METHODOLOGIC ISSUES

The ICD-10 injury mortality diagnosis matrix

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Objective: To standardize the presentation of the more than 1200 ICD-10 "S" and "T" codes from Chapter XIX by cross classifying the body region of injury by the nature of injury using the ICD-10 injury mortality diagnosis matrix. This paper explains the rationale for decisions made when developing the matrix and presents mortality data using the matrix.

Design: ICD-10 codes are organized by diagnosis groups and body regions of injury for the purpose of standardizing presentation. The categories can be collapsed to facilitate analysis at varying levels of detail. Findings from the United States 2002 injury mortality data are used as an example.

Main outcome measures: All injury diagnoses mentioned in deaths with an underlying cause of injury.

Results: There were a total of 247,195 injury diagnoses mentioned in the 161,269 deaths with an underlying cause of injury in 2002 in the United States. The matrix can be used to show that 30% of all injury diagnoses mentioned were to the head and neck region; 28% were system wide injuries, 17% were to the torso. Open wounds accounted for 17% of all injury diagnoses mentioned, and close to half of all open wounds were traumatic brain injuries. Twenty eight percent of injury diagnoses mentioned were unspecified as to their nature and 9.5% had no body region specified.

Conclusions: Multiple cause of death data are a rich but underused source of injury data often due to the complexity of the data and of the ICD classification system. Analytic techniques will need to be refined to accommodate deaths with multiple contributing injury diagnoses. The injury mortality diagnosis matrix will facilitate analysis as it is a useful tool for summarizing diagnosis data associated with injury deaths.

Injury deaths are described primarily by ICD codes for the external cause (for example, motor vehicle crash, firearm) and for the injury diagnosis (for example, crush injury to the head, open wound to the chest).¹ Both external causes and injury diagnoses are commonly referred to as "multiple cause of death" data. The term "injury diagnosis" is used in this paper to denote the ICD-10 coded description of the body region and nature of the injury mentioned on the death certificate.² Although understanding the external cause of the injury is a key component to preventing injuries, injury diagnosis data are important for prevention as well. For instance, by learning about the kinds of injuries sustained in fatal crashes, engineers may be able to improve vehicle design. This paper introduces the ICD-10 injury mortality diagnosis (IMD) matrix, a tool for categorizing the more than 1200 individual injury diagnosis codes by body region and nature of injury and for presenting multiple cause of injury diagnosis data.² The IMD matrix is a tool that can be used in the first stages of analysis when multiple cause data are available.

BACKGROUND

In 2002 the Barell matrix was published as a tool to classify injury morbidity data based on ICD-9-CM codes into a standard format.^{3–4} It has been used to describe national trends in injury related hospital discharge data⁵ and to aid in analysis of injury data⁶ from trauma registries. It has been adopted by the State and Territorial Injury Prevention Director's Association (STIPDA) as guidance to states in how to present their hospitalization data.⁷ The organization of the new IMD matrix is similar to the Barell matrix with rows for body region of injury and columns for nature of injury.

The IMD matrix is designed to complement the Barell matrix by providing a tool to organize injury diagnosis mortality data into meaningful groupings by body region and nature of injury. The ICD-10 IMD matrix was developed to be

as similar to the Barell matrix as possible, acknowledging the differences in data quality and coding systems. Differences between the Barell injury diagnosis matrix and the ICD-10 IMD matrix are primarily due to differences between the level of detail typically found in morbidity and mortality data and the relative lethality of some injuries over others. For example, it is far less likely for a sprain or strain to be listed on a death certificate than on a hospital discharge record. Thus, sprains and strains are included with the nature of injury category "other specified injuries" in the matrix.

