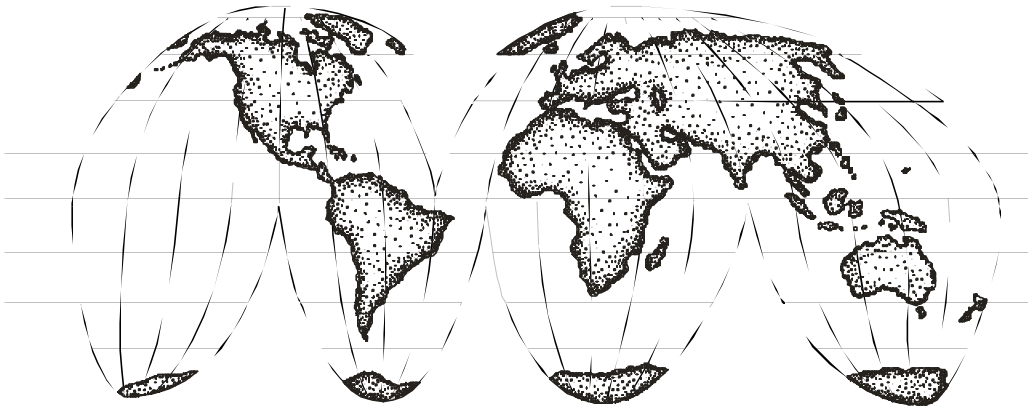
Proceedings of the International Collaborative Effort on Injury Statistics Volume III

From the CENTERS FOR DISEASE CONTROL AND PREVENTION/National Center for Health Statistics

Washington DC: 2nd Symposium



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Center for Health Statistics

Hyattsville, Maryland
April 2000

DHHS Publication No. PHS-00-1026-0

Preface

On June 2-3, 1999 the National Center for Health Statistics (NCHS) convened the second symposium of the International Collaborative Effort (ICE) on Injury Statistics. This symposium was co-sponsored by the National Institute of Child Health and Human Development (NICHD), National Institutes of Health.

The mission of the Injury ICE is to identify the problem(s) and propose solutions aimed at improving the quality and reliability of international statistics related to injury. In order to achieve the maximum benefits for participating researchers, the symposium brought together leading researchers from the United States and from many other countries to address the multiple issues related to the comparability of injury data.

The members of the ICE on Injury steering committee are from: the NCHS, Lois A. Fingerhut (Chair), Harry M. Rosenberg, Donna Pickett; the National Center for Injury Prevention and Control (NCIPC), Lee Annest; the National Institute of Child Health and Human Development (NICHD), Mary Overpeck; the Johns Hopkins Injury Prevention Center, Gordon Smith; the Israeli Ministry of Health,Vita Barell, the Australian National Injury Surveillance Unit, James Harrison; and the Office of National Statistics in England, Cleo Rooney.

This volume contains the papers presented at the symposium. Please refer specific questions to the individual authors.

For more information about the ICE on Injury Statistics, please visit the web site at: www.cdc.gov/nchs/about/otheract/ice/ice.htm

Acknowledgments

Overall responsibility for planning the content of these Proceedings was assumed by Lois A. Fingerhut, Chair of the ICE on Injury Statistics and Special Assistant for Injury Epidemiology, Office of Analysis, Epidemiology and Health Promotion (OAEHP, National Center for Health Statistics. In addition, Margaret Warner, Statistician in OAEHP oversaw the coordination of the Proceedings.

Many thanks to the individual authors for their contributions to this volume. Each of the presentations is included as submitted by the respective authors. Individual comments should be addressed to them.

Publications management was provided by Margaret Avery.

Participants

Last Name	First Name	Organization	Country
Ahmed	Sue	Consumer Product Safety Commission	USA
Annest	Lee	National Center for Injury Prevention and Control	USA
Bangdiwala	Shrikant	University of North Carolina-Chapel Hill	USA
Barell	Vita	Ministry of Health, The Gertner Institute	Israel
Barnes	Pat	National Center for Health Statistics	USA
Bartolucci	Alfred	UAB Injury Control Research Center	USA
Bay-Nielsen	Henning	Danish Institute for Clinical Epidemiology (DICE)	Denmark
Berenholz	Gerry	Berenholz Consulting	USA
Bradford	Maureen	ICE Ergonomics LTD	UK
Brenner	Ruth	National Institute of Child Health & Human Development	USA
Burt	Cathy	National Center for Health Statistics	USA
Cabecadas	M	Universidate Nova de Lisboa	Portugal
Chambers	Dawn	VSRC, ICE Ergonomics LTD.	UK
Champion	Howard	University of Maryland, Baltimore	USA
Cox	Chris	National Center for Health Statistics	USA
Cryer	Colin	King's College London	England
Driscoll	Tim	National Institute for Occupational Safety and Health	Australia
Ermakov	Sergei	Med Soc Econom Inform, Ministry of Health	Russia
Feyer	Anne-Marie	New Zealand Occupational and Environmental Research	New Zealand
Fingerhut	Lois	National Center for Health Statistics	USA
Forjuoh	Sam	Allegheny General Hospital	USA
Francis	Marlene	Caribbean Epidemiology Centre (CAREC)	West Indies
Frazier	Joyce	National Center for Health Statistics	USA
Frimodt-Moller	Birthe	Danish Institute for Clinical Epidemiology (DICE)	Denmark
Gallagher	Sue	Education Development Center	USA
Gerbaka	Bernard	Universite Saint Joseph	Lebanon

Last Name	First Name	Organization	Country
Gillum	Brenda	U.S. Consumer Product Safety Commission	USA
Glenn	Donna	National Center for Health Statistics	USA
Gotschall	Catherine	National Highway Traffic Safety Administration	USA
Greenberg	Marjorie	National Center for Health Statistics	USA
Hemenway	David	Harvard School of Public Health	USA
Holder	Yvette	National Center for Injury Prevention and Control	USA
Horan	John	National Center for Injury Prevention and Control	USA
Horte	Lars Gunnar	Department of Public Health Sciences	Sweden
Isenberg	Ruth	National Highway Traffic Safety Administration	USA
Jack	Susan	National Center for Health Statistics	USA
Jackson	Graham	GRO Scotland	Scotland
Kennedy	Christopher	Children's Hospital Medical Center of Akron	USA
Kessler	Eileen	U.S. Consumer Product Safety Commission	USA
Klebanoff	Mark	National Institute of Child Health & Human Development	USA
Kochanek	Kenneth	National Center for Health Statistics	USA
Kopjar	Branko	National Institute of Public Health	Norway
Kramer	Betsy	RA Cowley Shock Trauma Center	USA
Krug	Etienne	World Health Organization	Switzerland
L'hours	Andre	World Health Organization	Switzerland
Langley	John	University of Otago	New Zealand
LeGoff	Bernard	European Commission	European Commission
Luchter	Stephen	National Highway Traffic Safety Administration	USA
Lund	Johan	Norwegian Safety Forum	Norway
MacKenzie	Ellen	John Hopkins School of Public Health	USA
Mackenzie	Susan	Health Canada	Canada

Last Name	First Name	Organization	Country
Madans	Jennifer	National Center for Health Statistics	USA
McDonald	Art	U.S. Consumer Product Safely Commission	USA
Mickalide	Angela	National SAFE KIDS Campaign	USA
Miller	Ted	National Public Services Research Institute	USA
Mohan	Dinesh	Indian Institute Technology	India
Morrison	Anita	University of Glasgow	Scotland
Mulder	Saakje	Consumer Safety Institute	The Netherlands
Notzon	Sam	National Center for Health Statistics	USA
O'Donnell	Genny	National SAFE KIDS Campaign	USA
Overpeck	Mary	National Institute of Child Health & Human Development	USA
Petridou	Eleni	Athens University Medical School	Greece
Pickett	William	Queen's University	Canada
Pickett	Donna	National Center for Health Statistics	USA
Pless	Barry	McGill University	Canada
Pollock	Dan	National Center for Injury Prevention and Control	USA
Rogmans	Wim	Consumer Safety Institute	The Netherlands
Rooney	Cleone	Office of National Statistics	England
Rosenberg	Harry	National Center for Health Statistics	USA
Scheidt	Peter	Children's National Medical Center	USA
Schroeder	Tom	Consumer Product Safety Commission	USA
Seitz	Fred	National Center for Health Statistics	USA
Smith	Gordon	John Hopkins School of Public Health	USA
Sondik	Edward	National Center for Health Statistics	USA
Songer	Thomas	University of Pittsburgh	USA
Steenkamp	Malinda	FUSA Research Centre for Injury Studies	Australia
Stone	David	Royal Hospital for Sick Children	Scotland
Stout	Nancy	National Institute for Occupational Safety and Health	USA

Last Name	First Name	Organization	Country
Warner	Margaret	National Center for Health Statistics	USA
Weiss	Hank	University of Pittsburgh	USA
Williamson	Ann	University of South Wales	Australia
Zadka	Pnina	Central Bureau of Statistics	Israel

Contents

Opening Remarks - Welcome

Dr. Edward Sondik*

*Director, National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), Hyattsville, MD

Thanks. Let me add me add my welcome to that of Lois. This meeting is a very exciting event as international efforts are very integral to what we do at NCHS. Let me say a bit about NCHS because some of you may not know who we are. NCHS is one of those federal agencies that wears a number of hats. We are one of the designated federal statistical agencies like the Census Bureau and the Bureau of Labor Statistics. NCHS is the agency that deals with health statistics. We are also a component of the federal Centers for Disease Control and Prevention (CDC) which gives us an opportunity to work on a variety of different types of problems. Because we are part of CDC and have interactions with the National Institutes of Health (NIH) and other federal research agencies, we engage in a variety of research activities that many other statistical agencies do not address. In fulfilling our dual roles, in particular our role within CDC, our work in international activities is integral to what we do.

Prior to coming to NCHS about 3 years ago, I was at the National Cancer Institute at NIH. One of the things that I enjoyed the most at NIH was looking at statistics, in particular international cancer statistics. I found that we had so much to learn about cancer progression and the factors affecting cancer by comparing experiences across countries. In order to do this, we had to have a firm foundation and a standard language on which we could build.

Injury is a very important problem for us to handle. Certainly, as you all know, it's a major cause of morbidity and mortality. Over the past 10 to 15 years there has been a realization in the U.S. that injury can be addressed in the same way we address other causes of disease and disability. The rise of the National Center for Injury Prevention and Control at CDC, coupled with interests of the National Institute for Occupational Safety and Health (again at CDC), the National Institute of Child Health and Human Development at NIH, and other agencies attests to this realization of the magnitude of the health problems caused by injury. Of importance is the fact that the problem can be addressed through a solid base of research. That is what we have been seeing develop in the U.S. in particular over the last 10-15 years. While there has been a lot of interest and resources focused on injury, in order to understand our experiences and compare the experiences of other countries, we need a firm foundation and to develop a language all understand. This is the purpose for this meeting--to continue the development of that language.

My first experience with an ICE meeting was about 3 years ago. Under the auspices of NCHS and particularly Lois Fingerhut, an extremely productive meeting took place. I expect that this one will be equally as productive.

I would like to assure you of the stature of international activities in general at CDC, NIH, and the Department. There has always been a strong focus in my 20+ years in the department on international activities--whether at the Fogarty Center at NIH or at CDC where Jeff Koplan, the new Director of CDC, has made Global Health one of the four major priorities for the near term. NCHS has always enjoyed very strong position in international efforts, working with a variety

types of activities related to international health. Particularly important are the activities surrounding development of ICD-10.

We have a number of exciting things activities underway at NCHS. Let me mention a some of these. In addition to implementation of ICD-10, we plan to field a new NHANES Survey which will be annual instead every 3 years as in the past. NHANES is our Health and Nutrition Examination Survey. With a new information system called ISIS (Integrated Survey Information System) we will be able to get the information out from the field much more rapidly than in the past. Information is being collected electronically, and nothing is being written at the clinical site. That is quite exciting. We also have expanded our telephone survey capability so we are able to reach sections of the country on a more focused basis. We have an emphasis like all of you on data dissemination and using the Internet to do that. I would like to hear from all of you on how you disseminate data in your own country and elsewhere. Another important and exciting change concerns the bases for age adjustment from the 1940s to the year 2000; Harry Rosenberg on our staff is working in this area. I think it is a very important change that will make the figures we produce much closer in magnitude to the real extent of the problem. In that sense I think data will be more relevant. This change is going to cause some shifts in the public's and our own perceptions for the relative impact of disease and disability among minorities in the U.S..

Again, welcome to this important meeting; I am sure you will find it productive.

Overview

Lois A. Fingerhut*

*National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), Hyattsville, MD

It is my great pleasure to open the 2nd symposium of the International Collaborative Effort (ICE) on Injury Statistics. For many attending this symposium, this is your first experience with an ICE. The International Collaborative Effort (ICE) on Injury Statistics is one of several international activities sponsored by the Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS). The ICE on Injury Statistics also receives generous funding from the National Institutes of Health's (NIH) National Institute of Child Health and Human Development (NICHD), and for this we are especially grateful to Drs. Dwayne Alexander, Mark Klebanoff, and Mary Overpeck.

The purpose of this ICE is to improve international comparability and quality of injury data. We attempt to accomplish this by promoting dialog throughout the year, by participating in smaller working group meetings, and by sharing data. The ultimate goal is to provide the data needed to better understand the causes of injury and the most effective means of prevention.

To date we have been meeting annually. A time line of our meetings:

May 1994, Maryland, USA - 1st symposium

March 1995, Bethesda Maryland, USA- working group meeting

February 1996, Melbourne, Australia - working group meeting in conjunction with the 3rd World Injury conference

November 1996, Washington, DC, USA- working group meeting

May 1998, Amsterdam, the Netherlands - working group meeting in conjunction with the 4th World Injury conference

June 1999, Washington, DC, USA- 2nd symposium

March 2000, New Delhi, India- working group meeting to be held in conjunction with the 5th World Injury conference

The major Injury ICE general themes have centered on issues related to the coding, classification, and categorization of data. As such, the projects ICE participants have been involved with include:

Framework for presenting injury mortality data--external cause
Framework for presenting injury morbidity--diagnosis codes

Both of these projects are critical because of the need for standardization of data presentation.

Death registration practices in ICE countries
Morbidity registration and classification practices in ICE countries

The purpose is to try and sort out country variation in death rates that could be due to differential death registration practices

WET ICE: Comparative drowning statistics

This project was begun as a study of one cause of death—drowning— as an example of a cause that has more than one set of ICD injury codes (both external and nature of injury) and how using multiple cause coding can increase the numbers of deaths attributed to a particular cause.

Multiple cause of death analyses

ICE is exploring the use of multiple cause of death data to better understand injury mortality. Because the underlying cause of death is always the external cause of injury, the multiple cause data allow a closer examination of the nature of injury diagnoses associated with specific injury mechanisms.

International Classification of External Causes of Injury (ICECI)

The ICE has worked extensively with the working group that is developing the ICECI and has provided consultation and expertise as necessary.

International Inventory of Injury-related Data Sources
Harmonization of injury classification system

Both of these efforts were aimed at getting a better understanding of what is available in terms of sources of injury data and how the data elements are classified.

International comparisons of occupational injuries

Several ICE participants have been working in this area and are seeking others who are interested. Statistical collections of workplace fatal injury data have a critical role to play in identifying hazards and, consequently, the most appropriate targets for prevention.

ICE has partnered with the WHO Working Group of Injury Surveillance, the Injury Control and Emergency Health Services (ICEHS) section of the American Public Health Association and in particular with the members of the data committee; and with EURORISC. For additional information about the ICE, visit www.cdc.gov/nchswww/about/otheract/ice/ice.htm .

Following is a list of publications that acknowledge the work of the ICE on Injury Statistics:

From New Zealand:

1. Langley JD, Smeijers J. Injury mortality among children and teenagers in New Zealand compared with United States of America. Injury Prevention, 1997; 3:195-199

2. Smith G, Langley JD. Drowning surveillance: How well do E codes identify submersion fatalities. Injury Prevention, 1998; 4:135-139

3. Langley JD, Chalmers DJ. Coding the circumstances of injury: ICD-10 a step forward or backwards? Injury Prevention (in press)

From Scotland:

1. Stone DH, Morrison A and Smith GS. Emergency department injury surveillance systems: the best source of limited resources? Injury Prevention, 1999; 5:166-167.

2. Morrison A, Stone D. and the EURORISC Working Group. Unintentional childhood injury mortality in Europe 1984-93: a report from the EURORISC Working Group. Injury Prevention, 1999; 5:166-167.

From the United States:

1. National Center for Health Statistics. Proceedings of the International Collaborative Effort (ICE) on Injury Statistics Volume I , DHHS Pub No. (PHS) 95-1252 March 1995 (Edited by LA Fingerhut)

2. Fingerhut LA, Annest JL, Baker, SP, Kochanek KD and McLoughlin E. Injury mortality among children and teenagers in the United States, 1993. Injury Prevention 2:93-94. 1996.

3. National Center for Health Statistics. Proceedings of the International Collaborative Effort (ICE) on Injury Statistics Volume II , DHHS Pub No. (PHS) 96-1252 September 1996 (Edited by LA Fingerhut)

4. Fingerhut LA and Warner M. Injury Chartbook. Health, United States, 1996-97. Hyattsville, Maryland: National Center for Health Statistics. 1997

5. MMWR. Recommendations and Reports. Recommended Framework for Injury Mortality Data McLoughlin E, Annest JL, Fingerhut LA, Rosenberg H, Kochanek K, Pickett D and Berenholz G. Vol 46, no RR-14, August 29, 1997.

6. Fingerhut LA, Cox CS, Warner M, et al. International comparative analysis of injury mortality: Findings from the ICE on Injury Statistics. Advance data from vital and health statistics; no. 303. Hyattsville, Maryland: NCHS. 1998.

Keynote: Priorities for Injury Surveillance

John Langley*

*Injury Prevention Research Unit (IPRU), University of Otago, Dunedin, New Zealand

There has been a significant increase in injury surveillance activities worldwide as many countries are recognising the importance of injury, relative to disease, as a cause of mortality and morbidity. Given that resources are limited it is important we use them to ensure the maximum return for injury control. This paper identifies priorities for the future development of injury surveillance namely:

- Maintain the focus on important injury
- Promote consensus on minimum data sets for specific injury events
- Improve, develop, and apply classification systems/databases
- Get the most out of what we have got
- Improve the comprehensiveness and quality of international comparisons

It should be noted that the discussion presented here is from a western developed country perspective. It is acknowledged that many developing countries have more fundamental priorities.

1. Maintain the focus on important injury

The priorities for injury prevention resources should based on a consideration of deaths, and non fatal injury which is important in terms of threat to life, results in serious disablement, or is costly. These outcomes should, by definition, be the focus of our injury surveillance effort. Regrettably, that often appears not to be the case.

It is not uncommon to read or hear phrases to the effect that the injuries being described are "just the tip of the iceberg". This analogy relates to the fact that approximately 15% of an iceberg is visible at sea level. Applied to the New Zealand situation, for every death, there are 30 injuries requiring hospital inpatient treatment and for every inpatient injury there are 30 requiring outpatient treatment only, (1:30:900) and many more requiring general practitioner treatment.

The analogy with the iceberg is flawed. Whereas the ice we can at sea level is the same as that below sea level that is not the case for the injuries. Injuries resulting in death are clearly more serious than non-fatal injury requiring hospital inpatient treatment.

Another shortcoming with the analogy is that all cause injury ratios can mistakenly be applied to specific injury events and as a consequence result in significant over- or under-estimates. Take for example, submersion incidents. In 1996 in New Zealand there were 101 drowning deaths (defined as those events with one of the following E codes: 830,832,910,954,984. Applying the all cause ratio would result in an estimate of 3030 submersion incidents requiring inpatient treatment. The actual number was 134, 4% of that estimated by the application of the all cause ratio.

Table 1 shows the actual ratios for self-harm, falls, and striking against incidents and for New Zealand. It demonstrates quite clearly that injury icebergs do not comply with the characteristics of natural icebergs.

Table 1: Death to Injury Inpatient ratios - New Zealand: 1995

All injury	1:41
Self harm	1:5
Falls	1:76
Striking against	1:492

A further problem with the iceberg analogy is that often there is an implication that apart from the outcome (e.g., death, serious injury) these events are the same. But are they? Are the circumstances, risk factors and their relative contribution the same? Clearly they are not in many instances. For example, Table 2 shows that distribution of mechanism of self inflicted harm varies markedly depending on the outcome under consideration.

Table 2: Distribution of mechanism of self harm by outcome - New Zealand: 1995

	Deaths	**Serious injury**
Poisonings	35%	89%
Hangings	41%	2%
Submersion	4%	0%
Firearms	12%	1%
Sharp objects	2%	5%
Jump	3%	1%
Other	4%	2%

It has been this iceberg model which has indirectly lead to the development of injury surveillance systems based on emergency department visits. Many of these events are not priorities for injury prevention, and thus injury surveillance, since they are not important in terms of threat to life, disablement, or cost.[1,2] Those that are, are typically admitted (3). Given that many countries do not have national inpatient injury data systems their development should be a priority.

In addition, emergency department visits for minor injury are strongly influenced by social, health service supply, and access factors.[4,5,6,7]

More importantly, there are more pressing needs for injury surveillance. Most countries require better information on deaths, and injury requiring in-patient treatment. For example, in New Zealand and Australia, and no doubt many other countries, there is no simple way of determining from existing databases whether an injury is work related or not.[8,9]

Similarly, while Coroner's files maintain detailed information on the circumstances of death, they are not accessible electronically, and they vary in their quality.[10,11] The establishment of systems for determining the work-relatedness of deaths, and electronic uniform Coronial databases[12,13] are just two examples which deserve far more attention than the promotion of accident and emergency surveillance systems. Other equally important priorities for serious injury, as defined here, are outlined below.

2. Promote consensus on minimum data sets for specific injury events

In New Zealand, all reported fatal, and non-fatal, motor vehicle traffic crashes are investigated by the police and the detail recorded in a standard form which is then entered into the Land Transport Safety Authority (LTSA) database. The database has approximately 50 variables covering driver, vehicle, road, and environmental factors. Similar systems exist in other countries. The resources directed at this no doubt relate directly to the size of the problem. In 1996 suicides (32%) surpassed motor vehicle traffic crashes (30%) as the leading cause of injury death in New Zealand. Suicides are also investigated by the police in New Zealand, but in marked contrast to road deaths there is no specialized reporting form or supporting data base. This is much the same situation for all other injury deaths, even in areas where we have policy and legislation to support a specific problem. A good example of this is domestic pool drownings. New Zealand has pool fencing legislation. Despite this, the recording of circumstances of pool drowning deaths is such that one could not determine for the majority of cases whether, for example, the pool was fenced and whether it complied with the safety specifications required by law.

As an injury prevention research community we urgently need to develop recommended minimum data sets for specific injury events (e.g., falls, assault, drownings), mechanisms (e.g., firearms), activities (e.g., work, sport), and generic risk factors (e.g., alcohol). The recent efforts in relation to firearms[14] and partner assault serve as useful models.[15] Such initiatives are of political and public health importance, at least in the New Zealand context. For example, New Zealand recently introduced legislation which opened up its work-related injury compensation to competition. One requirement of the new legislation is that all insurance companies will need to provide data on the circumstances of injury to a central agency. It is intended that this data be used to monitor the impact of the changes to the scheme and to facilitate injury prevention.

The legislation was passed by parliament in December 1998 and come into effect on 1 July 1999. Government officials have been working studiously to arrive at a minimum data set for each injury case that all insurance providers will be required to provide to the central agency. This task has been seriously hampered by the absence of international or national consensus documents on what should be collected on occupational injury for the purposes of facilitating injury prevention. On a positive note it would appear that what is being proposed is more comprehensive than has been produced before. The proposal is, and will continue to be, under threat for cost reasons. Clearly those who support a comprehensive approach will need to demonstrate the utility of each data element. Given New Zealand's purported poor occupational injury performance their efforts would have additional impact if they could argue that the removal of specific data items would in effect mean that New Zealand would have a internationally substandard surveillance system.

3. Improve, develop, and apply classification systems/databases

3.1 Circumstances of injury

Internationally, the Supplementary Classification of External Causes of Injury and Poisoning (E-codes) of the World Health Organization’s (WHO) International Statistical Classification of Diseases, Injuries, and Causes of Death (ICD) is the most widely used coding frame for categorizing the circumstances of injury and poisoning.[16] The government agencies responsible for health statistics in most member countries of WHO are currently using the 9th revision of ICD

(commonly referred to as ICD-9) or a variation of it, such as the clinical modification (ICD-9-CM),[17] to summarize their trauma deaths. In a limited number of countries, authorities are also using ICD-9 to code injuries resulting in hospital inpatient treatment. In addition, other agencies and individuals use E-codes to summarize the circumstances of injury for injured persons presenting to other health service providers (e.g., general practitioners and emergency departments).

Despite their widespread use, these E-codes have been criticized as being inadequate for prevention purposes.[18,19,20] In response to this, agencies both in New Zealand, and in other countries have developed their own coding.[21,22,23] In some instances these map to the ICD[23] but in others they do not.[21]

In 1992, WHO released the tenth revision of the ICD (ICD-10)[24] which includes major revisions to the E-codes used to summarize injury and poisoning. Relative to its predecessor, ICD-10 represents a significant improvement in many areas,[25] Unfortunately, it still falls far short of the mark for many injury prevention needs. Firearm injuries serve to illustrate the point. From a public policy perspective it is important to be able to differentiate between handguns, long guns, military style semi-automatic firearms, and air guns/rifles.[26] Although firearm types have been elevated in status from the fourth digit level in ICD-9 to the three character level in ICD-10, there is a substantial loss of information on firearm type for countries that code at the four digit level using ICD-9 (Table 3). Whereas shotguns and military firearms were separate E-codes in ICD-9 they have now been lumped together (W33). Given the growing concern of many countries to control firearm injuries, this loss of specificity is inappropriate.

Table 3: ICD codes for unintentional firearm injury

ICD-9	**ICD-10**
Firearm missile	Handgun discharge
- Handgun	Rifle, shotgun and larger firearm
- Shotgun (auto)	Other and unspecified
- Military firearms	
- Other	
- Unspecified	

Some would argue that the ICD was not designed to meet many of the expectations which have been placed on it. While this may be true, it is also the case that many agencies and individuals seek to have more than the ICD has been able to deliver to date. One need look no further than the development of alternative coding frames in New Zealand, Australia, and Scandinavia. It is undoubtedly the case that this need will persist and grow as injury receives increasing recognition, proportionate to its impact on health status. In the absence of some internationally agreed classifications for meeting these needs there is bound to be an increasing proliferation of coding frames. These are likely to be poorly thought out, incompatible with one another, and unable to be mapped to the ICD.

The task of developing coding frames to meet the needs of injury practitioners has been taken up by the WHO Working Group on Injury Surveillance Methodology Development. That group released its draft proposal at the 4th World Conference on Injury Prevention and Control in Amsterdam.[27]

This provides a solid foundation for moving forward on this issue. To date however, recruitment to trail this has been less than satisfactory

3.2 Severity of injury

I have already argued that the development of injury surveillance systems based on emergency room visits is problematic since attendance is influenced by social and economic factors. Given that these factors will vary over time this seriously compromises the use of these data for measuring trends. As a consequence I have advocated we give priority to developing inpatient injury surveillance systems. Whether one gets admitted to hospital, however, is also influenced by factors other than the severity of one injury, albeit to a lesser extent than attendance as an outpatient to an emergency department. This situation can be addressed by the application of measures of injury severity. The situation is well illustrated in the New Zealand context by reference to trends in head injury.

Figure 1 suggests that New Zealand has been very successful in reducing head injury requiring inpatient treatment. Figure 2 shows the same data disaggregated according to ICD-AIS.[28] The majority of head injuries are AIS-2 and these are declining. This contrasts with the more severe head injuries which are relatively stable over time. The trend for AIS-2 injuries probably reflects two factors. First, the positive effect of interventions such as cycle helmet wearing.[29] Second, evidence suggests that the with the advent of improvements in the diagnosis of head injury through the use of computer tomography people who may have been admitted in the past for observation are now allowed home.[30]

Figure 1: Head injuries inpatient treatment - New Zealand: 1988-1996

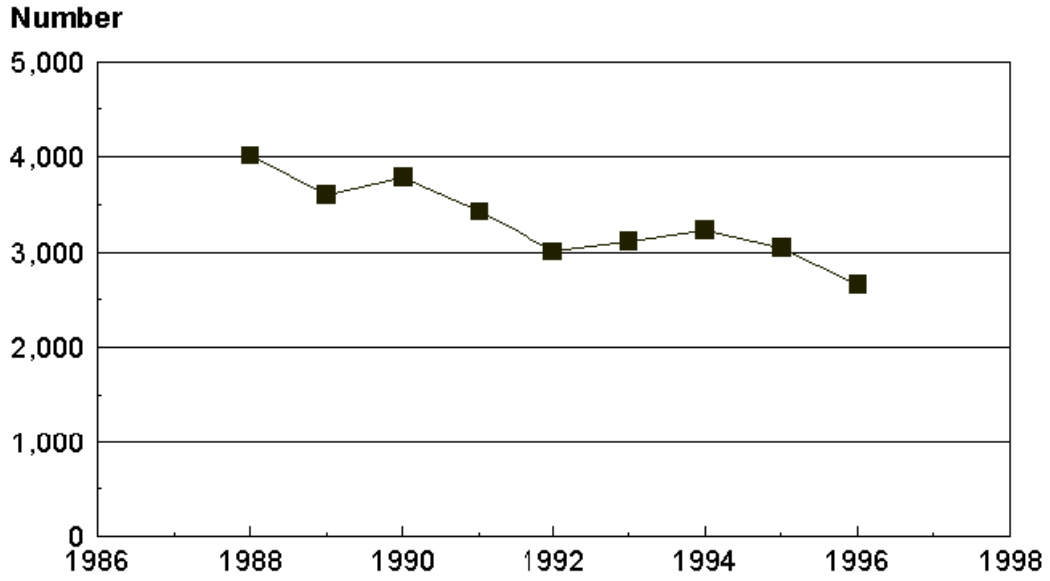
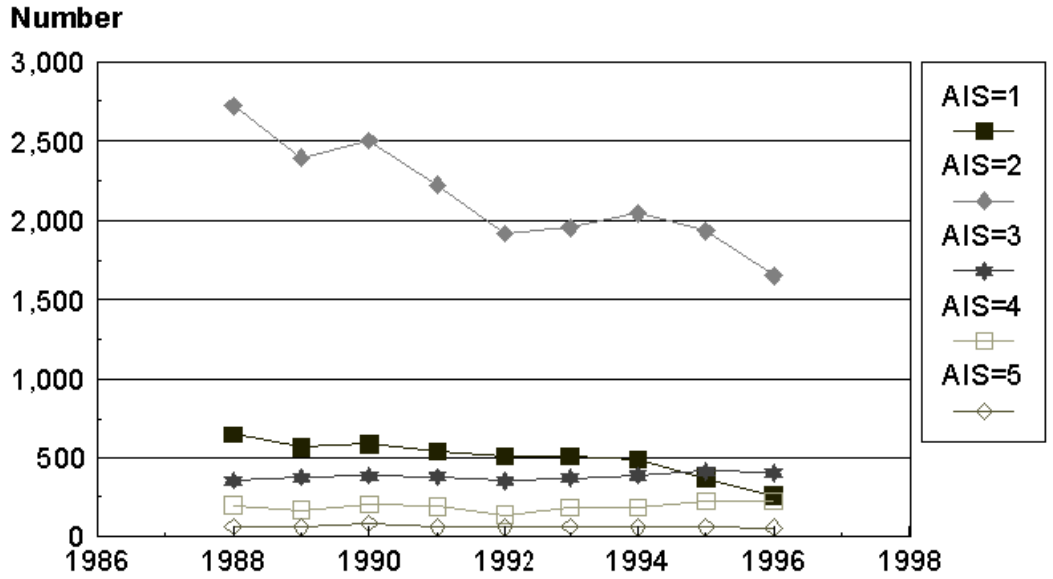


Figure 2: Head injuries inpatient treatment - New Zealand: 1988-1996 by AIS



AIS is the most widely used and accepted anatomical measure of severity. In the example above, AIS scores were derived from a programmed which maps from ICD-9-CM. There are limitations with this indirect method of determining severity (e.g., many ICD codes do not map, it is dependent on the quality of ICD coding). Of perhaps greater concern is that many countries do not use ICD-9-CM . In addition, others are introducing ICD-10, and at present there is no ICD-10 to AIS mapping programmed. One option is to undertake direct coding. Given that it takes 10-20 minutes to assign AIS scores, direct coding for population based surveillance systems based on injury victims who are admitted to hospital is a major financial barrier. More recently there have been efforts to develop systems which are based directly on ICD codes.[31] There have been limited evaluations of this method.

In summary, in considering the implementation of diagnostic coding systems for population injury surveillance a key consideration should be whether severity scores can be derived from these codes.

3.3 Disablement

The absence of data on non-fatal outcomes is a major barrier to prevention and rehabilitation efforts. For example, we need to be able to rapidly determine how many people are: blind, have a major cognitive loss, or are paraplegic as a result of injury. To the best of my knowledge no country records such information on an ongoing basis in a readily retrievable format. Such information is important for determining injury prevention priorities and determining how effective we have been at reducing these outcomes as a result of changes in critical care and rehabilitation services. The absence of readily available data on non-fatal outcomes is very surprising given that many countries have agencies which have a mandate to compensation and rehabilitation of injured victims. Typically such organizations refer to a reduction in injury claims and injury costs. Both of these measures, however, are susceptible to factors other than severity of disablement (e.g., changes in criteria for compensation, time limits on how long a victim may be compensated for). While they may meet many of the organizations performance measurement needs they may have little relationship to the societal (as opposed to an organization's) burden of disablement.

4. Get the most out of what we have got

4.1 Narratives

We will never develop, nor could we implement, coding frames which will meet all our prevention needs. Development is hampered by the diversity in the circumstances of injury and variety of non-mutually exclusive dimensions upon which we consider injury (e.g., work-related injury and crashes). Implementation is hampered by the cost of coding such information.

We need to remind ourselves that many countries do not even have reliable counts of the number of people who have died as a result of injury and many others have yet to implement ICD-9 E-coding for these injury deaths. Counting non-fatal injuries and coding them is a distant dream in countries which represent the a substantial portion of the world population.

Narratives have been shown to be a powerful tool for injury prevention, even for those countries which can afford to code the circumstances of injury.[32,33,34,35]

One thing, that tends to occur naturally is that injury victims, or witnesses, are asked "what happened". Sometimes the responses may be as brief as "I was in a car crash" and other times a more detailed account is provided. In many situations this is recorded in the form of hand written notes. In situations where there are not the resources to 'E-code' such information we should, as a minimum, be promoting the recording of this information electronically. Searching such information for key words is a simple process, at worst it could be done with a word processing package. The capture of such information also provides the opportunity to code it at some future date either manually or by machine reading.[36]

Obviously the quality of such information will be highly variable. While some guidance could be given as to what should be recorded for various classes of event such documentation would probably be a significant barrier to implementation and or compliance would be low. As a minimum however, we should be promoting the recording of a three verb/noun combinations to the questions in Table 4. Such information in conjunction with a diagnosis, which could also be uncoded (e.g., "concussion") is significantly better than recording nothing.

Table 4: Three key questions for the purposes of recording narratives on the circumstances of injury-with an example

Question	**verb**	**noun**
what were your doing	riding (my)	bike
what happened	skidded (on)	gravel
how were you injured	struck (head)	kerb

Finally, the recording of narratives need not be restricted to circumstances of injury. Considerable benefits can arise, for example, from recording occupation.[37]

4.2 Linkage

External linkage (linking two independent agencies files), and internal linkage (linkage of files within a database) present a range of opportunities to us.

External linkage enables us to: a) determine coverage and any bias in coverage of a database, and b) capitalise on the strengths of various databases. An example of each will serve to illustrate the points.

The official New Zealand Police crash database has been shown, by probablistic matching, to under-report by 37%, crashes which result in the victim being admitted to hospital for the treatment of injury.[38] Of greater concern is that reporting rates vary significantly by environmental, demographic, and injury factors. For example, Table 5 shows under-reporting varies significantly by class of road user. Similar results using a similar methodology have been reported elsewhere.[39] One needs to be aware of such biases when allocating resources or determining cost benefit ratios for interventions.

Table 5: Linkage: Bias

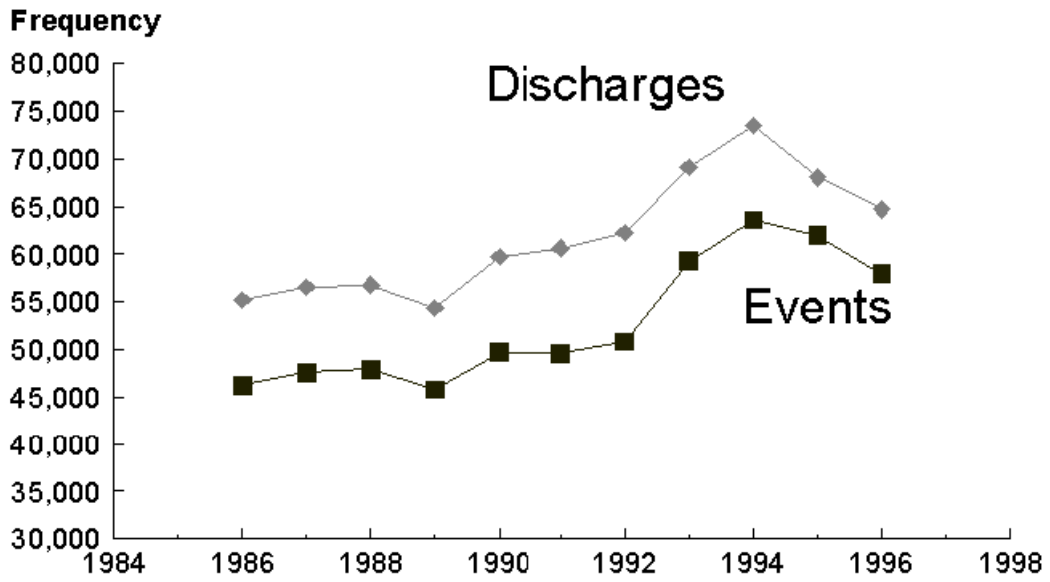
Percentage of records linked - occupant type	
	linked
Drivers	70%
Passenger	55%
MC: driver	60%
MC: passenger	54%

In most developed countries there are agencies which have legislative responsibilities for the prevention of specific injury problems. The best examples, are motor vehicle crashes and work-related injuries. Typically these agencies have investigative arms which collect very detailed information on the circumstances of injury. The quality of information they have on the nature and severity of injury is often limited and inaccurate. The reverse tends to be the case with health providers. Neither agency is ever likely to be able, or willing, to collect information at the level of detail the other agency would desire. Linkage provides an extremely useful means of: assessing the coverage of each data base, and enabling more accurate prioritisation, and evaluation.

Internal linkage enables us to: a) distinguish injury events form treatment events, b) the cumulative burden of specific events. An example of each is provided below.

New Zealand's hospital inpatient dataset is a record of discharge events. Thus, following discharge an individual can be readmitted three further times for further treatment. This would be listed as four separate discharges. Given that readmission rates may vary by severity of injury and over time (due to changes in service delivery) it is important to be able to distinguish injury events form discharge events. Figure 3 shows the how significant this difference can be.

Figure 3: Internal Linkage: Events vs discharges - New Zealand Public Hospitals 1986-96



The reference to "event" in the figure will not be technically correct in some instances. For example, one car crash can result in several people being injured. Further precision could be obtained by linkage with the LTSA database referred to earlier, although due to under-reporting this would not be possible for all cases.

Table 6 shows another benefit of internal linkage, namely, the estimation of the cumulative burden of injury for specific injuries. All too often when assessing the burden of specific injury we focus on the acute phase of inpatient treatment.

Table 6: Internal Linkage: Measurement of burden

% of Cumulative (24 months) days stay in hospital attributable to non-acute phase	
Fracture of Lower Limbs	16%
Injury to nerves and spine	26%
Poisoning: by drugs etc.	8%
All injury:	15%

In practice there were more drownings but these are "hidden" within other Ecodes[40].

4.3 Multicause coding

The ICD only allows for the coding of one underlying cause of death. In this context one E-code. Many injury events are multi-factorial and not well described by a single cause. As a consequence some events are under-reported and this may in turn result in missed opportunities for prevention. The situation is well demonstrated by a recent study using New Zealand data which showed that 15% of all drowning incidents were coded as motor vehicle crashes.[40] The use of multi-cause coding would overcome such problems.

5. Improve the comprehensiveness and quality of international comparisons

International comparisons can provide powerful political incentives at a national level where a country performs poorly relative to comparable countries. For example, New Zealand's youth suicide rate is among the worst of several OECD countries. New Zealand's very poor performance coupled with an substantially increasing rates in recent years has resulted in a concerted effort by a number of Ministries to try and reduce this mortality.

There are many traps for the unwary in international comparisons. For example, New Zealand recently opened its compulsory work-related injury insurance scheme to competition. Prior to this there was one single government agency that provided cover. The proponents for change argued that the single insurer system had failed as was evidenced by New Zealand's work-related injury performance relative to other countries.

At present we have no real basis on which to judge New Zealand on one of the key indicators of occupational health and safety performance, our rate of work-related fatal injury relative to other comparable countries. I am unaware of any published peer reviewed scientific paper which demonstrates that New Zealand has one of the worst work-related injury records in the world.

Even if it could be demonstrated that New Zealand's performance is worse than similar developed countries, there are several alternative and more credible explanations for the differences other than differences in work-related insurance arrangements. For example, different rates of work-related death might reflect differences between countries in what constitutes a work-related injury, and/or compliance with reporting.

However, the most significant alternative explanation for different rates of work-related death would probably be differences in the distribution of work-related activity. This is best illustrated by a simple hypothetical example.

Suppose two countries have the following overall work-related fatal injury rates

Country A: 10/100,000 workers
Country B: 20/100,000 workers

It has been demonstrated in several countries that the agricultural industry has very high rates relative to many other industries. Thus if Country B, relative to Country A, had an very high percentage of its workforce involved in agriculture we might expect this difference. In other words comparison of overall rates without reference the differences in hazards can be extremely misleading.

I have already alluded to the importance of ensuring that in comparing countries we need to ensure the definitions for the numerators is the same. The same applies to the denominators. When comparing industry specific rates it is vital to ensure that the industry populations that are being compared are similar. For example, in USA the industry classification of Agriculture, Forestry and Fishing excludes logging, whereas in New Zealand it includes logging. Logging is very high risk thus its inclusion or exclusion has the potential to dramatically affect the industry rate.

In conclusion, I believe insufficient thought has been given to prioritising injury surveillance needs. As a consequence resources are being directed at issues which could be better spent elsewhere. Moreover, we have some pressing surveillance needs in urgent need of attention.

References

1. Watson WL, Ozanne-Smith J. The Cost of Injury to Victoria. Victoria: Monash University Accident Research Centre, 1997.

2. Mackenzie EJ, Shapiro S, Moody M, Siegel JH, Smith RT. Predicting post-trauma functional disability for individuals without severe brain injury. Medical Care 1986;24(5):377-387.

3. Hobbs CA, Grattan E, Hobbs JA. Classification of injury severity by length of stay in hospital. Transport and Road Research Laboratory Report 871 1979:1-20.

4. Alwash R, McCarthy M. Accidents in the home among children under 5: ethnic differences or social disadvantage? British Medical Journal 1988;296:1450-1453.

5. Lyons RA, Lo SV, Heaven M, Littlepage BN. Injury surveillance in children-usefulness of a centralised database of accident and emergency attendances. Injury Prevention 1995;1(3):173-6.

6. McKee CM, Gleadhill DN, Watson JD. Accident and emergency attendance rates: variation among patients from different general practices. British Journal of General Practice 1990;40(333):150-3.

7. Padgett DK, Brodsky B. Psychosocial factors influencing non-urgent use of the emergency room: a review of the literature and recommendations for research and improved service delivery. Social Science & Medicine 1992;35(9):1189-97.

8. National Occupational Health and Safety Commission. Work-related traumatic fatalities in Australia, 1989 to 1992. Canberra: National Occupational Health and Safety Commission, 1998.

9. Langley J, Feyer A-M, Wright C, Alsop J, Horsburgh S, Howard M, et al. Workrelated Fatal Injuries in New Zealand 1985-1994: Recommendations on the establishment of ongoing work injury morality surveillance. Dunedin: Injury Prevention Research Unit and New Zealand Environmental and Occupational Health Research Centre, 1999.

10. Warner M, Smith G, J.D.L. Quality and completeness of alcohol data for drownings in coronial files. A report prepared for the Alcohol Advisory Council of New Zealand. Dunedin: Injury Prevention Research Unit, University of Otago, 1998.

11. National Injury Surveillance Unit. Coronial Information Systems: Needs and feasibility study. In: Moller J, editor. Adelaide: National Injury Surveillance Unit, 1994.

12. Selby HE. The Aftermath of Death: Coronials. NSW, Australia: The Federation Press Pty Ltd, 1992.

13. Selby H. The Inquest Handbook. Australia: The Federation Press, 1998.

14. Saltzman LE, Ikeda RM. Recommended Data Elements for Firearm-Related Injury Surveillance. American Journal of Preventive Medicine 1998;15(3S):113-119.

