surgical care (N = 106) and poisoning (N = 9). These 11,063 hospitalizations were required for 9,555 individuals.

More than 75 percent of all injury hospitalizations were in six broad external cause groups: transport-related incidents, falls, acts of violence, adverse effects of medical and surgical care, other accidents (being struck, caught, or cut), and suicides/attempts (Table 1). Transport-related events and falls together accounted for more than a third of all injury hospitalizations.

About 25 percent of IHS injury hospitalization records were coded using three-digit E codes for general or unspecified causes of injury, reflecting a lack of more detailed information about the injury events. Most frequently, records for falls, transport-related injuries, and assaults could be coded with only general E codes. For 540 records, the underlying cause of injury was not available, and coders used two non-specific codes, E887 (fracture, cause unspecified) and E928 (other and unspecified environmental and accidental causes).

Fourth-digit codes were assigned where appropriate. Coders assigned a fourth-digit code to all three-digits E codes requiring the additional character. For those three-digit E codes without an associated fourth-digit, IHS appropriately did not assign a fourth digit. For 22.6 percent of records with E codes requiring a fourth digit, a nonspecific fourth digit code was assigned because sufficient information to code the fourth digit was not provided in the record.

The E coding reliability evaluation was based on injury hospitalization records from two IHS Service Units. Ninety-seven percent of 333 discharge records receiving E codes were available to abstract and re-code. We assessed coding agreement on a hierarchical scale. When we compared recoded E codes with those assigned by IHS medical records personnel, 59 percent agreed completely (agreement to the three-digit level and agreement to the four-digit level where appropriate). Comparison of the three-digit agreement hierarchy is shown in Table 2. Overall, in 63 percent of the

TABLE 2—Percent Agreement of External Cause-of-Injury Codes for Injury Hospitalization Records, Indian Health Service

Level of Agreement	Percent Agreement*		
	Service Unit A (N = 240)	Service Unit B (N = 83)	Cumulative Percent (N = 323)
Three-digit E code	60	71	63
External cause group Intent**	76	91	81
	83	92	86

*A mutually exclusive hierarchy. For each hospital record, the E code assigned by IHS medical records personnel was compared to the E code assigned by one of the authors. Codes matching on the external cause group are those for which both coders assigned three-digit E codes from the same group of external causes (e.g., transport-related incident [E800–E848], falls [E880–E888], or assaults [E960–E978]) but did not assign identical three-digit E codes.

**Codes matching on intent are those for which both coders assigned E codes of the same intent classification (i.e., unintentional, intentional, or unknown intent) but did not assign identical three-digit E codes or codes from the same external cause group.

records, the original and recoded three-digit E codes matched. Eighty-one percent of records had matching three-digit codes or similar codes from an external cause group. An additional 5 percent of records had original and recoded E codes that fell under the same ICD-9-CM rubric of intent (i.e., unintentional, intentional, or unknown intent of injury). Neither three-digit E code, external cause group, nor intent agreed for 14 percent of records. For most of the nonmatching sets of codes, medical care providers recorded different scenarios of the injury event on an individual chart or E codes were selected on the basis of recorded injury event circumstances that did not fit well within the ICD-9-CM classification scheme (e.g., Should a fall out of an automobile be coded as a fall or as a transport-related event?).

Discussion

Because proposals to require universal E coding of hospital discharge data are gaining prominence,^{2-4,7,8} this examination of E code use in the IHS is valuable for public health practitioners and other researchers interested in injury surveillance and data collection. Few other opportunities exist for us to test the feasibility of requiring universal E coding and to understand the strengths and limitations of injury cause information obtained from E coded records. As shown in this evaluation, routine E coding of IHS hospital discharge data was a valuable, cost-effective method of quantifying and characterizing severe, nonfatal injuries. E codes provided us with a clear distribution of the underlying causes of injuries requiring hospitalization in this population, thus permitting us to identify priority injury problems. Community-based injury prevention programs, based in part on external cause information extracted from hospital records, are currently being coordinated and conducted by trained injury prevention professionals throughout IHS.⁹ The E coded records are also valuable for evaluating the effectiveness of these prevention programs.