Morbidity data tend to include more detailed descriptions of the injury as compared to mortality data, and therefore the Clinical Modifications of the ICD (that is, ICD-9-CM, ICD-9-AM) have many more codes than the non-modified version. Consequently, categorization of nominally similar injury diagnosis descriptions into body region and nature varied between the matrices because allowances had to be made for the fewer codes and generally poorer data quality in the mortality data. The codes that define the traumatic brain injury (TBI) category are an important example. "Open wound of head" is categorized as "TBI" in the IMD matrix but as "other head injury" in the Barell matrix. This apparent inconsistency is based on the experience using the US mortality data and is consistent with the definition of TBI recommended by the CDC's National Center for Injury Prevention and Control.⁸ In the US, 64% of death records with an underlying cause of death of suicide by firearm have a single injury diagnosis code. Over three quarters of those with a single code were in the range of ICD-10 S01 (.0–.9), "open wound of head". Presumably these deaths were a result an intracranial injury and the open wound code is a result of very little diagnosis information available on the death certificate. Because categorization is not dependent on external cause, all open wounds to the head (ICD-10 S01)

Abbreviations: IMD, injury mortality diagnosis; NCHS, National Center for Health Statistics; TBI, traumatic brain injury.

The matrix excludes the following codes that are not valid in the U.S.: T00(0-1, .6), T01(0-1, .6, .8), T02(0, .6-7), T03(0, .4), T04(0, .4, .7), T05(1, .4, .6), T06(0, .1, .8), T29. Also excluded are codes I78, T80-T88, I98.3 for adverse effects, not elsewhere classified and complications of surgical and medical not elsewhere classified, and their sequelae.

Figure 1 ICD-10 codes used to define cells of the injury mortality diagnosis (IMD) matrix.

Table 1 Injuries mentioned according to body region of injury by categorical level of detail among all deaths with an underlying cause of injury: US, 2002

Body region of injury	Level of detail*	Total mentions of injuries per level		
		Level 3	Level 2	Level 1
Head and neck, all	L1-1			74527
Traumatic brain injury	L3-1, L2-1	66601	66601	
Other head	L2-2		349	
Face	L3-2	108		
Eye	L3-3	44		
Other head	L3-4	197		
Neck	L3-5, L2-3	7507	7507	
Head and neck, other	L3-6, L2-4	70	70	
Spine and upper back	L1-2			3468
Spinal cord	L2-5		1648	
Neck	L3-7	331		
Thorax and upper back	L3-8	10		
Lower back	L3-9	1		
Trunk or spine other	L3-10	1306		
Multiple or cross body regions	L3-11	0		
Vertebral column	L2-6		1820	
Neck	L3-12	1135		
Thorax	L3-13	27		
Lower back	L3-14	161		
Lower back and pelvis	L3-15	0		
Trunk or spine other	L3-16	497		
Torso	L1-3			41980
Thorax	L3-17, L2-7	22826	22826	
Abdomen	L3-18, L2-8	4842	4842	
Pelvis and lower back	L2-9		1439	
Pelvis and genitourinary	L3-19	360		
Lower back and pelvis	L3-20	1079		
Abdomen, lower back, and pelvis	L3-21, L2-10	3418	3418	
Trunk, other	L3-22, L2-11	9455	9455	
Extremities	L1-4			12284
Upper extremity	L2-12		2123	
Shoulder and upper arm	L3-23	759		
Elbow	L3-24	51		
Forearm	L3-25	177		
Wrist and hand	L3-26	409		
Fingers	L3-27	11		
Upper extremities, multiple sites	L3-28	63		
Upper extremities, other	L3-29	653		
Hip	L3-30, L2-13	6601	6601	
Other lower extremity	L2-14		3560	
Thigh	L3-31	121		
Hip and thigh	L3-32	262		
Upper leg and thigh	L3-33	1211		
Knee	L3-34	242		
Lower leg	L3-35	855		
Foot	L3-36	21		
Ankle	L3-37	15		
Other and multiple ankle and foot	L3-38	82		
Toes	L3-39	5		
Other lower limb	L3-40	746		
Unclassifiable by body region	L1-5			91461
Multiple body regions	L3-41, L2-15	22229	22229	
System wide	L3-42, L2-16	69232	69232	
Unspecified	L3-43, L2-17, L1-6	23475	23475	23475
Total mentions		247195	247195	247195

*There are three hierarchical levels of detail in this axis of the matrix. Level one (L-1) has six body region categories, level 2 (L-2) has 17 body region categories, and level 3 (L-3) has 43 categories.

regardless of the external cause were categorized as TBIs. In contrast, morbidity data tend to have more detailed diagnostic descriptions available from which to code; thus, in the case of a self inflicted firearm injury to the head, there may be an open wound code in addition to a code for intracranial injury. If the injury did not involve the brain, "open wound to the head" would be categorized in the Barell Matrix with "other head injuries". These differences in categorization are a recognized limitation for comparing across the two matrices.