15. Saltzman LE, Fanslow JL, McMahon PM, Shelley GA. Intimate Partner Violence Surveillance: Uniform definitions and recommended data elements. Atlanta: Injury Prevention and Control, Centers for Disease Control and Prevention, (in press).

16. World Health Organisation. International Classification of Diseases - 9th Revision. Geneva: World Health Organisation, 1977.

17. National Centre for Health Statistics. The International Classification of Diseases, 9th Revision, Clinical Modification. Ann Arbor: Commission on Professional and Hospital Activities, 1979.

18. Langley J. Description and classification of childhood burns. Burns 1984;10:231235.

19. Langley J. The international classification of diseases codes for describing injuries and the circumstances surrounding injuries: A critical comment and suggestions for improvement. Accident Analysis and Prevention 1982;14(3):195-197.

20. Baker SP. Injury classification and the international classification of diseases codes. Accident Analysis and Prevention 1982;14(3):199-201.

21. Heidenstrom PN. Accident Recording: The need for a new approach. ACC Statistics 1982;1(1):4-7.

22. NOMESCO. NOMESCO Classification of External Causes of Injuries. Copenhagen, 1996.

23. National Injury Surveillance Unit. National Data Standards for Injury Surveillance. Adelaide, Australia: National Injury Surveillance Unit, Australian Institute of Health and Welfare, 1995.

24. World Health Organisation. International Statistical Classification of Diseases and Related Health Problems - 10th Revision. Geneva, 1992.

25. Langley J, Chalmers D. Coding the circumstances of injury: ICD-10 a step forward or backwards? Injury Prevention (in press).

26. Minister of Police. Review of Firearms Control in New Zealand: Summary and Conclusions. Auckland, 1997.

27. World Health Organization. International Classification for External Causes of Injuries (ICECI). Guidelines for counting and classifying external causes of injuries for prevention and control. Amsterdam: Consumer Safety Institute, WHO Collaborating Center on Injury Surveillance, 1998.

28. MacKenzie EJ, Steinwachs DM, Shankar B. Classifying trauma severity based on hospital discharge diagnoses. Medical Care 1989;27(4):412-422.

29. Scuffham P, Alsop J, Cryer C, J.D.L. Head Injuries to Cyclists and the New Zealand Cycle Helmet Law. Accident Analysis and Prevention (in press).

30. Beattie TF, Currie CE, Williams JM, Wright P. Measures of injury severity in childhood: a critical overview. Injury Prevention 1998;4(3):228-31.

31. Rutledge R, Hoyt DB, Eastman AB, Sise MJ, Velky T, Canty T, et al. Comparison of the Injury Severity Score and ICD-9 diagnosis codes as predictors of outcome in injury: analysis of 44,032 patients. Journal of Trauma 1997;42(3):477-87; discussion 487-9.

32. Sorock GS, Smith GS, Reeve G, Dement J, Stout N, Layne L, et al. Three Perspectives on Work-related Injury Surveillance Systems. American Journal of Industrial Medicine 1996;32:44116-128.

33. Jenkins EL, Hard, D L. Implications for the use of E codes of the International Classification of Diseases and narrative data in identifying tractor-related deaths in agriculture, United States, 1980-1986. Scandinavian Journal of Work, Environment & Health. 1992;18:49-50.

34. Langley JD. Experiences Using New Zealand's Hospital Based Surveillance System for Injury Prevention Research. Methods of Information in Medicine 1995;34(4):340-344.

35. Langley JD. Loss of narrative data in New Zealand Health Statistics public hospital discharge injury data files. Australian Epidemiologist 1998;5(4):18-20.

36. Lehto MR, Sorock GS. Machine Learning of Motor Vehicle Accident Categories from Narrative Data. Machine Learning from Accident Narratives 1996:25.

37. Langley J. Surveillance of serious occupational injury in New Zealand: taking a step backwards. Journal Occupational Health Safety-Australia New Zealand 1998;14(1):81-84.

38. Alsop J, Langley JD. A determination of biases in LTSA's Traffic Crash Report files with respect to serious occupant road crashes: a data linkage study. Dunedin: Injury Prevention Research Unit.

39. Rosman DL. The Feasibility of Linking Hospital and Police Road Crash Casualty Records Without Names. Accident Analysis and Prevention. 1996;28(2):271-274.

40. Smith GS, Langley JD. Drowning surveillance: how well do E codes identify submersion fatalities. Injury Prevention 1998;4:135-139.

Classification of External Causes of Injuries (ICECI) - an international task force under the auspices of the WHO

Wim Rogmans,* Saakje Mulder,* James Harrison** and Etienne Krug***

*Consumer Safety Institute, The Netherlands
**Flinders University, Australia
***World Health Organization, Geneva

1 Introduction

At the Fourth World Conference on Injury Prevention and Control (Amsterdam May 17-20, 1998) the WHO Working Group on Injury Surveillance Methodology Development presented the draft International Classification for External Causes of Injuries (ICECI). This classification is the result of at least two decades of exchange and debate on the need for improving the tools for injury data representation which is traditionally based on the International Classification of Diseases (ICD-chapter XIX and XX).

In this paper, the 'raison d'être' of a separate classification is presented as well as its scope and basic structure.

2 The needs for re-engineering current classifications for 'external causes'

2.1 Epidemiology as basis for prevention

Injuries are a most serious health problem in all nations of the world (Murray & Lopez, 1996). Today, we know to prevent a substantial proportion of the diseases that kill or disable, but our knowledge still appears to be insufficient to ensure effective injury control. As a result injuries rank among the leading causes of death and account for ten to twenty percent of all hospital admissions. Injuries are also a costly health problem, in particular due to the fact that children and young adults are at risk which results in long periods of handicapped life or loss of productive life due to premature death.

Any effort to reduce injuries should begin with examining the number and nature of injuries as well as the main determinants, i.e. the causal chain of events leading to the injury event. The realization that injury can be understood with the same tools we have directed against disease is recent. For much of this century injury prevention efforts focused on the assumed shortcomings of the victims and therefore directed much of their energy educational measures as the dissemination of pamphlets and posters. The modern view of injuries does not eliminate personal responsibility but assigns also weight to other factors such as structural environment, life styles and the technical properties of equipment involved in the injury event: injury prevention through *engineering* safer working and living conditions, through *enforcing* rules and regulations for safer practice and through *educating* continuously parents, youngsters and adults (the three E's).

2.2 Shortcomings in current data

Injury mortality data is the easiest to obtain because death records data are maintained in many nations. In a number of countries also hospital discharge statistics are available at national level, however they include much less detail as regards the causes of injuries and the relevant circumstances. The World Health Organization's International Classification of Diseases (ICD) has served for many decades as the main classification for these information systems in particular those implemented in the health sector (such as coroner reporting systems and hospital discharge statistics). But this classification was first developed a century ago, when modern concepts of injury control were still many decades in the future. In the 1980's a broad criticism with respect to the insufficiencies of the ICD commenced to rise, underlining the shortcoming of the nature of injury coding (that combines injuries for instance that are extremely diverse in their severity) and the lack of logic and flexibility in the external coding (E-codes) system.

The ICD is limited in its use for injury prevention due to:

- its being predominantly developed for mortality statistics and therefore not sufficiently discriminating in morbidity data;

- single dimensional in structure where the relevant information is in essence multi-dimensional;

- complex and inconsistent in structure and therefore poor in user-friendliness and certainly not flexible for application in less resourced settings of health care services; and

- insufficient in covering relevant aspects in more specific areas of interest such as injuries due to violence and work-related injuries.

Since the eighties, the need for establishing a logic and simple "modular system" was strongly voiced. Such a system should separate clearly the various aspects involved (i.e. the independent variables), such as the ethnologic agent, event-characteristics, the environmental features or products involved and the intention (purposely inflicted injury or not). In the 80's and 90's some progress has been made in that respect, in particular owing to initiatives from various parts of the world, such as:

- in the Scandinavian region by its Nordic Medico-Statistical Committee (Nomesco, third version published as 1997);

- in the United States of America and the U.S.-Centers for Disease Control;

- in Australia by issuing a National Data Standard for Injury Surveillance and in New Zealand through designing a Minimum Data Set; and

- in the Western European Region by the implementation of a European Home and Leisure Accident Surveillance System (EHLASS) since the early 80's (Rogmans & Mulder, 1998).

From these groups input has been given to the ongoing process of ICD-revision in the second half of the 80's, which as led to significant improvements in the final version of the tenth Revision of the ICD that is now in progress of being implemented in WHO-Member States. Yet the fundamental criticism on the E-coding system and its shortcoming in unfolding the logical dimensions, remains the same for the tenth revision.

This was the very reason for the WHO and its programme for Safety Promotion and Injury Control (SPIC), to help to create synergy between the various initiatives already taken in the different parts of the world and to establish a separate Classification of Injuries. This classification should meet the requirements of injury control practitioners and fit in the family of WHO-classifications for diseases and "health-related problems". This task has been taken up by a "WHO-Working Group on Injury Surveillance Methodology Development" (see annex) under guidance of the Violence and Injury Prevention-programme manager at WHO in Geneva.

3 Aims and scope of ICECI-classification

The ICECI-classification and its guidelines aim to ensure a high degree of uniformity in the methodology, structure and data content of injury surveillance systems that operate where injured people are treated. The guidelines and its classification serve as a general instrument for the health sector's routine registration of the aetiology of all types of injury, complementing to the already existing system of ICD and its section on external causes. The injury classification is, in essence, compatible with and collapsible to the relevant ICD-sections.

The purpose of the classification is to assist researchers and prevention practitioners in (WHO, 1998):

- defining more precisely the domain of injuries they are studying;

- answering questions such as where did the injury occur, how, under what circumstances and which products were involved?; and

- in providing a more detailed description of specific categories of injuries such as traffic related injuries and injuries due to violence.

In developing the classification due consideration is given to include at least the basic factors that are relevant for primary, secondary and tertiary injury prevention. In first instance, we focussed on basic data that is helpful for primary prevention, i.e., relevant information on "where and how did the injury occur" and not on secondary or tertiary prevention. However, it is our ambition to expand the guidelines and classifications in due course with data elements that are relevant for injury control and rehabilitation: injury typology and severity measurement, the role of protective equipment, first aid and emergency care, measurement of long term consequences and so on.

4 Structure of the classification

In developing the ICECI four basic conditions had to be fulfilled rigorously. It should ensure:

a. compatibility with ICD-10 and its chapter XX on injuries, poisonings and other external causes,

b. optimal relevance for injury prevention research and should therefore focus on the primary factors that influence injury risks and injury events,

c. world-wide relevance with respect to data items and categories included in the system, and

d. ensure also broad applicability of the classification at different levels of sophistication in research-implementation and facilitate in particular data capture in health settings in general and Emergency Departments in particular.

These requirements can only be met by developing a system that is flexible in adapting to the needs and demands in different settings and in different regions of the world while maintaining the basic principles of a logic structure: a system with an open and transparent structure.

4.1 Structure

For developing ICECI three steps have been taken:

1. Unravelling the fuzzy one-dimensional structure of ICD-external cause into the three essential dimensions that the ICD-designers collapsed into one: 'intent', 'mechanism', and 'objects involved in the injury event'.

2. Add additional codes to these three data items as well as to the activity and place item;

3. Develop additional sets of items that are specifically relevant for one or two subsets of cases such as traffic-related injuries or injuries due to violence.

For compatibility with ICD-10 codes for external cause, the following items provide the key: intent, mechanism, objects/substances, place, activity, transport mode and transport counterpart.

Figure 1 also demarcates the boundaries of both ICD and ICECI. ICECI adds to ICD a set of additional codes for the traditional variables as well as a limited set of additional modules. Both additional sets of codes and modules can be separated from ICECI and partially as well as fully applied as a complement to an already running ICD-based surveillance system without interfering in the integrity of the existing ICD-system.

4.2 Relation to ICD-10

Within the ICD-structure it is acknowledged that for some specialities, such as in oncology and in dentistry, it does not include enough detail and that information may be needed on different attributes of the classified condition than those included in ICD. The main ICD cannot incorporate all this additional information without losing its relevance and accessibility for the traditional users. Therefore the concept of 'family of disease and health related classifications' arose, allowing expansion of the mandatory three-digit and recommended four-digit character code. The ICECI, although not yet formally adopted as such, is an example of such a complementary classification that allow the allocation of diagnosis using different axes of classification in addition to ICD.

ICD-compatibility of any health services based injury classification will always remain essential as:

1. In the health sector the ICD provides the common nomenclature both to health professionals and to administrators in their professional and scientific work. It is the common language to which any supplementary information system should link as much as possible.

2. Most information related to deaths and increasingly also related to in-patients is classified in accordance with ICD. For comparising information from different sources, such as death certificates, hospital discharge statistics and ED-records, it is important that all data fit to the common core classification of ICD.

3. As important health indicators (such as DALY's), cost estimates (DRG's) and impairment assessment (ICDH) are based on ICD-structure, full linkage between ICECI and ICD is also important.

4. Most of the current regionally developed injury classifications took ICD as a reference frame, but made their own exegesis resulting in quite divergent structures. Any harmonisation should therefore start with 'the mother of classifications'.

In the current draft ICD-compatibility has been given prime, but not sole, priority. Compatibility was given an operational definition as follows: data collected according to ICECI should be able to be reported according to ICD-10 Chapter XX at three character level or better.

In practice , this goal can be approached by a multi-axial system meeting the other design criteria, but it appears to be impractical to meet it completely.

Various levels of compatibility can be achieved and this involves trade-offs against other characteristics of the classification. For example, the proportion of three character ICD-10 Chapter XX categories that can be mapped from ICECI to ICD can be increased at the cost of adding complex, rarely needed, or poorly ICD-defined categories to ICECI. Empirical testing is required to reveal the losses and gains in this process.

4.3 Guide for use

This section is not yet completed but certainly will contain a short guide to using the ICECI in different settings and environments. It is expected to include also suggested case definitions and inclusion criteria, an overview of technical and administrative issues and pointers to sources of further information.

5 Further development and maintenance

It is evident that ICECI is far from complete: additional modules still need to be developed for work-related injuries and sport injuries, and some of the data items, such as activity and place, need further redesigning. Also the violence module needs further development and specificity in accordance with the research needs on the one hand and the practical limitations on the other hand.

It is also intended to develop additional data items that can cover important information elements related to issues as: socio-economic status (indicator), alcohol and drug use and other precipitating factors.

The current version of the ICECI is deliberately intended for a much broader consultation among the injury prevention and research community. The Working Group will actively seek comments and suggestions from the various safety sectors involved (traffic/ work/ consumers/ violence prevention) and from the health sector. The main purpose of the field testing is to ensure the guidelines' utility and the classification's comprehensiveness and global applicability. It will include the following components:

- checking compatibility with ICD in situ;
- testing the hierarchy and the codes for mutual exclusivity and adequacy for purpose (including the completeness of instructions and clarifications);
- checking the utility and acceptability of operational definitions with relevant international agencies and sectoral interests (traffic, work, consumer products, violence control and so on); and
- identifying the size of the efforts and costs to be invested in collecting routine information in accordance with the protocol and in a variety of settings.

Testing in the field will be part of a process of screening and testing. This will include the following components:

- review of the content of the classification through screening its structure and testing it on paper;
- operational testing of the classification in different settings on a limited number of cases and looking into the process of data collection and coding, the specificity of the classification and in reliability and validity issues.
  This will be done in the course of 1999 allowing the Working Group to revise the ICECI into a version 1.0 for publication in 2000.

After this process of testing and revision, ICECI's implementation in practice will be continuously monitored by the Working Group. Regular updates will appear and new and interactive media will be used for that purpose.

The Working Group will also initiate the development of additional data items and support tools. Beyond that it will launch a programme of activities that aims at enhancing expertise and professional quality in injury epidemiology and injury surveillance in the various regions.

- For further information: Secretariat at the Consumer Safety Institute, WHO-Collaborating Center for Injury Prevention & Safety Promotion (director dr. Wim Rogmans), P.O. Box 75169, 1070 AD Amsterdam, The Netherlands. Request for a copy of the draft classification are welcome at this address or at fax number: + 31 20 6692831/e-mail: S.Mulder@consafe.nl

References

1. Murray, CJL, AD Lopez. The global burden of disease: a comprehensive assessment of mortability and diseases, injuries, and risk factors in 1990 and projected to 2020. Harvard University Press, World Health Organization, 1996

2. Nomesco Classification of external causes of injury. Third revised edition 3rd. ed. Nordic Medico-Statistical Committee, Nomesco, Copenhagen, 1997

3. Rogmans, WHJ, S Mulder. Measuring the severity and costs of accidental injuries: Proceedings of a European Conference on Measuring the severity and costs of accidental injuries, held in Oslo on October 10-11 1996. European Consumer Safety Association, Amsterdam, 1995

4. WHO, World Health Organization. International Classification for External Causes of Injuries: Guidelines for counting and classifying external causes of injuries for prevention and control. Consumer Safety Institute, Amsterdam, 1998

Figure 1 Relation between ICD-10 and ICECI-variables

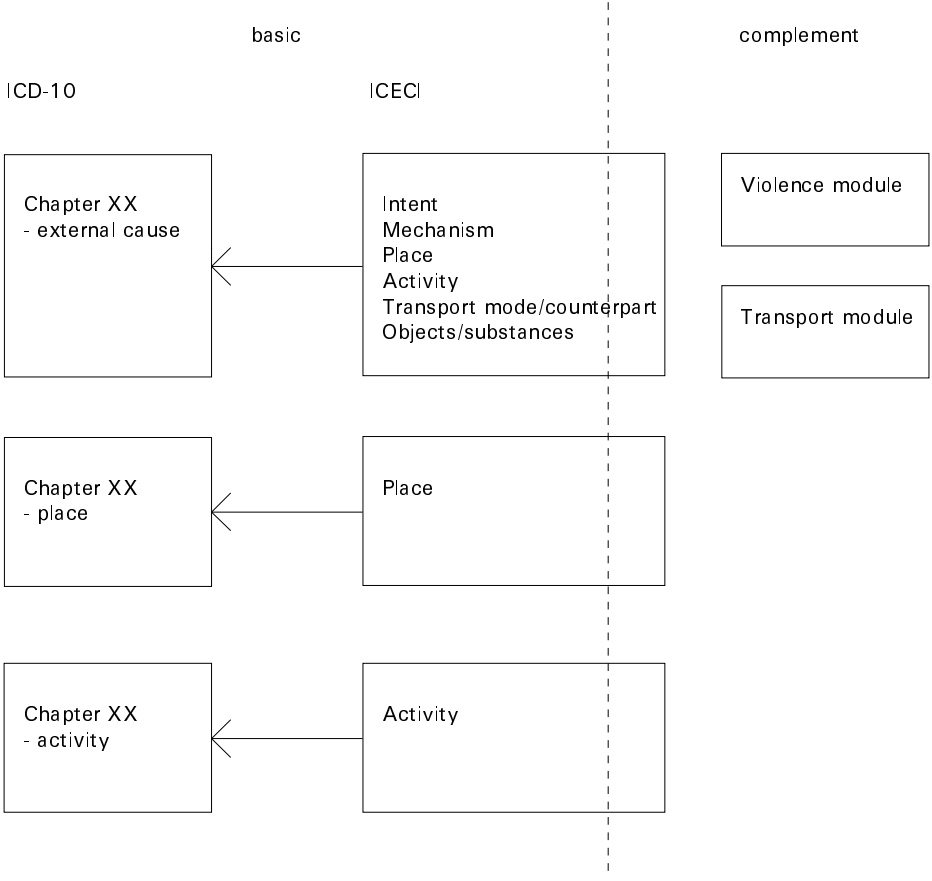
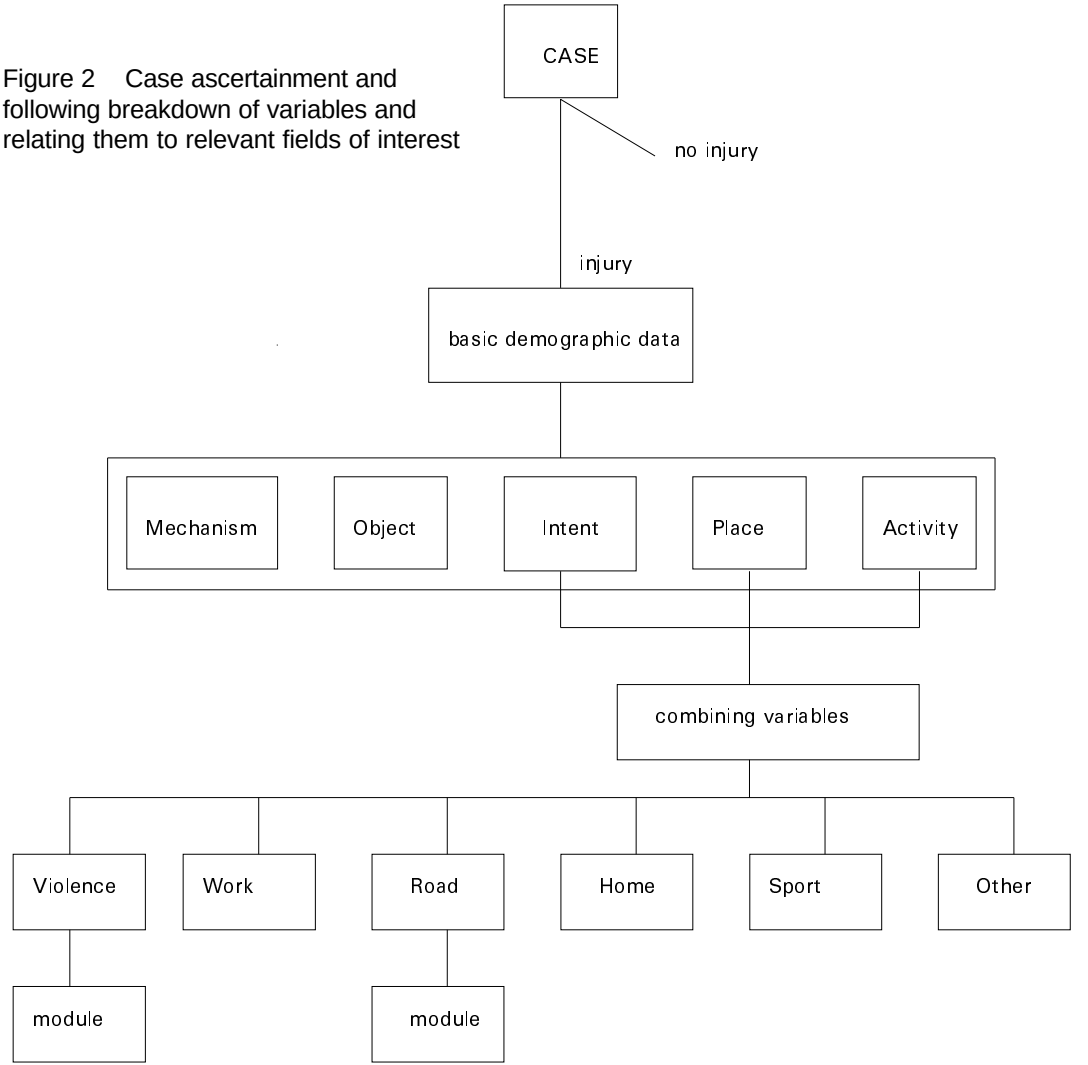


Figure 2 Case ascertainment and following breakdown of variables and relating them to relevant fields of interest



Testing ICECI

Saakje Mulder,* Anneke Bloemhoff** and Malinda Steenkamp**

*Consumer Safety Institute, The Netherlands, Chair of the Testing Group
**Consumer Safety Institute, The Netherlands, Member of the Testing Group

Introduction

The WHO Working Group on Injury Surveillance Methodology has developed a draft International Classification of External Causes of Injury (ICECI). The first draft was released for consultation in May 1998. After the first consultation round a second draft of the data dictionary was released in January 1999. This second draft will be tested in 1999 in order to assess its properties as a means for obtaining valid, reliable and useful information about the circumstances in which injuries occur. The final version will be released in November 2000.

Contents of ICECI

The data-elements included in ICECI:

- Intent
- Object or substance producing injury
- Place of occurrence
- Activity when injured
- Alcohol and drug use
- Violence module
    - Relationship between victim and perpetrator
    - Context of assault
    - Precipitating factors for suicide (attempt)
    - Type of legal intervention
- Transport module
    - Mode of transport
    - Counterpart
    - User
    - Context

Organisation

We installed a Testing Group with international participations:

Lee Annest (John Horan, Dan Polluck, Robin Ikeda)	CDC/NCIPC, USA
Saakje Mulder (chair)	Netherlands
Anneke Bloemhoff	Netherlands
Alberto Concha	PAHO
Lois Fingerhut	NCHS, USA
James Harrison	Australia
Yvette Holder	CAREC
Etienne Krug	WHO

Johan Lund	Norway
Susan Mackenzie	Canada
Malinda Steenkamp	Australia

This group drafted a testing protocol. Because there is only a small budget the basic principle of this protocol is to be practical and to make use of existing knowledge, experience and willingness to participate in the testing on a voluntary basis. This does not mean that the testing will be less valuable. It will be set up in small parts, so that organisations or individuals can participate in only parts of the testing.

Aim of the testing

The testing is aimed at three different aspects: validity, reliability and acceptability/feasibility. Each aspect is described below.

1. Validity:
- completeness: completeness of coverage, missing codes, lack of discrimination in codes, potential for misuse of codes, level of detail, completeness of the instructions, completeness of the variable definitions and the glossary
- clarity: clarity of codes, clarity of the instructions, clarity of the variable definitions and the glossary
- relevance: relevance of the classification and the glossary to specific types of injuries
- criterion validity: comparability of the coding of a study group with a 'gold standard' (made by reference group)

2. Reliability:
- inter-observer reliability
- intra-observer reliability

3. Acceptance/feasibility/utility:
- resource consumption: identifying the size of administrative efforts and costs
- collection and coding process: acceptability, feasibility
- acceptability/utility of the variable and term definitions according to relevant international agencies and sectoral interests

Outline of the testing project

To meet the aims, three parallel methods will be used in the testing:

1. Review of the ICECI:

   Based on their personal experience in injury surveillance and epidemiology reviewers will be required to closely examine the data dictionary and the glossary and complete a structured questionnaire. This review questionnaire consists of general questions and questions concerning the parts of the classification and glossary to be reviewed. Reviewers may indicate which parts of the data dictionary and the glossary they will review.

2. Field testing in ED setting:

   The main focus of the field testing is to test as much as possible in the setting for which ICECI is developed in particular, the Emergency Department (ED). (If ED-information is not available, data from a survey or from existing databases on injury surveillance data can be used.) ED coders will be required to use ICECI for coding injury cases in a ED setting. A coding form will be supplied. Based on this experience the coders will be required to complete a structured questionnaire with general questions and questions concerning the parts of the classification and glossary to be tested. ED coders may indicate which parts of the data dictionary and the glossary or which types of injuries they will test.

3. Coding case scenarios:

   Based on their personal experience of coding cases by means of specialised injury data systems or general health classifications coding experts will be required to code approximately 40 case scenarios using ICECI. They will also be asked to provide information on matters relevant to analysis (e.g. place, level and type of experience with coding).

Combining the aims and the methods results in a matrix, as seen in Table 1.

Table 1: Matrix of testing aspects together with methods used

Testing aspects x method	**Review**	**Field test**	**Case scenarios**
Completeness	x	x	x
Clarity	x	x	x
Relevance	x		
Criterion validity			x
Inter-observer reliability			x
Intra-observer reliability			x
Collection process		x	
Resource consumption		x	x
Acceptability/utility of definitions	x		

Organisations/individuals may choose in which of the three testing methods they will participate. The review and field testing questionnaires as well as the coded case scenarios will be analysed. The results of these three parts will be combined and used to improve the data dictionary and glossary and thus to develop a new version of the ICECI.

The persons/organisations who received the first draft of ICECI (about 140) were being regarded as potential participants. These experts received a short questionnaire. Questions were asked about willingness to participate, to which parts of the testing (review, case scenarios, field testing) and to which parts of the data-dictionary and glossary.

Proposed Short Version of the International Classification of External Causes of Injuries (Short ICECI)

Joseph L. Annest, Ph.D.,* Chester L. Pogostin, DVM,* Judy Conn, MS,* Lois A. Fingerhut, MA,** and Donna Pickett, RRA, MPH**

*National Center for Injury Prevention and Control (NCIPC), Centers for Disease Control and Prevention (CDC), Atlanta, GA
**National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), Hyattsville, MD

An international effort is underway to develop a new multi-axial classification system (i.e., having multiple data elements and code sets) for external cause of injury designed for use in hospital emergency departments (EDs) or similar health care settings. This new system is called the *International Classification of External Causes of Injuries* (ICECI).[1] The full version of the ICECI (full ICECI) is currently being pilot tested around the world. We are developing a companion, short version of the ICECI (short ICECI) as an alternative surveillance tool for capturing data on external cause of injury (see Figure). The short ICECI is structured with core data elements similar to the full ICECI but provides less details about the injury incident. The proposed short ICECI was developed to be compatible with the full ICECI and the *International Statistical Classification of Diseases and Related Health Problems, 10th version*[2] (ICD-10), external-cause-of-injury code set. Also, a crosswalk has been developed between code sets for data elements in the short ICECI and groups of codes in the full ICECI and ICD-10 systems.

The impetus for developing the short ICECI stemmed from an ICECI-Working Group meeting held in Atlanta in October, 1999 where key revisions to the first version of the full ICECI were discussed. At that meeting, Dr. Dan Pollock, medical epidemiologist and board-certified emergency physician on staff at NCIPC, proposed a new shorter code set for *injury mechanism.* This code set was derived from terms commonly used by clinicians to describe external causes of injuries in ED settings (e.g., motor vehicle crash, gunshot, stab, fall, fire/burn, poisoning). Sub-data elements with code sets were added to capture more details about the injury incident that were associated with specific mechanisms of injury. For instance, if a patient was being treated for a gunshot wound, the short ICECI has a sub-data element to record the type of firearm used. Also, a secondary data element for *injury mechanism* was added to capture other causes that are either important for injury prevention or commonly treated in hospital EDs in the United States. This list of secondary causes can be easily modified or extended to include other causes of importance in other countries.

These proposed data elements, sub-data elements, and code sets for *injury mechanism* were then combined with other data elements to form the short ICECI. These included shortened versions of data elements (e.g., *locale of injury incident, type of activity when injured, intent of injury*) in the full ICECI, *type of incident* (i.e., work-related or not), *safety equipment use* from Data Elements for Emergency Department Systems (DEEDS, 1.0),[3] a text field to capture up to three *consumer products,* and a narrative field to briefly describe the *circumstances of the injury incident*. As a final step, we evaluated all of the proposed code sets of data elements and sub-data elements for compatibility with the full ICECI and the ICD-10 external-cause-of-injury code set.

We are currently planning to pilot test the short ICECI in both a national and a statewide ED-based injury surveillance system. Pilot testing will include "gold standard case-scenario" testing and field testing similar to the full ICECI pilot test now in progress. We are also developing an instruction manual, training module, and coding guidelines as part of the short ICECI package. After pilot testing, our plan is to make these materials widely available as a tool for injury surveillance in hospital ED or similar health care settings. For those with limited resources, the short ICECI may be a useful alternative multi-axial surveillance tool for use in coding external cause of injury data in emergency care settings.

References

1. WHO-Working Group for Injury Surveillance Methodology Development and its Technical Group. International Classification for External Causes of Injuries (ICECI). Guidelines for counting and classifying external causes of injuries for prevention and control. Consumer Safety Institute, WHO-Collaborating Center on Injury Surveillance, P.O. Box 75169, 1070 AD Amsterdam, the Netherlands. April 1998.

2. World Health Organization. International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Volume 1. Geneva: World Health Organization. 1992; pp. 1011-1123.

3. Pollock DA, Adams DL, Bernardo LM, et. al. Data Elements for Emergency Department Systems (DEEDS). Release 1.0. Atlanta, Georgia, USA: National Center for Injury Prevention and Control, National Centers for Disease Control and Prevention. 1997; pp. 138-139.

International Classification of External Causes of Injuries

Short Version (Short ICECI) Data Collection Form

Proposed by

The National Center for Injury Prevention and Control (NCIPC)
Surveillance Working Group
Centers for Disease Control and Prevention (CDC)
Atlanta, Georgia

Prepared by

J. Lee Annest, PhD (jla1@cdc.gov)
Judy Conn, MS
Chet Pogostin, DVM
Office of Statistics and Programming, NCIPC, CDC

Lois Fingerhut, MA
Donna Pickett, RRA, MPH
Collaborators and Consultants, NCHS, CDC

August 13, 1999

Figure. International Classification of External Causes of Injuries Short Version (Short ICECI) Data Collection Form

Hospital I.D. _____
Patient I.D. _____
Treatment Date: _____
(MM/DD/YYYY)

***Instructions:* This form was designed to record information about circumstances of an injury incident for injured persons treated in an emergency department or a similar health care setting. Ideally this form could become part of the ED record for the patient. Some instructions for completing the form are given in italics. For further details about how an injury is defined and how to code each of the components given below, please see the instruction manual and coding guidelines.**

Type of Incident

1. Was the injury incident work-related (i.e., occur on the job) or not? ***(Check One)***
   - ❑ 1 Work-related
   - ❑ 2 Not work-related
   - ❑ 9 Not recorded/unspecified

Locale of Injury Incident

2. Where did the injury occur? ***(Check One)***
   - ❑ 01 Home/mobile home
   - ❑ 02 Residential institution
   - ❑ 03 Farm/ranch
   - ❑ 04 Street/highway
   - ❑ 05 Trade and service area
   - ❑ 06 Industrial/construction area
   - ❑ 07 School/educational area
   - ❑ 08 Other public building
   - ❑ 09 Sports and athletic area
   - ❑ 88 Other specified
   - ❑ 99 Not recorded/unknown

Type of Activity When Injured

3. What type of activity was the patient doing at the time of injury? ***(Check One)***
   - ❑ 1 Sports
   - ❑ 2 Leisure
   - ❑ 3 Traveling
   - ❑ 4 Paid work
   - ❑ 5 Unpaid work
   - ❑ 6 Educational activity
   - ❑ 7 Vital activity
   - ❑ 8 Other specified
   - ❑ 9 Not recorded/unspecified

Intent of Injury

4. Did the injury result from an unintentional event or intentional act? ***(Check One)***
   - ❑ 1 Unintentional
   - ❑ 2 Intentionally self-inflicted
   - ❑ 3 Assault, confirmed or suspected — Injury purposely inflicted by another person ***(Answer Questions 4a and 4b)***
   - ❑ 4 Legal intervention — Injured by police or other authorities during law enforcement
   - ❑ 5 Operations of war and civil insurrection
   - ❑ 9 Not recorded/undetermined

If your response to Question 4. was "Assault" please answer Questions 4a. and 4b., otherwise go to Question 5.

4a. What was the relationship of the perpetrator to the patient? ***(Check One)***
   - ❑ 01 Spouse or partner (includes spouse, partner, ex-spouse, ex-partner)
   - ❑ 02 Parent
   - ❑ 03 Other relative
   - ❑ 04 Unrelated care giver
   - ❑ 05 Acquaintance or friend
   - ❑ 06 Official/legal authorities
   - ❑ 07 Multiple perpetrators
   - ❑ 08 Stranger
   - ❑ 88 Other specified persons
   - ❑ 99 Not recorded/unknown

4b. What was the reason for the assault? ***(Check all that apply)***
   - ❑ 1 Altercation
   - ❑ 2 During illegal acquisition of money or property (includes completed or attempted)
   - ❑ 3 Drug-related
   - ❑ 4 Sexual assault
   - ❑ 5 Gang-related
   - ❑ 8 Other specified
   - ❑ 9 Not recorded/unknown

Figure (continue). International Classification of External Causes of Injuries Short Version (Short ICECI) Data Collection Form

Hospital I.D. _____
Patient I.D. _____
Treatment Date: _____
(MM/DD/YYYY)

Mechanism of Injury

5. What was the mechanism or cause of injury?
(Check all that apply)

- ❑ 01 Motor vehicle
  (Answer Questions 5.1.a. through 5.1.d.)
- ❑ 02 Pedestrian-vehicle crash
  (Answer Questions 5.1.a. and 5.1.d.)
- ❑ 03 Motorcycle
  (Answer Questions 5.1.a, 5.1.c., and 5.1.d.)
- ❑ 04 Pedal cycle
  (Answer Questions 5.1.a. and 5.1.d.)
- ❑ 05 Struck by/against or crushed
  (Answer Questions 5.1.e and 5.1.f)
- ❑ 06 Fall
- ❑ 07 Gunshot, firearm-related
  (Answer Question 5.1.g)
- ❑ 08 Stab/cut/pierce ***(Answer Question 5.1.h)***
- ❑ 09 Fire/burn ***(Answer Question 5.1.i)***
- ❑ 10 Smoke inhalation
- ❑ 11 Poisoning ***(Answer Question 5.1.j)***
- ❑ 12 Near-drowning/drowning/submersion
- ❑ 13 Foreign body
- ❑ 14 Overexertion
- ❑ 15 Other specified mechanism
  (Answer Question 5.1.k.)
- ❑ 16 Adverse effects of therapeutic use of drugs
- ❑ 17 Adverse effects of surgical and medical care
- ❑ 99 Not recorded/undetermined

5a. If more than one mechanism was selected in Question 5, which one is the immediate cause of the most severe injury being treated?
(Record the number given next to the mechanism in Question 5.) ❑

If one of your responses to Question 5. was "Motor vehicle," "Pedestrian-vehicle crash," "Motorcycle," or "Pedal cycle," please answer Questions 5.1.a. through 5.1.d., otherwise go to Question 5.1.e.

5.1.a. Was the crash traffic-related or not? ***(Check One)***

- ❑ 1 Traffic (occurs on a public highway/street/road)
- ❑ 2 Nontraffic (occurs in any place other than a public highway/street/road)
- ❑ 9 Not recorded/unknown

If one of your responses to Question 5. was "Motor vehicle," please answer Question 5.1.b., otherwise go to Question 5.1.c.

5.1.b. What type of vehicle was the patient riding in?
(Check One)

- ❑ 1 Automobile
- ❑ 2 Pickup truck or van
- ❑ 3 Heavy transport vehicle
- ❑ 4 Bus
- ❑ 5 3-wheel motor vehicle
- ❑ 6 Other specified
- ❑ 9 Not recorded/unknown

If one of your responses to Question 5. was "Motor vehicle" or "Motorcycle," please answer Question 5.1.c., otherwise go to Question 5.1.d.

5.1.c. What was the patient doing in or on the motor vehicle or on the motorcycle? ***(Check One)***

- ❑ 1 Driver
- ❑ 2 Passenger
- ❑ 3 Person boarding or alighting
- ❑ 4 Person on outside of motor vehicle
- ❑ 9 Not recorded/unknown

If one of your responses to Question 5. was "Motor vehicle," "Pedestrian-vehicle crash," "Motorcycle," or "Pedal cycle," please answer Questions 5.1.d., otherwise go to Question 5.1.e.

5.1.d. What was the counterpart to the crash? ***(Check One)***

- ❑ 01 Automobile
- ❑ 02 Pickup truck or van
- ❑ 03 Heavy transport vehicle
- ❑ 04 Bus
- ❑ 05 3-wheel motor vehicle
- ❑ 06 Motorcycle
- ❑ 07 Railway train/vehicle
- ❑ 08 Pedal cycle
- ❑ 09 Pedestrian
- ❑ 10 Animal or animal-drawn vehicle
- ❑ 11 Fixed or stationary object
- ❑ 12 No counterpart (rollover or overturning)
- ❑ 88 Other specified
- ❑ 99 Not recorded/unknown

Figure (continue). International Classification of External Causes of Injuries Short Version (Short ICECI) Data Collection Form

Hospital I.D. _____
Patient I.D. _____
Treatment Date: _____
(MM/DD/YYYY)

If one of your responses to Question 5. was "Struck by/ against or crushed," please answer Questions 5.1.e. and 5.1.f., otherwise go to Question 5.1.g.

5.1.e. What was the source of the force applied? ***(Check One)***
- ❑ 1 Human
- ❑ 2 Animal
- ❑ 3 Inanimate object or force
- ❑ 9 Not recorded/unknown

5.1.f. What type of force was applied? ***(Check One)***
- ❑ 1 Struck by
- ❑ 2 Crushed by
- ❑ 3 Striking against
- ❑ 9 Not recorded/unknown

If one of your responses to Question 5. was "Gunshot," please answer Question 5.1.g., otherwise go to Question 5.1.h.

5.1.g. What was the type of firearm used? ***(Check One)***
- ❑ 1 Handgun
- ❑ 2 Rifle
- ❑ 3 Shotgun
- ❑ 4 Larger firearm
- ❑ 9 Not recorded/unknown

If one of your responses to Question 5. was "Stab/cut/ pierce," please answer Question 5.1.h., otherwise go to Question 5.1.i.

5.1.h. What type of stabbing instrument, weapon, or object was involved? ***(Check One)***
- ❑ 1 Knife
- ❑ 2 Sharp instrument/tool other than knife
- ❑ 3 Sharp glass
- ❑ 8 Other specified
- ❑ 9 Not recorded/unknown

If one of your responses to Question 5. was "Fire/burn," please answer Question 5.1.i., otherwise go to Question 5.1.j.

5.1.i. What type of burn was it? ***(Check One)***
- ❑ 01 Fire/flame
- ❑ 02 Hot object
- ❑ 03 Hot liquid
- ❑ 04 Steam
- ❑ 05 Chemical
- ❑ 88 Other specified
- ❑ 99 Not recorded/unknown

If one of your responses to Question 5. was "Poisoning," please answer Question 5.1.j., otherwise go to Question 5.1.k.

5.1.j. What type of poisoning was it? ***(Check One)***
- ❑ 1 Drug (excludes alcohol)
- ❑ 2 Alcohol
- ❑ 3 Chemical (includes solid, liquid, gas or vapor, excludes drugs and alcohol)
- ❑ 8 Other specified
- ❑ 9 Not recorded/unknown

Continue on Page 4 with Question 5.1.k

Figure (continue). International Classification of External Causes of Injuries Short Version (Short ICECI) Data Collection Form

Hospital I.D. _____
Patient I.D. _____
Treatment Date: _____
(MM/DD/YYYY)

If one of your responses to Question 5. was "Other specified mechanism," please answer Question 5.1.k., otherwise go to Question 6.

5.1.k. What was the other specified mechanism or cause of injury? ***(Check One)***

- ❑ 01 Railway/streetcar (occupant) in motor vehicle crash
- ❑ 02 Other railway/streetcar transport
- ❑ 03 Water transport
- ❑ 04 Air transport
- ❑ 05 Thrown or fallen from animal or animal-drawn vehicle (noncollision)
- ❑ 06 Other transport (not elsewhere specified)
- ❑ 07 Inhalation/ingestion of food (blocking airway)
- ❑ 08 Inhalation /ingestion of other objects (blocking airway)
- ❑ 09 Hanging or strangulation
- ❑ 10 Suffocation by plastic bag, sheet, cloth or other material
- ❑ 11 Entrapment in closed space
- ❑ 12 Venomous bite or sting
- ❑ 13 Human bite
- ❑ 14 Dog bite
- ❑ 15 Bite by animal other than dog
- ❑ 16 Sting (other than venomous animal or plant)
- ❑ 17 Fireworks explosion
- ❑ 18 Explosive blast (other than fireworks)
- ❑ 19 BB or pellet gunshot
- ❑ 20 Other firearm (other than gunshot)
- ❑ 21 Lightning
- ❑ 22 Electrical current (excludes lightning)
- ❑ 23 Radiation
- ❑ 24 Welding
- ❑ 25 Machinery
- ❑ 26 Exposure to excessive natural heat
- ❑ 27 Exposure to excessive natural cold
- ❑ 28 Sunlight
- ❑ 29 Natural disaster
- ❑ 88 Other specified, not elsewhere classified

Safety Equipment Use

6. Was information given about safety equipment use or deployed at the time of injury? ***(Check One)***
   - ❑ 1 Yes
   - ❑ 2 No

If your response to Question 6. was "Yes," please answer Question 6a., otherwise go to Question 7.

6a. Which of the following types of safety equipment were described to be (in/not in) use or deployed at the time of injury? ***(Check <u>all</u> that apply)***

A=In use or deployed **B**=Not in use or deployed **C**=Unknown

A	B	C		
❑	❑	❑	01	Shoulder belt
❑	❑	❑	02	Lap belt
❑	❑	❑	03	Seat belt, not otherwise specified
❑	❑	❑	04	Driver's front airbag deployed
❑	❑	❑	05	Passenger's front air bag deployed
❑	❑	❑	06	Front air bag deployed, not otherwise specified
❑	❑	❑	07	Side air bag deployed
❑	❑	❑	08	Air bag deployed, not otherwise specified
❑	❑	❑	09	Child safety seat
❑	❑	❑	10	Helmet
❑	❑	❑	11	Eye protection
❑	❑	❑	12	Protective clothing
❑	❑	❑	13	Personal flotation device
❑	❑	❑	88	Other protective gear

7. Please describe up to three consumer product(s) that were involved in the injury incident. ***(Please Print)***

   1. _____
   2. _____
   3. _____

8. Please briefly describe the circumstances of the injury incident. ***(Please Print)***

_____

_____

_____

ICECI and compatibility with Chapter XX of ICD-10

André L'Hours*

*Technical Officer, Epidemiology and Burden of Disease, World Health Organization, Geneva, Switzerland

Although the ICD is suitable for many different applications, it does not always allow the inclusion of sufficient detail for some specialties, and sometimes information on different attributes of the classified conditions may be needed.