E codes were reproducible. Although the specific three- and four-digit codes assigned by independent coders sometimes differed, codes agreed closely according to the external cause group. The extent of E coding agreement compares favorably with previous evaluations of the reliability of death certificate and cancer registry information. In Connecticut, an analysis of autopsy reports and corresponding death certificates found major disagreement leading to reclassification of the underlying cause of death for 29 percent of

TABLE 1—Frequency of Three-Digit External Cause-of-Injury Codes from Hospitalization Records,* by Injury Group, Indian Health Service, Fiscal Year 1985

E Codes	External Cause Group	Frequency	Percent	Cumulative Percent
E800–E848	Transport-related	1896	17.1	17.1
E880–E888	Falls	1871	16.9	34.1
E960–E978, E990–E999	Assaults/legal/war	1606	14.5	48.6
E870–E879, E930–E949	Adverse effects of care	1367	12.4	60.9
E916–E920	Struck/caught/cut	973	8.8	69.7
E950–E959	Suicides/attempts	805	7.3	77.0
E980–E989	Intent unknown	477	4.3	81.3
E900–E909	Environmental	456	4.1	85.4
E928–E929	Other/late effects	455	4.1	89.5
E850–E869	Poisonings	366	3.3	92.9
E927	Overexertion	221	2.0	94.8
All Other E Codes		570	5.2	100.0

*N = 11,063

deaths.¹⁰ For an additional 26 percent of deaths, the death certificate and autopsy report agreed on the major disease category but attributed the death to a different specific disease. As part of the Third National Cancer Survey, death certificates for 48,826 cases of single primary cancer were compared to hospital diagnoses.¹¹ The underlying cause of death was found to be accurate in 65 percent of cases. In a comparison of data collected from interviews and those reported to the Missouri cancer registry,¹² 70 percent of occupation, 72 percent of industry, 83 percent of smoking status, and 65 percent of alcohol consumption codes agreed. In spite of these limitations, coded data from death certificates and cancer registries have been used extensively in public health practice. E coded hospital discharge data can be of similar value.

With increased attention to the value of E codes, reliability can be improved. E code users and potential users would benefit from standardized E coding guidelines and definitions, increased availability of E code training, and more rigorous evaluation of the current E code scheme. For example, because only 40.6 percent of hospitalizations for observation following trauma (V71.3–V71.6) received E codes in this analysis, we assume that the use of E codes for records coded with health services codes (V codes), and perhaps other injury codes, was not consistent. Due to reimbursement, hospitals have financial incentives to provide adequate training for coders to ensure accurate diagnosis and procedure coding. As more states require E coding of uniform hospital discharge data,⁷ the need for uniform E coding procedures and training will increase.

About a fourth of IHS injury records were coded with E codes for general or unspecified external causes. These general or unspecified codes are much less useful for public health surveillance and the development of injury prevention programs. The nonspecific E codes were used most often because more detailed cause-of-injury information was not recorded in the medical charts. Medical record keeping is, understandably, focused on recording clinical assessment and treatment. Generally, health care providers are not aware of the other ongoing or potential uses for medical record data or of the priority data items to collect for public health surveillance. By presenting studies such as this one, health care providers can be made more aware of the crucial role of the medical record in the flow of data through epidemiologic and statistical processes to health care policy development and evaluation.

Because almost all IHS discharge records with injury diagnosis codes received E codes (including multiple injury-related hospitalizations for individuals in the same fiscal year), these E coded records do not represent injury incidence. We could not determine whether the multiple admissions for individuals were due to multiple injury events or follow-up medical and surgical care for previous injuries. E codes could describe injury incidence, however, if coding rules were standardized, restricting E codes to the initial hospitalization following an injury, or if they were modified to include a separate code identifying the initial hospitalization. We could then code records for subsequent hospitalizations consistently using the existing diagnosis codes available for follow-up treatment and late effects of injuries.

Although E coded hospital discharge data have great

value for injury surveillance, they have more limited value for epidemiologic research. E codes can help us meet some of the priority objectives for public health surveillance—ascertaining cases, quantifying and characterizing injuries, and monitoring trends in a defined community.¹⁰ Because the number of E codes for certain specific injury events is restricted or absent, the detail needed for focused epidemiologic research is limited. To obtain more detailed cause-of-injury data or information about specific injury problems of interest (e.g., injuries associated with all-terrain vehicles) we will require other surveillance tools or analytic epidemiologic research.

Information about underlying causes is essential for the development, implementation, and evaluation of injury intervention strategies. E coding of hospital records, as performed in the IHS, provides much of this underlying cause information. By extending hospital record E coding to other health care systems, we can develop a standardized external cause data base for prevention programs.

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