The structure of the codes for injury diagnoses changed between revisions of the ICD. In ICD-9, the codes in the injury diagnoses chapter (chapter XIX) are organized by nature of injury and then body region within each nature.⁹ In

ICD-10, the axes in chapter XIX are reversed so the main block headings are body regions and within the body region blocks are the codes for the nature of injury.² We do not know if this modification affects the data because there is not a comparable ICD-9 injury mortality diagnosis matrix. If an ICD-9 IMD matrix were developed, the 1996 US mortality data coded using both ICD-9 and ICD-10 could be used to explore the differences. For complete documentation of the dual coded publicly available file and downloading instructions see the NCHS Data Warehouse.¹⁰

METHODS

The ICD-10 IMD matrix was developed by NCHS based on an initial draft developed by Richard Hockey from Australia in

Table 2 Total number of injury diagnoses mentioned according to nature of injury among all deaths with an underlying cause of injury: US, 2002

Nature of injury	Total number of injury diagnoses
Fracture	20665
Dislocation	528
Internal organ injury	26254
Open wound	42295
Amputations	177
Blood vessel	2475
Superficial and contusion	688
Crushing	925
Burn	3212
Effect of foreign bodies entering orifice	4730
Other effects of external causes	18076
Poisoning	41323
Toxic effects	8709
Multiple injuries	2216
Other specified injury	4872
including:	
Sprain or strain	25
Muscle and tendon injuries	34
Nerve injuries	105
Early complications of trauma	1130
Other	3578
Unspecified injury	70050
Total mentions	247195

2002 along with programming assistance from the US Pacific Institute for Research and Evaluation. The injury descriptions in ICD-10's chapter XIX ("S" and "T" codes) were reviewed and categorized into body region and nature categories with the attempt to be as similar as practicable to the Barell matrix. To maintain consistency with the external cause of injury mortality matrix (for both ICD-9 and ICD-10), adverse effects, not elsewhere classified (T78), and complications of surgical and medical care, not elsewhere classified (T80-T88) as well as their sequelae (T98.3) were excluded.¹ In addition, certain codes are invalid for use in the US and are shown at the bottom of figure 1.¹¹

At its most detailed level, the ICD-10 IMD has 20 nature of injury categories and 43 body region categories. In this paper, the detailed structure is collapsed into 16 nature of injury diagnosis categories and 17 body region of injury diagnosis categories. Categories for both axes were combined based on characteristics of the body region (for example, foot and ankle injuries are part of "other lower extremities") as well as the number of injury diagnoses mentioned in a category (for example, if there were too few). The latter was generally a reflection of the low lethality of the diagnosis (sprains and strains, for example). For some analyses, the body regions can readily be combined into six broad groups to make the data more readily interpretable by other dimensions, such as external cause of injury or age. Tables 1 and 2 show the matrix categories for each axis at different levels of detail.

Figure 1 shows the ICD-10 codes that are in each of the possible injury diagnosis matrix cells formed by crossing the 17 body region categories by the 16 nature of injury categories. ICD-10 codes for the complete 20×43 matrix can be found on the NCHS Injury Data and Resources website <http://www.cdc.gov/nchs/about/otheract/ice/projects.htm> under Reporting Frameworks. Similar to the Barell matrix there are some cells for which no ICD-10 codes apply (for example, fracture of the abdomen). Like the Barell matrix, injuries acting on the entire body including poisoning, toxic effects, and early complications of trauma are assigned the body region of "system wide" and populate only that body region. The nature of injury category "other effects of