During development of ICD-10 it was felt that the main ICD (the three- and four-character classification) could not incorporate all this additional information and remain accessible and relevant to its traditional users, so the idea arose of a "family" of disease and health-related classifications, including volumes published separately from the main ICD, to be used as required.

The "core" classification of ICD-10 is the three-character code, which is the minimum level of coding for reporting to the WHO mortality database and for general international comparisons. The four-character subcategories, while not mandatory for reporting at the international level, are recommended for many purposes and form an integral part of the ICD, as do the special tabulation lists.

There are two main types of classification. Those in the first group cover data related to diagnoses and health status, and are derived directly from the ICD by either condensation or expansion of the tabular list. The condensed lists can be used for many kinds of data presentation, for summary statistical tables, and potentially for information support in the development of primary health care, while the expanded lists are used to obtain increased clinical detail in the specialty-based adaptations. This group also includes classifications complementary to the tabular list, that allow the allocation of diagnoses using different axes of classification, such as the morphology and behaviour of tumours. The International Classification of Diseases for Oncology (ICD-O) uses the malignant neoplasms section of chapter II of ICD-10 for all tumour behaviours, because of the additional topographical detail that this provides for non-malignant tumours, and then supplements this with separate axes for morphology (histopathology) and behaviour. A conversion program is provided to enable transfer of ICD-O data to ICD-10.

The second group of classifications covers aspects related to health problems generally outside the formal diagnoses of current conditions, as well as other classifications related to health care. This group includes classifications of disablement, of medical and surgical procedures, and of reasons for contact with health care providers.

The ICECI could be considered as falling within the first group of classifications as a specialty-based adaptation of ICD-10 if it can be aggregated to the chapter XX (External Causes of Morbidity and Mortality) three-character categories as well as the place of occurrence and activity codes. This would be analogous to the approach adopted for ICD-O.

To achieve this it is not essential for the two classifications to be fully compatible at the lowest level of detail, although they should preferably be mappable from the minimum data set of the ICECI to the ICD-10 three-character level.

Similarly, the place of occurrence and activity codes could map from say the second or third digit of the ICECI classifications to the single digit codes contained in ICD-10.

Development and field-testing of the ICECI is strongly supported by the WHO Headquarters Prevention of Violence and Injury programme which has technical responsibility for its content and the Epidemiology and Burden of Disease Team which has overall responsibility for coordinating the development and maintenance of health-related classifications.

The WHO secretariat is not fully convinced of the utility of including complications of surgical and medical care in the ICECI given the care settings in which the data will be collected. However, if the injury prevention community consider their inclusion to be indispensable then full compatibility with ICD-10 could be achieved by using the relevant rubrics from ICD-10 categories Y40-Y84.

WHO believes that the advantages of full compatibility with ICD-10 in terms of the resultant international comparability of injury data are such that every effort should be made to achieve this even if it results in some minor illogicalities in the taxonomic structure of the ICECI.

Application of the ICECI Classification of External Cause of Injury to the WHO Health Behavior in School-Aged Children Survey

Mary D. Overpeck, DrPH,* William Pickett, PhD,** Matthew A. King, BSc,*** Michael Garner,** Lori Marshall, MHS,**** Lara B. Trifiletti, MA,***** Aaron Currey, BA,*****
William F. Boyce, PhD*** and Peter C. Scheidt, MD, MPH******

*Epidemiology Branch, Division of Epidemiology, Statistics and Prevention Research, National Institute of Child Health and Human Development, Bethesda, Maryland, USA
**Department of Emergency Medicine, Queen's University, Canada
***Social Program Evaluation Group, Queen's University, Canada
****Macro International, Calverton, Maryland, USA
*****Johns Hopkins University, Baltimore, Maryland, USA
******Children's National Medical Center, Washington, DC, USA

For more information:
Dr. Mary D. Overpeck
Epidemiology Branch
Division of Epidemiology, Statistics and Prevention Research
NICHHD
6100 Executive Boulevard, Suite 7B03
Bethesda, Maryland 20892-7510, USA

Email: Mary_Overpeck@nih.gov
Phone: 301 435-7597
Fax: 301 402-2084

Introduction

The World Health Organization released a draft version of a new guideline for the classification of external causes of injury in May, 1998. This classification system, the *International Classification of External Causes of Injury* (or ICECI),[1] was developed to provide a standard coding system for these external causes. It was designed to be compatible with the 10th revision of the *International Classification of Diseases*,[2] and was meant for use in a variety of injury coding situations. Goals of the new system included (1) providing more precise definitions of injuries under study, (2) addressing the multi-axial injury components of where injuries occurred, how, under what circumstances, involving which products, and (3) providing more detailed descriptions of specific categories of injuries such as sports injuries. The latter goal was expected to be achieved by subsequent addition of topical modules.

At the meeting of the International Collaborative Effort on Injury in that May, a call was made to members of the international injury control community to test this classification system with existing data. The hope was that practical feedback could be provided to the WHO-Working Group on Injury Surveillance Methodology Surveillance that was responsible for the development of ICECI. This would in turn assist in the refinement of the ICECI, in order that it become a practical system with more universal applicability.

We applied the 1998 draft version of the ICECI while coding injury data collected as an optional part of the *Health Behaviour in School-Aged Children* (HBSC) Study.[3] The latter is a periodic school-based health survey, currently conducted in about 30 countries, under the auspices of the World Health Organization. The injury questions of the HBSC were developed to address the same multi-axial components incorporated in the ICECI, making this coding approach feasible. Five countries used the ICECI guidelines to assign codes from a combination of pre-coded and open-ended injury questions. This paper focuses specifically on coding experience from data collected in Canada and the United States during the 1997-98 HBSC surveys.

The objectives of this paper are:

- to demonstrate the applicability of the ICECI coding system to structurally compatible survey data in the 1997-98 versions of the HBSC used in Canada and the United States;

- to identify salient coding issues that arose during our application of the ICECI to these HBSC injury data;

- to document common activities that were associated with the occurrence of youth injury in Canada and the United States, thus providing a supplemental module for use with the ICECI. Sports injuries, the predominate activity producing injury in adolescence, are further classified by the common underlying form of play for each activity. The common form, describing individual, paired, or team attributes of the game, may be predictive of the extent of contact in a sport that may be a factor in injury occurrence and severity.

The *Health Behaviour in School-Aged Children* Survey

The Health Behaviour of School-Aged Children (HBSC) Study is a collaborative cross-national research project involving countries in Northern Europe, the Middle East, Canada and the United States. Representative samples of youth with average ages of 11.5, 13.5, and 15.5 years are identified in school-based settings in each of the countries.

The goal of the HBSC is to use the information collected to improve the quality of health promotion programs for youth in these countries. International comparisons of these data also assist in understanding disparities in health indicators on a more global basis. The research emphasis of the HBSC provides an opportunity to understand contextual relationships of youth attitudes, behavior and health outcomes. Figure 1 identifies the countries that participated in the 1997-98 HBSC. Twelve countries collected injury data, with open-ended questions coded according to ICECI guidelines in five of these (USA, Canada, Republic of Ireland, Israel, and Switzerland). England used the open-ended questions but coded them according the ICD-9 guidelines.

Injury Items Used in the HBSC

Questions pertaining to injury were first introduced to the HBSC in 1993 based on experience from earlier U.S. survey data.[5,6,7] In the 1993/94 survey, a series of close-ended questions were available for use by participating countries.[4] Students were asked to report those injuries that happened during the 12 months prior to survey that resulted in treatment by a doctor or nurse. For

the one "most serious" of these injuries, additional questions were asked in order to describe the injury and its consequences. Questions were asked about the nature of the injury, type of treatment and number of days lost from school or other normal activities. Besides these questions used to address severity, the respondents were asked to name the place where the injury occurred, what they were doing when the injury occurred, and the month and year of occurrence.

During the planning stage for the 1997/98 version of the HBSC, it was determined that it would be helpful to have additional information about the circumstances and external causes of the reported injuries. An optional group of questions were developed for this purpose. Researchers charged with developing these items had to work within the limits of the HBSC. These included the need to: (1) be compatible with the earlier version of the survey so that temporal trends could be documented; (2) keep the number of questions to a minimum to improve questionnaire completion rates; and (3) use wording of questions that would be understandable to youth from ages 11-15, yet yield the desired information.

For these reasons, a very simple, open-ended question was developed for activity and mechanism of injury. This involved asking respondents to provide two sentences in answer to the questions: *at the time of the injury (a) what were you doing, and (b) how did it happen?* Three examples were provided in order to demonstrate how the information was to be recorded.
With minor modifications to the previous 1993/94 close-ended questions, a question was added on whether or not the injury happened while participating in organized sports or recreational activities to address injury prevention issues. Besides the questions on nature, severity, and treatment of the injuries, the 1997/98 HBSC injury questions used for coding within the ICECI multi-axial matrix are described below. Students were asked to mark the one best answer to describe their most serious injury:

1) Where were you when this injury happened?
   - at home (yours or someone else's)
   - at school (including school grounds)
   - at a sports facility or field (not at school)
   - in the street or road
   - other location: write it here _____

2) What were you doing when this injury happened?
   - biking
   - skating (including roller blades, skateboards, ice skating)
   - playing or training for sports (not biking or skating)
   - riding in a care or other motor vehicle
   - walking/running (not for sports or exercise)
   - fighting
   - other: write it here _____

3) Did this injury happen while participating in sports or other recreational activities?
   - No
   - Yes – organized activity on a team, league or club
   - Yes – informal/unorganized sport or recreational activity

Note: Canada did not use question No. 2 but used the open-ended questions to back-code activities into the categories used by the other countries that did not have access to open-ended questions.

The *International Classification of External Causes of Injury (ICECI)*

The ICECI is a "multi-axial code set" developed under the auspices of the World Health Organization.[1] The draft version of the ICECI released in 1998 provided a standardized, coding system for different aspects of injury circumstances, including place of occurrence, mechanism, objects involved, activity, intent of injury, and victim-perpetrator relationship.

The ICECI was viewed as a companion guide to the standard International Classification of Disease coding systems. It provides opportunity for more detailed data capture in a variety of settings, including in-hospital events, emergency departments, ad hoc studies, and health surveys. Many of the principles that appear in the coding system are consistent with those used in the more standard international classifications of injury, including ICD-10.[4] An additional feature of the ICECI is its adaptability, in that it takes into account the limitations of most data collection settings and allows for data capture and coding at various levels of specificity.

Approach to Coding

An abbreviated version of the ICECI was developed for use with the HBSC data. The latter was based upon the first level of codes available within the ICECI coding hierarchy. The abbreviated coding version, along with corresponding codes to be used by the six HBSC countries, appears in Appendix A. Each country also referred to the full ICECI draft instruction for guidance if questions occurred. Finally, unclear coding determinations were discussed through consultation among countries during the coding process.

Based on the open-ended questions, and on the close-ended questions about place of occurrence and organized league/activity, it was suggested that participating countries provide ICECI codes on 1) intent, 2) mechanism, 3) objects involved, 4) place of occurrence, and 5) activity, associated with each injury. In addition, because the activity codes provided by the ICECI system were quite non-specific, a list of more detailed activity codes were developed by the Canadian participants in the HBSC. Participating countries were also asked to apply these codes to their respective data. Additional codes were added by other countries, as needed. Codes shown in Table 1 include activities found primarily in Canadian and U.S. data although additional codes mentioned during consultation with other countries may also be present.

Table 1. Potential Codes for Sports and Recreational Activity Module in the ICECI, based upon Youth Injury Data Collected During the 1997-98 WHO-HBSC

Primarily Individual Activities	Primarily Paired/Small Group Activities	Primarily Team Activities
Aerobics	Badminton	Baseball
Archery	Boxing	Basketball
Ballet	Dance	Broomball
Billiards/Pool	Dodgeball	Curling
Bowling	Fencing	Cricket
Climbing	Frisbee	Football – American
Crafts	Hackeysack	Football – European (see soccer)
Cycling	Handball	Football – Flag/touch
Darts	Hide and seek	Football – Tackle
Diving from board	Martial Arts	Handball
Diving - other	Play fighting	Handball – European
Exercising	Playing catch	Hockey – Field
Fishing	Playing keep-away	Hockey – Ice
Golf	Racquetball	Hockey – Inline
Gymnastics/Trampoline	Squash	Hockey – Road/Street
Hiking	Table Tennis	Hurling
Horseback Riding	Tag	Lacrosse
Hunting	Tennis	Lacrosse – box
Jetskiing	Wrestling/wrestling for fun	Lacrosse – field
Jogging		Ringette
Playing/Playing around/Horsing around		Rugby/rugger
Running		Skating – Precision
Skateboarding		Soccer
Skating - Figure		Softball
Skating - Inline		Volleyball
Skating - Recreational		
Skating - Speed		
Skating - Not specified		
Ski Jumping		
Skiing – Alpine/downhill		
Skiing – Nordic/cross-country		
Skiing - Water		
Skiing - Not specified		
Snowboarding		
Snowmobiling		
Swimming/waterslide		
Tobogganing		
Track - Jumping events		
Track - Running events		
Track - Throwing events		
Water-skiing		
Weightlifting/Bodybuilding		

¶ Originally developed from the Canadian HBSC data by MA King of the Social Program Evaluation Group, Queen's University, Canada. Expanded with U.S. HBSC data and subsequently modified by CW Burt, National Center for Health Statistics, USA, based on open-ended text review of reasons for emergency department visits at all ages. Activities are organized according to the most common form of participation for a specific sport or recreation: individual, paired or small groups, or team sport. These activities are not intended to be mutually exclusive.

Coding of open-ended items was done within the individual countries. Each coder was supplied with the ICECI coding manual,[1] as well as a set of instructions and the abbreviated ICECI coding scheme provided by the Canadian and U.S. research groups. Canada used one coder for ICECI coding with additional help to verify coding decisions and apply supplemental activity codes. The United States employed three coders who each assigned both the ICECI system categories and the activity codes. Each coder was asked to maintain a log of all coding issues that arose during the course of their work. Coding differences were resolved through regular e-mail exchange. Major coding issues that suggested possible deficiencies in the ICECI were flagged for further discussion.

At the time of this presentation, the abbreviated version of the ICECI had been applied to approximately 11,000 HBSC injury records within Canada (n=4144) and the United States (n=7197). Based on this experience, we offer the following as major coding issues for consideration of the international working group that is refining the ICECI.

Coding Issues

1. Coding of Intent with Uncertain Information

The coding of intent is often problematic in any injury data setting, due to a lack of knowledge or inconsistent detail provided about the intent of the perpetrator and/or the victim. This was true in the HBSC coding situation, and is almost certainly true in emergency department settings where coding is based on medical records. Intent is traditionally assigned only in fatality data based on coroner or medical examiner determination or after legal proceedings.

The major problem that we encountered in the HBSC situation was how best to code the intent of injuries with insufficient descriptions. Traditional approaches to the resolution of this issue include coding the intent of injuries as unintentional, unless otherwise specified in the injury description. Alternatively, the ICECI allows one to code uncertain cases as having an undetermined intent. We recommend that the ICECI provide better and more specific instructions for use with nonfatal data, with examples, to ensure that consistent decisions can be made in situations where there is a dearth of information provided about intent.

The precoded questions used by most of the HBSC countries specifically asked about fighting; however, this question was not used in Canada. For the HBSC, the U.S. assigned an 'intentional' code only when the student indicated in either the pre-coded or open-ended questions that they were fighting when the injury occurred. However, these questions indicate only that interpersonal violence was involved without any knowledge of intent. Canada also included cases where it was clear in the open-ended questions that the injury was caused by an intentional act. (In either case, fights in the context of sports were excluded from this definition.) The two countries still reported very similar rates of injury that resulted from intentional acts.

2. Coding of Objects

The objects involved in injury events frequently raised questions at different levels. Some were simple but others involved complex issues for the purposes of prevention. One common question concerned knives. The ICECI includes knives in two categories: weapons or utensils. Most often,

the context of their use determines which category was appropriate. Unless they are used in the context of violence, we made the assumption that they should be coded as a utensil. (When is a kitchen knife a weapon or a utensil?) Frequently, information about objects at that level is missing.

3. Coding of Object in Self-induced Injuries

Many injuries reported by youth, both intentional and unintentional, are self-induced injuries. An example of this type of injury might include an overexertion injury caused when a person stretches to reach an object or person during the playing of sports. The ICECI provides no directions as to how to code this situation. We recommend that the ICECI provide better instructions, with an example, to ensure that this coding situation can be resolved easily. This may involve insertion of a code for "self" within the list of codes available to describe objects.

2.2 Coding of Contributing Objects in Addition to Primary Injury Vectors

The draft ICECI coding instructions indicates that more than one object can be coded for individual injury events. However, it also suggests that there may be situations where data collectors may only be concerned with coding one object. Our experience with the ICECI suggests that the latter practice should be discouraged. The rules surrounding the use of object codes suggest that the object that is most immediate to the occurrence of an injury should be coded first. For example, if a person falls down a set of stairs and lands on the ground, the primary object to be coded should be the ground and not the stairs as a contributing factor in the injury event. Second, if a cyclist collides with another vehicle and strikes a tree, then the ICECI rules suggest that the tree should be coded as the primary object. We recommend that, in the interests of prevention, at least two codes should be recorded for object in these types of injury circumstances and their order should follow the temporal logic proposed by the ICECI. Instructions should be provided by the ICECI to address this need.

4. Coding of Place of Occurrence

The most common ICECI questions about place of occurrence of injury for students are related to school premises. The order of preference is to code the first location mentioned if exact location (e.g., classroom, playground, or sports field) is not known. The *only* code available for injuries occurring at school specifies the educational area. No option is given for sports and athletic areas on school grounds in the coding. Neither is a gymnasium or auditorium mentioned even though these areas are frequently used for physical education classes. The next category listed is "Sports and athletic area" without a separate breakout to specify designation of school grounds. Further down on the list is "recreational or cultural area or public building". Playground areas of schools are specifically excluded from this latter category. If the coder picks the latter categories for sports related injuries, the school location is missed altogether. It would be better if the school areas were broken into multiple choices, with a minimum specification of inside or outside the school building and a separate category for sports fields on school property.

Since one goal is to identify responsible authorities, the opportunity to identify injuries on school premises that are part of school sponsored physical events are missed with the existing options. However difficult, the ability to discriminate between school sponsorship of events on school property and sponsorship of organized sporting events by other community entities is needed to

enable assignment or understanding of authority relationships. Equally important, the use of a question on the HBSC about whether sports injuries occurred during organized or unorganized activities allowed further discrimination of whether the individuals were playing on their own or during sponsored events with the potential for safety management by the sponsoring entity.

5. Coding of Activity:

Tables 1 and 2 describe the specific activities according to the ICECI categories for which injuries were reports for the adolescents ages 11-15 years. Table 1 is proposed as a starting basis for a sports and recreational activity module for the ICECI. The majority of injuries to adolescents occurred during these events. Table 2 lists the other activities during which an adolescent was injured. The work activities were not broken out in this presentation although the multi-axial matrix of the ICECI will allow better specification of occupational injury among youth than many other sources.

Table 2: Other Activity Codes from the WHO-HBSC

Transport Related activities	**Other Activities**
Passenger in car/truck/van	Household/daily activities
Driver of water transport other than jet ski	Laundry
Passenger on water transport other than jet ski	Food Preparation
Driver of three or four wheel ATV	Cooking
Passenger on a three or four wheel ATV	Cleaning
Driver of motorbike	Moving household objects
Passenger on motorbike	
Driver of farm vehicle	Personal activities
Passenger on farm vehicle	Eating or drinking
Passenger in bus	Washing/showering/bathing
Passenger in train	Sleeping/sitting/standing/resting
Passenger in airplane	Dressing/brushing hair
Passenger in subway	Sexual activity
Walking (for transport, not sport)	
Running/jogging (for transport, not sport)	Maintenance
	Gardening
	Do it yourself (carpentry, electrical, etc.)
	Do it yourself (vehicle maintenance)
	Intentional Injuries
	Assaulted/bullied/attacked
	Fight (not in context of sport)
	Intended self harm
	Sexual Assault
	Miscellaneous
	Encounter with animal
	Encounter with insect
	At work/working
	Body piercing/tattooing complications
	Other
	Unspecified/undecipherable/insufficient detail

4.1 Sports vs. Education vs. Leisure Activities

The coding of activity is very difficult in situations where youth are involved in injuries. This is mainly because many different activity codes might apply to these situations. For example, an injury that occurred while playing soccer during a school recess could arbitrarily be placed in any of the three categories. In uncertain situations, the ICECI recommends the coding of the first response that appears on the list, and the order that these appear are: 1) sports, 2) leisure and, finally, 3) education. The soccer example would therefore be coded as a sports activity. The problem with this practice is that, for prevention purposes, it would be advisable to code activity in manner consistent with the authority that has the responsibility to intervene. In our example, this would be an educational authority. Second, the ICECI provides no discussion about the basis upon which the order of the codes was arrived at, and we have observed that this order does not reflect patterns observed in our population-based study of youth injury. We therefore recommend that better instructions be provided in the ICECI about the importance of coding activities according to the responsible authority. Second we suggest that the practice of coding uncertain cases to the activity that comes first on the ICECI list be re-examined for youth injury contexts. Third, we suggest that a more precise set of examples be provided to illustrate those situations that should be considered education, sports, and leisure by the ICECI working group.

4.2 Sports activities and place of occurrence

There is an inconsistency in the ordering of activity and place of occurrence. For the latter, educational areas are placed ahead of sports and athletic areas in the coding. This is a reversal of the order used in the activity codes.

4.3 Coding of sports and recreational activities (definitional issues)

In the ICECI, sports injuries are defined as those that result from participation in sport with one or more of the following consequences: a) a reduction in the amount or level of sport activity, b) a need for advice or treatment, c) adverse social or economic effects. This definition includes both acute and overuse injuries, does not limit treatment to medical care, and covers factors such as loss for the team of an injured player (social effects) or absences from work or study (economic effects).[10] Finch defines sport or recreation related injuries as any type of injury associated with increased voluntary activity that is not occupational related.[11]

The ICECI goes on to distinguish between organized sports injuries (undertaken under the auspices of a sports federation, club or similar organization), and unorganized sports (activities similar to organized sports, but not under the auspices of an organization).
Recreational injuries are included in several ICECI activity codes (leisure, education, sports), but generally are most consistent with those classified as leisure. This includes activities undertaken mainly for pleasure, relaxation or leisure.

In practical terms, in the absence of information obtained by structured interviews it is often impossible to know the true context associated with these injuries. This makes the classification of activities associated with injury as "sport" or "recreational" difficult. Basketball injuries, for example, clearly could fall into either category depending upon whether the injury occurred during an organized game, or occurred in a less structured environment. For this reason, the classification

provided in Table 1 has been entitled "Sports and Recreational Activities", and we have made no attempt to distinguish between the latter activities in this classification. Activities that have traditionally been classified as sports may well be recreational injuries, and vise versa.

Table 1 is also organized according to the most common form of participation for a specific sport or recreation: individual, paired or small groups, or team sport. This enhances research capability to address underlying hypotheses related to extent of bodily contact allowed under the rules of the sport to be addressed. The nature and severity of injury trauma usually differs by the force and direction of energy transferred at the instant of contact with the object inflicting the trauma. The force and direction of energy transfer in paired and team sports are expected to differ from that occurring when an individual acts alone. The emphasis of the ICECI on determining the responsible authority to focus prevention efforts is enhanced by determination of the form of play (individual, paired or small group or team) when combined with information on the organizational structure of the activity. Structured questions in the HBSC ask the students whether the injury occurred during organized or unorganized play with teams. Combining the form of play with the organizational component increases the potential for prevention through education of responsible authorities and enforcement of rules of play.

4.4 Coding of Activity: Need for Further Detail

In evaluating the ICECI coding system, it is important to remember that its main purpose is to provide data that have utility for prevention. For youth and injury, the activity codes that are suggested by the ICECI provide insufficient detail to develop focused prevention initiatives. This is particularly true for sports and recreation injuries. There are only two codes provided for the classification of sports injuries: sports (organized) or sports (unorganized).

In order to address this lack of specificity, investigators at the *Social Program Evaluation Group* at Queen's University developed the supplementary list in Table 1 to more completely describe the activities reported during the HBSC. The latter was based upon observations made during the Canadian coding of the HBSC injury data, using both the NOMESCO[8] and CHIRPP[9] coding systems.

Table 1 provides this list of activities for sports and recreational injuries. It is our hope that this list could form the genesis for an ICECI sports injury module, to be developed in concert with the ICECI working group.

6. Other coding issues.

Since five countries in the HBSC coded extensive records with open-ended text responses on injuries according to the draft ICECI guidelines, a number of coding questions arose requiring consistent decisions that would be applicable across the international study. The examples and coding guidelines for these decisions are available from the first two authors of this paper upon request.

Originally developed from the Canadian HBSC data by MA King of the Social Program Evaluation Group, Queen's University, Canada. Expanded with U.S. HBSC data and subsequently modified by CW Burt, National Center for Health Statistics, USA, based on open-ended text

review of reasons for emergency department visits at all ages. Activities are organized according to the most common form of participation for a specific sport or recreation: individual, paired or small groups, or team sport. These activities are not intended to be mutually exclusive.

General Comments

There were a number of issues and concerns that emerged during our efforts to apply an abbreviated version of the ICECI to the injury data collected as part of the ICECI. Despite this, the systematic ICECI approach to multi-axial coding offers an opportunity to provide more depth on injury circumstances with a focus on prevention. Prior to the ICECI, the injury field lacked a universally accepted system for the coding of the external cause of injury, and in this respect the ICECI has the potential to become an important advance.

We found the coding system to be adaptable to our data coding needs. First, we were able to use a simple coding structure based on the first level of the ICECI hierarchy. In fact, we consider it unlikely that there will be many situations where the more detailed levels of coding can be applied in a consistent fashion. Second, the ICECI is adaptable in an analytical sense, in that it allows the cross-tabulation of many different factors that contribute to external causes of injury (e.g. mechanism by place of occurrence, activity by object). This should be of considerable use to the design and targeting of focused, prevention initiatives.

We do suggest that the ICECI working group address provision of adequate instructions for coders with limited available information when they make revisions to the current document. It is our understanding that this priority will be addressed based on work completed at the meeting at the ICE on Injury in June, 1999.

Finally, although the ICECI was developed with emergency department data collection systems in mind, it is applicable to written survey situations. The HBSC now has a simple protocol to follow in collecting this information from school-aged children. The latter could be applied in other survey and data collection contexts.

References:

1. WHO-Working Group for Injury Surveillance Methodology Development. ICECI: Guidelines for counting and classifying external causes of injuries for prevention and control. Amsterdam, the Netherlands; Consumer Safety Institute, WHO Collaborating Center on Injury Surveillance; May 1998.

2. World Health Organization. International Statistical Classification of Diseases and Related Health Problems: Tenth Revision: Volume 1 (ICD-10). WHO, Geneva, 1992.

3. Currie CE et al. Health Behaviour in School-Aged Children: Research Protocol for the 1997-98 Survey. Edinburgh, Scotland; WHO Coordinating Center for the Study of Health Behaviour in School-Aged Children, 1998.

4. King A, Wold B, Tudor-Smith C, Harel Y. The Health of Youth: A Cross-national Survey. Copenhagen, Denmark; WHO Regional Office of Publications, European Series No. 69; 1996.

5. Overpeck MD, Trumble AC, Brenner R. Population-based surveys as sources of U.S. injury data and special methodological problems. Proceedings of the International Collaborative Effort on Injury; Bethesda, Md., May 18-20, 1994. Hyattsville, MD: DHHS Pub No. (PHS) 95-1252;12-17.

6. Scheidt PC, Harel Y, Trumble AC, Jones DH, Overpeck MD, Bijur PE. Epidemiology of non-fatal injuries in children and youth. Am J Public Health 1995;85:932-938.

7. Harel Y, Overpeck MD, Jones DH, Scheidt PC, Bijur PE, Trumble AC, Anderson J. Effects of recall on estimating annual non-fatal injury rates for children and youth. Am J Public Health. 1994;84(4):599-605.

8. Nordic Medico-Statistical Committee. NOMESCO Classification of External Causes of Injuries. Third revised edition. Copenhagen, Denmark, 1997.

9. Uhlik C. Canadian Hospitals Injury Reporting and Prevention Program Coding Manual. Health Canada Centre for Disease Control. Ottawa, Canada, 1996.

10. Vulpen AT van. Sport for all: sports injuries and their prevention. Council of Europe Coordinated Research Project. National Institute for Sports Health Care. Oosterbeek, 1989.

11. Finch CJ, Ozanne-Smith J, Williams F. The feasibility of improved data collection methodologies for sports injuries. Monash University Accident Research Centre, Victoria, Australia, 1995.

Appendix A: Coding Specifications for use of the May 1998 draft of the ICECI with HBSC data

Suggested standard coding schemes

1. International Classification for External Causes of Injury (ICECI)
2. Canadian codes for activity and cause of injury (developed by SPEG; Queen's University)

Standard Data Elements

1. Full written description of activity (from HBSC questionnaire)
2. Full written description of how injury occurred (from HBSC questionnaire)
3. Intent (abbreviated version of ICECI; attached)
4. Mechanism (abbreviated version of ICECI; attached)
5. Primary Object (abbreviated version of ICECI; attached)
6. Contributing Object 1 (abbreviated version of ICECI; attached)
7. Contributing Object 2 (abbreviated version of ICECI; attached)
8. Place of Occurrence (abbreviated version of ICECI; attached)
9. Activity (abbreviated version of ICECI; attached)
10. Activity (Detailed Canadian list developed by SPEG; attached)
11. Optional: Cause of Injury (Canadian list developed by SPEG; attached)

Some general rules for Coding, using this modified version of the ICECI

We have created a coding system, based on a simplified version of the International Classification for External Causes of Injury (ICECI). The code sheets that follow provide suggested HBSC codes for five elements of each injury: intent, mechanism, object/substance (primary and up to 2 contributing), location and activity. On the right hand side of the coding sheets are the corresponding ICECI Codes (for reference purposes only).

In order to use this classification system, you will need to understand some basic rules. These are as follows:

Coding of Intent

1. Select the category that best describes the way the person was injured.
2. If 2 or more categories are judged to be equally appropriate, select the one that comes first on the code list.

Coding of Mechanism

1. Select the category that best describes the way the person was injured.
2. If 2 or more categories are judged to be equally appropriate (i.e. the mechanism can be described in 2 or more ways), select the one that comes first on the code list.
3. If more than one mechanism is involved in the occurrence of the injury, select the one that is most immediately and directly responsible for the trauma.

Coding of Object

1. Code the primary object first. This is the object that was most immediately and directly responsible for the trauma.
2. Code up to 2 contributing objects. These do not have to be coded in any particular order. Most of the time, there will not be more than one contributing object. Some of the time, there will be no contributing object, other than the primary object.
3. Do not code an individual type of object more than once for any particular injury.
4. If a person (self) is the sole object involved in the injury (e.g. some over-exertion injuries), the person (self) should be coded as the primary object.
5. A person can be a contributing object. If the description of the injury event implies that another person contributed to the injury, code this person as a contributing object.

Coding of Location

1. Select the category that best describes the location where the person was injured.
2. If 2 or more categories are judged to be equally appropriate, select the one that comes first on the code list.

Coding of Activity

1. Select the category that best describes the type of activity the person was involved in when injured.
2. If 2 or more categories are judged to be equally appropriate, select the one that comes first on the code list.
3. For sports injuries that occur in school environments, code these as sports: organized or unorganized.

Abbreviated Coding Schemes (Modification of the ICECI)

Intent

HBSC Code	Intent (pages 18-20; ICECI)	Corresponding ICECI Code (for reference purposes)
1	Unintentional	
2	Interpersonal (e.g. assault)	21-29
3	Intentional Self-harm	31-39
4	Legal intervention	4
5	Operations of war or civil insurrections	51-59
8	Undetermined	7
9	Other	6, any others

Mechanism

HBSC Code	Mechanism (pages 21-29; ICECI)	Corresponding ICECI Code (for reference purposes)
	Blunt Force	
1	Contact with blunt object	A1.1-A1.6
2	Application of bodily force	A2.1-A2.9
3	Crushing	A3.1-A3.9
4	Falling, stumbling, jumping	A4.1-A4.9
5	Blunt force: unspecified contact	A8-A9
6	Penetrating force	C1-C9
7	Other mechanical force	E1-E9
8	Thermal and Radiant Mechanisms	G1.1-G3.9
	Threats to Breathing	
9	Strangulation; asphyxiation	J1.1-J1.3
10	Drowning/Near Drowning	J2.1-J2.3
11	Confinement in oxygen deficient place	J3
12	Other specified threats to breathing	J8
13	Unspecified threats to breathing	J9
14	Therapeutic, surgical and medical care	L1.1-L9
15	Poisoning by, exposure to chemical substances	N1-N9
16	Physical over-exertion	P1-P9
17	Other and unspecified mechanisms	U1-U9

Object/Substance - use for coding primary and contributing objects

HBSC Code	Object/Substance Producing Injury (pages 30-49 ICECI)	Corresponding ICECI Code (for reference purposes)
1	Infant's or child's product	A01-A99
2	Furnishing	B01-B99
3	Household appliance	C01-C99
4	Utensil or container	D09-D99
5	Pedestrian	E01
6	Pedal cycle (bicycle)	E19
7	Animal, while used in transport	E05,E07
8	Other land vehicle used in transport	E21-E99
9	Special purpose vehicles, mobile machinery	F09-F99
10	Water craft and means of transport	G09-G99
11	Air craft and means of transport	H09-H99
12	Sporting Equipment	I01-I99
13	Tool, machine, apparatus	J01-J99
14	Animal	K29-K69,K95,K96
15	Plant	K07-K19
16	Person (self); only coded in instances when "self" is the sole object involved. Do not use this code in the contributing code categories	na
17	Person (other person(s))	K71,K75
18	Ground surface and conformations	L23-L99
19	Weather, natural disasters	M19-M99
20	Food, drink	N01-N99
21	Personal use item	O21-O99
22	Drugs, pharmaceutical substances	P01-P99
23	Chemical substance, non-pharmaceutical	Q09-Q99
24	Building, building component or fitting	R01-R99
25	Material	S09-S99
26	Weapon	T08-T99
27	Medical/surgical devices and procedures	U07-U99
28	Fire, flame, smoke	V09-V99
29	Miscellaneous object, substance	Z19-Z98
30	Unspecified object, substance	Z99

Location

HBSC Code	Place of Occurrence (pages 50-57; ICECI)	Corresponding ICECI Code (for reference purposes)
1	Home	1
2	Institutional area	21-29
3	Medical service area	31-39
4	School, educational area	41-49
5	Sports and athletics area	51-59
6	Transport area: street and highway	61-69
7	Transport area: other	71-72
8	Industrial and construction area	81-89
9	Farm	91-99
10	Recreational or cultural area or public building	101-109
11	Commercial area	111-119
12	Countryside	121-129
13	Other/Unspecified	13,14

Activity

HBSC Code	Activity When Injured (pages 58-61; ICECI)	Corresponding ICECI Code (for reference purposes)
1	Paid or unpaid work	1,2
2	Travelling	3
3	Sports: organized or unorganized	4,5
4	Leisure	6
5	Education	7
6	Health care	8
7	Vital activity	9
8	Being taken care of	10
9	Other/Unspecified	11-12

Decision Rules for Difficult Coding Issues – HBSC Survey

Variable	The Issue	Decision Rule
Intent	Coding of Sports Injuries	Sports injuries to be coded as unintentional, according to standard practice used in the various versions of the ICD coding of external cause. UNLESS: If there is a clearly stated indication that the injury was sustained as a result of an intentional act (i.e. there was an intent to injure), then code these sports injuries as intentional.
Mechanism	a) When multiple mechanisms are present, and the coder cannot decide which is most appropriate	a) Pick the mechanism that is most immediate to the injury event, e.g., if a fall from a tractor and then crushed by a tractor wheel, then code for the "crushing" rather than the "falling, stumbling, jumping"
	b) Physical overexertion, versus: falling, stumbling, jumping.	b) Physical overexertion is when the victim is exerting themselves beyond their capability (e.g., a soccer goalies is stretching for the ball, and pulls a muscle). However, we suggest that sports injuries where someone has explicitly stated that they have sprained or strained their ankle (or another body part) due to a trip or fall be coded as "falling, stumbling, jumping" injuries. All others – over-exertion.
	c) Application of bodily force versus contact with a blunt object, when humans are involved.	c) Application of bodily force is when the victim is assaulted or struck in some way by another person, or they strike or assault another person. All injuries that are consistent with these statements should be coded as "application of bodily force", and not "contact with a blunt object".
Object	When multiple objects contribute to the injury.	a) Code all injuries to the Canadian codes describing causes of injury. b) Code the object that directly causes the injury as the primary object (i.e. the object that is most immediately and directly responsible for the trauma, e.g.. a child is playing on the monkey bars and falls; the object producing injury is the ground.) c) Code up to two additional objects contributing to the injury (contributing objects), for cases when more than one object are involved in the injury

Example when "self" is the only object involved:

I was practicing for cross-country running, and stretched my groin.

Object involved: self

Primary Object: 11c Person (self)
No contributing objects

Example of three objects involved:

A child is playing in a tree-house, is pushed by another child, and falls to the ground.

Objects involved: ground, other person, tree-house

Primary Object:
12 Ground surface and conformations
Contributing Object 1:
11d Person (other person)
Contributing Object 2:
1 Infant's or child's product

(order of contributing objects 1 and 2 has no meaning)

Example of three objects, two from same category:

I was playing ice hockey, and was hit in the head by a shot.

Objects involved: puck, hockey stick, other person

Primary Object:
9 Sporting equipment
Contributing Object 1:
11d Person (other person)
Contributing Object 2:
None

(Don't count "sporting equipment" twice, so there is not double counting of any object).

If the descriptions imply that another person was involved in the injury event, code that person as a contributing object. This may involve some logical assumptions in some coding situations.

e.g., *I was playing baseball, and was hit by a ball.*

Primary object:
9 Sporting equipment
Contributing object 1:
11d Person (other person)

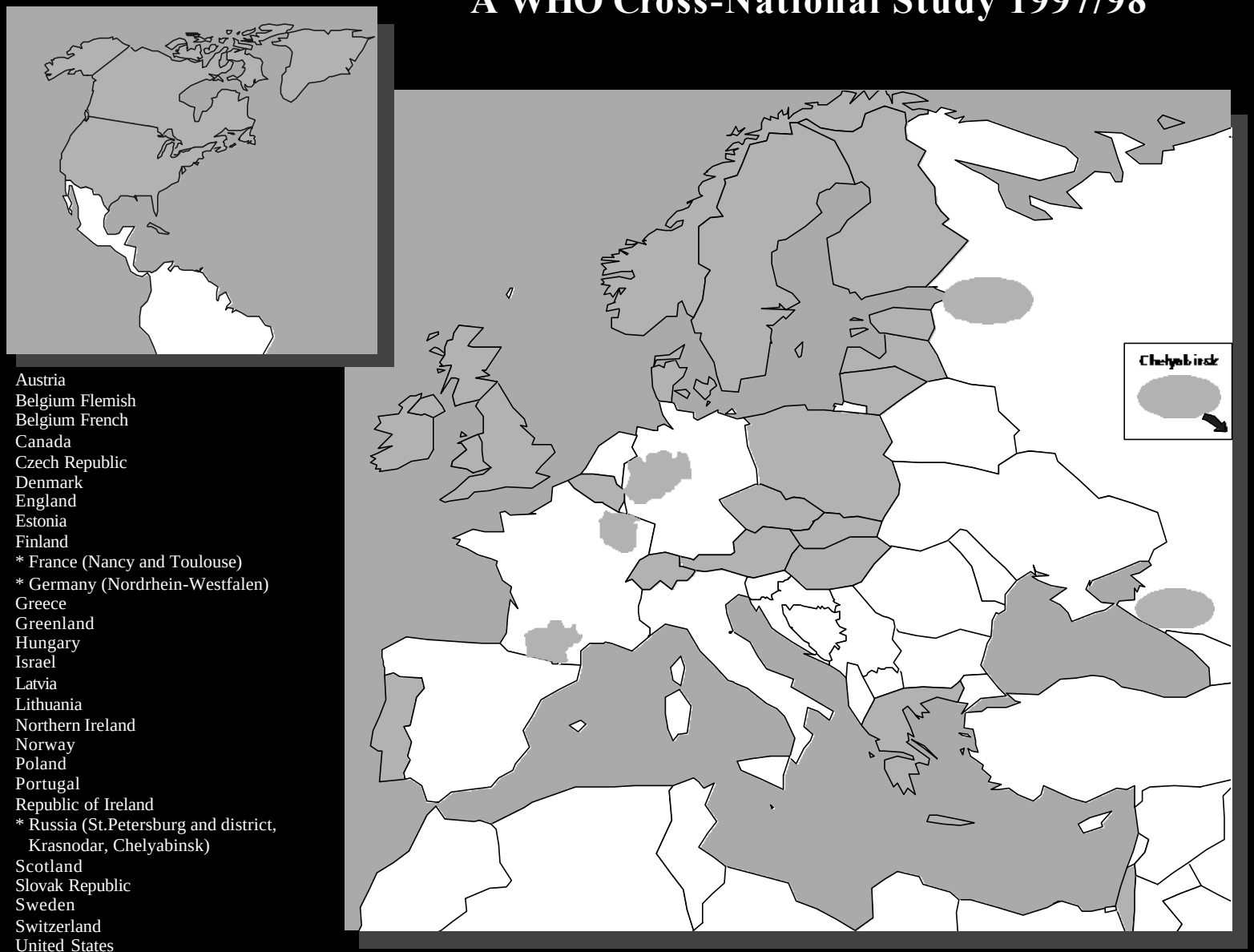
(Although the other person was not explicitly referred to in the description, common sense dictates that, in the vast majority of cases, the ball would have come from another person.)

Activity	Education versus organized sport	When an organized sport injury occurs at school, as denoted by the location code, it is to be coded as "sports: organized or unorganized" for the activity field.

Figure 1. Countries involved in the 1997-98 HBSC Survey, reproduced (with permission)

Health Behaviour in School-Aged Children

A WHO Cross-National Study 1997/98



Austria
Belgium Flemish
Belgium French
Canada
Czech Republic
Denmark
England
Estonia
Finland
* France (Nancy and Toulouse)
* Germany (Nordrhein-Westfalen)
Greece
Greenland
Hungary
Israel
Latvia
Lithuania
Northern Ireland
Norway
Poland
Portugal
Republic of Ireland
* Russia (St.Petersburg and district, Krasnodar, Chelyabinsk)
Scotland
Slovak Republic
Sweden
Switzerland
United States
Wales

MDIM - Minimum dataset for injury monitoring Background and model – MDIM in Norway and Syria

Johan Lund*

*University of Oslo, Institute of General Practice and Community Medicine, Department of Preventive Medicine

Background

In the first ICE-symposium in Washington in 1994, in one workshop a Minimum Basic Data Set (MBDS) for unintentional injuries was discussed. A report was given to the plenum with the conclusions from the workshop.[3]

There are a lot of different data sets on unintentional injuries around the world. The working group distinguished between three different types of data sets with regard to 1) the level of detail of the information and 2) the purpose of collecting the data set:

Level of detail of information	Type of data set	The purpose of collecting the data set
General case indicators + evt. free text	MBDS (A Core Set)	Policy setting Identify "hot spots" Follow trends National and international comparisons
More detailed indicators + evt. free text	Standard data set (SDS) ICD - X, chapter XIX, XX NEISS, NOMESCO, EHLASS, HASS, PORS	Identify more detailed "hot spots" Identify some preventive means (Research, to some extent)
Case stories	Expanded data sets (EDS) Modules on: Traffic, Burns, Falls, Products etc.	Identify preventive means Research

There are no sharp borderline between these three groups. When using a MBDS in order to fulfill the purpose of getting trends and making comparisons nationally and internationally, high accuracy is necessary, the amount of the non-registered cases should be known. When using a SDS, more money and time is required to get the same quality of data than when using a MBDS. In my country, it is probably impossible to get a sound SDS in the daily routine in the health system without extra registration resources. An EDS is mainly for preventive purposes, it is not necessary to know the exact number of that specific injury which is studied. A study of just one injury might give valuable information for prevention. It would be very costly to collect an EDS for all injured patients in the health system.

One of the problems in injury surveillance when using a SDS, is that the accuracy is seldom high enough for making valid statistics, and that the level of detail is seldom high enough to give an understanding of the causes to enable design of preventive means. The challenge is to design a surveillance system which gives accurate statistics and enables an identification of the injuries for collection of an EDS.

In the report from the workshop (Lund, Holder and Smith 1994), some suggestions to the content of a MBDS is given. During the years, there have been some attempts in Norway to establish a MBDS in primary care and general practice.[1,2] ICD - X was introduced in Norway in 1999. An abbreviated version of chapter XX is collected for all in-patients due to injuries together with some other variables. This dataset might be classified as a MBDS. In the city of Oslo (population of 500 000), a MBDS is introduced for registering all injured persons visiting the primary health system. The Ministry of Health in Norway has now asked the National Institute of Public Health to come up with a proposal for a MDIM for local registration, which might be a national recommendation.

