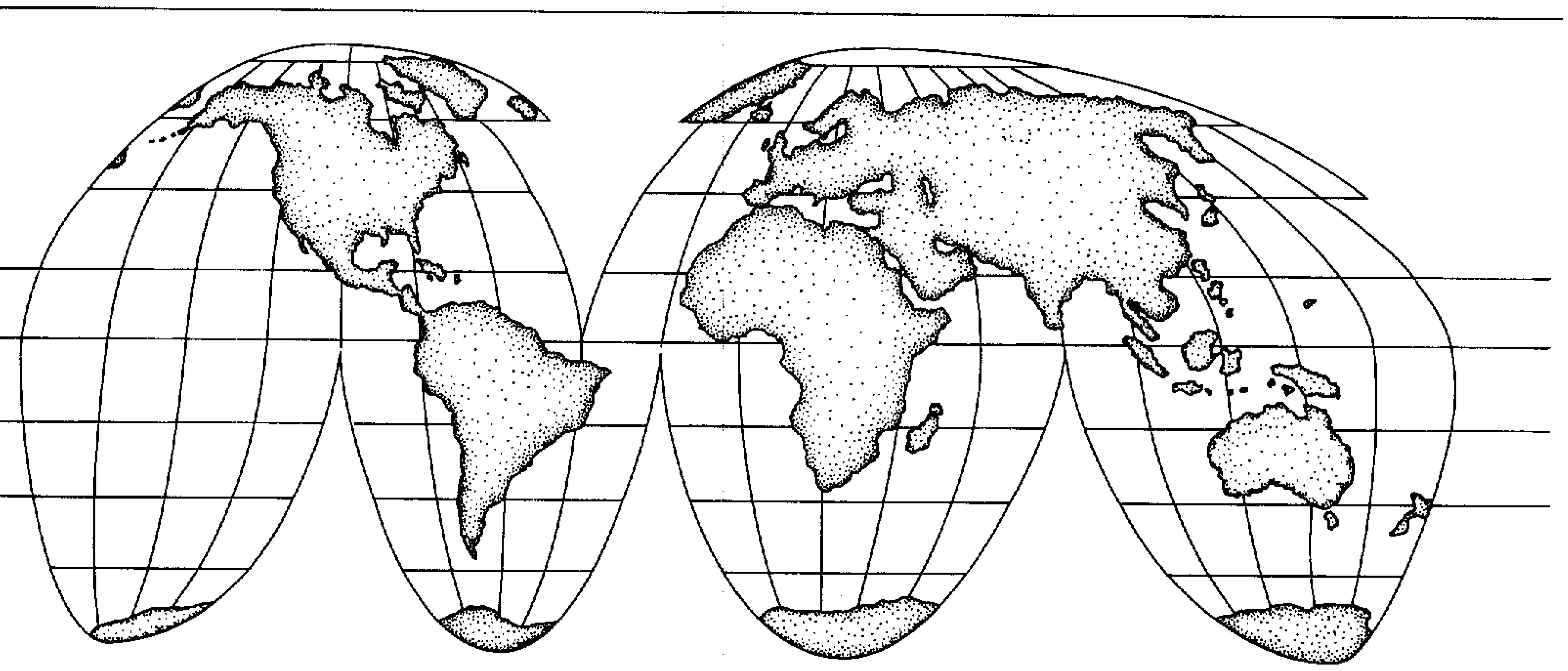
Proceedings of the International Collaborative Effort on Injury Statistics Volume II

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

Melbourne Meeting: Working Papers



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

Hyattsville, Maryland
September 1996
DHHS Publication No. (PHS) 96-1252

Preface

The mission of the Injury ICE is to identify the problems and propose solutions aimed at improving the quality and reliability of international statistics related to injury.

Following is a compilation of the working papers presented at the International Collaborative Effort (ICE) on Injury Statistics meeting held in Melbourne, Australia, February 23, 1996. The meeting was held in conjunction with the Third World Injury Conference.

As co-Chair of the ICE, I served as the meeting's facilitator. An update on current projects was provided as were papers representing work in progress.