external causes" which was included with "system wide" in the Barell matrix is also included in the ICD-10 IMD matrix with one exception—codes for frostbite (T33-T35) are included across appropriate body regions. In the Barell matrix, the category "effects of foreign body entering through orifice" (ICD-9-CM 930-949) is included with "system wide" injuries. We have reconsidered this for the ICD-10 IMD matrix and chosen to assign them a unique nature of injury category and spread the codes in the appropriate body region. Unlike the Barell matrix, ICD-10 codes for sequelae of injuries (referred to as "late effects" in ICD-9-CM) are included with their respective diagnoses. For example, sequelae of burns (T95[.0-.9]) is included with all burn injuries and assigned to the appropriate body regions. Although it could be argued that injuries such as "dislocations" and "superficial injuries and contusions" are less likely as other injuries to be fatal, these categories were retained for two reasons: there were more than 500 total mentions in each of these categories and for consistency with the Barell matrix.

Deaths with an underlying external cause (that is, injury) may have one or more injury diagnoses mentioned and, therefore, the unit of analysis (for example, deaths, total injury diagnoses mentioned) must be determined in order to summarize the data using the rows, columns, or cells of the IMD matrix. We have considered four methods to summarize the 2002 US multiple cause data: (1) total mentions of injury diagnoses;¹ (2) any mention of an injury diagnosis (or at least one mention);¹ (3) each mention of an injury diagnosis weighted proportionally to the number of injury diagnoses mentioned on the death certificate;¹² and (4) multiple injury profiles as suggested for use with the Barell matrix.^{6, 13}

As the aim of this paper is to introduce the matrix, we chose to present the data using only one method—total mentions. The unit of analysis when counting total mentions is each injury diagnosis mentioned in a death. Regardless of the way the data are categorized (that is, the level of detail used in the matrix), the total number of diagnoses mentioned will always add to the same number of diagnoses. For example, suppose a person was fatally injured in a motor vehicle traffic related crash and sustained three extremity fractures—one upper, one lower, and one to the hip. Assuming all three injuries are mentioned on the death certificate, the number of "total mentions" will be three regardless of the number of extremity categories of the matrix used.

We illustrate the effective presentation of the injury diagnosis mortality matrix using the 2002 US multiple cause of death file produced annually by the National Center for Health Statistics.¹⁴ In the data presented in figure 2, the total number of mentions and percent distribution of injury mentions in the matrix are restricted to those deaths for which the underlying cause was an injury (*U01-*U03, V01-Y36, Y85-Y87, Y89) as defined elsewhere.¹

RESULTS

In 2002, there were 247,195 injury diagnoses mentioned on death certificates where an external cause of injury was the underlying cause of death ($n = 161,269$ deaths), for an average of 1.5 injuries mentioned per death. This ratio varied by intent and by mechanism of injury. Details of those differences are reported elsewhere.¹⁴

Head and neck accounted for 30% of all injury diagnoses mentioned with the vast majority classified as TBI. TBI injuries were primarily spread across injuries of unspecified nature (11%), open wounds (8%), internal organ injuries (7%) (fig 2). "System wide" injuries accounted for 28% of the injury diagnoses mentioned. These include poisoning (17%),