ICECI-working group on MDIM (Minimum Data Set for Injury Monitoring) was established in 1998

During the discussions of the ICECI (International Classification of External Causes of Injury) at the world conference in Amsterdam in May 1998, a proposal of having a MBDS compatible to ICECI was put forward. A working group consisting of people from different parts of the world was established:

Johan Lund, Norway, chair
Alex Butchart, South Africa
Yvette Holder, PAHO (Pan American Health Organization)/WHO
Sayed Ali Hussein, WHO/EMRO (East Mediterranean Regional Office)
Ronald Lett, Canada, consultant for Uganda
Anne Lounamaa, Finland
Susan Mackenzie, Canada.

During the work, the abbreviation MDIM was introduced instead of MBDS, which has some unwanted connotations. A proposal to a MDIM was given in November 1998. I will show this proposal here, together with some experiences from Norway and Syria.

What is MDIM?

A Minimum Dataset for Injury Monitoring (MDIM) is for monitoring injuries in a population using the fewest possible variables. The number of fewest possible variables is to some degree dependent on the available registration resources. The absolute minimum variable, is: Injury - Yes/No. We wanted to go a bit further on, and included some more variables in the proposed MDIM.

A MDIM is supposed to be collected as a routine activity, mainly in the health system without additional economic or personal resources,

It consists of relevant variables to describe different characteristics of:

- injured person
- accident
- injury
- consequences.

Purposes with MDIM

A MDIM can serve many purposes. The two main purpose are:

a) monitoring:

   - determine size of injury problem (number, frequency, incidence), especially directed to authorities responsible or working with prevention of the different accident and injury types
   - establish priorities, policy setting
   - study injury risk over time
   - identify "hot spots" in a spatial/geographic sense
   - evaluate injury and accident prevention activities.

b) identification of cases for in-depth investigations.

Other purposes are:

c) allocation of resources to the national health system

d) assisting in developing injury prevention activities, however, a MDIM does not contain many details of the causes.

e) assisting in evaluation of injury prevention activities (by studying trends)

f) formulation of hypothesis for further investigation.

Content of MDIM

It is suggested to have a minimum core of variables and some optional variables due to local needs and/or restricted registration resources. These variables are listed below. The letters N and S in the margin indicate that this particular variable is contained in the Minimum Data Set introduced by the health authorities in Oslo, Norway (N) in 1998 and in Syria (S) in 1998. I got the opportunity to act as a WHO short term consultant in October 1998 to give advice to the Syrian authorities how to revise an existing national injury monitoring system in the primary and secondary health system. The MDIM proposal from the working group influenced this revision. On the other hand, the experience in Syria influenced the Minimum Core values of Place of occurrence and Activity of victim when injury occurred.

Minimum Core

N, S Registration unit, type/number (for identification of the source of the data)
N, S Personal data of victim: age, sex, municipality/suburb of residence (for rates calculation)
N, S Intent
N, S Place of occurrence
N, S Activity of victim when injury occurred
N, S Nature of injury (health system most often register diagnoses)

Optional variables (useful, but depending on your registration resources)

N Municipality/suburb where injury happened
N Date and time of injury
N Mechanism of injury (abridged E-code)
Body part injured
N Severity
S Disposition
N Free text describing the accident/injury event.

Three important variables in the proposed MBDS:

In the following, the values of three important variables will be shown:

- Intent
- Place of occurrence
- Activity of victim when injured

Also with regard to the variables, the principle of having optional values depending on registration resources/local needs is followed:

Intent

N, S Accidental/unintentionally
N, S Violence/interpersonal
N, S Intentional self harm
N, S Other
    - Optional:
    - Operation of war, civil insurrections, terrorism
    - Legal intervention
    - Undetermined
N Unspecified

Place of occurrence

N, S Street, highway incl. sidewalks, bicycle paths, traffic accident (traffic accident is asked for here in order to avoid an additional variable: Traffic accident – Yes/No)
N, S Street, highway, incl. sidewalks, bicycle paths, all other accidents
N, S Home and residential area
N, S Other

Optional:

N - Day care for children, kindergarten
N - Playground, excl. at home and at school
N - School, educational area, incl. playground, excluding day-care for children
N - Sports and athletics area, incl. at school and at institution
N - Old peoples home, nursing home
N, S - Farm, excluding home
- Commercial area
N - Countryside, open nature, water
N, S Unspecified

Activity of victim when injury occurred

N, S Paid work, incl. exercise, motion, sport during paid work
N, S Education, incl. sport in education
N, S Other sport, exercise, motion
N, S Other

Optional:

- Travel to/from work (in some countries, these accidents are occupational accidents, in other countries they are not.)
- Travel to/from education

- Leisure/play activities
N - Sport in education
N, S Unspecified

Accident-types for monitoring when combining place of occurrence and activity when injured

Minimum cores of place of occurrence and activity will give:

N, S Street, highway, traffic accidents
N, S Street, highway all other accidents
N, S Occupational accidents
N, S Home accidents
N, S Educational accidents, incl. sport accidents
N, S Other sport accidents
N, S Other accidents

The specified group of accidents in this minimum core will in Norway constitute of app. 60 - 70% of all medically treated injuries.

Optional:

N, S Farm accidents, excluding home accidents
N Kindergarten/day care accidents
N Playground accidents
N School area accidents
Sports accidents during education
Sport area accidents
N Old people home/nursing home accidents

Commercial area accidents
Recreational/cultural/public areas accidents
Accidents when travelling to/from work
Accidents when travelling to/from education
Leisure/play accidents
N Accidents in countryside, open nature, water

Some of the optional accidents types are sub-groups of the accident types in the minimum core. The accident types in the optional group will in Norway constitute of app. 20 - 30% of all medically treated injuries.

The accidents are defined using two dimensions. A home accident can also be an occupational accident. In the table below, a proposal for a standard is given. When the accidents are put into a table like this, it is possible to count the accidents by either dimension (place of occurrence and activity) and as a combination of those two dimensions.

Place of occurrence	Activity of victim when injured								
	Paid work[1]	To/fr work	Edu-cation[1]	To/fr edu.	Sport in educ.[2]	(Other) sport[1]	Play/ Leisure	Other[1]	Unspe cif.[1]
Street, highway, traffic acc. (T)[1]	T	T	T	T	T	T	T	T	T
Street/highway, all other acc. (S/H)[1]	Pw	Tfw	E	Tfe	SE	S	S/H	S/H	S/H
Home (H)[1]	Pw	Tfw	E	Tfe	SE	S	H	H	H
Day care for children/ Kindergarten (K)	Pw	Tfw	E	Tfe	SE	S	K	K	K
Playground (P)	Pw	Tfw	E	Tfe	SE	S	P	P	P
School, educational area (S/E)	Pw	Tfw	E	Tfe	SE	S	S/E	S/E	S/E
Sports, athletics area (S/A)	Pw	Tfw	E	Tfe	SE	S	S/A	S/A	S/A
Old peoples home/ nursing home (O/N)	Pw	Tfw	E	Tfe	SE	S	O/N	O/N	O/N
Farm, excl. Home (F)	Pw	Tfw	E	Tfe	SE	S	F	F	F
Commercial area (C)	Pw	Tfw	E	Tfe	SE	S	C	C	Co
Countryside, open nature (N)	Pw	Tfw	E	Tfe	SE	S	N	N	N
Other (O)[1]	Pw	Tfw	E	Tfe	SE	S	P/L	O	O
Unspecified (U)[1]	Pw	Tfw	E	Tfe	SE	S	P/L	O	U

[1]These accident types are defined when using the recommended mandatory dataset.
[2]Sport in education may or may not be included in education.

MDIM – ICECI relationship

It is important that there is compatibility between ICECI and a MDIM.

From a MDIM is possible to expand into various directions and modules depending on your study/prevention area and your registration resources:

- traffic accidents
- violence
- child accidents
- sport accidents
- etc. etc.

A MDIM is a tool for local, regional, national and international comparisons on the main accident and injury types, a tool which require a minimum of resources.

References

1. Grimsmo A and Johnsen K (1999) Data assisted review of medically treated injuries in general practice. *Eur J Gen Pract 5*: 59-65.

2. Lund H and Lium E (1997) Registration of accidents and injuries in primary health care. (in Norwegian with English summary) *Tidskr Nor Lægeforen 117*:3973-5

3. Lund J, Holder Y and Smith RS (1994) Minimum Basic Data Set (MBDS), Unintentional Injuries, pp. 34-1 – 34-4 in *Proceedings of the International Collaborative Effort on Injury Statistics, Volume 1,* U.S. Department of Health and Human Services, Bethesda, USA, 1994

Development of minimum dataset injury surveillance in Canada

Susan G. Mackenzie, Health Canada, Ontario, Canada

In Canada information on injured people treated in hospital emergency rooms (ERs) is available from the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP)[1], which is operated by Health Canada in collaboration with 16 hospitals, 10 of which are children's hospitals. Since they are not representative of Canadian hospitals, CHIRPP data cannot be used to provide national estimates of the numbers of ER-treated injuries or to calculate rates. However, the data do provide good information on the circumstances in which injuries happen. Twenty-eight data elements are used to describe the circumstances and each record also includes a free text description of how the injury happened.

The usefulness of the CHIRPP data is widely recognized and Health Canada is quite often approached by communities that want to join the program so they can obtain local injury data. Unfortunately, we have to turn them down because we do not have the resources for expansion. The reasons the communities want local data are: to build local relevance for injury prevention, to set local injury prevention priorities, to develop appropriate prevention initiatives and to evaluate those initiatives. Others who advocate increased ER-based injury surveillance point out that as out-patient treatment accounts for an ever-increasing proportion of health care, it is becoming more important to be able to capture information from ambulatory care settings.

Health Canada recognized the interest in local injury surveillance and in November 1998 held a meeting in Ottawa to discuss strategies for implementing minimum dataset injury surveillance (MDIS) in Canada. The meeting was attended by about 20 people with interests in and/or experience with local or minimum dataset injury surveillance. We were fortunate to be joined by Johan Lund from Norway and Joan Ozanne-Smith from Australia, both of whom provided valuable information and insights based on their experiences. After a day and a half of interesting presentations and discussion, the group developed the recommendations that are presented in table 1.

Table 1: Recommendations from the 1998 Ottawa meeting on minimum dataset injury surveillance (MDIS)

1. That a single MDIS system be developed and recommended for use in Canada.
2. That the MDIS system be usable in a variety of health care and other settings.
3. That the MDIS system comprise:
    a. A core set of variables that should include, but not necessarily be limited to, the mandatory and optional variables in the Minimum Dataset for Injury Monitoring presented by Johan Lund;
    b. Modules to collect other information as needed in the specific setting in which surveillance is carried out.
4. That standard modules be developed for commonly needed data to facilitate collection of comparable data from different settings.
5. That ICD-10 compatibility be maintained where feasible.
6. That MDIS be initiated in Emergency Rooms with expansion to other settings to follow.

7. That all data collection systems that include injury data (such as CHIRPP and the Canadian Institute for Health Information's National Ambulatory Care Reporting System) be compatible with the core data set.
8. That there be a commitment to the collection of more detailed data for the testing of hypotheses.
9. That the MDIS initiative be evaluated.

Comments on table 1

- The use of a single MDIS system would permit roll-up of local data to regional and provincial levels, and possibly to the national level if MDIS were to become widespread. A single system would also facilitate comparisons of patterns of injury occurrence between jurisdictions.

- Although MDIS would most likely be initiated in emergency rooms, there should be nothing to stop, for example, a school board that wants information on injuries suffered by its students, or a sports club that wants injury data, from setting up a surveillance system.

- Meeting participants were reluctant to agree to collection of limited amounts of information; they wanted to be sure they would be able to get information that would be useful in local planning. Participants also wanted modules to collect specific information. A sports module would probably be one of the first that would be needed and others could certainly be developed.

- The more detailed information mentioned in the ninth recommendation could be either the type of information that is available from CHIRPP or information from specially designed studies.

In addition to the recommendations in table 1, the group strongly encouraged the establishment of a body that would develop a national strategy for injury prevention and control, of which coordinated national surveillance would be a key component.

The eighth recommendation from the MDIS meeting referred to the National Ambulatory Care Reporting System (NACRS) of the Canadian Institute for Health Information (CIHI). The Institute collects, processes and maintains data for a number of national health databases including the Discharge Abstract and Hospital Morbidity Databases. NACRS is a new program that collects administrative and clinical data about patients seen in ambulatory care settings. As it was being developed, representatives of Health Canada and CIHI met to discuss the system's potential usefulness for collecting injury data. These discussions led to addition of the data element Activity and provision for inclusion of a line of free text to describe how the injury happened. CIHI decided that the fifth digit of the ICD-9 E-code would provide adequate information about where the injury happened. Table 2 presents listings of selected NACRS data elements.

Table 2: Selected data elements from the National Ambulatory Care Reporting System that would, or might be, useful in a minimum dataset injury surveillance system

Definitely useful	Possibly useful, or nice to have
Demographic data elements	
Chart number	Health care number
Postal code	Province issuing health care number
Gender	
Birth date	
Administrative data elements	
Date of visit	
Clinical data elements	
Visit disposition	Main intervention
(Visit completed, admitted etc.)	Other intervention(s)
Main problem (N-code)	
Other problem(s) (N-code)	
E-code	
ER data elements	
	Triage level
	(Level of illness/acuity)
Optional data elements	
Type of visit	Referred from
(First, follow-up or last visit for a problem)	Referred to
	Highest level of education
Narrative description of injury event	
Activity when injure	

NACRS is not only new, it is a voluntary program, and it is not yet used by many hospitals. This may soon change. In the province of Ontario, which is home to about 30% of the Canadian population, the Ministry of Health has indicated it intends to have NACRS implemented in all hospitals. We are looking forward to working with Ministry officials to evaluate the usefulness of NACRS as a tool for minimum dataset injury surveillance.

There is strong interest in local injury surveillance in Canada. It will be a significant challenge to develop a single set of data elements that will meet the needs of a wide variety of organizations.

Reference

1. Mackenzie SG, Pless IB. CHIRPP: Canada's principal injury surveillance program. *Injury Prevention* 1999; (in press)

Results of the ICE on Injury survey of injury death certification and vital statistics

Cleo Rooney,* Margaret Warner** and Lois Fingerhut**

*Office for National Statistics, London, England
**National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), Hyattsville, MD

Introduction

It might be imagined that statistics on deaths from injury would be more comparable than deaths from diseases. The events leading to injury deaths are thought of as dramatic and so easily recognised and counted. However, ICE participants are well aware of idiosyncrasies in the data on injury mortality in their own countries not all of which are apparent to data users. Previous research has identified a number of problems in making comparisons of death rates between countries related to how the information is collected and processed.[1,2,3]

The laws governing certification and medico-legal investigation of 'unnatural' deaths or deaths from injury and poisoning vary considerably between countries.[2] This in turn gives rise to differences in the length of time before the death is registered[4] and the amount and quality of the information which the vital statistics office receives.[5] Coding the underlying cause of these deaths requires information about how the injury was sustained and the intent of any perpetrator as well as the nature of the actual injuries.[3] This information is not all easily encapsulated in the standard certificate of cause of death. Discussions between ICE participants highlighted many differences in these processes, which we thought could affect the apparent death rates from injury in our countries.

We decided to investigate the processes through which information on injury deaths was collected and processed to produce mortality statistics in countries participating in the Injury ICE. We drew up a questionnaire which covered certification, investigation, registration and coding of the causes of deaths from injury; inclusion and exclusion criteria for deaths, methods of deriving population denominators; and whether delays for investigation affected mortality rates through incomplete registration or insufficient information about the cause. This was amended after piloting in three countries and discussion at the ICE meeting in Amsterdam in 1998. Revised questionnaires were sent to ICE participants, who then had them completed by a representative of their national vital statistics agency or themselves.

Answers to questionnaires

Questionnaires were completed for 18 countries, including all 11 countries whose data were used in international comparisons recently published through the ICE[6] (ICE-1 countries). We present data from all 18 countries whenever possible, and from the eleven ICE-1 countries when comparisons with mortality statistics are made.

In all participating countries, the same national office produced statistics on deaths from injury and deaths from natural causes. All countries published total figures/had an annual publication based on the whole range E800-E999 [or ICD-10 equivalent].

These deaths were referred to as		'external causes'
or	of	'injury and poisoning'
or		'accidents and violence'

No countries yet specifically excluded deaths due to adverse effects or misadventure in medical/surgical care from their routine published rates. England and Wales have just begun including deaths coded to ICD-9 304 and 305.2-.9, drug dependence and drug abuse,[7] in their annual publication on deaths from injury and poisoning because most of these were found to be acute poisonings.

Death certificates

More than half the countries reported using a single certificate for all deaths, though some countries had several different certificates for different circumstances (Table 1. England and Wales have a total of 7).

Table 1

Death certificates	**All ICE countries**	**ICE 1 data countries**
One certificate for all deaths	10	4
More than one certificate	8	7

No countries had different certificates for different causes of death. However, three had different certificates for completion by coroners or medical examiners. This effectively means that many or most injury deaths in these countries are on special certificates (see 'who certifies?' below).

Table 2

Reason for different certificates	**Country (All ICE countries)**	**Number of countries**
Legal/who certifies	E&W, NZ, Norway	3
Area within country	Canada, USA, Australia	3
Old/new versions	France	1
Age	NZ, E&W, Australia-neonates	3

Certification: Who certifies injury deaths?

Only two countries reported both coroners and medical examiners – Canada and Norway (both exist in parts of the USA, but no breakdown of proportion certified by each was available from vital registration). Sweden reported forensic pathologists as the alternative certifiers to physicians. In other countries, only one or other system is in use for medico-legal investigation of cause of death. These three categories have been combined as 'coroner/medical examiner'.

Participating countries seem to fall into 4 groups as to who actually certifies deaths from injury (Table 3):

- All deaths certified by attending physician
- Mixed physician and coroner/medical examiner
- All or nearly all coroner/medical examiner
- Information not available

Table 3

Main Certification	Percentage of injury deaths certified by country	Physician	Coroner or ME
all physician			
	France	100	0
	Scotland	100	0
mixed			
	Norway	65	35
	Sweden	56	44
	Denmark	30	70
	Canada*	28	67
all/nearly all coroner/ME			
	New Zealand	11	89
	England & Wales	10	90
	Australia	5	95
	Netherlands	0	100
no information			
	Israel		
	6 CAREC countries		
	USA		

*Canada reports 4% certified by nurse

Who is responsible for referring deaths for investigation?

In only 3 countries (3/18 and 3/11) is there no legal responsibility on the attending physician to refer deaths for investigation. E&W is one of these, though in practice more deaths are referred to the coroner from doctors than from any other source there.

Table 4

	Responsible for referral	
	Yes	No
Attending physician	8	3
Registrar of deaths/registration office	7	4
Funeral director	2	9
Police	8	3
Other, responsible for investigation*	2	9

*common law responsibility on any person with knowledge of death that should be investigated in Canada and E&W

What proportion of injury deaths have autopsies? Does this vary depending on who certifies injury deaths?

Only eight countries could say the proportion of injury deaths that had been subject to autopsy. The estimate for Denmark was much lower than any other country, at only 3%. Three countries report about half these deaths have autopsies, and the remaining four report 70-90%. Surprisingly, there does not appear to be any clear relationship between who certifies injury deaths and the proportion which have autopsies, though only eight countries had information on both (Table 5). Scotland, where doctors certify all injury deaths, and the Netherlands, where they are all certified by a coroner/medical examiner, both report a 70% autopsy rate. Certifier and autopsy are related in England and Wales, where coroners cannot legally certify cause of death there unless they order an autopsy or hold an inquest. The number of inquests held without autopsy is extremely small.

Table 5

Country	**autopsy %**	**% certified by coroner or ME**
Denmark	3	70
New Zealand	48	89
Canada	51	67
Sweden	52	44
Scotland	70	0
Netherlands	70	100
Australia	88	95
England & Wales	90	90

Manner of death, or intent - source, recording and use

Eight of 18 countries have a specific space on the certificate for recording manner of death, intent or verdict. In 5 this is a list of intents (accident, suicide, homicide, etc.), with boxes to tick ('check box').

Five countries use the text sections on the cause of death narrative description of 'how the injury occurred' (see below), to record intent (Australia, E&W, France, NZ and Scotland). Of these, only France includes specific instructions to the certifying physician to state the intent (on the cause of death lines).

In seven countries intent is derived from a legal verdict on some or all injury deaths: Denmark, Norway, E&W, Scotland, Australia, NZ and Sweden. This may be recorded as free text or as a specified field. Altogether 11 countries report that they use either manner of death or a legal verdict in assigning the E-code.

Narrative description of 'how the injury occurred'

Ten of the 18 countries have a space for narrative description of how injury occurred (including 8 out of 11 ICE-1 countries). However, only 2 countries have it completed for all injury deaths. In some countries the variation is geographic, for example in Australia it is completed in some states and not others. In E&W coroners are only legally required to complete this section for accidental deaths.

Table 6

Country	Injury Narrative	Narrative complete	Narrative used for E-code	Narrative stored electronically	Narrative available for analysis
Belize	NO	NO	NO	NO	NO
Dominica	NO	NO	NO	NO	NO
Jamaica	NO	NO	NO	NO	NO
Saint Lucia	NO	NO	NO	NO	NO
Trinidad & Tobago	NO	NO	NO	NO	NO
France	NO	NO	NO	NO	NO
Israel	NO	NO	NO	NO	NO
Scotland	NO	NO	NO	NO	NO
Australia	YES	NO	YES	NO	NO
Norway	YES	NO	YES	NO	NO
Denmark	YES	NO	YES	YES	NO
Guyana	YES	NO	YES	NO	YES
Canada	YES	NO	YES	NO	YES
Sweden	YES	NO	YES	YES	YES
England & Wales	YES	NO	YES	YES	YES
New Zealand	YES	NO	YES	YES	YES
Netherlands	YES	YES	YES	NO	NO
USA	YES	YES	YES	YES	YES

The 10 countries with narrative all use it when it is present to assign the underlying cause E-code. Five countries (NZ, USA, E&W, Sweden and Canada) store this narrative electronically for at least some recent years and could make it available for analysis in the ICE.

Delays in registration or registration before all information is complete?

Deaths from injury usually have to be investigated by the police or other authorities. In some countries, the death can be registered before investigation is complete, with incomplete or missing information about cause. In others, the death cannot be registered at all until the investigation is complete. Either of these procedures may mean that injury mortality is underestimated in vital statistics, because the death has not been registered by the time the annual file is closed or because there is no indication that it was due to injury.

Table 7

What happens when deaths are being investigated?

Number of Countries (total=18)

	Registration is delayed		
death certification by:	No	Yes	Total
all physician	2	1	3
all/nearly all coroner/ME	1	3	4
mixed	1	3	4
No information	2	5	7
Total	6	12	

	Death is registered with unknown cause		
death certification by:	No	Yes	Total
all physician	2	1	3
all/nearly all coroner/ME	1	3	4
mixed	3	1	4
No information	6	1	7
Total	12	6	

	Death is registered with unknown cause			
		No	Yes	Total
Registration is delayed	No	2	4	6
	Yes	10	2	12
	total	12	6	

It appears that many participating countries do suffer either from delay or from some deaths being registered with no information on cause. Australia and England & Wales have both delays and unknown cause registrations. Israel and Scotland both manage not to delay registration; they use available information to code cause immediately, and can amend it later. The numbers of countries are small, but it seems that delay in registration is more likely when deaths have to be certified by a coroner or medical examiner.

Of the twelve countries that have delayed registration, half manage to include them in annual publications. In some cases the statistics are based on the year that the death is registered, so the annual figures will always be complete, but may include deaths that actually happened in the previous year or even earlier. In others, inclusion is possible because publication is delayed even longer than registration. In some countries annual figures are not published until two or three years after the end of the data year.

Six ICE countries do have some level of underestimation of injury mortality in their annual publications because they are missing some deaths registered too late for inclusion. However, three of these six do regularly publish updated figures for past years.

In addition, six of the twelve countries in which registration is delayed by investigation say that they can make updated data available for analysis in some circumstances.

Table 8

Number of countries	**Revised data available for analysis?**		
Late death included	NO	YES	Total
YES	6	3	9
NO	6	3	9

17 countries report that they can amend causes when later information comes in. Eleven of these can make amended cause data available for analysis in some circumstances. This includes four of the six countries that register deaths with an unknown cause before investigation is completed.

Table 9

Number of countries	**Amendments available for analysis**		
Death registered with unknown cause	NO	YES	Total
NO	5	7	12
YES	2	4	6
Total	7	11	18

Coding cause of death

Automated or clerical?

Only 4 countries attempt to code all injury deaths automatically – Australia, Scotland and the USA use the NCHS system (SuperMICAR, MICAR and ACME) and Sweden uses its own. Some Canadian provinces code deaths with the NCHS software, while others code clerically. England and Wales code injury deaths clerically because the NCHS software did not code coroner's inquest certificates consistently with previous practice[3,8]

Which ICD revision:

Most countries except Denmark were using ICD-9 from the late 1970s or early 1980s until very recently (or are still using it). Table 10 shows the years in which countries have implemented or plan to implement ICD-10.

Table 10

ICD-10 before 1999		ICD-10 from 1999	ICD-10 later than 1999	
Denmark	1994	France	Scotland	2000
Saint Lucia	1996	Guyana	Canada	2000
Belize	1996	Australia	England & Wales	2001
Dominica	1996	USA		
Trinidad & Tobago	1996			
Norway	1996			
Netherlands	1996			
Israel	1997			
Sweden	1997			

Only Denmark and New Zealand report using special national adaptations of the international classifications. Most countries report using all available information from death certification, including cause of death text, manner of death/ verdict and narrative to assign the E-code. Only three countries indicated any order of priority between these variables.

Inclusion and Exclusion criteria used in vital statistics

Population denominators

Four countries use population registers alone to calculate their resident population at risk of dying, 12 use estimates based on a census. Israel uses estimates based on both, and no information was available for Jamaica. We did not ask about methods used to estimate inter-censal populations or the accuracy of population registers.

No ICE country included any measure of the tourist or non-permanent population in their denominators. They all included military personnel as long as they were deemed to be 'resident' in the country.

Deaths included or excluded

All countries included all deaths of residents within the country. Five included deaths of non-residents within the country, and 11 excluded them (no information was available for Jamaica). Only three countries always included deaths of their residents abroad, if they were told about them. Which deaths are included appears to be related to the method of deriving the denominator population (Table 11).

Generally, those countries using population registers as the denominator include in the numerator deaths of residents only, excluding deaths of people visiting the country. All these countries, except Denmark, include deaths abroad of registered residents. However, information on these deaths may not always be complete. In particular, the causes of deaths abroad may be missing. This will tend to affect sudden unexpected deaths more than others, and so may underestimate injury mortality

Most countries that use census based estimates of the resident population at risk include all deaths which occur in the country, whether of residents or non-residents, in the numerator for calculating death rates. Clearly this means that they are including in the numerator deaths of population groups such as tourists who are not in the denominator. However, it is generally assumed that this is balanced out by excluding deaths of their own residents abroad. In fact it may under or over estimate injury death rates depending on the relative numbers of travellers to and from the country who die. Only if the number of travellers is large in relation to the resident population, for example a small country with a large tourist industry, is the effect likely to be significant. There is no apparent relationship between the size of the resident population of ICE countries and whether deaths of non-residents are included in mortality rates. Most countries can identify deaths of non-residents separately, so that it would be possible to re-calculate rates using residents only and measure this effect.

The USA and Israel are exceptions - they exclude both deaths of visitors in their country **and** deaths of their residents abroad. Canada includes some deaths of Canadian residents abroad – if 'the death occurs in a major U.S. State visited by Canadians'. This may tend to exaggerate injury mortality in Canada, particularly in relation to U.S. rates.

Table 11

Population method	Deaths included in national mortality rates: Occur in country			Occur outside country
	residents	tourists	military	residents who die abroad
Population register				
Denmark	yes	no	yes	no
Netherlands	yes	no	no	yes
Norway	yes	no	yes	yes
Sweden	yes	no	yes	yes
Population register and census based estimates				
Israel	yes	no	yes	no
Census based estimates				
Australia	yes	yes	yes	no
Belize	yes	yes	yes	no
Canada	yes	yes	yes	yes[1]
Dominica	yes	yes	yes	no
England & Wales	yes	yes	yes	no
France	yes	yes	yes	no
Guyana	yes	yes	yes	no
New Zealand	yes	yes	yes	no
Saint Lucia	yes	yes	yes	no
Scotland	yes	yes	yes	no
Trinidad & Tobago	yes	yes	yes	no
USA	yes	no	yes	no[2]

notes
[1]Deaths of Canadian residents 'in major U.S. States visited by Canadians' are included in mortality statistics.
[2]If the death of a U.S. resident abroad is registered in the USA it is included

What information about the cause of injury deaths, in addition to underlying cause E-codes, is available for further analyses?

Ten countries (9 of 11 ICE-1 countries) say that they have either a legal verdict or another indication of intent (manner of death check box or text), or both, stored electronically independent of the underlying cause e-code, and available for analysis.

Fourteen countries say that they have multiple cause codes, though in several the number of conditions coded is limited to four or five in total. These are useful for

investigating differences between countries in selecting the underlying cause from all the causes mentioned on the certificate. For example, Wet ICE[9] has used these data to explore differences in deaths from drowning.

Table 12

Country	Verdict	Manner of Death	Narrative	Autopsy	Multiple cause codes
Israel	No	No	No	No	No
Saint Lucia	No	No	No	No	No
Norway	Yes	Yes	No	Yes	No
Canada	Yes	Yes	Yes	Yes	No
Belize	No	No	No	No	Yes
Dominica	No	No	No	No	Yes
Jamaica	No	No	No	No	Yes
Scotland	No	No	No	No	Yes
Trinidad & Tobago	No	No	No	No	Yes
France	Yes	Yes	No	No	Yes
England & Wales	Yes	Yes	Yes	No	Yes
Australia	Yes	No	No	Yes	Yes
Denmark	No	Yes	No	Yes	Yes
Netherlands	No	Yes	No	Yes	Yes
Guyana	No	No	Yes	Yes	Yes
New Zealand	Yes	No	Yes	Yes	Yes
USA	No	Yes	Yes	Yes	Yes
Sweden	Yes	Yes	Yes	Yes	Yes
	Verdict	**Manner of Death**	**Narrative**	**Autopsy**	**Multiple cause codes**
Number of countries with item available	7	8	6	9	14

Though nine countries have some record of autopsy available for analysis, in most of these it is only whether an autopsy was performed, or whether information from it was used in certifying the cause of death. New Zealand and some parts of Australia have much more detail of autopsy findings available for analysis on some or all injury deaths.

Free text from the cause of death and /or description of how the injury occurred ('narrative') has been used in several countries to improve the detail or accuracy of their

own data (for example finding deaths from poisoning with a particular drug,[7] deaths where drowning was mentioned but not assigned as the underlying cause,[9] and cases where tractors[11] or machinery were mentioned). However, some research is needed on how best to use stored narrative information to improve comparability.

Where do we go from here?

We have shown that there are substantial differences in the ways in which injury mortality rates are arrived at in the countries participating in the ICE on injury statistics. We have not yet measured the size of these effects, or how far they might bias comparisons of injury mortality between countries.

The answers to our questionnaires suggest that we could calculate more comparable injury mortality rates across participating countries. Additional information, which we already collect in our national registration systems, could be used to extract comparable data sets in each country.

Recommendations on how the ICE on Injury could produce more comparable injury mortality rates for participating countries include:

Define a uniform set of inclusion and exclusion criteria for deaths

- All injury deaths which occur in the country
- Residents and non-residents identified separately
- [probably not possible to get data from all countries on deaths of their residents abroad]

Agree denominators – resident population

Improve completeness and accuracy

- Include deaths registered too late for inclusion in publications
- Use latest amended cause of death
- Identify 'unknown cause' deaths which may be injury deaths

Make use of additional variables which are available

- Manner of death/verdict
- Multiple cause codes
- Uses of Literal text and narrative text needs to be explored
- Autopsy

Recalculate comparable 'best estimates' for participating countries of

- Total injury mortality rates
- Mortality rates for specific mechanisms and intents
- Including deaths of resident population in home country only
- And including deaths of non-residents

References

1. Smith GS, Langlois JA and Rockett IRH. International comparisons of injury mortality: Hypothesis generation, ecological studies and some data problems. Proceedings of the International Collaborative Effort on Injury Statistics Volume I; National Centre for Health Statistics, Hyattesville, MD (DHHS Publication No. (PHS) 95-1252), 1995; 13:1-15.

2. Rockett IRH and Smith GS. Suicide misclassification in an international context. Proceedings of the International Collaborative Effort on Injury Statistics Volume I; National Centre for Health Statistics, Hyattesville, MD (DHHS Publication No. (PHS) 95-1252), 1995; 26:1-18.

3. Rooney C. Differences in the coding of injury deaths between England & Wales and the United States. Proceedings of the International Collaborative Effort on Injury Statistics Volume II; National Centre for Health Statistics, Hyattesville, MD (DHHS Publication No. (PHS) 96-1252), 1996; 15:1-23.

4. Devis T and Rooney C. The time taken to register a death. *Population Trends* 88, pp 48-55, Summer 1997.

5. Lecomte D, Hatton F, Renaud G, et Le Toullec A, Les suicides en Ile-de-France chez les sujets de 15 a 44 ans; resutats d'une étude coopérative. Bulletin épidémiologique hebdomadaire 2, pp 5-6, 1994.

6. Fingerhut L, Cox C and Warner M, International Comparative analysis of injury mortality: Findings from the ICE on Injury Statistics. NCHS Advance Data No 303, October 1998. NCHS, CDC, U.S. Department of Health and Human Services.

7. Christophersen C, Rooney C and Kelly S. Drug related mortality: methods and trends. *Population Trends* 86, pp 29-35, Winter 1996.

8. Rooney C and Devis T. Mortality trends by cause of death in England and Wales 1980-94: the impact of introducing automated cause coding and related changes in 1993. *Population Trends* 86, pp 29-35, Winter 1996.

9. Smith GS and the WET ICE collaborative Group. International Comparisons of Injury mortality databases: evaluation of their usefulness for drowning prevention and surveillance. Proceedings of the International Collaborative Effort on Injury Statistics Volume II; National Centre for Health Statistics, Hyattesville, MD (DHHS Publication No. (PHS) 96-1252), 1996; 6:1-29

10. Smith GS and the WET ICE collaborative Group. International Comparisons drowning mortality. Proceedings of the International Collaborative Effort on Injury Statistics Volume III; National Centre for Health Statistics, Hyattesville, MD

11. Stout N, Jenkins EL. Use of narrative text fields in occupational injury data. Proceedings of the International Collaborative Effort on Injury Statistics Volume I; National

Centre for Health Statistics, Hyattesville, MD (DHHS Publication No. (PHS) 95-1252), 1995; 24:1-4.

Acknowledgements

We would like to thank all of the ICE participants, and their colleagues in national vital statistics offices, who commented on and piloted early versions of the questionnaire, and who completed the final questionnaires. Special thanks are due to Yvette Holder, who completed questionnaires for six countries in the Caribbean, demonstrating remarkable knowledge and patience.

The transition to ICD-10: Implications for injury mortality research

Lois A. Fingerhut,* Kenneth D. Kochanek* and Harry M. Rosenberg*

*National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), Hyttsville MD

The Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems, ICD-10, was first used for the coding of national mortality data in 1994. The United States began coding its national mortality data using ICD-10 in data year 1999, with the first available mortality statistics being published likely by the end of the year 2000. Major changes have been made from ICD-9 to ICD-10 in terms of both external cause of injury codes as well as injury diagnosis codes. In many ways, the injury chapters in ICD-10 are more like a new classification system rather than an update of ICD-9.

To illustrate:

1) The external cause of injury codes are no longer a supplementary chapter of the ICD as they were in ICD-9;

2) All chapters are divided into an alphanumeric coding scheme of one letter and two numbers at the 3-digit level with decimal subdivisions for the 4th digit. Injury diagnostic codes are found in Chapter 19 and are prefaced with letters S and T- thus, the use of the commonly used "N" code for nature of injury must be avoided lest is be confused with chapter on diseases of the genitourinary system that begin with the letter N. Similarly, external causes of injury are found in Chapter 20 and use letters V, W, X and Y- and thus are definitely not "E-codes"[E is found in the chapter for endocrine, nutritional and metabolic diseases];

3) ICD-9 was often criticized for its single axial approach to external causes of injury and not effective for injury prevention initiatives. As a result, the codes in ICD-10 are now multi-axial in concept, in that there are requisite codes for injury incidents for place of occurrence and for activity the victim was involved in when the death occurred;

4) The letter "V" is used for transportation related injuries with the first subdivisions, i.e., being for the victim's mode of transport (for example, pedestrian, occupant, pedal cyclist); the third character identified the victim's counterpart or the circumstance of the accident (collision with vehicle, non-collision). The fourth character identifies the activity of the victim (driver, passenger) and whether the incident occurred in traffic or a non-traffic situation. Realize how different this is compared with ICD-9 when the first piece of information is the vehicle and whether the incident was traffic-related or not....and only at the decimal place do we know if the person is the occupant of a car, mc, pedestrian or pedal cyclist;

5) "Fracture not otherwise specified" was classified with falls in ICD-9 but in ICD-10 is classified with "exposure to unspecified factors". Falls are also still problematic because of their specified exclusions- fall from an animal is a transportation code;

6) Late effects codes are now combined in one section rather than being placed with relevant sections of unintentional, suicide or undetermined intent;

7) New to ICD-10 are the optional activity codes describing what the person was doing prior to death;

8) The major subdivisions for diagnosis codes are by body part rather than by type of injury (as in ICD-9). For example, they are for head, neck, hip and thigh, knee and lower leg- rather than fracture, open wound, or superficial injury. Each of these categories are specified with body part.

Following are examples of how codes in ICD-10 should be read, of how ICD-10 differs from ICD-9 and examples of problems introduced with this revision of the ICD.

The ICD-10 is copyrighted by the World Health Organization (WHO) which owns and publishes the classification. WHO has authorized the development of an adaptation of ICD-10 for use in the United States for U.S. government purposes. As agreed, all modifications to the ICD-10 must conform to WHO conventions for the ICD. Except in rare instances, no modifications have been made to existing three-digit categories and four-digit codes, with the exception of title changes that did not change the meaning of the category or code.

In both ICD-10 and 10 CM injury diagnosis codes are found in Chapter XIX with leading alpha characters S & T

S codes
Injuries related to a single body region

T codes
Injuries to multiple or unspecified body regions, poisoning and certain other consequences of external causes

Injury diagnosis codes restructured according to body region first

▪ Head	S**0**0 - S09
▪ Neck	S**1**0 - S19
▪ Thorax	S**2**0 - S29
▪ Abdomen, lower back, lumbar spine and pelvis	S**3**0-S39
▪ Shoulder and upper arm	S**4**0-S49
▪ Elbow and forearm	S**5**0-S59
▪ Wrist and hand	S**6**0-S69
▪ Hip and thigh	S**7**0-S79
▪ Knee and lower leg	S**8**0-S89
▪ Ankle and foot	S**9**0-S99

and then according to nature of injury

3rd character

- 0 Superficial injuries
- 1 Open wounds
- 2 Fractures
- 3 Dislocations and sprains
- 4 Injuries of nerves
- 5 Blood vessels
- 6 Muscle and tendon
- 7 Crushing injury
- 8 Traumatic amputation
- 9 Other and unspecified injuries

How to dissect an injury 'S' code

- S02.5
  - S single body region
  - 0 injury to head
  - 2 fracture
  - .5 tooth

- S21.1
  - S single body region
  - 2 injury to thorax
  - 1 open wound
  - .1 front wall of thorax

T codes

- T00-T07 Multiple body regions
- T08-T14 Unspecified parts of trunk, limb or body region
- T15-T19 Effects of foreign body -entering through natural orifice
- T20-T32 Burns and corrosions
- T33-T35 Frostbite
- T36-T50 Poisoning -drugs
- T51-T65 Toxic effects of nonmedicinal substances
- T66-T78 Other & unspec effects of external causes
- T79 Certain early complications of trauma
- T80-T88 Complications of surg and med care nec
- T90-T98 Sequelae of injuries, poisonings and other consequences of external causes

Examples of T codes

T01.0 Open wounds involving head and neck
Open wounds of sites classified S01.- and S11.-

T20 Burn and corrosion of head and neck
Includes: ear, eye with other parts of face..., nose, scalp, temple
.0 burn of unspecified degree
.1 burn of first degree
...
.7 corrosion of third degree

ICD-10 codes for Poisoning

- T36 - T50 Poisoning by drugs, medicinals and biological substances
- T51-T65 Toxic effects of substances chiefly nonmedicinal as to source
- X40 - X49 Accidental poisoning by and exposure to noxious substances
- X60 - X69 Intentional self-poisoning
- X85 - X90 Assault by drugs, corrosive substances, pesticides, gases and vapors, and by other and unspecified chemicals and noxious substances

Carbon monoxide codes ICD-9 vs ICD-10

ICD-9

- Accidental poisoning by: E868 (506 deaths in 1995)
  - .0 liquified petroleum gas (57)
  - .1 other utility gas (13)
  - .2 mv exhaust gas (234)
  - .3 cm from incomplete combustion of other domestic fuels (44)
  - .4 cm from other sources (18)
  - .9 unspecified cm (140)
- Toxic effect of cm: 986

ICD-10

- X47 Accidental poisoning by and exposure to other gases and vapours
- T58 Toxic effect of cm

for 10 CM

External causes of morbidity and mortality

- Divided into alphanumeric sections
  - V01-V99 Transport 'accidents'
  - W00-X59 Other external causes of accidental injury
  - X60-X84 Intentional self-harm
  - X85-Y09 Assault
  - Y10-Y34 Event of undetermined intent
  - Y35-Y36 Legal intervention
  - Y40-Y84 Complications of medical and surgical care
  - Y85-Y89 Sequelae of external causes
  - Y90-Y98 Supplementary factors (not for underlying cause of death)

Official list of rankable external causes of injury death in ICD-10

Accidents	V01-X59,Y85-Y86
Intentional self-harm (suicide)	X60-X84, Y87.0
Assault (homicide)	X85-Y09, Y87.1
Legal intervention	Y35,Y89.0
Operations of war and their sequelae	Y36, Y89.1
Complications of medical and surgical care	Y40-Y84, Y88

Place of injury codes for W00-Y34 except Y06 and Y07 (neglect and maltreatment)

- Separate field for mortality / Extra digit for morbidity record
  - 0 Home
  - 1 Residential institution
  - 2 School, other institution and public admin. area
  - 3 Sports and athletic areas
  - 4 Street and highway
  - 5 Trade and service area
  - 6 Industrial and construction area
  - 7 Farm (not home or premises of home)
  - 8 Other specified
  - 9 Unspecified

Optional Activity codes for use in a supplementary character position with codes V01-Y34

- Separate field on mortality record indicating:
  - 0 While engaged in sports activity
  - 1 While engaged in leisure activity
  - 2 While working for income
  - 3 While engaged in other types of work
  - 4 While resting, sleeping, eating or other vital activities
  - 8 other specified activities
  - 9 unspecified activity
- Information will come from text item on death certificate: "describe how injury occurred"
- Quality of codes will be evaluated for data year 1999

V codes- transport accidents generally 4 characters with V as the 1st

- Codes relating to land transport accidents- V01-V89 reflect **first** the victim's **mode of transport (pedestrian, pedal cyclist, car occupant**, etc)
- Codes are further subdivided to identify the victim's **counterpart** or type of event (pedestrian injured in collision **with bus**)
- Lastly, codes are divided into traffic, nontraffic, driver, passenger, person alighting or boarding, or unspecified

V codes- transport accidents Person injured is the 2nd character

- V**0**1-V09 Pedestrian
- V**1**0-V19 Pedal cyclist
- V**2**0-V29 Motorcycle rider
- V**3**0-V39 Occupant of 3-wheeled mv
- V**4**0-V49 Car occupant
- V**5**0-V59 Occupant of pick-up truck or van
- V**6**0-V69 Occupant in heavy transport vehicle
- V**7**0-V79 Bus occupant
- V**8**0-V89 Other land transport

3rd character following V (as appropriate) 4=car occupant

for example, V40-V49

- 0 In collision with pedestrian or animal
- 1 In collision with pedal cycle
- 2 In collision with 2 or 3 wheeled mv
- 3 In collision with car, pick-up, or van
- 4 In collision with heavy transport vehicle or bus
- 5 In collision with railway train
- 6 In collision with other nonmotor vehicle
- 7 In collision with fixed or stationary object
- 8 In noncollision transport accident
- 9 In other and unspecified transport accidents

4th character (as appropriate) V44.5 (car occupant injured in collision with heavy transport vehicle or bus)

- 0 Driver injured in **nontraffic** accident
- 1 Passenger injured in **nontraffic** accident
- 2 Person on outside of vehicle injured in **nontraffic** accident
- 3 Unspecified bus occupant injured in **nontraffic** accident
- 4 Person injured while boarding or alighting
- 5 Driver injured in **traffic** accident
- 6 Passenger injured in **traffic** accident
- 7 Person on outside of vehicle injured in **traffic** accident
- 8 Occupant [any] in other specified transport accident
- 9 Unspecified bus occupant injured in **traffic** accident

Complexity of comparing ICD-9 to ICD-10: Motor vehicle traffic codes

- In 1995, the single most common E-code for mv traffic deaths was **E812.0** (19% of all mvt deaths)
- In ICD 10 there are **23 V** codes that E812.0 translates to including:
  - V32.5,V33.5,V39.4
  - V42.5,V43.5,V44.5,V49.4
  - V52.5, V53.5,V54.5,V59.4
  - V62.5,V63.5,V64.5,V69.4
  - V72.5,V73.5,V74.5,V79.4
  - V83.0,V84.0,V85.0,V86.0
- However, these V codes translate to other ICD-9 codes as well

V90-V99

- V90-V94 Water transport
  - 4th digit identifies vessel type
- V95-V97 Air and space transport accidents
  - 4th digit identifies type of aircraft, nonpowered craft and other specified
- V98-V99 Other and unspecified
  - for example, ski-lift, cable car

W00-Y05
New "problems introduced"

- **Firearm codes are less specific in ICD-10**
  - In ICD-9, there are separate codes for handguns, shotguns, hunting rifle, military firearms
  - In ICD-10 rifle, shotgun and larger firearms are combined

W00-Y05
New "problems introduced"

- Falls
  - E887 fracture, not otherwise specified has no comparable code in ICD-10. The only mappable code is X59- Exposure to unspecified factor
  - While the injury community doesn't recommend including E887 with falls, many nevertheless do

So.....