A special thanks to James Harrison for serving as our host.
This publication became a reality because of the efforts of Margaret Warner, who recently came to NCHS as a Fellow working on the ICE and other injury activities.

Each of these papers was submitted on diskette. I accept responsibility for any errors found due to "technology" involved in delivering this product.

Lois A. Fingerhut
Chair, ICE on Injury Statistics
Special Assistant for Injury Epidemiology
Office of Analysis, Epidemiology and Health Promotion

Meeting Participants:

Name	Affiliation
Malka Avitzour	Hadassah Medical Organization, School of Public Health Jerusalem, Israel MALKA@DALE.HADASSAH.ORG.IL
Vita Barell	Ministry of Health, Tel Hashomer, Israel EPIDE06@CCSG.TAU.AC.IL
Henning Bay-Nielsen	National Health Council, Copenhagen, Denmark VM@SUMSUS.DK
Gerry Berenholz	Berenholz Consulting, Boston, Massachusetts BERE102W@WONDER.EM.CDC.GOV
Phil Edwards	England P.J.EDWARDS@NEWCASTLE.AC.UK
Birthe Frimodt-Moller	National Health Council, Copenhagen, Denmark VM@SUMSUS.DK
Sue Gallagher	EDC, Boston,Massachusetts SUSANG@EDC.ORG
Rosa Gofin	Hadassah Hospital, Jerusalem, Israel GOFIN@DALE.HADASSAH.ORG.IL
Maria Isabel Gutierrez	School of Public Health, Cali Colombia MGUTIERR@MAFALDA.UNIVALLE.EDU.CO
James Harrison	National Injury Surveillance Unit, Australia NIJEH@NISU2.NISU.FLINDERS.EDU.AU
Mike Hayes	Child Accident Prevention Trust, London England MH@CAPT.DEMON.CO.UK
Steve Jarvis	England
Eric Jougla	INSERM, Paris, France PAVILLON@TOLBIAC.INSERM.FR
Branko Kopjar	National Institute of Public Health, Oslo, Norway JOHS.WIIK@LABMED.UIO.NO

John Langley	Univeristy of Otago, New Zealand JLANGLEY@GANDALF.OTAGO.AC.NZ
Johan Lund	Norwegian Safety Forum, Oslo, Norway fax-47-22-44-98-11
Morag Macdonald	Public Health, Manitoba, Canada fax-204-948-2040
Susan Mackenzie	Health Canada, Ottawa Canada SMACKENZIE@HPB.HWC.CA
Roderick McClure	Australia MCCLURE@SPIDER.HERSTON.UQ.EDU.AU
Saakje Mulder	Consumer Safety Institute, Amsterdam, The Netherlands SCVNL@XS4ALL.NL
Lenora Olson	University of New Mexico LOLSON@SALUD.UNM.EDU
Mary Overpeck	NICHD, Bethesda, Maryland OVERPECM@HD01.NICHD.NIH.GOV
Joan Ozanne-Smith	Australia JOS@ITS-MENZ.CC.MONASH.EDU.AU
Gerard Pavillon	INSERM, Paris, France PAVILLON@TOLBIAC.INSERM.FR
Ian Rockett	University of Tennessee IROCKETT@UTK.EDU
Wim Rogmans	Consumer Safety Institute., Amsterdam,The Netherlands SCVNL@XS4ALL.NL
Claude Romer	WHO-Geneva ROMERC@WHO.CH
Cleo Rooney	Office for National Statistics, London,England CLEO.ROONEY@OPCS.CO.UK
Gordon Smith	Johns Hopkins University, Baltimore, Maryland GSMITH@PHNET.SPH.JHU.EDU

Lorann Stallones	University of Colorado LSTALLONES@VINES.COLOSTATE.EDU
Johannes Wiik	National Institute of Public Health, Oslo, Norway JOHS.WIIK@LABMED.UIO.NO

From the Centers for Disease Control and Prevention:

<u>NCHS:</u>

Lois Fingerhut	LAF4@NCH07A.EM.CDC.GOV
Ed Bacon	WEB1@NCH09A.EM.CDC.GOV
Cathy Burt	CWB2@NCH09A.EM.CDC
Hsiang Kung	HCK0@NCH08.EM.CDC.GOV

<u>NCIPC:</u>

Lee Annest	JLA1@CIPCOD1.EM.CDC.GOV
Dan Pollock	DAP1@CIPCOD1.EM.CDC.GOV
Ken Powell	KEP1@CIPCOD1.EM.CDC.GOV

<u>NIOSH</u>:

Nancy Stout	NAS5@NIOSR1.EM.CDC.GOV

Contents

Updates on NCHS injury-related activities
by Lois Fingerhut

We have begun work on the project to produce a glossary of injury and related health care terminology. Catherine Rennert, MD, working with other staff in the Morbidity Classification group at NCHS, started the project and will continue working on it during the coming year. She will be in touch with Wim Rogmans and Claude Romer for their suggested input. A form will be mailed to ICE participants to be completed and returned to Dr. Rennert. NCHS will take responsibility for compiling country reports.

The core questions of the National Health Interview Survey have been redesigned and they include a significant injury component (under the leadership of Lois Fingerhut). These questions [see below] will be administered through a Computer Assisted Personal Interview in a national sample of households in the United States beginning in August, 1996. Questions about injuries requiring medical attention (including a phone call) in the 3 months up to the date of interview will be asked of all family members. Detail is being obtained on the type of injury and the circumstances surrounding the event causing the injury. This is the first time this level of detail is being obtained in a national household survey in the United States. Preliminary results will be analyzed and changes made to questions as appropriate during the first 6 months of data collection.

A comprehensive Injury Chartbook is being prepared (by Lois Fingerhut with the assistance of Margaret Warner) to be included with the annual NCHS publication, Health, United States, 1996. This will be released some time in the Spring of 1997.

Update on ICE International Inventory of Data Systems

ICE WORKING GROUP members: Lee Annest*, Judy Conn*, Sue Gallagher, Saakje Mulder and Mary Overpeck

* Office of Statistics and Programming
National Center for Injury Prevention and Control
Centers for Disease Control and Prevention
4770 Buford Hwy, NE, MS/K59
Atlanta, GA 30341-3724 USA
E-mail JLA1@CIPCOD1.EM.CDC.GOV
770-488-4656 (FAX 770-488-1665)

We are planning to develop an international directory of data systems that collect nationwide injury- and violence-related data. The inventory will include brief descriptions of the data system, types of injury data obtained, data sources, coding schemes (e.g., ICD, EHLASS, NOMESCO), a summary of data elements, and principal contacts and addresses for each system. This international inventory will be modeled after an *Inventory of Federal Data Systems in the United States for Injury Surveillance, Research and Prevention Activities*. This US report is scheduled to be released in May, 1996 by the National Center for Injury Prevention and Control, CDC, Atlanta, GA.

Government and, in some cases, private organizations that oversee national data systems will be asked to participate in the inventory. The scope of the inventory will be determined after obtaining a comprehensive list of nationwide data systems and contact persons. Potential data systems include criminal justice, law enforcement, fire safety, road safety, home and leisure, labor/occupational, medical examiner/coroner, vital statistics, hospital discharge, ambulatory care clinics and emergency departments, emergency medical services, and ongoing and periodic health and risk factor surveys.

A letter will be mailed out to central health statistics offices and agencies in different countries asking them for names of data systems and contact persons that contain nationwide injury- and violence-related data. From the universal list of data systems obtained via this mail out, we will define selection criteria for data systems to be included in the inventory. Contact persons directly responsible for selected data systems will then be sent a letter asking them to complete a general Worksheet about their data system. Using data obtained from the completed Worksheets, a data base will be developed at CDC for use in developing an international inventory report.

A Worksheet has been designed to capture information about data collection/reporting methods, data sources, types of injury data obtained, and strengths and limitations of data for injury research and practice. This Worksheet is generic by design, allowing us to obtain inventory information from various types of data systems using a standardized instrument.