Body region of injury	Nature of injury																
	All	Fracture	Dislocation	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Burn	Effect of foreign bodies entering orifice	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified injury	Unspecified injury
All injuries mentioned	247 195	20 665	528	26 254	42 295	177	2475	688	925	3212	4730	18 076	41 323	8709	2216	4872	70 050
Head and neck	74 527	5705	7	17 276	20 751	88	205	174	308	71	66	1	...	...	1165	1027	27 683
Traumatic brain injury	66 601	3592	...	17 276	19 011	...	...	...	273	...	...	...	...	...	999	755	24 695
Other head	349	92	7	...	9	6	7	146	...	•	9	1	...	...	...	47	25
Neck	7507	2021	•	...	1731	82	198	28	35	1	57	•	...	...	166	225	2963
Head and neck	70	...	...	...	...	...	...	...	...	70	...	•	...	...	...	...	...
Spine and upper back	3468	1287	477	1649	...	...	33	...	...	...	...	...	...	...	...	22	...
Spinal cord	1648	...	...	1648	...	...	...	...	...	...	...	...	...	...	...	...	...
Vertebral column	1820	1287	477	1	...	...	33	...	...	...	...	...	...	...	...	22	...
Torso	41 980	3130	•	7329	9873	5	1754	140	550	337	4660	•	...	...	496	2287	11 419
Thorax	22 826	2021	•	3060	7025	2	1510	61	405	1	10	•	...	...	479	1033	7219
Abdomen	4842	...	...	3160	1483	...	176	12	...	...	11	...	...	...	...	...	...
Pelvis and lower back	1439	1033	•	243	98	1	52	10	1	•	1	...	...	...	...	•	...
Abdomen, lower back and pelvis	3418	38	...	866	60	2	16	37	87	...	...	•	...	...	•	462	1850
Other trunk	9455	38	...	...	1207	•	...	20	57	336	4638	...	...	...	17	792	2350
Extremities	12 284	9528	44	...	1382	71	182	70	23	85	...	2	...	...	22	238	637
Upper extremity	2123	771	7	...	934	24	76	20	5	39	...	1	...	...	7	44	195
Hip	6601	6533	30	...	31	•	...	6	•	...	...	...	...	...	...	1	...
Other lower extremity	3560	2224	7	...	417	47	106	44	18	46	...	1	...	...	15	193	442
Unclassifiable by body region	91 461	551	...	...	3751	13	16	60	44	6	0	18 070	41 323	8709	85	1221	17 612
Multiple body regions	22 229	551	...	...	3751	13	16	60	44	6	...	•	...	...	85	91	17 612
System wide	69 232	...	...	...	...	...	...	...	...	...	...	18 070	41 323	8709	...	1130	...
Unspecified	23 475	464	...	...	6538	...	285	244	...	2713	4	3	...	...	448	77	12 699

Body region of injury	Nature of injury																
	All	Fracture	Dislocation	Internal organ injury	Open wound	Amputation	Blood vessel	Superficial and contusion	Crushing	Burn	Effect of foreign bodies entering orifice	Other effects of external causes	Poisoning	Toxic effects	Multiple injuries	Other specified injury	Unspecified injury
All injuries mentioned	100.0	8.4	0.2	10.6	17.1	0.1	1.0	0.3	0.4	1.3	1.9	7.3	16.7	3.5	0.9	2.0	28.3
Head and neck	30.1	2.3	0.0	7.0	8.4	0.0	0.1	0.1	0.1	0.0	0.0	0.0	...	...	0.5	0.4	11.2
Traumatic brain injury	26.9	1.5	...	7.0	7.7	...	...	...	0.1	...	...	...	...	...	0.4	0.3	10.0
Other head	0.1	0.0	0.0	...	0.0	0.0	0.0	0.1	...	•	0.0	0.0	...	...	...	0.0	0.0
Neck	3.0	0.8	•	...	0.7	0.0	0.1	0.0	0.0	0.0	0.0	•	...	...	0.1	0.1	1.2
Head and neck, other	0.0	...	...	...	...	...	...	...	...	0.0	...	•	...	...	...	...	...
Spine and upper back	1.4	0.5	0.2	0.7	...	...	0.0	...	...	...	...	...	...	...	...	0.0	...
Spinal cord	0.7	...	...	0.7	...	...	...	...	...	...	...	...	...	...	...	...	...
Vertebral column	0.7	0.5	0.2	0.0	...	...	0.0	...	...	...	...	...	...	...	...	0.0	...
Torso	17.0	1.3	•	3.0	4.0	0.0	0.7	0.1	0.2	0.1	1.9	•	...	...	0.2	0.9	4.6
Thorax	9.2	0.8	•	1.2	2.8	0.0	0.6	0.0	0.2	•	0.0	•	...	...	0.2	0.4	2.9
Abdomen	2.0	...	...	1.3	0.6	...	0.1	0.0	...	...	0.0	...	...	...	...	•	...
Pelvis and lower back	0.6	0.4	•	0.1	0.0	0.0	0.0	0.0	0.0	•	0.0	...	...	...	...	•	...
Abdomen, lower back and pelvis	1.4	0.0	...	0.4	0.0	0.0	0.0	0.0	0.0	...	...	•	...	...	•	0.2	0.7
Other trunk	3.8	0.0	...	...	0.5	...	...	0.0	•	0.1	1.9	...	...	...	0.0	0.3	1.0
Extremities	5.0	3.9	0.0	...	0.6	0.0	0.1	0.0	0.0	0.0	...	0.0	...	...	0.0	0.1	0.3
Upper extremity	0.9	0.3	0.0	...	0.4	0.0	0.0	0.0	0.0	0.0	...	0.0	...	...	0.0	0.0	0.1
Hip	2.7	2.6	0.0	...	0.0	...	...	0.0	•	...	...	...	...	...	...	0.0	...
Other lower extremity	1.4	0.9	0.0	...	0.2	0.0	0.0	0.0	0.0	0.0	...	0.0	...	...	0.0	0.1	0.2
Unclassifiable by body region	37.0	0.2	...	...	1.5	0.0	0.0	0.0	0.0	0.0	...	7.3	16.7	3.5	0.0	0.5	7.1
Multiple body regions	9.0	0.2	...	...	1.5	0.0	0.0	0.0	0.0	0.0	...	•	...	...	0.0	0.0	7.1
System wide	28.0	...	...	...	...	...	...	...	...	...	...	7.3	16.7	3.5	...	...	...
Unspecified	9.5	0.2	...	...	2.6	...	0.1	0.1	...	1.1	0.0	0.0	...	...	0.2	0.0	5.1