- No more E codes
- Instead there are V, W, X and Y codes
- No more N codes
- Instead there are S and T codes
- Codes for transportation related injuries are very different
- More extensive place and activity codes
- Official leading causes of injury death have changed

ICD-10-CM

Donnamaria Pickett*

*Medical Systems Administrator, National Center for Health Statistics, Center for Disease Control and Prevention, Hyattsville, MD

In September 1994 NCHS awarded a contract to the Center for Health Policy Studies (CHPS) to evaluate ICD-10 focusing on the suitability of ICD-10 as a statistical classification for morbidity reporting in the U.S., specifically emphasizing comparisons with ICD-9-CM. The initial purpose of this comprehensive evaluation was to:

- verify whether ICD-10 was a significant enough improvement over ICD-9-CM to warrant its implementation for morbidity reporting in the U.S.
- develop recommendations to improve ICD-10 and to correct any problems identified during the course of the evaluation.
- develop a revised index and a crosswalk

The Technical Advisory Panel (TAP) convened under the contract consisted of 20 members representing a broad cross-section of the health care and coding community: federal members (HCFA, NCHS [Office of Analysis and Epidemiology and the Division of Vital Statistics], Agency for Health Care Policy and Research); classification experts; hospital representatives; and physician representatives. Considerable effort, from a diverse group of knowledgeable classification experts, was necessary to ensure that the results of the ICD-10 evaluation and the recommendations for clinical modification meet or exceed the high standards of previous revisions, adaptations, and modifications.

The TAP, in conducting the U.S. evaluation recognized the many advantages of the ICD-10 structure over ICD-9-CM, but also were cognizant of some deficiencies as a morbidity classification. These deficiencies included: the continued use of the dagger and asterisk convention (this convention was modified in ICD-9-CM by introducing combination codes for many conditions--the dagger asterisk was never introduced in the U.S. with the implementation of ICD-9-CM); the need to return to the level of specificity implemented in ICD-9-CM; the need to facilitate Alphabetic Index use to assign codes; need to modify code titles and language to enhance consistency with accepted U.S. clinical practice; the need to remove codes unique to mortality coding, those designed specifically for the needs of emerging nations.

The TAP concluded that there were compelling reasons for recommending an "improved" (clinical modification) version of ICD-10 (ICD-10-CM) which would overcome most of the limitations. Therefore, the TAP strongly recommended that NCHS proceed with implementation of a revised version as soon as possible, stating:

> "ICD-10-CM represents a significant improvement in the clinical specificity, ease of use, and accessibility over both ICD-10 and ICD-9-CM. Hence, we make the strongest possible recommendation that the ICD-10-CM Tabular List and Alphabetic Index be adopted and implemented as the standard U.S. classification as soon as practical."

Following receipt of the final report, NCHS staff began further evaluation of the draft of ICD-10-CM developed under the contract. This second phase builds upon the completed evaluation study and the draft of ICD-10-CM. The focused reviews have concentrated on the following areas: (1) evaluation of residual categories ("Other") to determine whether further specificity is needed; (2) further evaluation of ICD-9-CM expansions that may not have achieved the desired effect or may require revision because of new data needs (e.g., insulin maintenance in non-insulin-dependent diabetes mellitus); (3) review of previous ICD-9-CM Coordination and Maintenance committee recommendations that could not be incorporated into ICD-9-CM due to space limitations; and (4) further evaluation of ICD-10 categories that may not have the desired specificity to provide information for ambulatory and managed care encounters, clinical decision-making and outcomes research. These areas are important to ensure the practical utility of a classification that is used for multiple morbidity applications.

During this second phase of modifications we have worked closely with speciality societies, to ensure clinical utility. We have held discussions and meetings and received comments from a number of medical clinical specialty groups and organizations. To date we have worked with the American Academy of Pediatrics, the American Academy of Neurology, the American College of Obstetricians and Gynecologists, the American Urological Association, the National Association of Childrens Hospitals and Related Institutions, the American Burn Association, the Burn Foundation, the National Center for Injury Prevention and Control, the Office of Analysis and Epidemiology, the National Center for Infectious Diseases, the ANSI Z16.2 workgroup, the American Psychiatric Association, the American Academy of Dermatology, the CDC Diabetes Program, and the VA's National Diabetes Program, to discuss specific concerns or perceived unmet clinical needs encountered with ICD-10-CM. We have also had preliminary discussions with other users of the classification, specifically nursing, rehabilitation, primary care providers, NCQA, and the long-term care, home health care and managed care organizations to solicit their comments about the classification.

The major modifications to ICD-10-CM include: combining of dagger/ asterisk codes; the addition of sixth character; incorporation of common 4th and 5th digit subclassifications; plan for full code titles; laterality; creation of combination diagnosis/symptoms codes; reassignment of certain categories to different chapters; deactivation of procedure codes; deactivation of "multiple" codes; and further expansion of post-operative complication codes. Additionally, ICD-10-CM remedies many cumbersome classification dilemmas that have impaired ICD-9-CM, such as a major expansion in the chapter dealing with Factors Influencing Health Status and Contact with Health Services (Z codes) and the musculoskeletal chapter (M codes).

Modifications to the injury chapter include expansion of detail at open wounds and superficial injuries to provide greater specificity: open wounds have been expanded to individually identify lacerations with foreign body; lacerations without foreign body; puncture wounds with foreign body; and puncture wounds without foreign body. Similarly, detail has been added to superficial injuries to identify abrasion, blister, contusion, superficial foreign body and insect bite.

Poisonings in ICD-10-CM have been enhanced to include intent (undetermined, unintentional, intentional self-harm, assault) as a fifth digit (e.g., T39.02, Poisoning by salicylates, intentional self-harm).

In some instances, the ICD-10 has less detail than ICD-9 (and ICD-9-CM). An example of this occurs with carbon monoxide poisonings where specificity as to the source of the carbon monoxide has been omitted. In ICD-10-CM this detail has been returned, added as fourth-digit subcategory to the poisoning codes in the injury chapter (Example: T58.1, Toxic effect of carbon monoxide from utility gas).

In ICD-10, place of occurrence appears as a fourth character subdivision. In ICD-10-CM, a new three-digit code for place of occurrence has been created. This is consistent with the representation place of occurrence in ICD-9-CM (code E849). This unique three and four-digit codes allows for further expansion, where fifth digits have been added to the following subcategories: home, residential institution, school, sports and athletic area, trade/service area, and other specified place). Similarly, ICD-10's optional subclassification for activity appears in ICD-10-CM as a new three-digit category, with expansions at the fourth and fifth-digit levels.

The entire draft of the Tabular List of ICD-10-CM, and the preliminary crosswalk between ICD-10-CM and ICD-9-CM were made available on the NCHS website for public comment. All comments receive during the comment period, which began December 1997 and ended February 27, 1998. More than 1,200 comments were from 22 organizations and individuals were received during the open comment period. Forty-eight percent of those comments focused on the injury and external causes chapter.

Upon the completion of the review of the final report of the public comments NCHS will determine which comments will be incorporated into ICD-10-CM and make changes to the Tabular List. Educational materials, training programs and final crosswalks between ICD-9-CM/ICD-10-CM will be finalized after changes have been made to the Tabular List and Alphabetic Index are completed. A comparability study will also be conducted to assist users of NCHS data (NHDS, NHAMCS, and NAMCS) to discriminate between real changes in utilization by diagnosis and those changes that are artifacts of changes to the classification system. Additionally, NCHS plans to make available electronic formats as well as the traditional printed formats.

No decision has been made regarding the implementation of ICD-10-CM. The designation of standards to be used for administrative and financial transactions now falls under the Administrative Simplification provisions of the Health Insurance Portability and Accountability Act (HIPAA) and includes standards for medical/surgical code sets. The proposed notice for standards to be used beginning Year 2000, published in a proposed notice of rule making (NPRM) on May 7, 1998 has recommended the use of existing standards, namely ICD-9-CM (for diagnosis and procedures), CPT-4, HCPCS, etc. Once Year 2000 standards are approved, any subsequent recommendations to move to a new standard must go through a new cycle of public hearings, publication of an NPRM and a final notice. Once the final notice has been published, the industry will have 24 months to prepare for the actual implementation date.

Lastly, there will be no changes to ICD-9-CM on October 1, 1999. Even though the ICD-9-CM Coordination and Maintenance Committee conducted public meetings and considered approval of coding changes for FY 2000 implementation, changes to ICD-9-CM codes for FY 2000 will not occur. The Health Care Financing Administration HCFA has undertaken, and continue to undertake, major efforts to ensure that all of the Medicare computer systems are ready to function

on January 1, 2000. Changes to the classification at this time would endanger the functioning of the Medicare computer systems, and, specifically, might compromise HCFA's ability to process hospital bills. Proposals to modify ICD-9-CM presented at the public meetings held in 1998 will be considered for inclusion in the next annual update for October 2000 (FY 2001).

International Occupational Injury Mortality Comparisons

Anne-Marie Feyer*, Ann Williamson**, Nancy Stout*** and Tim Driscoll****

*New Zealand Environmental and Occupational Health Research Centre, New Zealand
**University of New South Wales, Australia
***National Institute for Occupational Safety and Health, U.S.
****National Occupational Health and Safety Commission, Australia

Statistical collections of workplace fatal injury data have a critical role to play in identifying hazards and, consequently, the most appropriate targets for prevention. They also have a critical role to play in benchmarking national occupational health and safety performance. International comparisons of such statistical collections have a major contribution to make in both of these roles. International comparisons can provide unique insights into the influence of geographic, social, economic and political factors on different hazards and how they come about. From examination of similarities and differences in the circumstances of fatal injuries between comparable countries, possible directions for prevention can be identified. For example, effective control of hazards in one of several comparable countries, identified through a low rate of fatal injury, can prompt the question: what is being done in that country that is not being done elsewhere? Thus, international comparisons have the potential to be a powerful catalyst for change: in areas where a given country's performance is poor, comparisons can stimulate change; in areas where comparisons indicate that a given country performs well, it may be possible to transfer practice to other areas. Finally, international comparisons can be very revealing about the best ways of recording, analyzing and applying surveillance data.

Despite all of these potential benefits, to date, there have been few direct international comparisons of work-related fatal injuries data. Usual practice has been to examine international published data and to simply use these to draw comparisons. This practice has serious shortcomings, however. At best, such comparisons are poor estimates while at worst they are misleading about similarities and differences between countries. Stout, Frommer and Harrison (1990), comparing Australian and U.S. fatal injury experience, highlighted the serious impediments to making accurate comparisons: differences in case ascertainment, inconsistent case definitions and inconsistent classification of occupation and industry variables making the comparison of rates very problematic. The issue then, is to undertake accurate informative comparison of work-related fatal injury experience among comparable countries, in order to harness the potential benefits that such comparisons offer.

The present project aims to compare the extent, nature, distribution and circumstances of occupational fatal injuries in three countries: the U.S., Australia and New Zealand. This presentation reports on progress of this collaborative effort to date.

Aims

To compare the patterns of occupational injury in three countries overall and by gender, age, manner of death, mechanism of injury, occupation and industry.

Method

The essential starting points for undertaking a formal international comparison study are identifying suitable countries for comparisons, and establishing the collaborative links among those countries necessary for exchange of data. For this collaboration, initial discussions were held at two international meetings, the National Occupational Injury Research Symposium (NOIRS) meeting in Morgantown in October 1997, and followed up at the occupational mortality symposium held at the 4th World Conference on Injury Prevention and Control in Amsterdam in May 1998. In addition, the custodians of the data met in Sydney in January 1998 to discuss the nature of the data available in each country and the structural impediments such as institutional agreements and data access.

Data sources

Recent data collections in Australia and New Zealand provide data comparable to the data routinely collected from vital records in the U.S. Although New Zealand and Australia currently have no on-going surveillance, both countries had recently undertaken purpose-specific studies based on vital records.

Each of the data sets are designed to be a national census of all occupational fatalities, although there are indications of underreporting in the U.S. dataset.[1,2,3,4] Both the Australian and New Zealand datasets come from Coroners' records from a period of years - four years in Australia (1989–1992 inclusive) and ten years in New Zealand (1985–1994 inclusive). The Australian data set includes cases from all states and territories. The U.S. data includes data from the on-going National Traumatic Occupational Fatality (NTOF) data set which includes all states and the District of Columbia in which the data by year and age group cover the period 1989-1992 inclusive and the data by industry and occupational group cover the years 1990-1992 inclusive. The New Zealand dataset includes all deaths nationally. The period 1989–1992 inclusive was selected as the comparison period because it is the common period available for all three datasets, but the entire ten year period is being used for the New Zealand dataset in order to increase the number of deaths available to include in the comparison.

Results

At this stage, work on achieving comparable datasets has been completed, and the results of that work are presented below.

Data comparability

Two main impediments compromised the comparability of the datasets.

1) Case classification and definition

Each of the three datasets had a number of different inclusion and exclusion criteria, so that the universe of deaths were rather differently defined in each country's data. To overcome this impediment, the same inclusion and exclusion criteria were applied to the data from each country to provide comparable final datasets for analysis. Table 1 shows the inclusion and

exclusion criteria of each of the initial datasets and those used for the final analysis. Perhaps the most significant example of difference between the datasets concerned deaths due to motor vehicle traffic crashes (MVTCs). It is well documented around the world that crashes are the leading mechanism involved in work-related fatal injuries. The Australian dataset was the most inclusive in this regard, including both those cases where the crash occurred in the course of work, and where the crash occurred in the course of commuting to/from work. The U.S. dataset included crashes during the course of work, but not commuting, and the New Zealand dataset did not include any deaths due to MVTCs. It should be noted that the absence of these data from the New Zealand dataset is not because MVTC deaths are considered non-occupational; rather, it reflects the current status of data collection there. A separate project to analyse work-related fatalities due to MVTC is about to begin in New Zealand. In the meantime, comparison of the MVTC deaths in the U.S. and Australian datasets is about to be undertaken.

Table 1: Case Selection Criteria: United States, Australia and New Zealand.

Groups	United States	Australia	New Zealand	Combined Data Set
Civilian Labor Force, > 15y	Y	Y	Y	Y
Civilian Labor Force, = 15y	N	Y	Y	N
Civilian Labor Force, < 85y	Y	Y	Y	Y
Civilian Labor Force, = 85y	Y	Y	N	N
Military personnel	N	Y	Y	N
Domestic/home duties	N	Y	N	N
Unpaid students	N	Y	Y	N
Trainees to work	N	Y	Y	N
Bystanders to work	N	Y	Y	N
Homicides	Y	Y	Y	Y
Suicides at work	Y	N	N	N
Injuries occurring during breaks	Y	Y	Y	Y
Injuries to volunteers	N	Y	Y	N
Injuries to unpaid family helpers in for-profit operations	Y	Y	Y	Y
Injuries to self employed people	Y	Y	Y	Y
Deaths occurring > or = to 1 year after the injury	Y	Y	N	N
Injuries on public highway which do not involve traffic	Y	Y	Y	Y
Traffic injuries occurring on a public road	Y	Y	N	N
Injuries occurring while commuting between home and work	N	Y	N	N

Further strategies to understanding the comparability of case definition are also being examined. Reliability of case classification based on a standard set of cases, using each country's classification criteria is also being undertaken.

2) Classification of occupation and industry

Comparison of information from specific occupation and industry groups was identified as one of the key aspects of analysis. The classifications systems for industry and occupation used for both the numerator and denominator data for each country are based on international classification systems. Despite this, there are a number of important differences between the classifications used in the three countries, even at the most aggregated levels of classification. Tables 2 and 3 provide some examples of the sort of harmonisation required to allow meaningful analysis by occupation and industry.

Table 2 shows examples of the problems of attaining compatibility of industry classification codes. It is clear that the categorisation of industry is basically the same for each country, but there are also a number of differences that required a range of strategies such as changing the coding of some categories, collapsing other categories, and if these were not possible, tolerating inconsistency between data sets for other categories.

Table 2: Examples for issues of harmonisation of industry classification between the U.S., Australia and New Zealand

INDUSTRY	*United States* SIC codes	*Australia* ASIC codes	*New Zealand* ANZSIC codes
Agriculture, Forestry & Fishing	A0 Logging not included (18..36% cases)	A0 Logging included	A0 Logging included
Mining	B1 Services to mining included but not specified	B1 Services to mining separately specified	B1 Services to mining separately specified
Manufacturing	D Logging included here	C2	C2/C3
Construction	C1	E4	E4
Transport, Storage, Communications	E4	I6	G5
Public Utilities	E4	D3	D3
Wholesale Sales	F5	F4	F4
Retail Sales	G5	G5	F4

For example, in the Australian and New Zealand collections, logging is coded in the Agriculture, Forestry and Fishing category, whereas for the U.S. collection it was coded in manufacturing. Examination of the U.S. data indicated that there were 341 cases of fatal injuries to loggers, which represented 18.36% of the Agriculture, Forestry and Fishing category for the U.S. if it had been compiled on the same basis as for the Australian and New Zealand data. Given the extent of this potential underestimate, the inconsistency needed to be overcome. It was possible to move logging in the NTOF collection into the Agriculture, Forestry and Fishing category, making all collections compatible. In contrast, in the U.S. collection, Public Utilities are coded in the same category as Transport, Storage and Communications, whereas it was coded in a separate category for Australia and New Zealand. To solve this problem, cases in the Public Utilities category were collapsed into the Transport, Storage and Communications category for Australia and New Zealand. While some categories are reasonably compatible at the two digit level of classification used thus far, it is likely that subgroups will not be entirely comparable. For example, the Mining code is inconsistent at more specific levels of classification between the three countries as in the Australian and New Zealand classification it includes an identifiable subgroup, Services to Mining, which is not separately specified in the U.S. coding system. On the other hand, it will be possible to tolerate some such inconsistencies if they are thought to reflect only a small number of cases or a relatively small number of workers. Taking Services to Mining as a case in point, preliminary examination of the Australian fatality data set indicated that there were only a small number of cases in the subgroup (4% of all Mining cases and 0.5% of the dataset) and examination of the New Zealand dataset showed that there were no cases that fell into this subcategory. In addition, the number of workers in each of these groups is not large.

Similar decisions were necessary to make occupational coding compatible between the three datasets. As shown in Table 3, it was necessary to collapse a number of categories to achieve similar classifications. For example, to achieve a reasonably comparable dataset, it was necessary to collapse Executive, Administrative and Managerial occupations with Professional Specialty and Technical occupations. Even when this was done, the classifications were not compatible as there were still a number of occupations that were in the U.S. coding, but were not included in the Australian and New Zealand codes. It was decided to tolerate these differences however, as they reflected only small numbers of cases in each collection (1.8% in Australia and 2% in New Zealand). Even where mapping across countries appeared to be reasonably consistent, grey areas still exist within classification systems. Sales occupations provide a case in point. For the U.S. classification, as Table 3 shows, some sales occupations are to be found in the amalgamated Executive, Administrative and Managerial/Professional Specialty and Technical occupations. In addition, the U.S. Sales and Service category includes a large proportion of the clerks, those who are coded as Sales Clerks (N=884, representing 51.3% of all Sales and Service deaths), which are coded in the Clerks category for Australia and New Zealand.

Table 3: Examples of issues for harmonisation of occupation classification

OCCUPATION	*United States* SOC codes	*Australia* ASCO codes	*New Zealand* ANZSIC codes
- Executive, Administrative, & Managerial - Professional Specialty - Technical, Sales & Administrative Support	1-3	1-3 *included elsewhere administrators, financial officers, funeral directors, underwriters, legal assistants, licensed practical nurses, sales occupations. (1.8% of cases)	1-3 *included elsewhere inspectors, compliance officers, adminsitrators, protective service workers, sales occupations, administrative support, investigators & adjusters, messengers (2% of cases)
Clerks	45-47	50-56,59	4
Sales & Service	50-52, 40-44	65-66,72,89	51-52

*denotes occupations that are displaced as a result of achieving compatibility with the U.S.: these occupations included in this category for U.S. data and but not included in this category for the Australian and New Zealand data.

All of the adjustments identified for classification of occupation and industry needed to be applied to both numerator and denominator data. A further complicating factor for being able to comparably manipulate the labor force (denominator) data was presented by the fact that in all cases the labor force data are collected separately by a different agency and provided in categorised form. Nevertheless, acceptable harmonisation of the numerator and denominator data for each country was achieved.

Other strategies for overcoming the problems associated with aggregated classification of occupation include examination of relatively homogenous high risk occupational groups common to each data set, and examination of mechanism of injury. Both of these comparisons are likely to yield data that are more revealing about the nature of the hazards related to occupational fatal injuries, compared with data in more coarsely defined occupational categories such as those described in Table 3.

Discussion

The collaborative effort described here underscores a number of important aspects of international comparisons of occupational fatal injury data. First, it is clear that even for apparently highly comparable datasets, considerable preparatory work is needed before meaningful analysis of the data can be undertaken. Second, it is clear that without this

preparatory work, as is the case when published data are used, comparability may be quite severely compromised.

The formal analysis of the harmonised datasets for fatal occupational injuries in the U.S., Australia and New Zealand is currently underway. The results will be submitted for publication in the refereed literature before the end of 1999. Several presentations describing the results are also planned for the proposed symposium of the International Collaborative Effort on Injury Statistics at the 5th World Conference on Injury Prevention and Control, in New Delhi in 2000.

Acknowledgements

We would like to gratefully acknowledge the contribution of our collaborators at each participating institution:

Heidi Usher, University of New South Wales;
Leigh Hendrie, National Occupational Health and Safety Commission;
Suzanne Kirsner, National Institute for Occupational Safety and Health;
Simon Horsburgh, New Zealand Environmental and Occupational Health Research Centre.

References

1. Murphy DJ, Seltzer BL, Yesalis CE. Comparison of two methodologies to measure agricultural occupational fatalities. American Journal of Public Health 1990;80(2):198-2000.

2. Russell J, Conroy C. Representativeness of the injury-at-work item on the death certificate: implications for surveillance. American Journal of Public Health 1991;81(12):1613-8.

3. Stout N, Frommer MS, Harrison J. Comparison of work-related fatality surveillance in the U.S.A. and Australia. Journal of Occupational Accidents 1990;13:195-211,

4. Stout N, Bell C. Effectiveness of source documents for identifying fatal occupational injuries: a synthesis of studies. American Journal of Public Health 1991;81(6):725-728.

Mortality Medical Data System Processing Injury Data

Donna E. Glenn*

*National Center for Health Statistics (NCHS), Research Triangle Park, NC

Thank you for inviting me to attend your meetings related to Injury Statistics. This presentation focuses on how injury information reported on a death certificate is assigned an ICD code through use of the software developed by NCHS.

During this time, I plan to:

1. Provide a description of a medical entity
2. Explain how the system assigns an entity reference number to this entity
3. Explain how ICD codes are assigned based upon entity reference numbers.

Please feel free to ask questions during my presentation. As a preview, I will review the acronyms used in our systems.

MICAR

MICAR is an acronym for Mortality Medical Indexing, Classification and Retrieval.

MICAR actually consists of 3 separate systems: 2 for data entry and 1 processing

PC-MICAR Data Entry:

Requires a trained data entry operator enters the causes of death reported on the death certificate in standardized medical terminology. In addition to entering the terms, PC-MICAR requires that the user indicate the position of the condition on the record. Training for MICAR data entry requires approximately 1 - 2 months.

SUPERMICAR Data Entry:

SuperMICAR is an enhanced version of PC-MICAR. The main purpose of this improved version of MICAR is to allow data entry operators to enter the cause of death information as it is literally reported. With essentially no translation or standardization of the input required, training is minimal. Such a literal entry system is essential to the development of an electronic death certificate system.

MICAR200:

This part of the system is the multiple cause rules application program. It automates our 2b instruction manual. MICAR validates each entry, assigns a tentative ICD code, applies any coding rules that relate one entry to another, and then produces the appropriate set of ICD codes for input to ACME.

ACME:

> ACME is an acronym for Automated Classification of Medical Entities and has been in use for over 30 years. Its primary purpose is to assign the underlying cause of death when presented with a set of multiple cause codes as input.

TRANSAX:

> TRANSAX, stands for TRANSlation of Axis. This program translates or converts the multiple cause of death data that were prepared as input to the ACME system into a form better suited for analysis.

This afternoon's discussion focuses on how the input to the ACME system is generated. Tomorrow there will be another discussion concerning how the multiple cause data can be used in analyzing injury data.

A medical entity is a word or set of words that describe a cause of death. It may be a disease, a disease process, abnormality, disorder, symptom, complications, injury, poisoning, or a mode of dying (e.g., respiratory arrest). For the purposes of MICAR data entry, it is important to consider entities as being divided into three groups: Diseases, injuries or adverse reactions cause by some external force, and description of external force causing the injury. These are refereed to as diseases, injuries, and external cause.

All disease and injuries acceptable to MICAR are stored in a large data base referred to as the MICAR Dictionary or Big Book of Deaths (the file extension BBD - for those familiar with our software). The MICAR dictionary has approximately 100,000 unique entries.

> 78% are diseases (of these 59% are neoplasms)
> 6% are injuries
> 6% are surgeries

Standardized MICAR nomenclature requires that each entity be created in the following order:

1. Acute or Chronic (includes subacute)
2. Adjectives - entered in the order reported on the certificate
3. Site - body site
4. Lead term

Typically, both diseases and injuries are reported as either one word (e.g., emphysema, burns) or a multiple words (cardiac arrest, open wound) that are adjacent to each other. With a fairly short and easy to understand set of rules and some training in medical terminology and anatomy, each medical entity can be translated into MICAR nomenclature.

The "lead term" is not necessarily a single word. The MICAR instruction manual contain a complete list of alternate lead terms. This list is predominately used with injuries. Alternate

lead terms make data entry easier and faster. For example, the following are considered to be lead terms:

blunt force injury
bullet wound
crushing injuries
incised stab wound
puncture wound

Each entity is assigned an Entity Reference Number in the MICAR dictionary. This number is a 6-digit number. There is no relationship between entity reference numbers and ICD codes. The number are totally independent.

In general, all entities have unique entity reference number. Terms may be entered using either the adjectival form or the noun form of the site. These are considered to be synonymous.

ABDOMEN TRAUMA	095709
ABDOMINAL TRAUMA	095709

However, the Latin and English form of a words are not synonymous.

RENAL CANCER	035234
KIDNEY CANCER	035142

With injuries, there are many more synonymous terms that are assigned the same ERN. The dictionary equates BLUNT TRAUMA, BLUNT FORCE and BLUNT IMPACT. For example, ERN 099135 is assigned to:

BLUNT IMPACT HEAD INJURY
BLUNT HEAD INJURY
HEAD BLUNT INJURY
HEAD BLUNT IMPACT
BLUNT FORCE HEAD INJURY
HEAD BLUNT FORCE INJURY
HEAD IMPACT INJURY
BLUNT FORCE IMPACT HEAD INJURY
IMPACT HEAD INJURY

We have automated the creation of correct MICAR nomenclatures for diseases and injuries in SuperMICAR. All of the above terms are assigned the ERN 099135 by SuperMICAR with the "formal" definition of the entries: BLUNT FORCE TRAUMATIC HEAD INJURY.

Many adjectives (such as massive or extensive) reported with diseases or injuries are frequently considered to be insignificant by the classification. For example, if EXTENSIVE HEAD INJURY is entered into MICAR, the system will assign ERN 095133 for HEAD

INJURY. These adjectives do not appear in the MICAR dictionary; however, the PC-MICAR user is instructed to enter the words in correct MICAR order. The system is designed to drop a maximum of three words while trying to match a term in the dictionary.

Unfortunately, the same adjectives may affect the code assignments for a specific group of diseases or injuries. The system is aware of these limitations and will not drop certain words if the resulting term is assigned an ICD code indicating an injury. The following terms are not dropped when the resulting term is an injury:

> BOTH, BILATERAL, MULTIPLE, UPPER, LOWER, and terms indicating a late effect code: OLD, REMOTE, HEALED.

External Causes (e.g., accidents, falls, fires) are often reported in a set of words or phrases not adjacent to one another. With external causes, the rearrangement is more difficult than with disease or injuries. The information need to form a single entity is frequently scattered and even repeated in several locations of the medical certification. Moreover, information extraneous to classification is frequently reported and easily confounded with relevant information. Because of the difficulty of interpreting external causes, a system of programmed instructions have been designed to combine the relevant information together to form a medical entity. This set of instruction are referred to as "prompts".

I have chosen one of the easier external prompts to show as an illustration:

> Ia Gunshot wound to the head
>
> How injury occurred: decedent shot himself while cleaning a hunting rifle

Accidents involving firearm, require 2 pieces of information:

1. The type weapon and
2. The circumstances

The correct external cause prompt for this entry is: I1502.

I: Firearms
15: Rifle
02: while cleaning, handling or playing with gun

This prompt is considered to be an entity and is assigned ERN 900239.

Automating the coding of the external causes is our most important challenge. The ICD-10 version of SuperMICAR does not code any external causes. We were not satisfied with the current processing so we removed it completely. We expect to implement the external cause processor within the year. Once that is accomplished, SuperMICAR should be able to code at levels equivalent to PC-MICAR with the bonus that the operator can become proficient in a few days as opposed to a few weeks.

Tentative ICD Code:

Each entity in the dictionary including the external cause prompts are assigned an ICD code. The dictionary provides space for a maximum of 3 ICD codes per entity. The majority of disease and external cause entities only have one ICD code assigned. In rare circumstances, a disease may have 2 ICD codes. However, injuries always have a minimum of 2 ICD codes. The first code is the injury code (referred to as the N-code); the second code is an assumed external cause code (referred to as the E-code). (All three ICD positions are used with entities indicating a surgery and some injuries).

LUNG STAB WOUND Other injuries of lung Assault by a sharp object	S273	X99
LUNG KNIFE STAB WOUND Contact with knife, sword, or dagger	S273	W26
LEG FRACTURE Fracture of femur, part unspecified Exposure to unspecified factor	S729	X59
In ICD-9, the default E-code for fracture was FALL,	I1502	W33

At this stage of processing, all entities, diseases, injuries, and external causes, has been assigned an entity reference number with a "default" ICD code. Any record on which one or more terms could not be assigned an entity reference number is set aside for manual coding. Records which have an ERN assigned to all term are processed through the rules application program. The ICD code from the dictionary may or may not be the best code assignment for each record. Moreover, the record may have multiple injuries; therefore, multiple external cause codes.

MICAR200 is the rules application program. This program uses the entity reference numbers to assign the most appropriate ICD code. This program automates are 2b instruction manual.

This is what I call:

Diseases that are Injuries
Injuries that are diseases
Sequella of injuries

CONDITIONS QUALIFIED AS TRAUMATIC

In ICD-10, some conditions have both a non-traumatic and traumatic code. Consider these conditions to be traumatic and code as traumatic when they are qualified as "traumatic" or they are reported as due to or with injury NOS, trauma NOS, any specified injury (injuries) or an external cause. Do not apply this instruction when the condition is reported due to a non-traumatic condition.

This rule is applied:

1. The word TRAUMATIC cannot be deleted if the resulting term is a disease. If a given term is not in the MICAR dictionary, the record will be rejected for manual review.

2. If an ERN indicating an injury is reported on a lower line, the ERN on the upper line will be converted to traumatic is the ICD provides a separate code.

Example of MICAR Decision Table

TRA14	000099	J129		PNEUMONIA
	097177	T798	X59	TRAUMATIC PNEUMONIA

Ia.	Pneumonia	000099	J189	
b	Hip Fracture	094920	S720	X59

Using the TRAUMATIC Tables, MICAR will convert the entry on line a to ERN 097177 - TRAUMATIC PNEUMONIA with ICD codes T798 X59

INTENT OF CERTIFIER

In order to arrive at the most appropriate code for a given diagnostic entity, it is sometimes necessary to take other recorded information and the order in which the entries are reported into account because the coding of information taken out of context may not convey the meaning intended by the certifier. However, do not apply provisions in ICD-10 for linking two or more diagnostic terms to form a composite diagnosis classifiable to a single ICD-10 code. The objective is to code each diagnostic entity in accordance with the intent of the certifier without combining separate codable entities.

If fracture (of any site) is reported due to specified disease, including M800 - M839, the fracture is considered to be pathological.

IC112	094920	S720 X59	HIP FRACTURE
	090096	M844	PATHOLOGICAL HIP FRACTURE

Ia	Pneumonia	000099	J189	
b	Hip Fracture	094920	S720	X59
c	Osteoporosis	090094	M819	

Using the Intent of Certifier table, the entry in line b is converted ERN 090096 - PATHOLOGICAL HIP FRACTURE with ICD code M844. In addition, the traumatic table entry used above is not longer applicable since the hip fracture is no longer considered to be an injury.

RELATING AND MODIFYING

"Injury" due to disease conditions

Consider "injury," "hematoma," "laceration," (or other condition that is usually but not always traumatic in origin) of a specified organ to be qualified as nontraumatic when it is indicated to be due to or reported on the same line with a disease that could result in damage to the organ, provided there is no statement on the death certificate that indicates the condition was traumatic. If there is provision in the Classification for coding the condition that is considered to be qualified as nontraumatic as such, code accordingly. Otherwise, code to the category that has been provided for "Other" conditions of the organ (usually .8).

ID102	095915	S268 X59	HEART LACERATION
	400119	I518	NONTRAUMATIC HEART LACERATION

Ia	Laceration heart	095195	S268 X59
b	Myocardial infarction	000092	I219

Using the Injury Due to Disease table, the entry in line a is converted ERN 400119 - NONTRAUMATIC HEART LACERATION with ICD code I518.

LATE EFFECTS:

When there is evidence that death resulted from residual effects rather than the active phase of conditions for which the classification provides a Sequela code, code the appropriate Sequela category. Code specified residual effects separately. Apply the following interpretations to the Sequela categories.

LEF01	095074	S065	X59	SUBDURAL HEMATOMA	
	214456	T905	Y86	LATE EFFECTS SUBDURAL HEMATOMA	

Ia	Subdural Hematoma	1 year	095074	S065 X59
b	Fall		900127	W19

Using the Late Effects table, the entry in line a is converted ERN 214456 - LATE EFFECT SUBDURAL HEMATOMA with ICD codes T905 Y86. In addition the external cause, FALL, is marked to be converted to LATE EFFECT code since it caused a condition with a duration of 1 year.

FINAL ICD INPUT TO ACME

After the MICAR decision tables have been applied, the final step is to write the ICD codes as input to ACME. With diseases, this is an easy process. The ERN's are converted to ICD codes

and move to the ACME input format which includes provisions for indicating the location of the entity on the certification.

Ia	Pneumonia	000099	J189
b	Hip Fracture	094920	S720 X59
c	Osteoporosis	090094	M819

J189/M844/M819

However, each injury has been assigned an external cause code in addition to the injury code. Therefore, it is necessary to determine which e-code should be used and where this e-code should be placed.

Injuries and external cause entities are assigned a weight or importance factor:

E-code — are generated through use of the prompts. These entities are the strongest conditions. The inclusion of an E-code overrides all other external cause codes.

N/E Code: Certain one-term entities state or imply cause (external code) and effect (nature of injury code).

E.G.: bite, cut, drowning, stab, sunstroke

These entities are the second strongest and will cause all other external cause code to be eliminated.

N-Codes: These are the weakest codes in terms of retaining the assumed external cause code. As note above, any other class of external cause codes will be retained before we keep an assumed e-code.

If there is more than 1 n-code, there is a rather complicated list of rules to determine which assumed e-code will be retained.

Ia	Pneumonia	T798 X59
b	Hip Fracture	S720 X59
c	Cerebral Vascular Disease	I679

T798/S720*I679 &X59

I will close my presentation with some general comments related to injuries and the ICD-10 code structure

ICD-10 T00 - T07
Injuries involving multiple body regions

In general MICAR codes individual components of all reported injuries

If Open Wounds of head and neck

MICAR will code: Head Injury S099
Neck Injury S199

T0101 Open wounds involving head with neck will not be used.

However, we have discussed applying the codes for multiple regions in the TRANSAX processing.

In addition, we do not consider the plural form of injury nor the plural form of the site to indicate multiple. When the injury is state as multiple, bilateral, both, the entity will be codes as multiple.

Fractured Hips S720 not T025

This was done for QC purposes - handwritten certificates, difficulty in reading.

Probably not a popular decision.

MICAR Dictionary - needs to be reviewed. The first step in generating the ICD-10 system was to convert the dictionary from ICD-9 code to ICD-10 codes. We were not consistent in out interpretation of the 4th digits 8 and 9. All injury codes will be reviewed before our 2000 system is released

Injury
- head S09.9
-- specified NEC S09.8

This concludes my presentation. If you would like to see the automated systems, I have them installed on my laptop.

We are now open for questions and/or comments.

Mortality Medical Data System Processing Injury Information

Donna Glenn
NCHS\RTP

- Description of Medical Entity
- Assignment of Entity Reference Number
- Assignment of ICD codes

MICAR

- Mortality Medical
- Indexing
- Classification
- And
- Retrieval

MICAR Components

- Data Entry Software
  - PC-MICAR Data Entry
  - SuperMICAR Data Entry
- MICAR200

ACME

- Automated
- Classification of
- Medical
- Entities

TRANSAX

- TRANSlation of
- AXis

Medical Entity

- Disease
- Injury
- External Cause

MICAR Dictionary or the Big Book of Death (BBD)

- @ 100,000 unique entities
- 78% Diseases
  - 59% Neoplasms
- 6% Injuries
- 6% Surgeries

Standardized MICAR Nomenclature

1. Acute\Chronic
2. Adjective(s)
3. Site
4. Lead Term

Alternate Lead Terms

- Blunt Force Injury
- Bullet wound
- Crushing injuries
- Incised stab wound
- Puncture wound

Entity Reference Number

- Synonymous
  - Abdomen Cancer 042659
  - Abdominal Cancer 042659
- Not Synonymous
  - Renal Cancer 035234
  - Kidney Cancer 035142

Synonymous Injury terms

- Blunt trauma
- Blunt Force
- Blunt Impact

ERN 099135

- BLUNT IMPACT HEAD INJURY
- BLUNT HEAD INJURY
- BLUNT HEAD IMPACT
- BLUNT FORCE HEAD INJURY
- BLUNT FORCE IMPACT HEAD INJURY
- IMPACT HEAD INJURY

Drop Words

- Massive
- Extensive
- Poorly Controlled
- Advanced Effects
- Approximately
- Terminal Stage
- Irreversible
- Controlled

Cannot be Dropped With Injury

- Both
- Bilateral
- Multiple
- Upper
- Lower
- Terms indicating Late effects
  - old, remote, healed, etc.

Death Certification

- Ia Gunshot wound to the head

- How Injury Occurred:
  - decedent shot himself while cleaning a hunting rifle

External Cause Prompts

- I Firearms
  - Type of Weapon
    - 05 Pistol
    - 10 Shotgun
    - 15 Rifle
  - Circumstances
    - 01 Playing Russian Roulette
    - 02 While cleaning, handling, playing with gun

MICAR Dictionary

099189	Lung Stab Wound	S273 X99
099188	Lung Knife Wound	S273 W26
094971	Leg Fracture	S729 X59
I1502	(prompt)	W33

MICAR200:

Rules Application Program

MICAR200

- Disease that are Injuries
- Injuries that are Diseases
- Sequella of Injuries (and External Causes)

Qualifying Conditions as Traumatic

- Reported as traumatic
- Reported DUE TO or with an injury or external cause

MICAR Decision Table

Table: TRA14

Input: 000099 J129
Pneumonia

Result: 097177 T798 X59
Traumatic Pneumonia

Medical Certification

Ia	Pneumonia	000099	J189
b	Hip Fracture	094920	S720 X59

Ia	Traumatic Pneumonia	097177	T798 X59
b	Hip Fracture	094920	S720 X59

Intent of Certifier

- Using other information and the order in which entries are reported to convey the meaning intended by the certifier
  - Fractures reported due to specified disease imply a pathological fracture

MICAR Decision Table

Table: IC112

Input: 094290 S720 X59
Hip Fracture

Result: 090096 M844
Pathological Hip Fracture

Medical Certification

Ia	Pneumonia	000099	J189
b	Hip Fracture	094920	S720 X59
c	Osteoporosis	090094	M819

Ia	Pneumonia	000009	J189
b	Path. Hip Fracture	090096	M844
c	Osteoporosis	090094	M819

Relating and Modifying

- Injury Due to disease condition
- Consider injury, hematoma, laceration - non traumatic if reported due to a disease that could result in damage to the organ

MICAR Decision Table

Table: ID102

Input: 095915 S268 X59
Subdural Hematoma

Result: 400119 I518
Nontraumatic Heart Laceration

Medical Certification

Ia	Laceration Heart	095195	S268 X59
b	Myocardial Infarction	000092	I219

Ia	Nontraumatic Heart Laceration	400119	I518
b	Myocardial Infarction	000092	I219

Late Effects

- Death resulted from residual effects rather than active phase
- Classification provides a Sequela code
- Code residual Effects separately

MICAR Decision Table

Table: LEF01

Input: 095074 S065 X59
Subdural Hematoma

Result: 214456
Late Effects Subdural Hematoma

Medical Certification

Ia	Subdural Hematoma	1 year	
	095074	S065 X59	
b	Fall	900127	W19

Ia	Late Effect Subdural Hematoma	214456	T905 Y86
b	Fall	900127	W19

Set flag to convert E-code to Late Effects

Final ICD: Input to ACME

Ia	Pneumonia	J189
b	Hip Fracture	M844
c	Osteoporosis	M819
II	Cerebral Vascular Disease	I679

J189/M844/M819*I679

Classification of Injuries

- E-Code Prompt
- N\E Code — Imply Cause (E-code) and Effect (N-code)
- N-Codes — Assumed Cause

Final ICD: Input to ACME

Ia	Pneumonia	T798 X59
b	Hip Fracture	S720 X59
II	Cerebral Vascular Disease	I679

T798/S720*I679 &X59

ICD-10: T00 - T07
Injuries Involving Multiple Body Regions

T01.0	Open wounds involving head with neck
S09.9	Head Injury
S11.9	Neck Injury

ICD-10: T00 - T07
Injuries Involving Multiple Body Regions

Multiple Hip Fractures	T025
Fracture Both Hips	T025
Fractured Hips	S720

MICAR Dictionary: Problems

ICD Index Entry

Injury
- Head S09.9
- - specified NEC S09.8

For 2000 system, review all codes for injuries

Mortality Medical Data System Processing Injury Information

Donna Glenn
NCHS\RTP

The End

Morbidity issues in registration of injuries

Branko Kopjar, MD, MS, PhD*

*Department of Disease Prevention, National Institute of Public Health, Oslo, Norway

Injuries are a major public health problem around the globe. The consequences of injuries are primarily documented in a significant mortality. In addition to mortality, the burden of injury is evident by a large number of non-fatal injuries. Burden of non-fatal injuries is in high costs of treatment and rehabilitation, short and long term dysfunction and impairments, lost productivity, and quality of life loses.

Definition

Injuries occur in a wide range of severity levels, from trivial injuries that majority do not notice and do not call an injury to a severe life-threatening multiple trauma patients. There is no clear cut-off point for what severity should be counted as injury. In practice, one uses two approaches. The first is to count as injury all events resulting in contact with health services. This approach is common in injury surveillance systems operating on hospital or community levels. Examples are European Home and Leisure Injury Surveillance System (EHLASS), National Injury Surveillance System in Australia, injury registration in Victoria, Australia, Norwegian National Injury Register. The second approach is to include also injuries that result in activity limitation, but not necessarily in the contact with health services. Such definition of injury is usually applied in surveys of health status in the population. Usually one applies a cut-off point for the duration of the limitation (e.g., half-a-day limitation in performing usual activities). Example is the National Health Interview Survey in the U.S.
Further differences exist in definition of injury. For example, back pain is usually not considered an injury in Europe but it is in the U.S.

Based on these variations, the reported rates of injuries vary among the countries. The most commonly reported overall rates are between 10-20 injury events per 100 population annually.

Level of care

Injuries can be treated at various levels of health services. A smaller portion of injuries is treated on in-patient basis. In majority of the health care systems acute care hospitals operate ERs that treat injuries on outpatient basis. Some health care systems operate also emergency clinics in communities that usually treat injuries of light to medium severity. How large number of injuries is treated in physician offices varies among the health care systems. In some systems this may represent a large portion, in others it is minimal. In addition to patients that present with injuries, a portion of patients can make only a phone consultation. This is often a case with poisoning. Finally, a portion of minor injuries is self-treated or not treated.

Data sets

Data sets on injuries are health care data and other data sources.