This inventory will potentially be useful to the international injury research and academic community, organizations and agencies that manage injury data systems, and injury control practioners around the world.

We plan to complete and publish the inventory by September 1997.

Uniform Emergency Department Data Set: Project Update

Daniel A. Pollock, M.D.
National Center for Injury Prevention and Control
U.S. Centers for Disease Control and Prevention

The National Center for Injury Prevention and Control, Centers for Disease Control and Prevention (CDC), is coordinating the development of a Uniform Emergency Department Data Set. The goal is to develop a data set that:

- meets the common data needs of multiple data users, including data needed for public health surveillance and epidemiologic research
- is compatible with existing or rapidly emerging standards for computer-based patient records
- is used to create patient records in 24-hour, hospital-based emergency departments (EDs) throughout the United States.

The impetus for this effort comes from practitioners, educators, researchers, payers, administrators, public health professionals, and medical information specialists who have long recognized the need for greater uniformity of ED data.

Joining CDC in cosponsoring this effort are the Agency for Health Care Policy and Research, American College of Emergency Physicians, American Health Information Management Association, American Hospital Association, Emergency Nurses Association, Health Resources and Services Administration, National Association of EMS Physicians, National Highway Traffic Safety Administration, and Society for Academic Emergency Medicine. Representatives of these agencies and organizations drafted a data set that was reviewed at the National Workshop on Emergency Department Data on January 23-25, 1996, in Atlanta.

The Workshop was a public forum in which 160 participants distributed themselves into one of six concurrent sessions, each of which focused on a segment of the proposed 82-element data set. Many participants in the Workshop represented national professional associations or public agencies that have a keen interest in EDs and the services they provide. Other participants represented data standards organizations, accrediting bodies, and third party payers. Numerous information system vendors and other interested individuals also participated, including participants from the United Kingdom, Canada, and Israel.

The injury incident data elements discussed at the Workshop were:

Text description	Alcohol- and drug-relatedness
Mechanism	Suspected maltreatment
External cause code	Work-relatedness
Cause category	Occupation/Industry
Activity	Consumer product-related injury
Intent	Protective/Safety equipment
Address and location type	

The recommendations that emerged from the Workshop and additional recommendations solicited after the meeting will be used to revise the data set. The revised version will be distributed for public review and comment in spring 1996. Plans call for completion of the data set in summer 1996.

Australian Injury Surveillance Data Standards

James Harrison, Director
AIHW National Injury Surveillance Unit
Adelaide, South Australia.

Routine scrutiny of the occurrence of injury is an essential component of effective public health injury control. Much can be achieved using data which are collected mainly for reasons other than public health injury surveillance. Coroners' records, hospital admission data, and workers' compensation records are examples of such data sources. The special virtue of these sources is that they are already in place, and the cost and difficulty of establishing a data collection system need not be borne (entirely) by those interested in injury prevention.

Typically, however, the data collected by these systems are of limited value, often because of the selection of data items, and the ways in which data are classified. Most Australian hospital admission data, and all deaths data, are classified in a way that enables (most) injury deaths to be identified. The data sets enable analysis of the data by age, sex, and a few other demographic variables. As for information useful for prevention - particularly on how injury comes about - relatively little is provided. A four-digit 'external cause' code (or 'E-code'; currently as specified in the 9th revision of the International Classification of Diseases, ICD-9) provides some insight.[1] E-codes are available for Australian deaths data and for hospital separation data. The E-code classification distinguishes categories such as 'Motor vehicle traffic accident involving collision with another vehicle: injury to pedal cyclist' (E813.6), 'Accidental drowning and submersion in bathtub' (E910.4), and 'Suicide and self-inflicted injury by other and unspecified means: jumping or lying before moving object' (E958.0).