Notes:

Other specified includes injuries to nerves, muscles and tendons, sprains and strains, early complications of trauma as well as other specified injuries.

Other head includes injuries to face, eye and other head injuries.

• Quality is zero

... Not applicable

0.0 quantity is > 0 but less than 0.1

Figure 2 Total mentions of injuries and percent of injuries classified by the ICD-10 injury mortality diagnosis matrix among all deaths with an underlying cause of injury: US, 2002.

other effects of external causes (that is, submersion or asphyxiation) (7%), and toxic effects (nearly 4%).

Seventeen percent of all injury diagnoses were to the torso, 9% were to the thorax region of the torso. A third of the thorax injuries were open wounds and another third were classified as unspecified nature of injury. Extremity injuries accounted for only 5% of all injuries mentioned while spinal cord and vertebral column were even less likely to appear on death certificates.

By nature of injury, open wounds accounted for 17% of all injury diagnoses mentioned, and 45% of all open wounds were classified as TBIs. The nature of injury was unspecified for 28% of injury diagnoses mentioned compared with 9.5% of all injury diagnoses having no body region specified.

CONCLUSION

The IMD mortality matrix is a framework for presenting diagnosis specific mortality data. The Barell matrix was initially designed for non-fatal injury data involving both single and multiple diagnoses.³ The IMD matrix is designed for mortality data also using either single or multiple diagnoses (generally dependent on what is available from a country's dataset).

If a single injury is selected from among multiple injury diagnoses in the data (for example, first listed, primary diagnosis, or main injury), presentation using the matrix is uncomplicated. However, important information may be lost when analyzing by a single injury. For example, events involving multiple injuries may be more severe than those

Key Points

- The ICD-10 injury mortality diagnosis (IMD) matrix was developed to be as similar to the Barell matrix as possible given the differences in data quality and coding systems between morbidity and mortality data.
- Having a uniform method of categorizing injury diagnoses is important for comparative analyses.
- At its most detailed level, the ICD-10 IMD matrix has 20 nature of injury categories and 43 body region categories.
- To maintain consistency with the external cause of injury mortality matrix (for both ICD-9 and ICD-10), adverse effects, not elsewhere classified (T78), and complications of surgical and medical care, not elsewhere classified (T80–T88) as well as their sequelae (T98.3) were excluded from the ICD-10 IMD matrix.

involving a single injury. Multiple injury profiles show combinations of injury diagnoses by body region, nature of injury, or cross classification of the two.⁶ As they present the commonly occurring combinations, they are useful to describe multiple cause data.