Health care data are usually viewed as the most reliable source of information on injuries. There are several different sources of health care data on injuries. Hospitals discharge registers are relatively uniform source of data based on the common core elements (e.g., age, sex, and date of admission, nature of injury). To varying degree these data also include information about the external cause of injury (E-codes). Discharge registers are administrative sources of data and their quality is questionable. More information is often available in medical records. The limitation is that these records usually require manual or semi-manual search for the information and are therefore less available. Other types of health services data exist in different systems. Claims data and health plan utilization data can be a good source of information on injuries.

In addition to the health services, other sources of data on injuries are available. Most common are police reports on traffic accidents, reports on occupational injuries, school records about the injuries to students, insurance companies data on car damages and other.

Finally, data are available from various general and injury-specific surveys.

Dimensions

Injury occurs as the consequence of injury event and results in some consequences. Different types of information around injury are needed for different purposes. For prevention purposes it is the information about the circumstances of the injury event, what has happened that has caused the injury, that is the most useful.

Several dimensions and levels of details in information are used to describe injuries.

Case identification is the minimum information. *Nature of injury* is the next level of information that is often available for all cases. *Circumstances* of the event occurrence is the information collected in a specially designed surveillance systems. *Severity of injury* is measured by the AIS scale and is not routinely collected. *Utilization of care* services is at minimum provided as the level of service. Extended information includes length of stay, major surgical and medical procedures and possibly more detailed clinical utilization information. Limited information about the *consequences* of injuries is collected in the registration systems (e.g., dead and alive). More extended information requires special follow-up designs.

Purpose of the registration

Registration of injuries can be done for different purposes. General s*urveillance* is the most common purpose and is used for population health surveillance. Registration is also performed for setting up of priorities in injury prevention. Other uses are to guide prevention efforts, estimate burden of injury to communities and societies, advocacy for injury control. Finally, injury data are used for the evaluation of the interventions and other research purposes.

Circumstances of injury events

Circumstances (external causes) of injuries are collected to a various degree of details in the registration systems. There is sometimes a misunderstanding about what data on circumstances of injuries describe. It happens often that data on circumstances of injuries are assumed to describe etiologic causes of injuries. That is not necessarily the case. Etiologic causes of injuries are much more complex and consists of both external and intrinsic causes (e.g., osteoporosis). The information about the intrinsic causes are rarely routinely collected.

Use of health care utilization data

Health care utilization data such are discharge registers are the most common and easily available source of morbidity data. Limitations of such data sets should be remembered. First, these data represent a mixture of both incident and prevalent cases of injuries. Often it is difficult to differentiate between first time contacts and transferals. In many countries there are multiple providers that serve the same population making it difficult to define the denominators for the rates. Finally, changes in the health care system and medical practices affect these data.

International comparisons

What possibilities exists to use morbidity data for the international comparisons? The purpose of the international comparison is to analyze possible differences in the risk of injury in the population. This may appear a challenging task. As explained above, the information that is available is the information about the utilization of health services. Numerous other factors but the risk of injury affects these data. Examples are differences in the accessibility (e.g., health insurance coverage, physical accessibility due to distances). Cultural factors play an important role in the utilization of services. Health systems have various strategies to manage the utilization of the services. Further, coding systems and practices may differ among the systems.

These factors make it difficult but not impossible to compare injury morbidity among the countries. The possible approaches that may work is to use population based hospitalization rates for injuries. Such rates are only an indicator of injury risk in the population as they may depend on many other factors. To improve validity of the comparisons based on the hospital separation data it is needed to define indicator injuries (e.g., hip fractures). Case definition of the hospitalization should be standardized. If possible, the population rates should be derived.

In summary, morbidity data on injuries depend on many factors but injury risks. If these data should be used for the research purposes it is important to resolve several issues. Case definition should be made more precise. The purpose of the comparison should be clearly defined. The comparisons should be probably based on few indicator conditions.

Morbidity issues in registration of injuries

Branko Kopjar, MD, MS, PhD
ICE conference
Washington, DC June 2-3

Morbidity

- Non-fatal injury
  - rate of 10-20 per 100 population
- Importance of non-fatal injury
  - costs of treatment and rehabilitation
  - lost productivity
  - permanent and long term impairment

Level of care

- Treated by health services
  - in-patients (65,000)
  - ER & Emergency Clinics (400,000)
  - Other levels (???)
  - Other types of contact (e.g. phone call) ???
- Self-treated & not treated (???)

Data sets

- Health services
  - Hospital (administrative) discharge registers
  - Medical records
  - Claims data
  - Health insurer data

Data sets outside the health services

- Traffic accidents
- Occupational injuries
- School records
- Sport clubs records
- Surveys

Dimensions

- Case identification
- Nature of injury
- Circumstances of the event occurrence
- Severity of injury
- Utilization of care
- Consequences of injury
- Outcomes of care

Purpose of the registration

- Surveillance
- Setting up of priorities in injury prevention
- Guides prevention
- Burden of injury
- Advocacy
- Evaluation of interventions
- Research

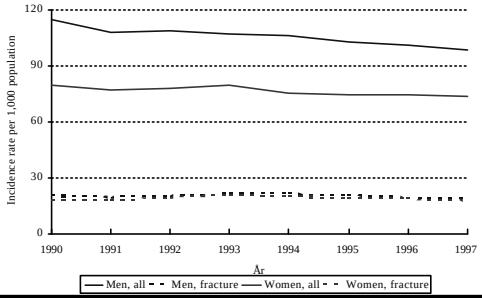
Circumstances of injury events

- Circumstances (external causes)
- Etiologic causes
  - external
  - intrinsic
- Prevention does (should) not necessarily focus on external causes

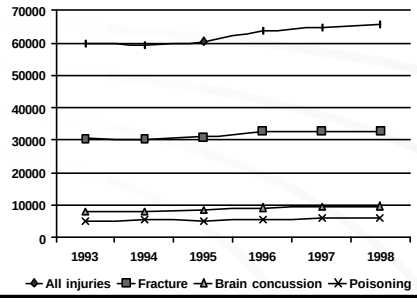
Use of health care utilization data

- Incident vs. prevalent case
- Referrals and transferals
- Re-admissions
- Denominator unknown
- Sensitive to changes in health care utilization

Incidence rate of injuries, Norway 1990-1997



Hospitalized injuries, Norway 1993-1998



International comparisons

- Risk of injury in the population
- Factors that influence utilization of health services
  - accessibility (e.g. insurance, physical accessibility)
  - cultural factors
  - utilization management
- Coding differences

Possible approaches

- Available:
  - Population based hospitalization rates
  - Other?
- Required:
  - Indicator conditions
  - Case definition
  - Population based injury incidence rates

Challenges

- Case definition
- Purpose of the registration
- Scope of the registration
- Collection of data about the cases or the exposures?
- Epidemiologists, clinicians, health services researchers

Nature -- site matrix
International comparison

Branko Kopjar, MD, MS, PhD

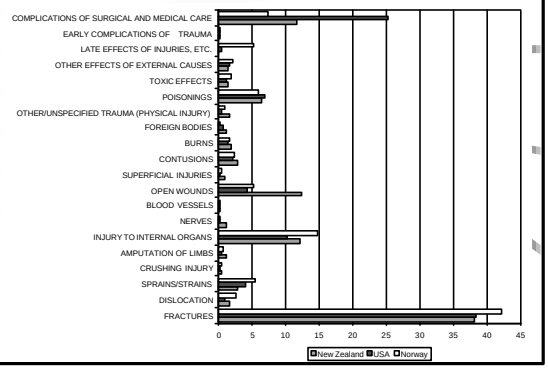
ICE conference

Washington, DC June 2-3

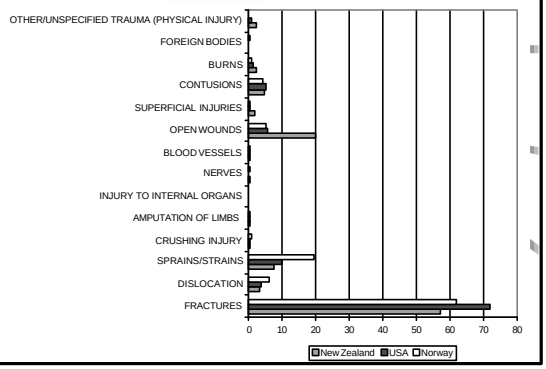
Data contributions

- US -- Ellen McKenziee
- New Zealand -- John Langley
- Norway -- Branko Kopjar

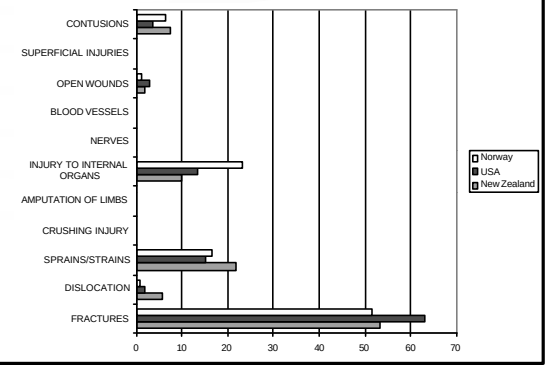
Nature of injury



Upper extremity



Spine & back



Recommendation

- Analyses appear interesting
- Expanding number of countries
- Calculating population based rates
- In-depth analyses
- Expanding to include non-hospitalized injuries

Development of a Matrix for Classifying Injuries According to their Nature and Body Region

Ellen MacKenzie* and Howard Champion**

*The Johns Hopkins School of Public Health, Baltimore, MD
**University of Maryland, Baltimore, Annapolis, MD

To facilitate uniform reporting of injuries by their nature and body region, a matrix classification of ICD-9 N-codes is proposed. The proposed grouping of ICD codes according to the two axes of the matrix (Axis A: Body Region and Axis B: Nature of Injury) is attached. These groupings were defined to be compatible with the ICD-10. Also, the groupings were defined assuming that only four digit ICD codes were available as many databases (e.g., emergency department and ambulatory care data, vital statistics and some hospital discharge data) do not use a fifth digit. A modified classification is also presented when injuries are classified using only the three digits of the ICD. More refined classifications are possible when more information (i.e., a fifth digit) is available. The proposed classification encompasses all ICD codes 800-999. For several categories (e.g., poisonings, late effects etc.), however, the two way classification is not applied or irrelevant.

Axis A: Body Region: Region Classification. Injuries are classified into the following categories using the rules accompanying the attachment:

Skull and Brain
Front of Neck (excl. Spine)
Thorax
Abdomen, incl. Pelvic Contents and Genital Organs
Spine and Back
Upper Extremity
Lower Extremity and Bony Pelvis excluding Neck of Femur
Neck of Femur
Other and Ill-Defined Body Region
Foreign Bodies
Poisonings
Toxic Effects
Other and Unspecified Effects of External Causes
Late Effects
Early Traumatic Complications
Complications of Surgical and Medical Care

Axis B: Nature of Injury: Injuries are classified into the following categories using the rules accompanying the attachment:

Fractures
Dislocations
Sprains and Strains
Cursing Injury

Amputation of Limbs
Injuries to Internal Organs (incl. CNS injuries)
Nerves
Blood Vessels
Open Wounds
Superficial Injuries
Contusions
Burns
Effects of Foreign Bodies
Injury (physical) - other and unspecified
Poisonings
Toxic Effects
Late Effects
Early Complications of Trauma
Complications of Surgical and Medical Care

In comparing this matrix to the matrix proposed from Israel by Barell and colleagues, many similarities are apparent. They both group ICD codes by nature of the injury and body region. Barell's matrix, however, relies on the coding of injuries using all five digits of the ICD-CM. The resulting matrix includes more categories and a more refined classification by both nature and body region. It cannot be used, however, when fifth digit ICD coding is not available.

With some refinement of both matrix classifications, one unified approach could be developed in such a way that the more refined classification would be collapsible into the broader categories. Then, depending on the application and the characteristics of the database available, users could choose to summarize their data using either classification while maintaining uniformity of definitions across studies and countries. Priority should be given to developing this unified approach.

In developing the matrix classification, several issues were raised that need to be discussed more broadly by the ICE committee and recommendations made to assure uniformity in the application of the matrix. A principal issue that needs to be addressed is the handling of multiple injuries within single body systems or body regions and multi-system injuries. For persons with multiple injuries to a single system, a hierarchy of ICD codes could be established to appropriately assign these individuals to one cell in the matrix. For persons with injuries to multiple body systems, similar rules could be established but may be less acceptable. An alternative would involve using the first listed diagnosis as the basis of classification. Such an approach is problematic, however, as the first listed diagnoses is used in very different ways across databases. Alternatively, the matrix could be constructed to take into account the most common patterns of multiple injury.

Also to be considered is the development of recommendations for the uniform coding and reporting of injury severity across databases. The Abbreviated Injury Scale (AIS) has become the most widely used and accepted measure of injury severity based on anatomic descriptors.[1,2] Several functions of the AIS for measuring overall patient severity across body regions have been introduced in the literature (i.e., the Injury Severity Score (ISS), the Anatomic Profile (AP) and most recently, the New Injury Severity Score (NISS)).[3,4,5] The widespread use of

these measures is constrained, however, because of the time and cost involved in AIS coding. There has long been interest in using the ICD as an alternative to AIS. Several severity classification systems based on ICD have been proposed, although controversy exists regarding their validity. One approach has been the development of a computerized mapping of ICD-9CM rubrics into AIS body regions and severity values.[6] These derived ICD/AIS values can then be used to compute ISS, AP and NISS scores. Severity scoring systems have also been derived directly from ICD coded discharge diagnoses and are therefore independent of the AIS severity classification. Most recently, Rutledge and colleagues have proposed the ICISS score which is derived by multiplying survival risk ratios (SRR) associated with individual ICD diagnoses.[7] Further work is needed to evaluate these alternative strategies so that recommendations could be forthcoming regarding their use.[8]

References

1. Association for the Advancement of Automotive Medicine. Committee on Injury Scaling. *The Abbreviated Injury Scale – 1990 Revision (AIS-90*). Des Plaines, IL, 1990.

2. MacKenzie EJ. Injury Severity Scales: Overview and directions for future research. *Amer J Emer Med* 1984;2:537-549.

3. Baker SP, O'Neill B, Haddon W and Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. *J Trauma*. 1974;14:187-96.

4. Copes WS, Champion HR, Sacco WJ, Lawnick MM, Gann DS, Gennarelli T, MacKenzie E, Schwaitzberg S. Progress in characterizing anatomic injury. *J Trauma*. 1990;30:1200-1207.

5. Osler T and Baker SP, Long W. A modification the Injury Severity Score that both improves accuracy and simplifies scoring. *J Trauma*. 1997;43:922-26.

6. MacKenzie EJ, Steinwachs DM, Shankar B. Classifying trauma severity based on hospital discharge diagnoses. Medical Care. 1989; 27:412.

7. Osler T, Rutledge R, Deis J, Bedrick E. ICISS: An international classification of disease-based injury severity score. *J Trauma*. 1996;41:380-388.

8. Sacco WJ, MacKenzie EJ, Champion HR et al. A comparison of alternative methods for assessing injury severity based on anatomic descriptors. *J Truama* (in press)

Injury Morbidity Matrix Codes for Body Region of Injury
(Axis A)

Please note: the following list can be used if ICD is coded to the 4th digit; if only 3-digit codes are available follow instructions next to **.

1. Skull and Brain: excl. face[1,2] (incl. scalp)	800-801, 803-804	
	850-854	
	873.0-873.1	** Code 873 under Other
	873.8-873.9	** Code 873 under Other
	951	
2. Face	802	
	830	
	848.0 - 848.1	** Code 848 under Other
	870 - 872	
	873.2 - 873.7	** Code 873 under Other
	910	
	918	
	920-921	
	925.1	** Code 925 under Other
	940	
	947.0	** Code 947 under Other
	950	
Head[1,2] (Skull&Brain&Face)	*800-804*	
	850-854	
	870-873	
	830	
	848.0 - 848.1	** Code 848 under Other
	910	
	918	
	920 - 921	
	925.1	** Code 925 under Other
	940	
	947.0	** Code 947 under Other
	950-951	
3. Neck [2,3,5,8]	807.5 - 807.6	**Code 807 under Thorax
	848.2	**Code 848 under Other
	874	
	900	
	925.2	**Code 925 under Other
	947.1	**Code 947 under Other

4. Thorax [4,5]	807.0 - 807.4	**Code 807 under Thorax
	848.3 - 848.4	**Code 848 under Other
	860 - 862	
	875	
	879.0 - 879.1	**Code 879 under Other
	901	
	922.0 - 922.1	**Code 922 under Other
	947.2	**Code 947 under Other
5. Abdomen, pelvic contents, genital organs	863 - 868	
	878	
	879.2 - 879.5	**Code 879 under Other
	902	
	922.2	**Code 922 under Other
	922.4	**Code 922 under Other
	926.0	**Code 926 under Other
	947.3 - 947.4	**Code 947 under Other
6. Spine and Back[6,7,8]	805	
	806	
	876 - 877	
	922.3	**Code 922 under Other
	839.0 - 839.5	**Code 839 under Other
	847	
	952 - 953	
7. Upper Extremity	810 - 818	
	831 -834	
	840-842	
	880 - 887	
	903	
	912 - 915	
	923	
	927	
	943 - 944	
	955	
	959.2 - 959.5	**Code 959 under Other

8. Lower Extremity and Bony Pelvis [6]	808	
	821-827	
	835 - 838	
	843 - 845	
	846	
	848.5	**Code 848 under Other
	890-897	
	904	
	916 - 917	
	924	
	928	
	945	
	956	
	959.6 - 959.7	**Code 959 under Other
17. (Neck of femur fracture)[9]	820	
9. Other and Ill-Defined Body Region	809	
	819	
	828	
	829	
	839.6 - 839.9	** Code 839 under Other
	848.8 - 848.9	** Code 848 under Other
	869	
	879.6 - 879.9	**Code 879 under Other
	911	
	919	
	922.8 - 922.9	**Code 922 under Other
	926.1	**Code 926 under Other
	926.8 - 926.9	**Code 926 under Other
	929	
	941-942	
	946	
	947.8 - 947.9	**Code 947 under Other
	948-949	
	954	
	957	
	959.0 - 959.1	**Code 959 under Other
	959.8 - 959.9	**Code 959 under Other
10. Foreign Bodies	930-939	
11. Poisonings	960-979	
12. Toxic Effects	980-989	

13. Other and Unspec Effects of External Causes	990-995
14. Late Effects	905-909
15. Early Traumatic Complications	958
16. Complications of Surgical and Medical Care	996-999
18. No Injury	000-799

Notes to Body Region of Injury Classification

(1) Include 804 under *Head* (instead of *Multiple Body Regions*) even though it reads: *Multiple fractures involving skull or face with other bones*: assume that principal fracture is to the skull or face.

(2) Code all injuries to blood vessels of Head or Neck (900) under *Neck*; it is not easy to distinguish whether blood vessel is part of head or neck based only on third or fourth digit of ICD

(3) Injuries to trachea (typically categorized at 4th or 5th digit) is classified under *Neck* (instead of *Thorax*)

(4) Injuries to the *trunk* unless otherwise specified are coded under *Other* since these injuries could be to the region of the thorax, abdomen or back

(5) Fx to larynx and trachea (807.5-807.6) are coded under *Neck* unless rad digit code only, then code under *thorax* and assume injury (fx) is more likely to be to ribs and /or sternum.

(6) Injuries to sacrum and coccyx are coded under *Spine* as they are typically only distinguishable form other injuries to the spine at the 4th or 5th digits.

(7) Injuries to buttock region (e.g.. 877) are coded under *Spine and Back*

(8) Injuries classified under *Neck* include only those injuries to the front of the neck or soft tissue; injuries to the neck portion of the spine are classified under *Spine and Back*

(9) Neck of femur fractures have been classified separately.

Injury Morbidity Matrix Codes for Nature of Injury
(Axis B)

1. Fractures [1,2]	800-805; 807-829
2. Dislocations	830 - 839
3. Sprains and Strains	840-848
4. Crushing Injury	925-929
5. Amputation of Limbs	885-887; 895-897
6. Injury to Internal Organs[2,3,4,5] incl. CNS injuries	860-869 850-854 952-953 806
7. Nerves [4]	950-951; 954-957
8. Blood Vessels	900-904
9. Open Wounds[3,5]	870-884, 888-894
10. Superficial Injuries	910-919
11. Contusions	920-924
12. Burns	940-949
13. Effects of Foreign Bodies	930-939
14. Other Injury - (other and unspecified)	959
15. Poisonings	960-979
16. Toxic Effects	980-989
17. Other and Unspec. Effects of External Causes	990-995
18. Late Effects of Injuries etc.	905-909
19. Early Complications of trauma	958

20. Complications of Surgical and Medical Care	996-999
21. No Injury	No diagnosis codes above 799

Notes to Nature of Injury Classification

(1) *Fractures* include skull fractures with intracranial injury; HOWEVER, if data are coded to the fourth digit; include the following codes (i.e., intracranial injuries with skull fx) under Injury to Internal Organs:

800.1 - 800.4	801.1 - 801.4
800.6 - 800.9	801.6 - 801.9
803.1 - 803.4	804.1 - 804.4
803.6 - 803.9	804.6 - 804.9

(2) *Fractures* exclude spine fxs with SCI; they are classified under *Injuries to Internal Organs;*

(3) *Injuries to Internal Organs* include CNS injuries (injuries to the brain and spinal cord); they also include injuries to larynx, trachea, pharynx and thyroid; they do NOT include injuries to internal structures of the eye, ear, and nose (these are included under *Open Wounds*);

(4) *Injuries to Nerves* exclude injuries to nerve roots to spine and spinal plexus (953) -- these are included under *Injury to Internal Organs*;

(5) *Open Wounds* includes injuries to the larynx, trachea, pharynx and thyroid; HOWEVER, if data are only coded to the fourth digit, include codes 874.0-874.5 (i.e., injuries to larynx, trachea, pharynx and thyroid) under *Injury to Internal Organs*.

The Israeli "Nature of Injury by Site" Diagnostic Matrix

V. Barell, R.J. Heruti ,* MD, A. Abargel, MD,* A. Ziv
Health Services Research Unit, Ministry of Health, Israel
*Trauma Branch, Medical Corps, Israel Defense Forces

The Israeli "Nature of Injury by Site" diagnostic matrix was developed in 1996 , in the Injury Prevention and Control Section of the Health Services Research Unit, Ministry of Health. Researchers from this department and clinical personnel from the Trauma Branch of the Israeli Defense Forces Medical Corps were instrumental in its' design.

The environment and circumstances in which this took place are highly relevant. Development occurred within the National Trauma Registry, a multi-center collaboration, aimed at assisting in the evaluation and improvement of quality of care at the individual hospital level. The registry was endorsed by the National Trauma Council which oversees trauma system development.

The criteria for registration in the Israeli Trauma Registry are: all casualty admissions to hospital, emergency department deaths, and transfers to a higher level trauma center. In other words, not the standard trauma center exclusion criteria of those survivors released before 48 or 72 hours.

At the national level, management and policy-oriented analyses of injury data were required. There was interest in obtaining information on the nature and extent of severe injury, as well as on long term morbidity, residual disability, resource allocation and cost.

The matrix was developed in order to respond to the need for a supplementary tool which would standardize queries into the data collected; questions such as the number and characteristics of patients with fractures of the acetebulum, and the patterns of injury associated with pedestrian accidents. There were queries relating to service planning, including requests for estimates of the immediate and long term outcome of eye trauma, manpower needs for orthopedic trauma, and effectiveness of triage and transfer for neurosurgical cases. Thus, the background in which our matrix was developed was a very particular one, and influenced our approach.

The purpose of the matrix was to enable easy and uniform access to patient records, grouped by clinically meaningful diagnosis, and to enable counts of the injured persons and not only of numbers of injuries. We wanted to describe case load in a manageable number of diagnostic categories. Additional aims were to enable case-mix adjustment and to identify injury profiles.

Matrix Characteristics

The matrix is ICD-9 CM based. There are 120 diagnostic cell groups, as compared with 74 diagnostic groups in the U.S. matrix, developed by MacKenzie, Champion and Cox. In response to the needs of the environment in which the matrix was developed, the Israeli matrix has 22 injury sites while the U.S. matrix has 9. The 12 nature of injury categories are equivalent in both classifications. The comparison being made between the two matrices is for

traumatic injury only, so that foreign bodies and poisoning are not included.

There is relatively easy access to detailed diagnostic cells; the matrix is flexible and is easily collapsed into larger categories and easily broken down into greater detail. Patients with burns or fractures can be identified using a complete column count. Hip fractures are a one-cell subgroup.

The Israeli matrix, designed for five ICD-9 positions (XXX.XX) for trauma registries and based on a clinical rationale, allows identification of severe injuries and surgical specialties, and in the future will, hopefully, identify patterns of injury related to disability. The U.S. matrix has been developed for a wider range of databases and is appropriate for 3 and 4 digit hospital discharge data as well.

There are, of course, great similarities in the distribution of codes in the Israeli and U.S. matrices, although the Israeli matrix is more detailed as demonstrated in the following comparison: Traumatic brain and mild brain injury were defined separately, in line with the CDC definition of central nervous system injuries, and other head injuries were categorized separately. These can all be combined and collapsed into one group. Injuries to the eye have been separated from other facial injuries. There has been a recent request to identify maxillo-facial injuries separately.

Differentiation between cervical, thoracic, and lumbo-sacral injuries to the spinal cord is an integral distinction in the Israeli matrix, while the U.S. version is not subdivided by regions.

The abdomen and pelvis are defined separately in the Israeli matrix. The pelvic ring (without the pelvic vertebrae), pelvic contents and genital organs are a separate site group; the U.S. matrix includes the pelvic ring in with the lower extremities and abdominal and pelvic injuries are jointly defined. Those are, basically, the differences between the matrices.

However, as many of the Israeli subdivisions are based on the fourth and fifth digit of the ICD code, some of the regional distinctions may be lost in redefining the diagnostic cell classification to three and four digit codes. This task remains to be done, and considerable detail may be lost in doing so.

Implementation of the Matrix

Summary and analysis of injury diagnostic data using the matrix is important. The U.S. matrix has been applied to NCHS data, using the primary diagnoses in the hospital discharge data file, i.e., one diagnosis on the hospital discharge record was selected. This may be in the first diagnosis field recorded, or the most severe according to some classification system. However, it is important to access ALL diagnoses on the record. This is the way to define injury cases and the way that we think it is appropriate to summarize injury data - regardless of whether the database is a trauma registry or a hospital discharge record. The matrix would be used to summarize all recorded injury diagnoses.

There is a problem in dealing with the first recorded diagnosis only. All cases with a specific injury are never included when using only the principal diagnosis. Any specific injury

diagnosis may appear in any position in the discharge data record, so that you never get a complete picture of any given injury. In addition, there is a lack of adherence to guidelines existing for definition of first recorded or principal diagnosis. In Israel, there is no clear guideline for definition of the principal diagnosis and, in practice, considerable variation exists. There is also the issue of assigning the principal diagnosis. It is difficult to determine in cases of an injured person who has both a brain laceration and a ruptured aorta. What is the major injury? This is a difficult question to answer.

There are a number of advantages to using multiple diagnoses. They reflect the actual injury pattern in the individual. Multiple injuries are associated with greater severity and those who use the Injury Severity Score (ISS) understand that multiple injury is at the core of the whole injury picture. Utilization of all recorded injury diagnoses promotes the identification of common profiles of multiple injuries, for example: a head-on collision between a motor vehicle and a pedestrian often results in a multiple injury pattern of injury to the head, abdomen and lower extremities.

The matrix is a tool that was developed to be used in the analysis of data and its' presentation. There are two major ways of analyzing injury data. One would be by identifying and selecting for separate analysis all persons with a particular kind of injury, such as eye trauma. Specification of the appropriate matrix cells is important so that persons with any eye diagnoses are included, regardless of other injuries. Another method of analysis, perhaps more important, is through the development of mutually exclusive categories of grouped diagnoses, so that persons are counted only once, i.e., when dealing with the distribution of injury patterns in a population.

One of our first attempts at dealing with injury diagnostic groups may be seen in Table 1. Data is based on informatiofrom the eight hospitals participating in the Israeli trauma registry for 1997 and 1998. 11.6% of the 28,108 injured persons had a traumatic brain injury as defined in the matrix i.e., any one of 32 ICD 9 CM codes. These represent about half of the deaths in the registered population. Forty percent of the population had a fracture of the upper or lower extremities: 14.3% upper, and 27.5% lower. Some casualties had fractures of both the upper and the lower extremities. It is possible to explode the categories and present subgroups on a more detailed level (Table 2). For example, among those casualties with a fracture of the face, neck, or trunk, 3.3% had a fracture of the vertebral column. 1.2% of the casualties had a spinal cord injury, and, of these, 0.3% had an injury of the C-spine. The relative proportions between the different diagnostic groups are informative.

Table 1. Persons by Diagnostic Group Trauma Registry 1997-1998

DIAGNOSTIC CATEGORY	Persons with		All	
	Single Injury	Multiple Injury	No	%
Total	20375	7733	28108	100.0
Traumatic Brain Injury (head3)	1465	1795	3260	11.6
Mild brain injury (head2)	2981	2514	5495	19.5
Fracture of Face, Neck & Trunk[1]	1299	2816	4115	14.6
Spinal Cord Injury	135	198	333	1.2
Fracture of Extremities All	8171	3091	11262	40.1
Dislocation	165	345	510	1.8
Crush	138	165	303	1.1
Internal Injuries[1,2]	359	1562	1916	6.8
Sprain & Strains All	305	529	834	3.0
Superficial Injury All	574	853	1427	5.1
Contusion with Intact Skin Surface All	1381	2229	3610	12.8
Open Wound All[2]	1941	2651	4592	16.3
Burns	1252	71	1323	4.7
Blood Vessels[2]	78	315	393	1.4
Nerves[1]	58	189	247	0.9
Fractures unspecified	3	17	20	0.1
Unspecified Injury	66	97	162	0.6

[1]not including Spinal Cord Injury Rev.
[2]not including Traumatic Brain Injury

Table 2. Distribution of Diagnoses in Injured Population Israel Trauma Registry: 1997-1998

	Number	Percent
TOTAL IN REGISTRY	28108	100.0
BURNS	1323	4.7
SUPERFICIAL, CONTUSION, SPRAINS	2355	8.4
MODERATE	19827	70.5
Extremities[1]	10691	38.0
Head/Face	5211	18.5
Thorax/Neck[2]	710	2.5
Abdomen/Pelvis	675	2.4
Unspecified	25	0.1
Multiple Moderate	2515	8.9
Head and Thorax	306	1.1
Head OR Thorax OR Abdomen AND Extremities	1528	5.4
ThoracoAbdomenal	95	0.3
Head, ThoracoAbdomenal w/wo Extremities	73	0.3
Other Multiple Injuries	513	1.8
MAJOR	4603	16.4
Head/Face	2166	7.7
Thorax/Neck[2]	938	3.3
Abdomen/Pelvis	468	1.7
Multiple Major	1031	3.7
Head and Thorax	315	1.1
Head OR Thorax OR Abdomen AND Extremities	289	1.0
ThoracoAbdomenal	176	0.6
Head, ThoracoAbdomenal w/wo Extremities	79	0.3
Other Multiple Injuries	172	0.6

[1]Including AIS $ 3 if no other body region was injured.
[2]Including Back & Trunk body regions.

Identification of persons with multiple injury and the nature of their injury pattern, is more complex. Figure 1 indicates the proportions of persons with injuries in selected diagnostic categories. Within each category, the proportion of individuals having only that injury, and those having additional injuries as well, can be seen. The latter tend to be the more severely injured, and to require multiple surgical specialties on arrival in trauma units. As seen in Table 1, fractures of the extremities were the largest group.

People with major central nervous system (CNS) injuries (here including all traumatic brain and spinal cord injuries) tend to have additional injuries as well, while casualties with minor brain injuries have fewer multiple injuries. Burns tend to occur at multiple sites. However, persons with burns tend not to have other anatomic disruptions.

There are a number of approaches to the development of mutually exclusive diagnostic groups, so that the distribution of casualties with multiple injuries can be analyzed. Profiles may be developed of combinations of diagnostic groups, priority coding may be applied, etc. One possibility, feasible if working with a trauma registry or other platform in which diagnoses are mapped into the Abbreviated Injury Score (AIS), is to use this severity score to assist in determination of major or minor injuries (Table 3). Burns were dealt with separately as they tend to be defined by depth and extent of injury, and tend not to have other types of injury. Almost all of the superficial injuries, contusions or sprains and strains tended to be mild (AIS 1 or 2) and, if no additional types of injuries were present, were also put in a separate group.

Table 3. Persons by Diagnostic Group Trauma Registry 1997-1998

DIAGNOSTIC CATEGORY &SUB-GROUP	Persons with		All	
	Single Injury	Multiple Injury	No	%
Total	20375	7733	28108	100.0
Traumatic Brain Injury (head 3)	1465	1795	3260	11.6
Mild brain injury (head 2)	2981	2514	5495	19.5
Skull Fracture	520	708	1228	4.4
Concussion	2404	1979	4383	15.6
Fracture of Face, Neck & Trunk	1299	2816	4115	14.6
Face and Trachea, Larynx (Face 1, Neck 1)	389	1138	1527	5.4
Trunk All (Neck 2, Thorax 2, Abd 2, Pelvis 1, 2, Trunk)	838	1801	2639	9.4
Column all (Neck 2, Thorax 2, Abd 2, Pelvis 2)	357	576	933	3.3
Spinal Cord Injury	135	198	333	1.2
Cervical (Neck 3)	23	49	72	0.3
Thoracic (Thorax3)	80	98	178	0.6
Lumbo Sacral (Abd 3, Pelvis 3)	32	58	90	0.3
Fracture of Extremities All	8171	3091	11262	40.1
Upper	2092	1988	4030	14.3
Lower	5912	1833	7745	27.5
Hip fracture	3295	521	3816	13.6

Major injuries had at least an AIS score of 3 or more. This kind of approach was reached after discussions with trauma surgeons, and asking them how they would describe and summarize cases with 7-9 recorded injuries. They tended to describe casualties as having a major thoraco-abdominal injury or a major brain injury, etc. Using this as an analytic approach, persons having at least one injury of AIS 3 or more were identified. After evaluation of the distribution of injuries with AIS scores of 3 or more, the 22 sites in our matrix were collapsed into 4 body regions: head (including brain), thorax, abdomen, and extremities. Multiple major injuries, or multiple trauma means that there are major injuries (AIS 3 or more) in more than one anatomic region. **[Using this definition, 3.6% of the trauma registry population had major multiple injuries. An additional 16.4% had at least one major injury in the head/brain region, the thorax or abdomen]**.

What is the next stage? First of all, the matrix and some of the diagnostic combinations used will be presented for expert review and comment. The matrix must be adjusted so that it is appropriate for hospital discharge data, that is, for 3 and 4 digit ICD codes instead of the 5 digit codes on which the work to date has been done. A lot of the specificity in detail will probably be lost and that will redefine the injury files. The iterative approach to both descriptive and analytic tasks will enable evaluation of both the relevance and the effectiveness of the "nature of injury by site" diagnostic matrix. We hope that it will improve the quality of diagnostic recording and assist in development of guidelines for the promotion of international harmonization of injury data analysis.

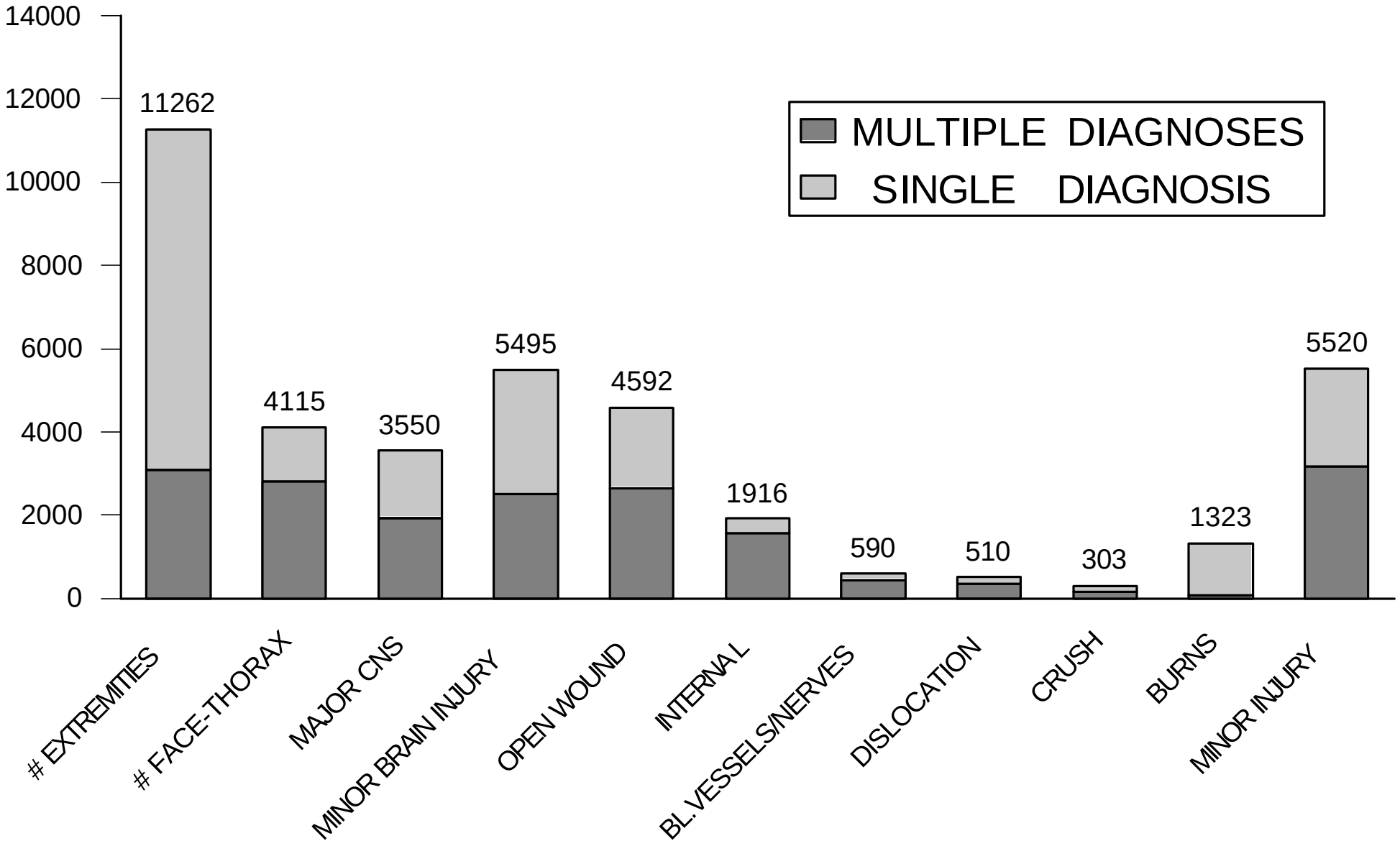
	Fracture	Dislocation	Sprain/Strain	Crush	Internal	Blood Vessels	Nerves	Open Wound	Contusion	Superficial	Burns	Unspecified
Head 1 (no TBI)	/	/	/	/	/	/	950.1-.3 950.9 951	873.0 873.1 873.8 873.9	/	/	941.x0 941.x6 941.x9	/
Head 2 (mild TBI)	800, 801, 803, 804 (.0, .5)	/	/	/	CONC 850	/	/	/	/	/	/	/
Head 3 (TBI)	800, 801, 803, 804 (.2-.4, .6-.9	/	/	/	851 854.0-.1	852-853	/	/	/	/	/	/
Neck 1	807.5-.6	/	848.2	925.2	/	9090 Incl. head and neck	957.0 Incl. head and neck 953.0 954.0	974	/	/	941.x8	959.0\Incl. face, scalp and/or neck
Neck2	805.0-.1	839.0-.1	847.0	/	/	/	/	/	/	/	/	/
Neck 3 (VC and/or SC - with SCI)	806.0-.1	/	/	/	/	/	952.0	/	/	/	/	/
Face 1	802	830	848.0-.1	925.1 INcl. face, scape	/	/	/	872 873.2-873.7	920 Incl. face, scape and/or neck	910 Incl. face, scape and/or neck	941.x1-5 941.x7 947.0	/
Face 2 (Eye)	/	/	/	/	/	/	950.0	870-871	921	918	940	/
Throax 1	807.4 flail chest; 807.0-.3	839.61 839.71	848.3-.4	926.19	861-861; 860 Pneumothorax	901	953.1	875 879.0-.1	922.0 922.1 922.33	/	942.x1-x2 947.1-.2	/
Thorax 2 (VC - no SCI)	805.2-.3 805.8-.9 (Unspecified)[1]	839.21 839.31 839.40 *1 839.49 * 839.50 * 839.59 *	847.1	/	/	/	/	/	/	/	/	/
Throax 3 (VC and/or SC - with SCI)	806.2-.3 806.8-.9 (Unspecified)[1]	/	/	/	/	/	952.1 958.8 952.0	/	/	/	/	/
Abd 1	/	/	/	/	863-866, 868	902.0-.4 902.87, .89	953.2 953.5	879.2-.5	922.2	/	942.x3 947.3	/
Abd 2 (VC - no SCI)	805.4-.5	839.20 839.30	847.2	/	/	/	/	/	/	/	/	/
Abd 3 (VC and/or SC - with SCI)	806.4-.5	/	/	/	/	/	952.2	/	/	/	/	/
Pelvis 1	808	839.69 839.79	846 848.5	926.0 926.12	867	902.5 902.81-.82	953.3	877-878	922.4 922.32	/	942.x5 947.4	

Pelvis 2 (VC - no SCI)	**805.6-.7**		**839.41-.42 839.51-.52**	**847.3-.4**	/	/	/	/	/		/	/	/	/
Pelvis 3 (VC and/or SCI - with SCI)	**806.6-.7**		/	/	/	/	/	**952.3-.4**	/		/	/		/
Upper Ext	**810-818 819 Incl. Ribs & sternum**		**831-834**	**840-842**	**927**	/	**903**	**953.4 955**	**880-884**	**AMP 855-887**	**923**	**912-915**	**943 944**	**959.2-.5**
Lower Ext.	**820 hip fracture**	**821-827**	**835-838**	**843-845**	**928**	/	**904.0-.8**	**956**	**890-894**	**AMP 895-897**	**924**	**916-917**	**945**	**959.6-.7**
Trunk[1]	**809**		/	/	**926.8-.9**	/	/	**954.1 954.8-.9**	**879.6-.7**		**922.8-.9**	**911**	**942.x0 942.x9**	**959.1**
Back[1]	/		/	**847.9**	**926.11**	/	/	/	**876**		**922.31**	/	**942.x4**	/
Unspecified	8282 multiple fractures	829 unspecified bones	**839.8-.9**	**848.8-.9**	**929**	**889**	**904.9**	957.1, 957.8-.9, 953.8-.9	**879.8-879.9**			**919**	946, 948, 947.8-.9, 949, 994.8	**959.8-.9**

[1]Included in Injury of spinal cord or spinal column.

PERSONS IN EACH DIAGNOSTIC GROUP

N=28108



HSRU - TRAUMA REGISTRY 1997-1998

Nature of Injury by Site Diagnostic Matrix:
Differences Between the Israeli and the U.S. Versions

V. Barell, R.J. Heruti ,* MD, L. Daniel-Aharonson, A Ziv, A. Abargel, MD*
Health Services Research Unit, Ministry of Health, Israel
*Trauma Branch, Medical Corps, Israel Defense Forces

The concept of the Israeli and the U.S. injury diagnostic matrices are similar as both are ICD-9 CM based and are bi-axial, with the nature of injury on one axis and indication of the body region injured on the other.

Most of the differences result from the greater classification of injury site regions in the Israeli matrix (22 sites), designed for five ICD-9 positions (XXX.XX) as recorded in the Israeli National Trauma Registry. The U.S. matrix, with 9 injury sites, has been developed for a wider range of databases and is appropriate for 3 and 4 digit hospital discharge data, but with considerable loss of detail. As a result, in the Israeli matrix, developed by Barell, Heruti et al, there are 128 diagnostic cell groups, based on a clinical rationale allowing identification of specific severe injuries and surgical specialties, as compared with 74 diagnostic groups in the U.S. matrix, developed by MacKenzie, Champion and Cox.

Neither the U.S. nor the Israeli matrices classify a number of external causes by site. Many of these are non-traumatic, systemic injuries, such as poisonings (960-979), toxic effects (980-989), and other and unspecified effects of external causes (990-995). The late effects of injuries (905-909), early complications of trauma (958) and complications of surgical and medical care (996-999) were also not classified by site. The rest of the 12 nature of injury categories are similar in both classifications. Two subset classifications are accessed separately in the U.S. matrix: amputations are a separate, independent nature of injury and hip fracture is an independent site. In the Israeli version, amputations are a subset of open wound and can be accessed separately or as part of the open wound group. Hip fracture is a subset of lower limb fractures.

The Israeli body region classification is subdivided into more detailed sites than is the U.S. matrix. As many of the subdivisions are based on the fourth and fifth digit of the ICD code, some of the site distinctions are lost in redefining the diagnostic cell classification to three and four digit codes. When regrouped, these become quite similar to those in the U.S. matrix. In the expanded Israeli version, they enable more specific questions to be asked. For example, head injuries are subdivided into 3 groups and facial injuries in 2 groups, as follows: Traumatic brain injury (further classified into definite and possible or mild brain injury) was defined in accordance with the CDC definition of central nervous system injuries[*]: other head injuries were categorized separately. These can all be collapsed into one group of head injuries. Eye injuries have been separated from those in the rest of the face.