E-codes provide useful information, but have important limitations. For example, E-codes do not (with a few exceptions) distinguish work-related cases, nor sporting and recreational cases, nor cases occurring in educational institutions. Yet all of these categories are important, because they define classes of injuries whose prevention falls into the domain of particular organisations and sectors. Nor do standard E-codes specifically distinguish drowning in domestic swimming pools, which are lumped into a group 'Accidental drowning and submersion: other'. Yet drowning accounts for one-third of injury deaths at ages 1-4 years in Australia, and about half of these deaths occur in domestic pools. A more general concern is that the E-code approach to classification begins by requiring a decision on the role of human intent in the occurrence of the injury ('accident', 'suicide', 'assault and homicide', 'uncertain intent'). Intent is more complex than is implied by the E-code approach, and the intent-based classification tends to obscure features such as the overall role of firearms as a cause of death.

Another part of ICD-9 provides codes to represent the nature and bodily location of injury. Examples are 'Fracture of neck of femur: trans-cervical fracture, closed' (820.0), 'Late effect of tendon injury' (905.8), and 'Poisoning by sedatives and hypnotics: barbiturates' (967.0). This classification (or its more detailed 'Clinical Modification', ICD-9-CM[*M]) is used for hospital in-patient classification, but not for Australian deaths data.[2]

One reaction to the limitations of existing data systems has been development of special data systems, designed for the purpose of injury surveillance. The Injury Surveillance Information System (ISIS) is one such system.[3] ISIS was designed (largely by Mr Jerry Moller) mainly for use in hospital emergency departments, and was developed and piloted by the National Injury Surveillance and Prevention Project. When ISIS was developed, few emergency departments had electronic case information systems in place. Hence, ISIS was developed as a 'stand-alone' system. A principle of its design was to create a 'multi-axial' classification, with a separate classification for each concept of interest.

In contrast, the ICD folds several concepts into a single classification, in a somewhat complex manner. For example, some E-codes embody each of the following concepts: intent (eg suicide); type of location (eg public highway); type of road user (eg motorcycle passenger); dynamics of an injury-producing event (eg 're-entrant collision with another motor vehicle); occupation (eg crew member of a commercial aircraft); context of person when injured (eg undergoing surgical or medical care); type of substance or object involved in producing injury (eg methyl alcohol, powered lawn-mower); type of 'breakdown event' (ie 'what went wrong' and resulted in injury; eg fall from slipping, tripping or stumbling); and the mechanism whereby injury was sustained (eg immersion, poisoning, burning, exposure to electricity).

The ISIS data set and classifications have been implemented in a software application that has been used at several dozen hospitals for periods of up to 5 years. More than 600,000 records have been collected.

The experience of using the ISIS data set has been mixed, and use of the system has declined in recent years. Strengths include the relatively great depth of information, both in the coded items (notably 'body part', 'nature of injury', 'context', 'location', and 'factors'), and in the free text fields (notably the 'what went wrong' field). Limitations include difficulties with some classifications (particularly 'breakdown event' and 'mechanism'); the total size of the data set (found to be difficult to apply with good reliability and completeness of ascertainment given the limited resources typically available); and difficulties in linking or comparing with data from other sources (in part because of differences in data definition and classification).

An alternative to the creation of a 'stand alone' injury surveillance data system is to develop a data set and classifications designed mainly to be taken up into other data systems, such as hospital case information systems. With this approach in mind, NISU and a number of others

---

[M*] A first Australian edition of ICD-9-CM was published in 1995, by the National Coding Centre, and has been used for coding all hospital separations beginning in July 1995. The Australian ICD, based on the US edition, will be updated annually.

interested in the subject proposed a data set for this purpose, late in 1991. The data set, originally referred to as the minimum data set for 'basic routine injury surveillance', was the basis for the NMDS (Injury Surveillance), version 1.1, released in February 1994.[4] The National Data Standards for Injury Surveillance (NDS-IS) are the next stage in this process.[5]

National Data Standards for Injury Surveillance

The National Injury Surveillance Unit, in conjunction with injury surveillance and prevention practitioners in Australia, has defined a set of data standards for public health injury surveillance.