In about a third of the injury deaths in the US, there is more than one injury diagnosis listed as contributing to the death.¹ Given the range in the training and experience of the certifiers, we believe there is variability in the way death certificates are completed. For example, in the case of a motor vehicle crash, some certifiers will write down a single injury, (for example, crushed chest), some certifiers will write down each injury sustained (for example, open wound of chest, fractured rib, fractured femur), while others will record “multiple injuries”. Choosing to present total injury diagnoses mentioned is a straightforward method albeit not the only one.

For countries that have their own clinical modification of ICD-10, the matrix presented here will need to be modified to be compatible with morbidity data and expanded to accommodate the additional codes. However, basic differences between the mortality and morbidity matrices will remain until causes of death are better documented. For example, the “open wounds to the head” in the mortality data will be classified as TBI and in morbidity data will be classified to other head injuries.

More detail on the matrix can be found in the 2002 annual report on injury mortality from the National Center for Health Statistics.¹⁴ The injury mortality diagnosis data

provide a systematic approach for presenting the myriad of injury diagnoses in the International Classification of Diseases.

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REFERENCES

- 1 Anderson RN, Minino AM, Fingerhut LA, et al. Deaths: injuries, 2001. *Natl Vital Stat Rep* 2004;**52**:1–86.
- 2 World Health Organization. *International statistical classification of diseases and related health problems (10th revision)*. Geneva: World Health Organization, 1992.
- 3 Barell V, Aharonson-Daniel L, Fingerhut LA, et al. An introduction to the Barell body region by nature of injury diagnosis matrix. *Inj Prev* 2002;**8**:91–6.
- 4 US Department of Health and Human Services. *International Classification of Diseases, Ninth Revision, Clinical Modification*. In: Official Washington, DC: US Department of Health and Human Services, Centers for Disease Control and Prevention, Centers for Medicare and Medicaid Services, 2004.
- 5 Heinen M, Hall M, Boudreault M, et al. *National trends in injury hospitalizations, 1979–2001*. National Center for Health Statistics, 2005.
- 6 Aharonson-Daniel L, Boyko V, Ziv A, et al. A new approach to the analysis of multiple injuries using data from a national trauma registry. *Inj Prev* 2003;**9**:156–62.
- 7 Injury Surveillance Workgroup. *Consensus recommendations for using hospital discharge data for injury surveillance*. In: Marietta GA, ed. State and Territorial Injury Prevention Directors Association, 2003.
- 8 Langlois J, Rutland-Brown W, Thomas K. *Traumatic brain injury in the United States: emergency department visits, hospitalizations, and deaths*. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2004.
- 9 World Health Organization. *Manual of the international statistical classification of diseases, injuries, and causes of death: based on the recommendations of the Ninth Revision Conference, 1975, and adopted by the Twenty-ninth World Health Assembly*. Geneva: World Health Organization, 1977.
- 10 NCHS. Comparability of cause-of-death between ICD revisions. Available at <http://www.cdc.gov/nchs/datawh/statab/unpubd/comp.htm#A%20guide%20to%20state%20implementation%20of%20ICD-10> (accessed October 2005).
- 11 NCHS. *Computer edits for mortality data, including separate section for fetal deaths effective 2005*, Instruction Manual, Part 11. Available at http://www.cdc.gov/nchs/data/dvs/2005_PT11.pdf (accessed October 2005).
- 12 Finkelstein EA, Corso PS, Miller T, et al. *Incidence and economic burden of injuries in the United States, 2000*. Oxford University, 2005.
- 13 Aharonson-Daniel L, Giveon A, Peleg K. Gaps in injury statistics: multiple injury profiles reveal them and provide a comprehensive account. *Inj Prev* 2005;**11**:197–200.
- 14 Miniño AM, Anderson RN, Fingerhut LA, et al. Deaths: injuries 2002. *Natl Vital Stat Rep* 2006 (in press).