---

*Thurman D.J., Sneizak J.E., et al. Guidelines for Surveillance of Central Nervous System Injury. Atlanta: Centers for Disease Control and Prevention, 1995

Differentiation between cervical, thoracic, and lumbo-sacral injuries to the spinal cord is an integral distinction of the Israeli matrix, while the U.S. version combines all the CNS spinal cord regions. Injury to spinal vertebra is also subdivided by regions.

The abdomen and pelvis are defined separately in the Israeli matrix: the pelvic ring (without the pelvic vertebrae), pelvic contents and genital organs are a separate site group. The U.S. matrix includes the pelvic ring in with the lower extremities and abdominal and pelvic injuries are jointly defined.

Body region is specified for burns, nerve injuries and effects of foreign bodies entering through orifice in the Israeli matrix: the U.S. matrix assigns burns for all sites in *other* and all nerve injuries to *other* body region except for those which belong to the spine, head or face. All foreign body injuries have been grouped together in the U.S. matrix. In the Israeli matrix, foreign body is assigned according to the body region of the affected orifice (not shown).

The most important conceptual difference lies in the way the matrices are used. The U.yS. example presented at the ICE meeting accesses only the first recorded or primary injury diagnosis, while the Israeli proposal accesses all diagnoses recorded on the injury report. The Israeli analytic approach enables a more complete and accurate profile of the nature and type of injuries for individual patients, as multiple diagnoses reflect the actual injury pattern in the individual. Multiple injuries are generally associated with greater severity, as is shown when using the Injury Severity Score (ISS). All cases with a specific injury are never included when using only the first recorded or principal diagnosis, as any specific injury diagnosis may appear in any position in the discharge data record. In addition, guidelines may not exist for definition of first recorded or principal diagnosis, and in practice, considerable variation exists. It is also difficult to assign one principal diagnosis: what is the major injury in an injured person who has both a brain laceration and a ruptured aorta? In any case, only one of these would be counted should only first recorded diagnosis is used.

Work remains to done to present a joint nature by site of injury diagnostic matrix which is suitable for all levels of ICD classification, as well as ICD-10 as the matrix is used in selection of different patient groups or casualty types, or in response to different analytical tasks. We believe that it will become a basic tool in clinical or epidemiological research, and promote comparability of data in widely differing settings.

Hospital Discharge National Databases Pilot questionnaire design testing and results

Pnina Zadka,* Lois Fingerhut,** Margaret Warner** and Vita Barell***

*Central Bureau of Statistics, Jerusalem, Israel
***National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), Hyattsville, MD
***Health Services Research Unit, Ministry of Health, Israel

Background

Estimating injury morbidity in non-fatal injuries, is essential in order to estimate the prevalence of severe injuries. Injury morbidity prevalence can be estimated through two main data sources; population-based surveys and health care agencies. The first step toward these data sources was to obtain information on injuries resulting in a hospital stay.

Hospital stay, unlike mortality, is dependent on the to local and national medical care delivery system, on health policy issues, registration issues and medical insurance coverage. Other factors that may affect hospitalization rates are tradition and attitudes of the medical professions as well as classification schemes and the population included in the hospitalization databases.

In order to evaluate the degree of comparability of the available national hospitalization databases, an adequate description of these databases is required. The description should cover all the issues that might distort comparability of national hospitalization rates and differences should be identified and explained in a standard format.

Format standardization may be accomplished by a constructing a questionnaire designed to evaluate comparability of national hospitalization databases in those countries participating in the ICE on Injury Statistics.

Questionnaire design

As current knowledge on the variability of the existing national hospitalization data systems is limited, it was decided that the pilot questionnaire would mainly an open ended, and ask for textual description on issues that might distort comparability i.e. a "short questionnaire with long answers".

The pilot questionnaire covered issues such as: admission policy, health insurance, data collection systems, population included and excluded from the database, criteria for inclusion, type of information included as well as definitions and classification systems (see questionnaire in appendix).

Main Issues Addressed in the Pilot

(1) Availability of national hospitalization/inpatient databases (NDB)

(2) NDB based on census or sample of hospitalizations, if based on a sample: sample type, size and design.

(3) Data sources and collection system: how is the data obtained from hospitals, a description of the reporting system, types of hospitals and/or hospitalizations which are not reported or excluded from the NDB. How are transfers within and between hospitals counted (counted as new admission). NDB based on admission or discharges. Information obtained on each hospitalization event. Possibilities of identifying re-admission. Type of medical, demographic and social data on each entity.

(4) Injury data description, type of data available on each injury such as injury event, type of injuries, external cause, place and activity, availability of narrative description on the event and the injury.

(5) Classification systems used in the NDB, for: injury, circumstances, co-morbidity etc.

(6) Number of diagnoses and procedures on each discharge included in the database.

(7) Data on the population used for calculating rates. Inclusion and exclusion of groups such as military and non-residents.

(8) Agency responsible for data collection and NDB maintenance.

(9) Agency responsible for data dissemination and publication. Type of data available to other organizations. Availability of micro-data (individual) files. Requirements for obtaining unpublished data.

Main Results from Pilot Questionnaire Testing

The questionnaire was disseminated among six countries participating in the ICE on Injury Statistics. Five countries responded and completed the questionnaire, USA, Canada, Australia, Norway and Israel.

a. Data sources

Databases are based on direct abstraction from hospital patient records in all five countries. It was not clear whether these data are obtained manually or electronically (computerized). The extent to which these are based on pre-coded forms was not clear from the responses.

b. Data collection

All five counties maintain a national database (NDB). In three of the countries; (Canada, Australia and Norway) the NDB is based on a full count of hospitalizations (census). In the U.S., the NDB is based on a probability sample and in Israel it is a combination of full count of hospitals providing computerized files and probability sample hospitals providing manual records (90% and 10% of hospitals respectively). It was not clear from the responses whether transfers are counted as separate discharges. The Canadian NDB relates only to trauma cases. The Australian NDB excludes some provinces for some of the years.

c. Type of hospitals included in the NDB

NDB in all five countries include short stay, general care and children's hospitals. Long-term care is excluded from NDB in all five countries. In the U.S., hospitals with less than six beds, military hospitals and Department of Veterans hospitals are excluded from the NDB. The definition of general care and short stay may differ from one country to another, and should be clarified.

d. Information about the hospital

This information could be an integral part of the NDB or available through a separate database that could be matched to the NDB. Information such as size (number of beds), ownership, rural/urban/inner city, average length of stay etc. are relevant in order to assure that the inclusions/exclusions are comparable. If not, their effect can be estimated.

e. Patient information

In all five countries the NDB includes patient's demographics, such as age, sex, residency status and place of residence. Length of stay and date of admission are available in all five countries. It was not clear from the responses how transfers are being reported.

In three countries (U.S., Australia and Israel) status at disposition (discharge) is reported and place of disposition if discharged alive. Diagnoses are available in all five countries NDB. In at least three countries, procedures are available as well. The number of diagnoses and procedures listed for each discharge differs between the countries and ranges from 20 in Australia to 3 in Norway.

The U.S. NDB contains information on payment source. In some of the countries this information is less relevant as they have comprehensive health insurance coverage.

f. Classification systems

In 10 years, the five countries have used five classification versions:

ICD-9	Canada Norway up to 1998
ICD-9-CM	U.S. Israel
ICD-9-CM-AU-I	Australia
ICD-9-CM-AU-II	Australia
ICD-10	Australia Norway

This inter and intra country variability contributes to the complexity of international comparisons of hospitalization rates.

g. Population Estimates

All five countries use population estimates based on residents in the country. The number of hospitalizations also includes non-residents, the latter are estimated as there are very few in all of the countries and therefor do not affect estimated rates. The U.S. uses only the civilian population in hospitalization estimates as well as in population estimates.

h. Data dissemination

All five countries produce printed publication reports. The printed reports may be available only in the native language. U.S., Canada, Australia and Israel disseminate micro-data files as well, with national confidentiality restrictions.

Conclusion of pilot

Pilot testing the questionnaire in five countries raised several issues that might induce major discrepancies in comparison of international hospitalization rates. It also raised issues that were not addressed in the questionnaire and have the potential of causing distorted international comparison. Such issues are the principal of choosing the main or first listed diagnoses; cause of admission, main condition treated etc. Currently there are no internationally accepted rules for selecting the first diagnosis in patient records (parallel to the underlying cause of death) or on the number and order for listing multiple diagnoses and there is no rule for listing relevant state-post conditions. The number and order of listing diagnoses and procedures is subject to national as well as inter-hospital and intra-hospital policies. These policies are often influenced by payment schemes and could affect the place, order and frequency for listing diagnoses and injuries on the patient record.

The differences in classification version would require extensive bridging procedures to overcome the variability and enable international comparisons.

The pilot questionnaire and comments that were made by the countries and persons completing the questionnaire raised a number of issues that should be addressed in the final questionnaire:

1. Data availability intervals; annual or periodical.
2. Type of injuries excluded from database e.g., poisoning, physiological fractures.
3. Identification of transfers between and between different departments within hospital.
4. Emergency room admissions, the criteria for inclusion.
5. Day care admissions, the criteria for inclusion.
6. Injury severity threshold for hospital admission.
7. Evaluation of coding quality.
8. Plans to implement ICD-10.

A draft report on the comparability of hospitalization NDB in the countries participating in ICE on Injuries is planned for March 2000. To achieve this goal, the following time table is planned:

1.	Comments to questionnaire from ICE participants	August 1999
2.	Updated questionnaire design	November 1999
3.	Dissemination of updated questionnaire	December 1999
4.	Receiving completed questionnaires	January-February 1999
5.	Draft summary report	March 1999

Full and timely cooperation is needed in order to achieve the goal.

Appendix

Questionnaire on Hospital Injury Morbidity Data

First Draft , November 1, 1998

Is a national estimate of inpatient injury morbidity available for your country?

If so, please provide documentation you feel would assist us in developing a more detailed questionnaire whose aim is to enumerate differences between countries that might affect comparisons of injury morbidity both in terms of numbers and rates of "hospitalizations". In addition to your written responses, please send any written documentation as well as recent tabular material on injury morbidity.

In your response, please try to address the following issues:

1. Are data based
   On a national census of hospitals?
   On a national sample survey of hospitals? (specify also size and type of sample)
   On another kind of sample?

2. What is the basic source of information?
   Patient records
   Hospital administrative records
   Patient interviews

3. How are data obtained?
   direct abstraction from patient record
   special survey/census forms used

4. How is the universe of hospitals defined?
   Inclusions
   Exclusions

5. Are there within hospital inclusions or exclusions?

6. What information can be used to "describe" the injury? What is collected, tabulated?

   Hospital characteristics
   Patient characteristics
   Injury diagnoses:

7. For injury diagnoses, what classification scheme is used?

8. How many diagnoses
   a. per recorded?
   b. Published/Tabulated?
   c. Available for analysis?

(Both external cause of injury E-codes as well as Nature of injury diagnosis?)

9. What agencies: collect, process and disseminates the data

10. What is the denominator of morbidity rates (what population is included or excluded)

11. How are data disseminated?
Reports (printed or magnetic media)
Data tapes (individual - micro)

International Comparisons of Drowning Mortality: the value of multiple cause data

G.S. Smith* and the Wet ICE Collaborative group.**

*Center for Injury Research and Policy, John Hopkins School of Public Health, Baltimore MD, USA
**Wet ICE Collaborative group: Team Leader: Gordon Smith gsmith@jhsph.edu
Henning Bay-Nielson, Ruth Brenner, Chris Cox, Lois Fingerhut, John Langley, Susan Mackenzie, Cleo Rooney, Margaret Warner. This paper reflects the opinions of the author only and not necessarily those of the group.

Introduction

Comparisons of disease rates between countries have identified wide variations in incidence between countries. Many of these differences have been found to be real and have lead to important suggestions for identifying etiological factors. However, some of these differences are due to variations in mortality coding practices between countries. Previous work, both as part of this injury, ICE and others has also identified wide variations in injury rates between countries.[1,2,3] However, questions have been raised as to whether these observed variations are due to real differences in incidence or due, in part, to differences in coding practices for injury deaths. For example, our earlier work suggested that dramatic differences in fall mortality between New Zealand and the United States may be due in large part to differences in coding injury deaths in the elderly.[4,5,6]

As part of this ICE on injury statistics, the Wet ICE Collaborative group has been using drownings as a sentinel, or tracer condition to examine in detail differences in injury rates in order to uncover potential problems, and differences in coding injury deaths between countries. Unintentional or "accidental" drowning deaths were found to vary widely between countries. However, when drownings were examined with the matrix developed to examine injuries regardless of intent, there was much less variation in rates. This suggests big differences in coding intent. For example, 40% of all drownings in England and Wales were coded as undetermined intent (E984), while only 5% were so coded in the United States and New Zealand (only 1% in Israel).[3,7,8]

Injuries may also have multiple causes that are not adequately described by single underlying causes of death. Multiple cause of death coding records all conditions listed on the death certificate. Many drowning deaths for example may be coded as due to other causes such as transportation, or falls. Our earlier work found that 17.6% of all drownings were coded with other injuries as the underlying cause.[9] In addition disease conditions may be coded as the underlying cause (UC).[10,11,12,13] WHO coding rules actually specify that drownings related to epilepsy should be coded as epilepsy rather than injury.[10] This study seeks to evaluate international differences in drowning rates and coding practices between those countries in the injury ICE that we identified with some form of with multiple cause coding.

Methods

ICD code N994.1 and drowning E-codes E830, E832, E910, E954, E964 & E984 were used to identify all drowning deaths using multiple cause of death data from England and Wales, Canada, Denmark and The United States. Free text searches for the word drown were used to identify multiple cause drownings in New Zealand.

Multiple cause data for the United States was for 1995. The same year was used for Canada, but multiple cause data was available for only 20% of all injury deaths (from certain provinces). Data for England and Wales was for 1995-97. Denmark did not have full multiple cause codes but include one primary injury (N) code only. This data was for 1994-95 and was coded using ICD-10 which we converted to ICD-9 codes for comparability. New Zealand did not use multiple cause code data, but we used their free text data for 1992-97 using the word "drown" and other possible permutations to identify drownings as described in our earlier work.[9]

Results

The traditional drowning E-codes do not identify all drownings as defined by the nature of injury codes for drowning (N991.4) or by free text search (Table 1a & b). E-codes only identified 82.4% of drownings in New Zealand and 94.0% in England. In England, 35.5% of drownings were of undetermined intent (E984) while in most other countries it was less than 5%, although in Denmark it was 12.8% (Table 1). Motor vehicle traffic deaths comprise 11.4% of drownings in New Zealand but only 0.9% in Denmark. Only a small percentage of the drowning N-code deaths were coded with disease as the underlying cause (Table 2). These range from 5.5% in England and Wales, to only 1.9% in the United States, and 4.9% in New Zealand (data not shown).

Table 1a: Comparison of drowning deaths N991.4 by Country for injury deaths. (Number)

Assigned E codes	USA No.	CANADA No.	ENGLAND/ WALES No.	DENMARK No.	NEW ZEALAND No.
Drowning codes					
E830 Boat damage	288	113	29	27	412
E832 Boat - no damage	254	74	32	19	99
E910 Accidental drowning	3757	498	665	111	1024
E954 Suicide drowning	405	123	233	197	277
E964 Assault drowning	62	4	11	2	7
E984 Undetermined drowning	242	50	596	58	94
Subtotal	5008	863	1566	414	1913
Non-drowning codes					
E810-E819 Motor vehicle traffic	448	82	46	4	264
E820-E825 Motor vehicle non traffic	29	42	1	–	16
E831, E833-E838 Water transport	38	11	5	1	16
E840-E848 Air and space transport	29	7	5	–	16
E880-E888 Accidental falls	77	6	2	–	19
E900-E909 Natural/environmental	45	1	6	–	12
E950-E953, E955-E959 Suicide	79	11	11	2	30
E960-E963, E965-E989 Homicide	29	1	1	–	–
E980-E983, E985-E989 Undetermined	10	1	13	2	–
Other injuries	64	5	9	27	35
Subtotal	848	167	99	36	408
Total injuries	5856	1030	1665	450	2321

Table 1b: Comparison of drowning deaths N991.4 by Country for injury deaths. (Percent)

Assigned E codes	USA (%)	CANADA (%)	ENGLAND/WALES (%)	DENMARK (%)	NEW ZEALAND (%)
Drowning codes					
E830 Boat damage	4.9	11	1.7	6	17.8
E832 Boat - no damage	4.3	7.3	2	4.2	14.3
E910 Accidental drowning	64.2	48.3	40	24.7	44.1
E954 Suicide drowning	6.9	11.9	13.9	43.8	11.9
E964 Assault drowning	1.1	0.4	0.7	0.4	0.3
E984 Undetermined drowning	4.1	4.9	35.5	12.8	4
Subtotal	85.5	83.8	94	92	82.4
Non-drowning codes					
E810-E819 Motor vehicle traffic	7.7	7.9	2.8	0.9	11.4
E820-E825 Motor vehicle non traffic	0.5	4.1	0.1	--	0.7
E831, E833-E838 Water transport	0.6	1.1	0.3	0.2	0.7
E840-E848 Air and space transport	0.5	0.7	0.3	--	0.7
E880-E888 Accidental falls	1.3	0.1	0.1	--	0.8
E900-E909 Natural and environmental	0.7	0.1	0.4	--	0.5
E950-E953, E955-E959 Suicide	1.3	1.1	0.7	--	1.3
E960-E963, E965-E989 Homicide	0.5	0.1	0.1	--	–
E980-E983, E985-E989 Undetermined	0.2	0.1	0.8	0.4	–
Other injuries	1.2	0.5	0.5	6	1.5
Subtotal	14.5	16.2	5.9	8	17.6
Total injuries	100	100	100	100	100

Table 2: Comparison of deaths with drowning as nature of injury (N994.1) by underlying cause, disease vs. injury, USA, Canada, England and Wales.

	USA		CANADA		ENGLAND/WALES	
	No.	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Drowning E	5008	(83.9)	863	(81.8)	1566	(88.9)
Other injury	848	(14.2)	167	(15.8)	99	(5.6)
Disease deaths	113	(1.9)	25	(2.4)	96	(5.5)
Total deaths	5969	(100)	1055	(100)	1761	(100)

* Denmark no disease deaths UC with primary injury

The drowning nature of injury code (N994.1) was used as one of the multiple cause codes for 98.8% of the drowning E-codes as the underlying cause in the United States, 97.3% in Canada and 98.9% in England and Wales (Table 3). In contrast only 18.8% of the boat trauma deaths in the United States had N994.1 in any field.. The underlying causes of death for drownings identified by N994.1 are presented in the injury matrix format (regardless of intent)[7] in Table 4 and summarized by intent in Table 3. Suffocation/asphyxia was the underlying cause for 4.2% of drownings in Denmark but only 0.1% in Canada.

Table 3: Drowning deaths as underlying cause and proportion with N994.1 on record by country.

Drowning Mechanism	**USA**	**Canada**	**England/ Wales**
Boat	96.8	94.0	98.4
Accident	99.1	97.6	97.8
Suicide	98.9	96.9	100
Homicide	92.5	100	100
Undetermined	99.1	98.0	99.7
TOTAL	98.8	97.3	98.9
Boat trauma	18.8	NA	11.9

Table 4a. Injury matrix for drownings (N994.1) by country, number of injuries

			Number	
Mechanism	**USA**	**Canada**	**England/Wales**	**Denmark**
1 Cutting/pierce	3	–	1	–
2 Drowning	5008	863	1566	414
3 Fall/pushed	133	11	4	1
4 Fire/burn	9	–	–	1
5 Firearm	3	–	–	1
6 Machinery	16	3	–	2
7 MV traffic	458	83	46	4
8 Pedal cyclist, other	5	–	–	1
9 Pedestrian, other	–	–	–	1
10 Transport, other	96	61	35	1
11 Natural/environ	45	1	6	1
12 Overexertion	–	–	–	–
13 Poisoning	19	1	2	1
14 Struck by, against	3	–	–	–
15 Suffocation	17	5	1	19
16 Other specified	9	2	9	0
17 NEC	18	–	–	1
18 Unspecified	14	–	13	2
19 Adverse effects	–	–	2	–
Total injury	5856	1030	1665	450

Table 4b. Injury matrix for drownings (N994.1) by country, distribution of injuries

	Percent distribution			
Mechanism	**USA**	**Canada**	**England/Wales**	**Denmark**
1 Cutting/pierce	0.1	–	0.1	–
2 Drowning	85.5	83.8	94.0	92.0
3 Fall/pushed	2.2	1.0	0.2	0.2
4 Fire/burn	0.2	–	–	0.2
5 Firearm	0.1	–	–	0.2
6 Machinery	0.3	0.3	–	0.4
7 MV traffic	7.7	7.9	2.8	0.9
8 Pedal cyclist, other	0.1	–	–	0.2
9 Pedestrian, other	–	–	–	0.2
10 Transport, other	1.6	5.9	2.1	0.2
11 Natural/environ	0.8	0.1	0.4	0.2
12 Overexertion	–	–	–	–
13 Poisoning	0.3	0.1	0.1	0.2
14 Struck by, against	0.1	–	–	–
15 Suffocation	0.3	0.5	0.1	4.2
16 Other specified	0.2	0.2	0.5	–
17 NEC	0.3	–	–	0.2
18 Unspecified	0.1	–	0.8	0.4
19 Adverse effects	–	–	0.1	–
Total injury	100	100	100	100

Death certificates often include medical diagnoses with the drowning deaths. Table 5 shows those drownings where the medical condition was listed as the underlying cause of death. For all drownings, medical conditions were the underlying cause of death for 1.9% of drownings in the United States, 2.4% in Canada and 5.5% in England and Wales. Additional analyses (not shown) found that 4.9% of drownings in New Zealand had a medical condition as an underlying cause. Denmark did not have full multiple cause data. Heart disease was the underlying cause of 0.8% of drownings in the United States, 0.7% in Canada, 0.4% in England and Wales and 1.1% in New Zealand.

Table 5: Medical conditions as underlying cause of death with drowning (N994.1) listed on death certificate. Number (and percent) of deaths by country.

Disease Group (ICD Code)	U.S.	Canada	England/ Wales
Neoplasm (140-239)	3 (0.1)	–	–
Metabolic (240-279)	1[x]	–	1 (0.1)
Alcohol/drug abuse/dependence (303-305)	4 (0.1)	1 (0.1)	–
Mental retardation (319)	–	1 (0.1)	–
Epilepsy (345)	41 (0.7)	15 (1.4)	85 (4.8)
Other CNS, PNS[2] (340-344, 344-359)	4 (0.1)	–	–
Acute MI[3] (410)	7 (0.1)	3 (0.3)	–
Other ischaemic HD[4] (411-414)	6 (0.1)	3 (0.3)	7 (0.4)
Cardiac dyschymias (427)	3 (0.1)	–	–
Ill defined HD[4] (429)	17 (0.3)	1 (0.1)	–
Other HD[4] (390-409, 415-426, 428)	11 (0.2)	–	–
Cerebrovascular (430-438)	3 (0.1)	–	1 (0.1)
Asthma (493)	–	–	1 (0.1)
Other respiratory (460-492, 494-519)	4 (0.1)	1 (0.1)	–
GI & GU[5] (520-629)	2[x]	–	–
Other congenital heart (746)	2[x]	–	1 (0.1)
Newborn (760-779)	5 (0.1)	–	–
Total disease	113 (1.9)	25 (2.4)	96 (5.5)
AII N994.1	5969 (100)	1055 (100)	1761 (100)

1 hypoglycaemia non-diabetic 2512
2 central and peripheral nervous system; includes demyelinating disease, cerebral palsy, muscular dystrophy
3 myocardial infarction
4 heart disease
5 gastrointestinal and genitourinary
x less than 0.1%

For epilepsy the WHO coding rules states that this should be the underlying cause for drowning deaths.[13] This rule was the result of pressure upon WHO from international epilepsy groups. Table 6 shows the analysis of drowning and epilepsy codes for the United States (ICD code for epilepsy is 345, but there is also a code 780.3 for non-specific convulsions that may include some epilepsy cases). In the United States, epilepsy is not always coded as the underlying

cause; only 41 of 51 cases (80%) were. In addition, 149 cases of drowning also have a convulsion (780.3) code; fifteen of these cases also have an epilepsy code. There is considerable variation in the proportion of drownings coded with epilepsy as the underlying cause: United States (0.7%), Canada (1.4%), England and Wales (4.8%) and New Zealand (1.1%).

Table 6. Drowning and epilepsy, USA 1995.

WHO rule says epilepsy should be coded as underlying cause for drowning. ICD 780.3 convulsion also exists

Underlying cause	**All deaths**	**Epilepsy (ICD 345)**	**Convulsion (ICD 780.3)**	**Both (ICD 345 & 780.3)**
Drowning E codes no 994.1	63	1	1	–
Drowning E codes with 994.1	5008	7	140	–
Subtotal Drowning	5071	8	141	–
Other injury with 994.1	920	2	8	–
Epilepsy with 994.1	41	41	15	15
Convulsion with 994.1	–	–	–	–
TOTAL	6032	51	164	15

SUMMARY

	All drowning		Drowning with N994.5		Epilepsy U/C
	No.	(%)	No.	(%)	
Any drownings with epilepsy (N or E code)	51	(0.8%)	50	(0.8)	41
Any drownings only convulsion	149	(2.5%)	148	(2.5)	–
Total either	200	(3.3%)	198	(3.3)	41
Total drownings	6032	(100)	5969	(100)	41

An important issue in analysing multiple cause data is to determine what is the main or immediate cause of death. The issues involved in this are discussed in depth in the accompanying paper in this symposium by Chris Cox.[14] For the purposes of our analysis, we selected the immediate cause as the first listed injury on the death certificate. Aside from drowning, the next listed immediate cause was asphyxiation/strangulation (0.7%), hypothermia (0.4%) and head injury (0.1%) for all the drowning deaths identified (Table 7). When all boating fatalities (including boating trauma E830-838) were examined, only 74.1% had drowning listed as the intermediate cause, with head injury (7.5%) listed as the next leading cause (Table 8). These results are shown graphically in Figure 1 by the main injury groups.

Multiple cause data provide a useful means to understand what exactly are the injuries resulting from boating deaths. They also suggest that occupant protection may be an important, but previously unrecognized issue, in boating fatalities.

Table 7. Drowning deaths (all E-codes) by immediate cause of death and any injury on death certificate, U.S. 1995

	Immediate cause		**Any injury**	
	No.	(%)	No.	(%)
Drowning (N994.1)	4938	(97.4)	5008	(90.3)
Asphyxia/strangulation	22	(0.7)	37	(0.7)
Hypothermia	20	(0.4)	83	(1.5)
Head injury	13	(0.3)	82	(1.5)
Internal injury	7	(0.1)	33	(0.6)
Early complications	11	(0.2)	20	(0.4)
Fracture spine/back	4	(0.1)	11	(0.2)
Poisoning	2*		99	(1.8)
Burns	1*		6	(0.1)
Toxic effects	0		16	(0.3)
Late effects	1*		13	(0.2)
Comp surg/med care	0		1*	
Multiple sites	17	(0.3)	32	(0.6)
Other/unspec. sites	6	(0.1)	38	(0.6)
Other injuries	17	(0.3)	48	(0.9)
No injury codes	22	(0.4)	22	(0.4)
TOTAL	5071	(100)	5549	(100)

* less than 0.1%

Table 8. Boating fatalities by immediate cause of death compared to any injury in record axis, U.S. 1995

	Immediate cause		Any injury	
	No.	**(%)**	**No.**	**(%)**
Drowning(N994.1)	565	(74.1)	580	(61.5)
Head injury	57	(7.5)	93	(9.9)
Internal injury	29	(3.8)	60	(6.4)
Hypothermia	14	(1.8)	43	(4.6)
Toxic effects	8	(1.0)	10	(1.1)
Blood vessels	8	(1.0)	11	(1.2)
Fracture spine/back	5	(0.7)	7	(0.7)
Burns	4	(0.5)	5	(0.5)
Early complications	4	(0.5)	5	(0.5)
Asphyxia/strangulation	2	(0.3)	3	(0.3)
Multiple sites	31	(4.1)	73	(7.7)
Other/unspec. sites	17	(2.2)	39	(4.1)
Other injuries	13	(1.7)	9	(1.0)
No injury codes	5	(0.7)	5	(0.5)
TOTAL	762	(100)	943	(100)

Conclusions

Multiple cause of death data allow all deaths due to drowning to be identified, not just those coded using standard ICD codes. The wide variation in the proportion of all drownings coded to the various underlying cause categories suggests that some of the wide variation in drowning rates between countries may in fact be due to differences in coding practices. Accidental drowning rates (E910) are low in England but 36% of drownings are of undetermined intent, much higher than for other countries. Even among injury deaths the proportion of drownings classified as other causes indicate that many drowning deaths are missed by traditional E codes. In addition there are wide variations in selecting drowning as the underlying cause. Multiple cause coding is a means of improving our understanding of injury etiology and determining if differences in injury rates are real or due to differences in coding practices. They may also provide important information on exactly what type of injuries people die from, which may be useful in designing prevention strategies. However, more work is needed to fully understand

how injury data are coded and processed in different countries[15] and how it influences multiple cause analyses.

References

1. Rockett IRH, Smith GS. Homicide, suicide, motor vehicle crash and fall mortality: United States' experience in a comparative perspective. American Journal of Public Health, 1989; 79:1396-1400.

2. Smith GS, Langlois JA, Rockett, IRH. International comparisons of injury mortality: Hypothesis generation, ecological studies and some data problems. In: Proceedings of the International Collaborative Effort on Injury Statistics. Volume 1. National Centre for Health Statistics, Hyattsville, MD. DHHS Publication No. (PHS) 95-1252, 1995;13:1-18.

3. Fingerhut L, Cox C, Warner M. International comparative analysis of injury mortality: Findings from the ICE on Injury Statistics. NCHS Advance Data, No. 303, October 1998. NCHS, CDC, U.S. Department of Health and Human Services.

4. Rooney C. Differences in the coding of injury deaths between England & Wales and the United States. In: Proceedings of the International Collaborative Effort on Injury Statistics Volume II. National Centre for Health Statistics, Hyattsville, MD. (DHHS Publication No. (PHS) 96-1252, 1996;15:1-23.

5. Rockett IRH and Smith GS. Suicide misclassification in an international context. In: Proceedings of the International Collaborative Effort on Injury Statistics. Volume I. National Centre for Health Statistics, Hyattsville, MD. (DHHS Publication No. (PHS) 95-1252, 1995;26:1-18.

6. Langlois JA, Smith GS, Baker SP, Langley J. International comparisons of injury mortality in the elderly: issues and differences between New Zealand and the United States. International Journal of Epidemiology, 1995;24:136-143.

7. Centers for Disease Control and Prevention. Recommended framework for presenting injury mortality data. MMWR 1997; 46 (RR-14):6-7.

8. Smith GS and the Wet ICE Collaborative Group. International Comparisons of Injury mortality databases: evaluation of their usefulness for drowning prevention and surveillance. In: Proceedings of the International Collaborative Effort on Injury Statistics. Volume II. National Centre for Health Statistics, Hyattsville, MD (DHHS Publication No. (PHS) 96-1252, 1996;6:1-29.

9. Smith GS, Langley JD. Drowning surveillance: how well do E codes identify submersion fatalities: Injury Prevention, 1998;4:135-139.

10. Israel RA, Rosenberg HM, Curtin IR. Analytical potential for multiple cause-of-death

data. American Journal of Epidemiology, 1986;124(2)161-79.

11. Rosenberg HM, Kochanek KD. The death certificate as a source of injury data. In: Proceedings of the International Collaborative Effort on Injury Statistics, Volume I. National Centre for Health Statistics, Hyattsville, MD (DHHS Publication No. (PHS) 95-1252, 1995:8-1.

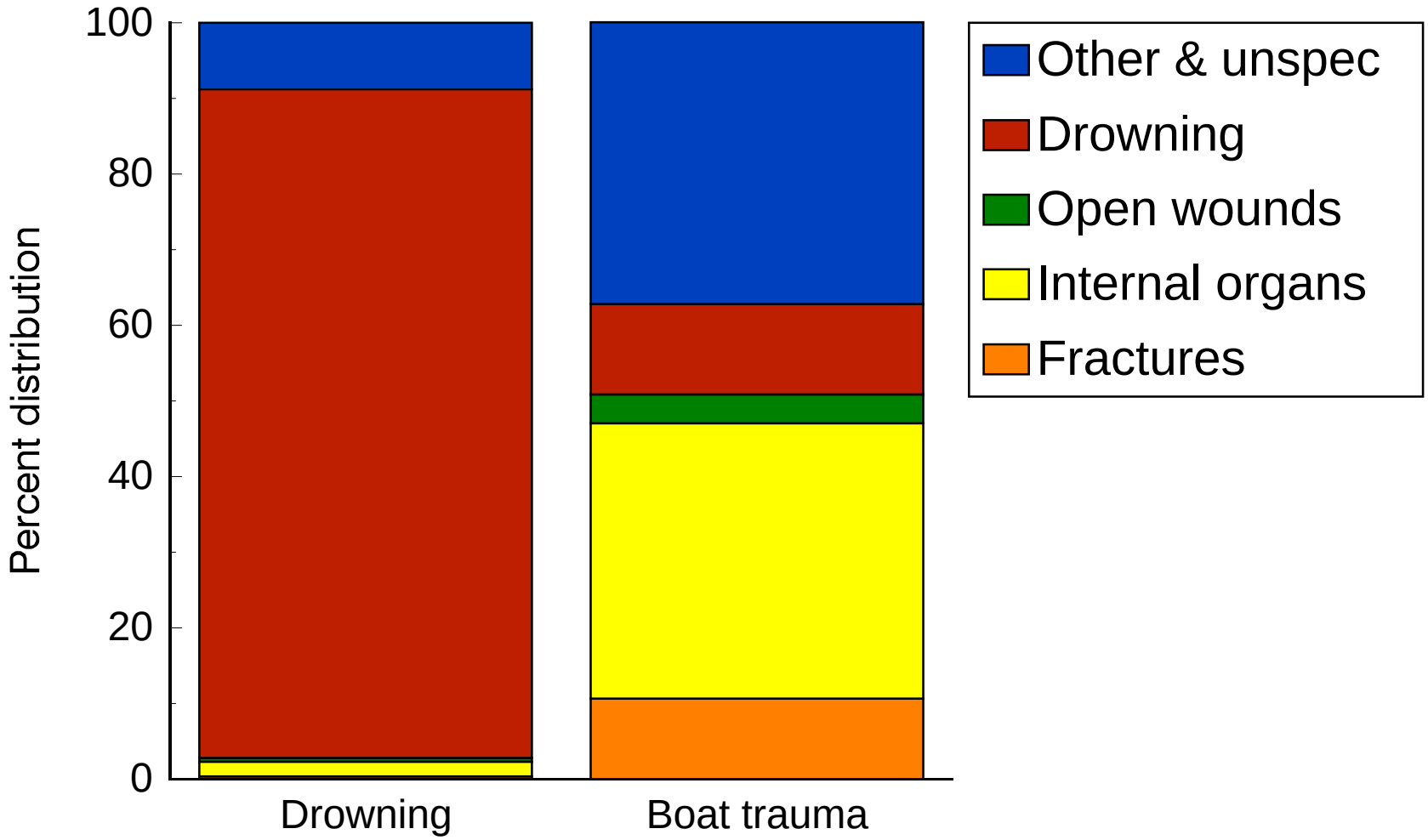
12. National Centre for Health Statistics. Vital statistics, instructions for classifying the underlying cause of death. NCHS instruction manual; part 2a. Hyattsville, MD: Public Health Service. Published annually.

13. 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. Volume I. Geneva: World Health Organization. 1977.

14. Cox C S. Multiple Cause of Death and Injury. In: Proceedings of the International Collaborative Effort on Injury Statistics, Volume 3. National Center for Health Statistics, Hyattsville, MD. In this proceedings.(DHHS Publication 2000).

15. Rooney C, Warner M, Fingerhut LA. Mortality registration and classification results. In: Proceedings of the International Collaborative Effort on Injury Statistics, Volume 3. National Center for Health Statistics, Hyattsville, MD. In this proceedings. (DHHS Publication 2000)

Proportion of all injuries associated with drowning and boating cases: U.S., 1995



Multiple Cause of Death and Injury

Christine S. Cox*

*National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC), Hyattsville, MD

Mortality data are routinely tabulated utilizing a single underlying cause of death which identifies only one cause that is considered to have initiated the sequence of events leading to death. However, seldom is there a single factor involved in a death and often other diseases or conditions are contributory, such as diabetes and heart disease. The practice of publishing single cause of death data results in much loss of information as to factors involved in the death. For injuries this has been even more problematic because two types of ICD-9 codes are used to describe injuries, one which describes the nature of the injury (e.g., head injury), and the other which describes the mechanism of the injury (e.g., fall). By convention only the external cause (e.g., fall) is routinely published.[1,2]

Multiple cause of death information is obtained from death certificates and can be coded using several different automated coding systems (ACME, TRANSAX, MICAR, etc.) that are described elsewhere.[3] The implementation of automated multiple cause of death coding allows for: 1) the coding of all the reported conditions on the death certificate and, 2) the utilization of a set of standardized coding rules for determining the Underlying Cause of Death thereby increasing consistency of death certificate coding. In the United States, the routine coding of the multiple causes of death began in 1968.

Prior to the routine coding of the multiple causes of death, injury researchers were limited to the analysis of a single underlying external cause of death, which describes the mechanism that caused the injury death such as a car crash or a fall. However, this single external cause code did not describe the resulting injuries that were listed on the death certificate. The implementation of multiple cause-of-death coding made data available on the nature of all reported injuries sustained in fatal injury events. For example, in the event of a car crash fatality, the underlying external cause of death code describes the type of car crash and the multiple cause-of-death codes describe the types of injuries sustained (e.g., head trauma, hip fractures, etc.). In addition, death certificates may include information on more than one external cause for a injury death. Specific coding rules are utilized in the U.S. for selecting the underlying cause of death when more than one external cause is listed on the death certificate.[4] All external and nature of injury conditions listed on the death certificate are coded and provided in the multiple cause of death codes, including in most cases the external cause code selected as the underlying cause of death.

Many countries now collect and code information on multiple causes of death. However, there are often significant differences in the registration and coding practices for each country. The International Collaborative Effort on Injury Statistics (Injury ICE) commissioned a questionnaire to collect information regarding mortality registration and coding practices in each participating country and has presented the results from this questionnaire at this symposium.[5] Some countries such as, the U.S., the U.K., Canada, and Australia, provide all the conditions listed on the death certificate. Others provide a limited number of conditions and

still others identify a single nature of injury code or a "main injury" diagnosis associated with the underlying external cause of death.

One of the goals of the Injury ICE is to compare injury data internationally. However, to date most of these analyses have been restricted to comparative analysis of the underlying external cause of death.[6] Even in the United States, which has had multiple cause of death data for over 20 years, the primary emphasis of injury mortality research remains focused on the underlying external causes of injury death. The Injury ICE collaborators hope to develop a framework for presenting injury statistics that both identifies the types of injuries sustained in injury deaths as well as the external mechanism that caused the death.

A further complication towards conducting international comparisons of injury mortality is the significant variation in the coding and tabulation of multiple cause of death data among the Injury ICE collaborating countries. Some countries utilize guidelines published by WHO in the volumes of the ninth revision of the International Classifications of Diseases (ICD-9).[7] These guidelines provide a hierarchy for selecting the primary nature of injury code when more than one type of injury is listed on the death certificate. Other countries may select the first listed injury as the primary injury. Further attempts will be made to ascertain what selection process is utilized by those countries that currently code a primary injury diagnosis. Since many countries code at least a principal injury diagnosis for injury deaths we may want to select this level of analysis to maximize the comparison of international data in future studies.

This paper further examines the published multiple cause of death data for injury deaths in the U.S. as a first step in comparing fatal injuries between countries.

There are two types of multiple cause of death codes available in the U.S., entity axis and record axis codes. Entity axis multiple cause codes are the ICD coded conditions from the death certificate listed in the same order that they appear on the death certificate. The entity axis code itself includes information about which line of the certificate it was listed on and whether more than one condition was listed per line. These data are unedited; they are entered on the data file in the order that they appear on the death certificate. The number of diagnoses and level of detail on the certificate varies widely from one certifier to the other, even for the same conditions.

The record axis codes are the edited version of the multiple cause data derived by an editing program (TRANSAX) which edits the conditions listed on the death certificate. TRANSAX edits inconsistent information appearing on the death certificate or combines conditions listed separately on the certificate that according to the ICD-9 should be entered as one code.[8] Record axis multiple cause codes do not include any information regarding their placement on the death certificate, they are entered on the data tape in numerical order from lowest to highest. The record axis editing process seeks to standardize the diagnoses as much as the available data will allow. Therefore, for each injury death the following information is available: unedited entity axis codes which provide information about the actual location and order of the injury on the death certificate and edited record axis codes that do not include information regarding the location and order of the injury on the death certificate.

Both record and entity axis codes have important uses in injury mortality research, but they

each serve different purposes. Each researcher must decide which is the better data source for their analysis. The practical implication of this coding issue is that if we want to conduct international comparisons of the patterns of injury in injury fatalities we must find a comparable way to analyze data across different countries.

One crude approximation of determining the "main injury" in injury fatalities in the U.S. would be to use the first listed injury code in the entity axis codes which assumes that the certifier records the most serious injury first. Attempting to define a main injury diagnosis in this manner may be somewhat controversial since presumably death certifiers do not fill out death certificates with the understanding that the data might be tabulated in this way. The instructions to the certifiers are to enter data in the causative order and not necessarily in order of severity. Furthermore, the certifier may not always be certain which of many severe injuries actually caused the death. One of the many activities the Injury ICE will be conducting is determining how consistent selection rules are between countries that code a main injury diagnosis code and to establish in the future common coding guidelines for data comparability. As a first step in this process, the 1995 U.S. Multiple Cause of Death data file[9] was analyzed to determine how injury conditions were currently coded in the U.S.

Number of Injury Conditions

Table 1 shows the number of injury conditions listed on death certificates for injury deaths for the U.S. in 1995. There were a total of 226,130 injuries coded from the death certificates for 147,891 injury deaths. This is an average of about 1.5 injuries per death. Less than 1% of injury deaths had an external cause of injury coded without an associated nature of injury code. Sixty-four percent of all injury deaths in 1995 had only one nature of injury diagnosis code reported on the death certificate. Therefore, for nearly two-thirds of the 1995 U.S. injury deaths, the main injury is already defined, with the remaining 36% to be defined after consensus on coding guidelines for main injury is reached among the international collaborators.

Framework for Injury Diagnosis Codes for Mortality

An additional goal of the Injury ICE is to develop standardized formats for presenting injury data. This symposium included a proposal for the adoption of a framework or matrix for presentation of injury diagnosis codes for morbidity.[10,11] The proposed framework for coding injury diagnosis codes for use with injury morbidity data has been adapted for this analysis to illustrate its potential use with mortality data. [See Appendix I] These frameworks provide a cross-classification format that allows for further analysis of both the type of injury (fractures, internal organ injury, trauma, etc.) and the site of the injury (brain, thorax, extremities, etc.). We will continue to work closely with our international partners on refining this framework to allow for consensus in the presentation format of nature of injury codes for both morbidity and mortality injury analyses.

What can be gained from a matrix presentation of the multiple causes of death in injury mortality?

The matrix presentation format utilized in this analysis provides interesting insight into the patterns of reported injuries that result from different external causes of death. The underlying external causes of death are grouped by mechanism and intent in the recommended format for presenting injury mortality data.[12] All injury conditions listed on the death certificate were included in these analyses.

Figure 1 shows the types of injuries associated with four different external causes of injury death: motor-vehicle traffic, firearm, cut or pierce, and fall deaths. Fractures account for 30% of all injuries sustained in fall deaths, 13% in motor-vehicle deaths, and a very small percentage of injuries sustained in firearm and cut/pierce deaths. Conversely, open wounds account for 78% and 68% of the injuries reported in firearm and cut/pierce deaths while they make up less than 1% of the injuries in motor vehicle or fall deaths.

Internal organ injuries account for about 45% of all injuries sustained in motor-vehicle traffic and fall deaths. By utilizing the matrix approach to injury diagnosis, differences in the location of the internal organ injury can be further examined. As shown in Figure 2, 84% of internal organ injuries in fall deaths are brain injuries. However, half of all internal organ injuries sustained in motor vehicle deaths are to the brain and 26% occur in the thorax. By further classifying internal organ injuries by site a very different pattern of injury emerges.

Figure 3 provides a second example of the importance of the matrix, by examining the pattern of fracture injuries associated with motor vehicle and fall fatalities in the U.S. for 1995. Overall, fractures account for 13% of all injuries reported for motor vehicle deaths and 29% of all fall deaths, indicating twice as many fractures are reported in fall deaths then motor vehicle deaths. As was the case for internal organ injuries, fracture patterns by body site are quite different for these two external causes. Thirty-five percent of all fractures sustained in motor vehicle deaths are to the skull, 24% are to the spine and back, 11% are to lower extremities, with less than 1% to the hip. However, nearly half (48%) of all fractures recorded in fall deaths are hip fractures with other lower extremity fractures the next most frequently recorded fracture in fall deaths (16%).