The following principles have guided development of the standards. They should:

- Provide information seen as being of central importance by injury prevention practitioners;
- Be sufficiently small and simple to use (at least in its simplest form; it is hierarchical) to enable its incorporation as part of the routine operation of important types of data collection site (hospital emergency departments; possibly also hospital inpatient services, coroners' offices, etc);
- Have good compatibility with the International Classification of Diseases and with other widely-used data standards; and
- Be capable of providing reliable and valid data.

Development has focused on "core" data items whose inclusion in a data system is largely or solely for the purposes of injury surveillance. In contrast, "general information items" which are not specific to injury surveillance and are part of many health data systems, have been adoped from standard sources.

The current edition of NDS-IS provides for two levels of surveillance data, and foreshadows a third.

The *first*, minimal, level (almost the same as its predecessor, the NMDS–IS, version 1.1) the Level 1 standard is proposed for use in basic, routine public health surveillance.

The ***second*** level surveillance data standard builds on the first with more extensive classification of some items and several additional data items. This data set is suitable for use in emergency departments in hospitals and has been developed to reflect the need for a standard for use in the emergency departments of hospitals and in other settings where at least some special resources are available for injury surveillance data collection.

A ***third*** level data standard has been proposed for specialised surveillance or research involving detailed collection of special data items. Level 3 is in the early stages of development.

The standards are documented more fully in the report titled "National Data Standards for Injury Surveillance", on which this paper is based.[5] A summary of the three levels of NDS-IS is presented in Table 1, and the data items are summarised in Table 2.

While development of the NDS-IS has focused on providing tools for data collection in hospital emergency departments, they are intended to be applicable to other data necessary for injury surveillance. Indeed, an aim is to provide a basis for improving comparability of injury data from a variety of sources.

The Level 1 standard has now been taken up quite widely. It has been embodied in State health department data dictionaries for emergency departments and will be included in the next edition of the National Health Data Dictionary. One State, so far, has mandated collection according to the standard. It has been included in commercial software designed for use in emergency departments, and embodied in a new national register of admissions to spinal units. The Level 2 standard has only recently been released. Interest in using it at several sites has been expressed, and pilot implementation will commence soon.

A key deficiency for injury surveillance in Australia at present is the lack of a source of national quantitative data suitable for monitoring consumer product safety. The most promising solution to this deficiency is collection of data on a well-defined sample of emergency department attendances. Current developments in emergency department data collection, and the national data standards for injury surveillance, are foundations for such a system. In the process, the NDS-IS will be tested and further developed as a tool for injury prevention and control.

References

1. World Health Organization. International Classification of Diseases, 9th revision. Geneva: World Health Organization, 1975.

2. National Coding Centre. Australian Version of the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM). Sydney: National Coding Centre, University of Sydney, 1995.

3. Vimpani G, Hartley P. National injury surveillance and prevention project: final report. Canberra: Australian Government Publishing Service, 1991.

4. AIHW National Injury Surveillance Unit. National Minimum Dataset for Injury Surveillance, version 1.1. Adelaide: AIHW National Injury Surveillance Unit, 1994.

5. AIHW National Injury Surveillance Unit. National Data Standards for Injury Surveillance (version 2.0 December 1995). Adelaide: AIHW National Injury Surveillance Unit, 1995.

Table 1: Three levels of the National Data Standards for Injury Surveillance

Level	Purpose	Data Items: Injury items	Data Items: General items	Intended coverage
1	To provide the information most necessary for basic routine public health surveillance of injury levels and patterns: · as a basis for broad policy development · to inform communities · to generate hypotheses · to monitor most targets	• Narrative • Four categorical items based on ICD	• Ten items (a subset of NHDD items)	Universal data collection in settings for primary care of injuries (including EDs) and for surveillance of injuries in all settings
2	To provide information to: · assist identification of hazards and solutions · enable target setting · identify and monitor new/unusual injury events	As for Level 1 except: • Full ICD classification instead of short code lists • Extended classifications for Place and Activity • Four additional items	As for Level 1 except: • Three additional items	Preferred level for EDs and all settings where sufficient resources are available for collection and use of the data. Aim for representative or sentinel coverage in each state.
3	To investigate particular classes of injury events at a fine level of detail to increase understanding of risk factors and enable research and evaluation	To be decided	To be decided	Where defined need requires more detail, and if resources permit. Cases may be sampled from collection at a lower level.