Figure 4 shows how the pattern of specific type of injury differs based on the intent provided in the external cause. This graph demonstrates the differences in the location of internal organ injuries for firearm deaths. Internal organ injuries account for 15% of all injuries recorded in firearm suicide deaths and range up to 20% of all injuries recorded in unintentional firearm deaths. The location of the internal injuries is very different however depending on the manner of death. Eighty percent of the internal organ injuries in firearm suicide deaths are to the brain, 54% of the internal organ injuries are to the brain in unintentional firearm deaths, and 31% are to the head in firearm homicides. There are significantly more internal injuries to the thorax and abdomen in firearm homicides than in the other firearm intent categories.

These are just a few examples of the types of analyses that illustrate the value of multiple cause analyses. More detailed analysis will provide greater insight into the types of injuries associated with each external cause of injury death.

How can multiple cause of death data be used to further identify injuries that are not captured by the underlying cause of death?

Another use of the multiple cause-of-death data is to further identify certain types of external causes of injury that are not listed as the underlying cause of death but appear on the death certificate as a contributing cause of death. There are a limited number of mechanisms of injury death that can be coded in ICD-9 both as external cause codes (E800-E999) and as nature of injury codes (800-999). For example, deaths caused by suffocation will be coded with an underlying external cause of death code of E911-E913, E953, E963, or E983. Deaths involving asphyxiation and strangulation but not primarily caused by suffocation can be coded with a nature of injury code of 994.7 as a multiple cause of death.

Figure 5 illustrates how multiple cause-of-death data can provide additional information about the number of deaths caused by suffocation or involving suffocation. In 1995, there were 10,376 deaths with suffocation listed as the underlying cause of death. Sixty-nine percent of these deaths were also coded with an ICD-9 diagnosis code of 994.7 (asphyxiation and strangulation), 31% of these deaths did not have coded information involving asphyxiation or strangulation in the multiple causes of death data. An additional 1,234 deaths are noted where suffocation was not determined to be the underlying cause of death but asphyxiation and strangulation were listed as contributing injuries in that death. Ninety-two percent of these deaths were injury deaths with motor vehicle traffic the most frequently coded underlying cause of death (28%). In these cases, it would seem that while the death was not ultimately determined to be principally caused by suffocation, suffocation did however play a part in the injury fatality. This is an important concept for understanding the causal pathways in an injury death. By examining the multiple causes of death, it is possible to capture additional information about certain types of injuries that contributed to deaths that were ultimately attributable to other external causes.

The multiple causes of death data also provide an additional opportunity to investigate the role of "secondary" external cause codes. These are additional codes for mechanisms of injury that were not determined to be the underlying external cause of death but also contributed to the injury death. Table 2 highlights the number of secondary external cause of death codes that appear in the multiple cause data for selected injury deaths. In 1995, there were 4,143 additional external causes coded for all injury deaths. The most commonly reported secondary external cause codes are for poisoning and suffocation. This table provides yet another illustration that by further examining the multiple causes of death there is a wealth of additional information available from death certificate data to injury researchers.

Conclusion

The analyses presented provide examples of a few of the practical uses of multiple cause of death data. They are meant to stimulate discussion among the ICE collaborators as to how to approach multiple cause data for injuries. By using an agreed upon framework for defining type and site of injury, injury researchers could use multiple cause –of-death data to determine the number of reported head injuries in a given year and what are the associated external causes or mechanisms of death. An additional application would be to examine the pattern of injuries sustained in car crash fatalities and the trends over time as additional safety features are implemented.

It is hoped that the proposed framework for presentation of the nature of injury codes from multiple cause of death data will be useful for comparative studies by other countries. However, much work remains to be done prior to any detailed comparisons of injury data between countries.

First, we need to conduct a comprehensive review of the number of countries that code multiple cause data and answer the following questions:

How many conditions are coded from the death certificate?

Is the coding process automated?

What version of ICD is used for coding death certificates?
What years of data are available?
Is multiple cause of death data coded for all deaths or a sample?

Second, to maximize the scope of the international collaboration we need to determine a consistent method for identifying a main injury diagnosis code. In addition, we will need to determine what coding guidelines are used to select the main injury for those countries that already do so.

Third, consensus must be reached on the framework for presentation of injury diagnosis data for morbidity and the adaptation for use with mortality data.

Finally, we need to recruit collaborators who would be willing to conduct a comprehensive review of their countries multiple cause coding procedures, be willing to work to achieve data comparability of the main injury diagnosis code and who would be willing to provide tabulated data for analysis.

Although there is a lot of work ahead we believe that this paper shows the usefulness and importance for these efforts. We look forward to working with other countries to conduct these analyses.

References

1. 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. Volume 1. Geneva: World Health Organization. 1977.

2. Israel RA, Rosenberg HM, Curtin LR. Analytical potential for multiple cause-of-death data. Am J of Epidem 1986;124(2)161-79.

3. Rosenberg HM, Kochanek KD. The death certificate as a source of injury data. In: Proceedings of the International Collaborative Effort on Injury Statistics, Volume 1. National Center for Health Statistics, Hyattsville, MD (DHHS Publication No. (PHS) 95-1252, 1995:8-1.

4. National Center for Health Statistics. Vital statistics, instructions for classifying the underlying cause of death. NCHS instruction manual; part 2a. Hyattsville, Maryland: Public Health Service. Published annually.

5. Rooney C, Warner M, Fingerhut LA. Mortality registration and classification results. In: Proceedings of the International Collaborative Effort on Injury Statistics, Volume 3. National Center for Health Statistics, Hyattsville, MD (DHHS Publication No. (PHS) 00-1026, 2000;11-1.

6. Fingerhut LA, Cox CS, Warner M, et al. International comparative analysis of injury mortality: Findings from ICE on Injury statistics. Advance data from vital and health statistics; no. 303. Hyattsville, Maryland: National Center for Health Statistics. 1998.

7. 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. Volume 1. Geneva: World Health Organization. 1977:730.

8. Chamblee RF and Evans MC. TRANSAX, the NCHS System for Producing Cause-of-Death Statistics, 1968-1978. National Center for Health Statistics. Vital and Health Statistics. Series 1, No. 20. June 1986.

9. National Vital Statistics System: Multiple cause of death for ICD-9 1995 data. Hyattsville (MD): National Center for Health Statistics. 1997.

10. Mackenzie E. Injury diagnosis morbidity matrix. In: Proceedings of the International Collaborative Effort on Injury Statistics, Volume 3. National Center for Health Statistics, Hyattsville, MD (DHHS Publication No. (PHS) 00-1026, 2000;17-1.

11. Barell V, Heruti RJ, Abargel A, Ziv A. The Israeli "nature of injury by site" diagnostic matrix. In: Proceedings of the International Collaborative Effort on Injury Statistics, Volume 3. National Center for Health Statistics, Hyattsville, MD (DHHS Publication No. (PHS) 00-1026, 2000;18-1.

12. Centers for Disease Control and Prevention. Recommended framework for presenting injury mortality data. MMWR 1997; 46 (No. RR-14):6-7.

Appendix I

Injury Mortality Matrix Codes for Body Region of Injury
(Axis A)

Please note: the following list can be used if ICD is coded to the 4th digit; if only 3-digit codes are available follow instructions next to **.

1. Skull and Brain: excl. face[1,2] (incl. scalp)	800-801, 803-804	
	850-854	
	873.0-873.1	** Code 873 under Other
	873.8-873.9	** Code 873 under Other
	951	
2. Face	802	
	830	
	848.0 - 848.1	** Code 848 under Other
	870 - 872	
	873.2 - 873.7	** Code 873 under Other
	910	
	918	
	920-921	
	925.1	** Code 925 under Other
	940	
	947.0	** Code 947 under Other
	950	
Head [1,2] (Skull&Brain&Face)	800-804	
	850-854	
	870-873	
	830	
	848.0 - 848.1	** Code 848 under Other
	910	
	918	
	920 - 921	
	925.1	** Code 925 under Other
	940	
	947.0	** Code 947 under Other
	950-951	
3. Neck[2,3,5,8]	807.5 - 807.6	**Code 807 under Thorax
	848.2	**Code 848 under Other
	874	
	900	
	925.2	**Code 925 under Other
	947.1	**Code 947 under Other

4. Thorax[4,5]	807.0 - 807.4	**Code 807 under Thorax
	848.3 - 848.4	**Code 848 under Other
	860 - 862	
	875	
	879.0 - 879.1	**Code 879 under Other
	901	
	922.0 - 922.1	**Code 922 under Other
	947.2	**Code 947 under Other
5. Abdomen, pelvic contents, genital organs	863 - 868	
	878	
	879.2 - 879.5	**Code 879 under Other
	902	
	922.2	**Code 922 under Other
	922.4	**Code 922 under Other
	926.0	**Code 926 under Other
	947.3 - 947.4	**Code 947 under Other
6. Spine and Back[6,7,8]	805	
	806	
	876 - 877	
	922.3	**Code 922 under Other
	839.0 - 839.5	**Code 839 under Other
	847	
	952 - 953	
7. Upper Extremity	810 - 818	
	831 -834	
	840-842	
	880 - 887	
	903	
	912 - 915	
	923	
	927	
	943 - 944	
	955	
	959.2 - 959.5	**Code 959 under Other

8. Lower Extremity and Bony Pelvis[6]	808	
	821-827	
	835 - 838	
	843 - 845	
	846	
	848.5	**Code 848 under Other
	890-897	
	904	
	916 - 917	
	924	
	928	
	945	
	956	
	959.6 - 959.7	**Code 959 under Other
17. (Neck of femur fracture)[9]	820	
9. Other and Ill-Defined Body Region	809	
	819	
	828	
	829	
	839.6 - 839.9	** Code 839 under Other
	848.8 - 848.9	** Code 848 under Other
	869	
	879.6 - 879.9	**Code 879 under Other
	911	
	919	
	922.8 - 922.9	**Code 922 under Other
	926.1	**Code 926 under Other
	926.8 - 926.9	**Code 926 under Other
	929	
	941-942	
	946	
	947.8 - 947.9	**Code 947 under Other
	948-949	
	954	
	957	
	959.0 - 959.1	**Code 959 under Other
	959.8 - 959.9	**Code 959 under Other
10. Foreign Bodies	930-939	
11. Poisonings	960-979	
12. Toxic Effects	980-989	
13. Other and Unspec Effects of External Causes	990-995	

Effects of reduced temperature	991
Effects of heat and light	992
Drowning	994.1
Asphyxiation and strangulation	994.7
Electrocution	994.8
All other Effects of External Causes	990, 993, 994.0, 994.2-994.6, 994.9, 995
14. Late Effects	905-909
15. Early Traumatic Complications	958
16. Complications of Surgical and Medical Care	996-999
18. No Injury	No diagnosis codes above 799

Notes to Body Region of Injury Classification

(1) Include 804 under *Head* (instead of *Multiple Body Regions*) even though it reads: *Multiple fractures involving skull or face with other bones*: assume that principal fracture is to the skull or face.

(2) Code all injuries to blood vessels of Head or Neck (900) under *Neck*; it is not easy to distinguish whether blood vessel is part of head or neck based only on third or fourth digit of ICD

(3) Injuries to trachea (typically categorized at 4th or 5th digit which is not available for mortality data) is classified under *Neck* (instead of *Thorax*)

(4) Injuries to the *trunk* unless otherwise specified are coded under *Other* since these injuries could be to the region of the thorax, abdomen or back

(5) Fx to larynx and trachea (807.5-807.6) are coded under *Neck* unless 3rd digit code only, then code under *thorax* and assume injury (fx) is more likely to be to ribs and /or sternum.

(6) Injuries to sacrum and coccyx are coded under *Spine* as they are typically only distinguishable form other injuries to the spine at the 4th or 5th digits.

(7) Injuries to buttock region (e.g., 877) are coded under *Spine and Back*

(8) Injuries classified under *Neck* include only those injuries to the front of the neck or soft tissue; injuries to the neck portion of the spine are classified under *Spine and Back*

(9) Neck of femur fractures have been classified separately.

Injury Mortality Matrix Codes for Nature of Injury
(Axis B)

1. Fractures[1,2]	800-805; 807-829
2. Dislocations	830 - 839
3. Sprains and Strains	840-848
4. Crushing Injury	925-929
5. Amputation of Limbs	885-887; 895-897
6. Injury to Internal Organs[2,3,4,5] incl. CNS injuries	860-869 850-854 952-953 806
7. Nerves[4]	950-951; 954-957
8. Blood Vessels	900-904
9. Open Wounds[3,5]	870-884, 888-894
10. Superficial Injuries	910-919
11. Contusions	920-924
12. Burns	940-949
13. Effects of Foreign Bodies	930-939
14. Other Injury - (other and unspecified)	959
Multiple sites	959.8
All other sites	959.0-959.7
Unspecified sites	959.9
15. Poisonings	960-979
16. Toxic Effects	980-989
17. Other and Unspec. Effects of External Causes	990-995
Effects of reduced temperature	991
Effects of heat and light	992
Drowning	994.1
Asphyxiation and strangulation	994.7
Electrocution	994.8
All other Effects of External Causes	990, 993, 994.0, 994.2-994.6, 994.9, 995
18. Late Effects of Injuries etc.	905-909
19. Early Complications of trauma	958
20. Complications of Surgical and Medical Care	996-999
21. No Injury	No diagnosis codes above 7990

Notes to Nature of Injury Classification

(1) ***Fractures*** include skull fractures with intracranial injury; **HOWEVER**, if data are coded to the fourth digit; include the following codes (i.e. intracranial injuries with skull fx) under Injury to Internal Organs:

800.1 - 800.4	801.1 - 801.4
800.6 - 800.9	801.6 - 801.9
803.1 - 803.4	804.1 - 804.4
803.6 - 803.9	804.6 - 804.9

(2) ***Fractures*** exclude spine fxs with SCI; they are classified under ***Injuries to Internal Organs;***

(3) ***Injuries to Internal Organs*** include CNS injuries (injuries to the brain and spinal cord); they also include injuries to larynx, trachea, pharynx and thyroid; they do NOT include injuries to internal structures of the eye, ear, and nose (these are included under ***Open Wounds***);

(4) ***Injuries to Nerves*** exclude injuries to nerve roots to spine and spinal plexus (953) -- these are included under ***Injury to Internal Organs***;

(5) ***Open Wounds*** includes injuries to the larynx, trachea, pharynx and thyroid; **HOWEVER**, if data are only coded to the fourth digit, include codes 874.0-874.5 (i.e. injuries to larynx, trachea, pharynx and thyroid) under ***Injury to Internal Organs***.

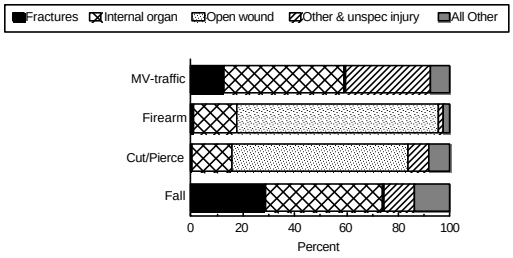
(6) The United States Multiple Cause of Death does not include 4th digit classification for intracranial injuries with skull fx (800-804) or injuries to larynx, trachea, pharynx and thyroid (874.0-874.5).

Table 1. Percent distribution of nature of injury conditions for injury deaths (n = 147,891), U.S., 1995

Number of injury conditions on death certificate	Percent of certificates
0	0.9
1	64.0
2	23.7
3	7.2
4	2.5
5+	1.7
Total	100.0

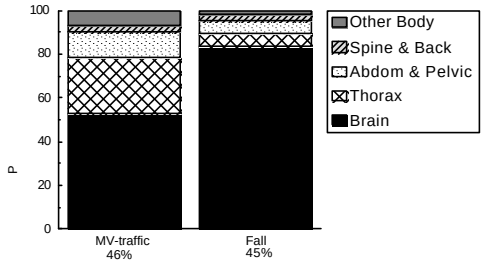
Note: Injury conditions are defined as ICD-9 codes: 800.0 - 999.9

Figure 1. Injuries associated with specified external causes: U.S., 1995



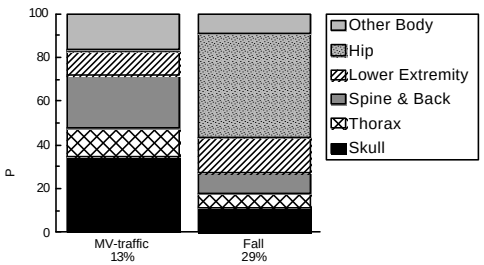
NOTE: See Injury Mortality Matrix Codes for Nature of Injury (Axis B) for ICD-9 coding definitions.

Figure 2. Internal organ injuries by body site associated with motor vehicle and fall fatalities: U.S., 1995



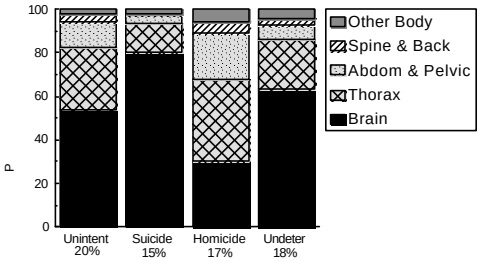
NOTE: See Injury Mortality Matrix Codes for Body Region of Injury (Axis A) and Nature of Injury (Axis B) for ICD-9 coding definitions.

Figure 3. Fracture injuries by body site associated with motor vehicle and fall fatalities: U.S., 1995



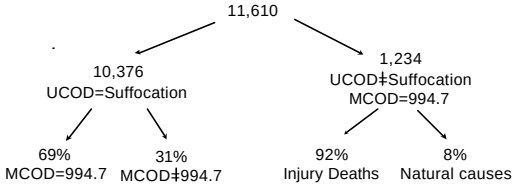
NOTE: See Injury Mortality Matrix Codes for Body Region of Injury (Axis A) and Nature of Injury (Axis B) for ICD-9 coding definitions.

Figure 4. Internal organ injuries by body site associated with firearm fatalities: U.S., 1995



NOTE: See Injury Mortality Matrix Codes for Body Region of Injury (Axis A) and Nature of Injury (Axis B) for ICD-9 coding definitions.

Figure 5. Deaths caused by or involving suffocation, U.S., 1995



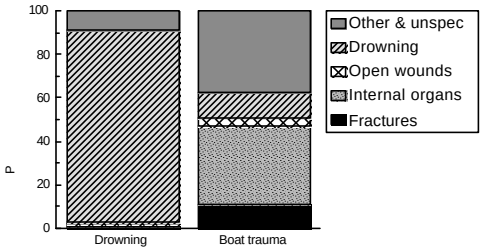
NOTE: Suffocation is defined as Underlying Cause of Death (UCOD)= E911-913.9, E953.0-.9, E963, E983.0-.9 or Multiple Cause of Death (MCOD) = 994.7

Table 2. Number of secondary E-codes by Underlying Cause of Death, U.S., 1995

	Total injury deaths	Underlying Cause of Death					
		MVTC	Firearm	Poison	Falls	Suffoc	Unspec.
Number of Deaths	147,891	42,452	35,957	16,307	11,275	10,376	7,878
Secondary E-code							
MVTC	59	13	4	10	4	4	8
Firearm	93	3	48	5	1	1	7
Poison	1,608	63	45	1,193	33	90	16
Falls	60	0	3	15	13	3	2
Suffocation	684	110	46	134	94	35	128
Other Spec	45	3	4	5	11	7	5
NEC	84	0	20	10	2	15	2
Unspec.	144	10	15	39	6	22	7
Other E codes	340	9	56	68	28	41	36
Total	3,117	211	241	1,479	192	218	211
% of deaths with a secondary E-code	2.1	0.5	0.7	9.1	1.7	2.1	2.7

Note: E-codes are defined as ICD-9 codes: E800.0 - E999.9

Proportion of all injuries associated with drowning and boating cases: U.S., 1995



e

r

c

e

n

t

Injury Codes Outside of Chapter 17

Donnamaria Pickett*

*Medical Systems Administrator, National Center for Health Statistics, Center for Disease Control and Prevention, Hyattsville, MD

- There are approximately 13,000 codes in ICD-9-CM

- Some of these codes identify injuries

    - Most injury codes are found in Chapter 17
    - Some injuries may be found in Chapters 1 -16 and injury related V-codes
    - Some of the codes, though injury-related, may be conditions secondary to the initial injury

- Some codes identify conditions that have an external cause but are not injuries

The objective of this analysis is to identify codes for injuries and conditions in Chapters 1-16 that should be included in data analysis.

For this discussion the following conditions have been excluded: (iatrogenic conditions, occupational conditions (chronic conditions due to long-term exposure to external agent), and drug- and anesthesia- induced conditions.

The ICD classification acknowledges that not all injury codes are located in the Injury and Poisoning chapter of ICD (Chapter 17 in ICD-9 and Chapter 19 in ICD-10).

> ICD-9
>
> p. 547, Volume 1, ninth revision, Supplementary Classification of External Causes of Injury and Poisoning: **Certain other conditions which may be stated to be due to external causes are classified in Chapters I to XVI of ICD**, and for these the "E" code classification should be used as an additional code for multiple-condition analysis only. In mortality tabulation in the U.S. the cases outside of Chapter 17 may be identified through multiple cause analysis only."
>
> ICD-10
>
> p. 103 volume 2, tenth revision, Coding of external causes of morbidity: "For injuries and other conditions due to external causes, both the nature of the condition and the circumstances of the external cause should be coded. The preferred "main condition" code should be that describing the nature of the condition. **This will usually, but not always, be classifiable to Chapter 19**. The code from chapter 20 indicating the external cause would be used as an optional additional code.

Acute Injuries

A condition or injury that is the immediate and direct result of the external cause of injury

Ear	
Acute swimmer's ear	380.12
Eye	
Solar retinopathy	363.31
~~Choroidal wound or rupture~~	~~363.63~~
Photokeratitis (includes snowblindness/sun blindness	370.24
Superficial injury of cornea due to contact lens	371.82
Acoustic trauma (explosive) ear	388.11

Secondary and chronic conditions resulting from injuries A condition secondary to the acute injury

Infectious Disease	
Tetanus	037
Mental health	
Post-concussion syndrome	310.2
Eye	
Foreign body, intraocular, magnetic	360.5x
Foreign body, intraocular, non-magnetic	360.6x
Glaucoma due to ocular trauma	365.65
Traumatic cataract	366.20 - 366.23
Radiation cataract	366.46
Retained foreign body, eyelid	374.86
Foreign body, orbit	376.6
Retained (old) foreign body following penetrating wound of orbit	376.6

Ear		
Acquired stenosis of external ear canal, secondary to trauma	380.51	
Retained foreign body, middle ear	385.83	
Noise-induced hearing loss	388.12	
Skin and Subcutaneous		
Foreign body granuloma, skin & subcut. tissue	709.4	
Diseases of the Musculoskeletal System and Connective Tissue		
Traumatic arthropathy	716.1x	
Internal derangement	717.x	
Other derangement of joint	718.x	Except 718.2x & 718.6x
Traumatic spondylopathy	721.7	
Foreign body granuloma, muscle	728.82	
Old or residual foreign body in soft tissue	729.6	
Malunion of fracture	733.81	
Fracture non-union	733.82	

Codes Dropped from Consideration

A- Conditions that may be due to an external cause but the condition is not an injury:

Hemoglobinuria caused by training for marathon run	283.2	
Contact dermatitis and other eczema	692	
Dermatitis due to substances taken internally, drugs	693.1	
Dermatitis due to substances taken internally, other substances	693.8	
Hives due to cold and heat	708.2	Allergic reaction. Exposure not necessarily excessive to invoke response

Respiratory

Respiratory conditions due to chemical fumes and vapors	506.0 - 506.3
Pneumonitis due to inhalation of oils and essences	507.1
Pneumonitis due to solids and liquids (inhalation)	507.8
Acute pulmonary manifestations due to radiation	508.0 & 508.9

Chronic respiratory

Chronic respiratory conditions due to chemical fumes and vapors	506.4	
Unspecified respiratory conditions due to fumes & vapors	506.9	
Chronic and other pulmonary manifestations due to radiation	508.1	
Respiratory conditions due to other specified external agents	508.8	Includes acute, subacute, & chronic conditions
Respiratory conditions due to unspecified external agent	508.9	Includes acute, subacute & chronic conditions

B- Some codes contain conditions that may be due to trauma **or** injury. These cases should not be included in the data analysis without verifying the cause.

376.47	Deformity due to trauma or surgery
376.52	Enophthalmos due to trauma or surgery
518.5	Pulmonary insufficiency following trauma and surgery
364.61	Implantation cysts of iris, ciliary body, and anterior chamber due to surgery or trauma
376.52	Enophthalmos due to trauma or surgery
598.1	Traumatic urethral stricture (may be due to trauma or post-obstetrical)
767.0	Subdural and cerebral hemorrhage, which may be due to birth trauma or to intrapartum anoxia or hypoxia

C- Some codes contain injury-related conditions in addition to many other non-injury-related conditions

Retrograde amnesia	780.9 (contains other conditions, such as cold intolerance, hypopyrexia, generalized pain, specified symptoms NEC, etc.)

Injury in pregnancy	648.9 (contains other conditions complicating pregnancy such as malnutrition, diseases of arteries, arterioles and capillaries)

Several mental health codes also fall into this category:

Some codes capture conditions that may be due to an external cause of injury or other than injury (e.g., emotional trauma such as witnessing a violent act:

Post-traumatic amnesia	294.0
Acute situational	308.3
Posttraumatic stress	309.81

D- Obstetrical Codes

Codes 664-665 are not injuries. These conditions are the result of birth process and not an external cause

F- Skin and Subcutaneous

Inflammations, infections and ulcers may be injury-related, but are not the immediate and direct result of an injury.

Abscess/Cellulitis	681 & 682
Acute lymphadenitis	683
Other local infections of skin and subcutaneous tissue	686
Chronic skin ulcer	707

Accident without injuries

Patient without <u>signs and symptoms</u> suspected of having abnormal conditions but upon examination condition is found not to exist

Observation following accident at work	V71.3
Observation following MVA	V71.4
Observation following alleged rape or seduction	V71.5
Observation following inflicted injury (victim or culprit) NEC	V71.6
Observation for other specified suspected conditions	V71.8

History of injury event

Personal history presenting hazard to health, physical abuse	V15.41
Personal history presenting hazard to health, injury	V15.5
Personal history presenting hazard to health, poisoning	V16.6
Aftercare involving the use of plastic surgery	V51
Plastic surgery following healed injury or operation	
Other orthopedic aftercare	V54.0
Counseling for victim of spousal and partner abuse	V61.11
Counseling for victim of child abuse	V61.21

Newborn Codes

Codes for injuries due to forces of labor or medical/surgical interventions. E-code assigned would be in range of E870-E876 (Misadventures to patients during surgical and medical care).

Injury to spine and spinal cord due to birth trauma	767.4
Facial nerve injury due to birth trauma	767.5
Injury to brachial plexus due to birth trauma	767.6
Other cranial and peripheral nerve injuries due to birth trauma	767.7
Other specified birth trauma Includes: Eye damage Hematoma of: liver (subcapsular), testes, vulva, Rupture of: liver, spleen, Scalpel wound Traumatic glaucoma	767.8
Fetus or newborn affected by maternal injury (conditions classified to 800-995)	760.5

Snowblindness: temporary loss of sight due to injury to superficial cells of the cornea caused by ultraviolet rays of the sun reinforced by those reflected by the sun

Birth injury: Impairment of body function or structure due to adverse influences to which the infant has been subjected at birth

Late Effects of Injuries, Poisonings, Toxic Effects, and Other External Causes

These codes are used as a secondary diagnosis and should never be used as a principal diagnosis. The residual effect (condition produced) after the acute injury has terminated is assigned as the principal diagnosis. Example: shortened arm due to fracture of elbow at growth plate 736.89+905.2.

EURORISC: The story so far

David H. Stone,* Anita Morrison** and the EURORISC Working Group

*European Review of Injury Surveillance & Control Projects, Pediatric Epidemiology and Community Health Unit, Royal Hospital for Sick Children, Glasgow, Scotland
**University of Glasgow, Peach Unit, Department Child Health, Royal Hospital for Sick Children, Glasgow, Scotland

The EURORISC project is a concerted action funded by the European Commission (EC) (DGXII) that brings together 16 participants from nine European countries. The project was funded subsequent to a number of important policy documents. Firstly, the Treaty on European Union (EU) signed in Maastricht in November 1993 included a commitment to public health which stated, 'the Community shall contribute towards ensuring a high level of human health protection'. In a subsequent communication setting out the Commission's proposals for developing work on public health, accidents and injuries were identified as a priority area for action. Following this, a major public health policy review was undertaken in 1994. Its report highlighted the lack of adequate data on injuries and their causes as a barrier to effective injury prevention.

The EURORISC Project commenced in January 1997, with its administrative base at the Paediatric Epidemiology and Community Health (PEACH) Unit, Department of Child Health, University of Glasgow. The main aims of EURORISC are to review current injury surveillance activities and to make recommendations for future ISC practice in the EU. The study comprises of three phases, each lasting 12 months. Each phase has a number of specific objectives (Figure 1). This short paper gives an overview of the EURORISC tasks completed so far.

Figure 1: EURORISC Project timetable and key objectives

Phase	Year	Key objectives
1	1997	to describe the contemporary epidemiology of injury in the EU. to identify current IS activity in the EU.
2	1998	determination of IS evaluation criteria world literature review formulation of a statement of good practice
3	1999	comparison of current IS in the EU with the statement of good practice. formulation of recommendations for future ISC in the EU.

Methods

Mortality data were obtained from the WHO and national government agencies to examine the trends in age-standardised mortality in all 15 current EU member states. Morbidity data were obtained from the injury surveillance systems operating in the EU. Information on the

characteristics of injury surveillance systems was collected using three strategies: an electronic literature database search, a participant questionnaire and by contacting organisations with a professional interest in injury prevention throughout the EU.

Epidemiology

Over 1.9 million fatalities due to injury were recorded between 1984 and 1993. Of these, 69% were due to unintentional injuries, 24% were due to suicide and self-inflicted injuries, 2% due to homicide and 5% due to "other violent causes'. Age standardised mortality rates due to unintentional injuries decreased from 30 to 24/100,000 over the study period. Age standardised mortality rates due to suicide and self-inflicted injury decreased from 11 to 10/100,000. Rates of homicide remained stable at 1/100,000 and rates of 'other violent causes' increased from 2 to 3/100,000.

Substantial improvements in unintentional injury mortality were observed in many countries over the study period. However, in both 1984 and 1993, marked differences in age standardised mortality rates were observed between counties. Finland, Portugal and France experienced mortality rates more than double those observed in Sweden, the Netherlands, and the U.K. In most countries, age-standardised mortality rates due to suicide and self-inflicted injuries decreased over the study period. As with unintentional injury, there were stark variations in rates between countries. Countries in southern Europe had consistently lower mortality rates due to suicide and self-inflicted injuries than those in northern Europe, with the exception of the Netherlands and the U.K.; these countries experienced low rates throughout the study period. Rates of homicide were low and stable over the study period.

Current data sources on non-fatal injury

While mortality data are helpful in providing baseline information on the epidemiology and causes of injury and monitoring progress towards national and local accident prevention targets, data on non-fatal injuries are also required to assess injury incidence, monitor progress towards targets and to evaluate the effectiveness of injury control interventions. We have been documenting the other sources of injury data available in the EU (Figure 2). These include data collected by routine systems and surveys, and specially designed injury surveillance systems.

Figure 2: Examples of sources of non-fatal injuries in the EU

- Hospital discharge statistics
- EHLASS (European Home and Leisure Surveillance System)
- IRTAD (International Road Traffic and Accident Database)
- CARE (Community database on road traffic accidents)
- National injury surveillance
  HASS/LASS (U.K.), LIS (Netherlands), EDISS (Greece)
- Local injury surveillance
  CHIRPP (Glasgow) AWISS (Wales) PHISSCH (Newcastle), ISIS (Trieste)
- Fire, ambulance, police services
- Poisoning centres
- Occupational injury registers
- Household surveys

Methodological aspects

The methodological difficulties involved in making international comparisons are well documented, for example we have conducted a survey of hospital discharge data collected in participating countries highlights important differences in the data collection procedures and data items collected. In some countries only short stay admissions are included in hospital discharge statistics. Strict inclusion criteria may help make comparisons more reliable. However, the use of hospital discharge data generally is open to criticism due to the bias in admissions relating to supply factors and socio-demographic characteristics.

In the face of limited resources, alternative strategies to total surveillance of all cases presenting with injuries have been considered. Retrospective sampling of the CHIRPP database operating at Yorkhill Hospital in Glasgow was conducted to establish whether systematic sampling is a valid alternative to total patient surveillance. This study showed that a well planned and executed sampling strategy could be an alternative if a number of potentially problematic practical issues were overcome. These include staff forgetfulness, potentially biased case selection according to severity and the inability of the sample to collect data on rare events.

Evaluation of injury surveillance systems

The literature suggests that the overall aim of injury surveillance is to reduce the frequency and severity of injury in a target population. However, systems have been established for a variety of purposes including epidemiological research, targeting and prioritising prevention efforts, evaluating injury prevention initiatives and assessing the costs of injury. We have identified six criteria for the evaluation of surveillance systems operating in the EU. The literature suggests that to be successful a system should have six key characteristics: it should be practical, stable, relevant, valid, accessible and effective.

Practical: The operation of an ISS must be an a feasible objective within the data collection setting. A successful ISS has sufficient human, technical and financial resources to support both implementation and operation.

Stable: An ISS should be usable for the analysis of secular trends. This is only possible if definitions, denominators, sampling techniques, classification systems and coding methods remain constant over time. Where possible, internationally agreed coding and classification systems should be adopted.

Valid: An ISS should generate information of an acceptable quality. The representativeness, sensitivity, specificity and accuracy of data should be primary considerations. Ideally, some measurement of injury severity should also be included.

Relevant: Data collected by the ISS should be useful and relevant to injury prevention professionals who utilise the system for the planning and evaluation of injury control programmes.

Accessible: The ISS should be easily accessible to injury prevention professionals. If potential users are unable to obtain information in a relevant and comprehensible format, the ISS will not fulfil its function.

Effective: Evaluation should be an integral part of the development process. There are remarkably few published scientific data upon which to judge the impact of injury surveillance on the frequency or pattern of injury in a population.

Injury surveillance systems around the world collect information on a wide range of data items. In accordance with developments elsewhere in the world, we have drafted a minimum and extended data-set as part of the evaluation procedure for EURORISC (Figure 3). Surveillance systems operating in the EU will be compared to the minimum and extended data sets developed by the EURORISC team.

Figure 3: Draft minimum and extended data-sets

Minimum data set	Extended data set
Personal identifier	Geographical location code (of injury)
Sex	Ethnic group
Date of birth	Occupation
Date of attendance	Time of injury
Date of injury	Products involved
Geographical location code (of home)	Mechanism of injury
Narrative description of the injury event	Severity score
External cause	Use of safety equipment
Intent	Alcohol use
Activity when injured	Drug use
Place of injury occurrence	
Nature of principal injury and body part injured	

Conclusion

The EURORISC project in scheduled to end in December 1999. Comparing the current status of injury surveillance in the EU with our six criteria and data-sets is the next and final task. However, it is hoped that the collaborative network developed as part of EURORISC will be retained and expanded, perhaps in the context of the new EC Injury Prevention Programme.

Report from European Commission

Bernard LeGoff*

*European Commission, Directorate-General V, Employment, Industrial Relations and Social Affairs

On behalf of the European Commission, I would like to thank the Department of Health and Human Services for giving me the opportunity to present what will be one of the main challenges on injury at European Union level.

In the foreword of the survey 'How States are Collecting and Using cause of Injury Data' granted by the American Public Health Association and conducted by different partnerships, Mark Rosenberg, Edward Sondik and Mohammad Akhter wrote that major obstacles must be overcome for all States to have State wide hospital discharge and emergency department data systems that provide cause-specific non-fatal injury data.

They clearly emphasised 4 obstacles. The most crucial of all is:

1. Convincing the legislators of the need to make injury prevention a high priority.

- At European level, the decision number 372/99/EC of the European Parliament and of the council adopting a programme of community action on injury prevention in the framework for action in the field of public health (1999-2003) has been adopted the 8 February 1999.

The aim of this programme is to contribute to public health activities which seek to reduce the incidence of injuries, particularly injuries caused by home and leisure accidents, by promoting FIRST, the epidemiological monitoring of injuries by means of a Community system for the collection of data and the exchange of information on injuries based on strengthening and improving on the achievements of the former EHLASS system; by promoting SECONDLY, information exchanges on the use of those data to contribute to the definition of priorities and better prevention strategies.

2. The second Obstacle was the cost of operation. The financial framework to implement this programme for the period 1999-2003 is set at 14 million Euro.

3. The third obstacle was developing a computer-based infrastructure.

Today, all Member States of the European Union have been connected together in a telematic virtual private network (EUPHIN network) using the most modern IP technology.

4. The fourth obstacle was to identify people with appropriate technical expertise.

In agreeing a work programme 1999 on injury, Member States of the European Union and European Commission decided to focus on a small number of priority areas within this broad field:

- **home and leisure accidents** which represent an important cause of possible injuries and deaths but which represent possibilities of rapid intervention and which are cost effective with a strengthening of the "acquis communautaire".
- **other injuries** which may have links to social and cultural change in our society and/or which constitute major problems of public health requiring an inventory and a prospective approach.

As regards the Home and Leisure Accidents (HLA) approach, an epidemiological network has been set up with experts nominated by the competent expert organisations of the Member States. This network will :

- co-ordinate the collection of information and data and aim at improving the quality and representativity of the data
- develop new approaches to and innovative methods of dealing with the current methodological problems
- facilitate the transmission of the data to the EUPHIN Network
- prepare the analysis and reports of those data and information

For the Other Injuries, a thorough analysis of other injuries, which are of public health importance should be carried out in a network project involving all Member States' relevant experts institutes. The key determinants of these injuries should be analysed including the environmental and behavioural factors. It should outline the opportunities for prevention, describe the availability of relevant data, and make reference to other Community programmes and work done in international organisations.

The European Union legislators decided deliberately to use the public health approach for the field of injury and in particular HLA instead of the consumer policy approach as it was in the past. The three main reasons were that first, strategies using the public health approach go beyond the injury mortality problem and effectively address the much larger problem of non-fatal injuries. Moreover, they also take into account the requirements of health protection in other community policies. Secondly, the legislator wished understanding in a much better way, the magnitude and distribution of the non-fatal injury problem at European Union level and finally, and not least, the large number of injuries caused each year in Europe has incalculable repercussions not only for the individuals concerned but also in social and economic terms.

As an example, home and leisure accidents are responsible for 83,000 fatalities each year, 2 million hospital admissions and an estimated cost of 23 billion U.S. dollars per year as total cost.

What did we achieve in the last six months since our legal basis of work is coming into force?

1. We built up a health monitoring surveillance system for sharing and transferring health data, in particular, injury data and using the telematic means as the principal means (EUPHIN Network).

2. We uploaded in a central oracle database, 12 years of data on HLA with a common agreed aggregated level and using the same data and data dictionary

structures. This data structure is based on the coding manual for HLA edited by the EC.

3. We already started the technical and functional design for an oracle database for individual coded-cases data with all related security policies and using a common agreed record structure on HLA.

4. The EU legislators consider that:

    1. Systematic injury data collection is a vital activity and therefore they committed themselves for a systematic data collection on injury at European Union level and emphasised the aspects of comparability and compatibility of data, the criteria of representativeness and the guarantee of quality of data.

    2. Data needs to be disseminated in a meaningful way and they consequently adopted the telematic means as the way to exchange and disseminate data.

    3. The usefulness of this data should be demonstrated to develop effective injury prevention programmes and policy initiatives. Therefore, they decided on the creation of the two epidemiological networks with their relevant experts.

    4. Finally, the strengthening of international co-operation and work is extremely important to achieve the goal of having cause-specific data on non-fatal injuries on an ongoing basis.

Consequently, you now understand my presence for the first time within this ICE meeting. You also understand that the European Union undertook a first official step to have a common approach on injury surveillance. Therefore, a strengthened co-operation with this ICE on injury is welcome.

At the end of the day, data collection, classifications etc. are important, but what is of more importance is the use of these data for understanding the injury problems for prevention strategies, for intervention and especially for policy initiatives at European level.

World Report on Violence

Dr. Etienne Krug*

*World Heath Organization, Geneva, Switzerland

Objective of the presentation:

Inform members of ICE about the World Report on Violence and invite them to participate.

Introduction:

Violence can be defined as the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community ! that either results in, or has a high likelihood of resulting in injury, death, or other adverse social, psychological, or economic effects. There are many different forms of violence (such as war, conflict, child abuse, violence against women, violence against elderly, firearm-related violence, organized crime, suicide, etc). They all cause an enormous toll internationally. It has been estimated that in 1990, worldwide 786,000 deaths were due to suicide, 563,000 deaths were due to homicide, and 502,000 deaths were due to war. In 1990, war was the
the leading cause of disability adjusted years of life lost (DALYs), self-directed violence the 17th, and interpersonal violence the 18th. It is projected that in 2020, war will be the 8th leading cause, self-directed violence the 14th, and interpersonal violence the 12th. In view of what it described as a dramatic increase in the incidence of intentional injuries, the Forty-Ninth World Health Assembly adopted resolution WHA 49,25 declaring violence a leading worldwide public health problem and urged member states to assess and develop science-based solutions to the problem.

The WHA resolution was followed by the WHO plan of action to prevent violence. The plan of action recommends, as a first step toward prevention, the acquisition of the knowledge describing the magnitude, scope, and characteristics of the problem. Worldwide, this first step of describing violence-related deaths by manner and method has not been undertaken to date. A document that describes the extent of fatal violence-related injuries in the world is therefore urgently needed and will help inform a global strategy for setting priorities and informing the search for solutions.

Purpose

The World Report on Violence will describe epidemiological data on fatal and non-fatal injuries due to interpersonal, conflict-related and self-directed violence at international, regional and local levels. It will also seek to better characterise links between the occurrence of violence and socio-demographic and other characteristics of societies.

The goals of this document are to raise world-wide awareness about the public health aspects of violence and to highlight the contributions of public health to understanding and responding to the problem of violence. More specific objectives of the document are 1) to describe the magnitude and impact of violence cross-nationally; 2) to elucidate cross-national patterns of

violence; 3) to provide a baseline for measuring change and progress; 4) to summarize existing information on risk factors, prevention approaches, and policy responses; 5) to provide directions for future research; 6) to make recommendations for future action in public health.

The primary audience for the report will be decision-makers, public health officials and practitioners, and journalists.

Methods

Data sources:

The main database used for the report will be the WHO Mortality database. More than 70 of the world's nations report detailed information on mortality in their country to the WHO Mortality database. This information is based on International Classification of Diseases (ICD) codes. Performing data management functions (i.e., data editing, range checks, logic/consistency checks, or other quality control measures), analyzing, and publishing the more detailed information for all causes of death is not performed routinely. WHO will edit the data, perform range checks, logic/consistency checks, and other quality control measures to prepare data for analysis. In addition, countries that are not currently reporting to WHO will be contacted directly and invited to provide data on violence-related mortality. Finally, estimates of mortality will be produced for some of the major countries who will not have provided data for the report. These estimates will be calculated based on existing studies. Some of the existing data on morbidity will be summarized and included in the report. Finally, whenever appropriate, data from other UN sources will be used to complement information provided by the above sources (e.g., availability of weapons). Subsequently, tables and figures will be produced (see list of tables in appendix 1).

Format of the report

The proposed format will include two sections: the first with topic-specific chapters and boxes, and the second with tables. It will focus on fatal and non-fatal injuries resulting from interpersonal, war-related and self-directed violence. To obtain more stable estimates and avoid confidentiality issues, data for a 3-year period will be pooled (1993-1995 or most recent years available).

- *Chapters:* Together with some of its Collaborating Centers for Injury Control, the World Health Organization will coordinate the writing of several chapters. A number of international experts on interpersonal, self-directed, and war-related violence will be selected to write the chapters based on the data analysis and on current relevant issues. Scientific review and editing of the chapters will be performed by the Editorial Committee and a number of scientists from diverse cultural and institutional background.

  Each chapter will contain definitions, a discussion of data, risk and protective factors, prevention programs as well as recommendations for actions. A draft table of contents of the report is described in annex.

- *Boxes:* A number of international experts will also be selected to write brief reports on case studies or violence-related topics that deserve special attention. These brief reports will be published in one-page boxes. The boxes will also undergo peer review.

- *Tables:* Section two of the document will be derived from data analysis. An outline of the tables to be produced can be found in appendix.

Dissemination

WHO will coordinate the publication of the report. The report will be released at the WHO Executive Board Meeting in January 2001. Fifteen thousand copies will be produced. These copies will be widely distributed by WHO, its collaborating centers and the sponsors to governmental and non-governmental agencies. The report will also be made available on the World Wide Web in a format that will allow easy use of the data to researchers. Several peer-reviewed papers summarizing the findings of the report will be published in scientific journals at the time of release. Finally, policy briefings providing recommendations for concerned countries and institutions will be organized. The report could be made a periodical publication (updated every three years).

Appendix

Outline of Report

I. Preface
II. Foreword
III. Introduction --- Why this report?
IV. Executive Summary
V. Violence as a Public Health Problem
VI. Interpersonal Violence
VII. Self-Directed Violence
VIII. Organized or Collective Violence/Political Violence
IX. Violence Against Women
X. Violence Against Children
XI. Violence Against the Elderly
XII. Summary of Recommendations/Cross-cutting Recommendations
XIII. Tables