NHDD = National Health Data Dictionary

Table 2. NDS-IS Data Items

Item	Level 1	Level 2
Description of injury event	Short narrative	Unlimited structured narrative
Main 'External Cause'	Major groups *29* Intent groups *11*	External Cause codes (ICD 9 or 10) *hundreds*
Type of Place	Place of injury occurrence: type *13*	Place of injury occurrence: sub-type *65* Place of injury occurrence: part *47*
Type of Activity	Activity when injured: type *9*	Activity when injured: sub-type *140*
Trauma	Nature of main injury *32* Bodily location of main injury *22*	Principle diagnosis: injury or poisoning (ICD9 or 10) *hundreds*
Major factors		Major injury factors *137*
Mechanisms of injury		Mechanisms of injury: types *54*
Date of injury		DDMMYYYY
Time of injury		HHMM

1. General information items: case ID, establishment ID, sex, birth date, area of residence, departure mode, country of birth, Aboriginality, employment status, occupation, preferred language, date and time of attendance
2. *Italics* indicate the number of categories in each classification

Hidden drownings: A New Zealand case study

John D Langley, PhD *
Gordon Smith MB.ChB., MPH**

*Injury Prevention Research Unit
Department of Preventive and Social Medicine
University of Otago Medical School
Dunedin
New Zealand

**Johns Hopkins School of Public Health
Center for Injury Research and Policy
Baltimore
Maryland
USA

Introduction

As part of the International Collaborative Effort on Injury Statistics (ICE) studies are being undertaken which seek to evaluate and compare differences in vital statistics using specific injury types. One such study is of drowning and New Zealand is participating in that study.

In order to determine rates, participating countries are being asked to use standard codes to define drowning. These codes are:

E830: Accident to watercraft causing submersion
E832: Other accidental submersion or drowning in water transport accident
E910: Accidental drowning and submersion
E954: Suicide and self-inflicted injury by submersion [drowning]
E964: Assault by submersion [drowning]
E984 Submersion [drowning] undetermined whether accidentally or purposely inflicted

Although this is the complete range of specific E codes for drownings unfortunately it does not identify all cases of drowning in a country, since there are drownings which occur under other circumstances and are hidden within other E codes. An insight into the potential significance of such cases is provided by reference to some of the exclusions for E910 listed in ICD 9. The full list of exclusions is:

•diving accident (NOS) resulting in injury except drowning (E883.0)
•diving with insufficient air supply (E913.2)

•drowning and submersion due to cataclysm (E908-E909)
•machinery accident (E919.0-E919.9)
•transport accident (E800.0-845.9)
•effect of high or low pressure (E902.2)
•injury from striking against objects while in running water (E917.2)

Thus in the case where a drowning resulted from a single motor vehicle incident in which the vehicle failed to take a corner and crashed into a river, this would be coded as E816: Motor vehicle traffic accident due to loss of control, without collision on the highway.

Rates based on the E codes listed for the proposed international drowning study will therefore underestimate the extent of the problem. By how much will depend to some degree on the physical environment in a given country, such as the length of roadway alongside lakes and rivers. The aim of the study described here was to determine for New Zealand:

1) to what degree use of the ICD drowning codes underestimates the incidence of drowning;
2) how the "hidden" drownings are distributed across the full range of E codes; and
3) whether the proportion of drownings which have been hidden has changed over time.

Method

New Zealand maintains an electronic national mortality data file. All injury deaths are coded according to the International Classification of Diseases Supplementary Classification of External Causes of Injury and Poisoning, commonly referred to as E codes (WHO 1975). Injury diagnoses are not coded neither are multiple causes of death. For each injury death there is an electronic field of up to 95 characters of narrative, which is used to briefly describe the circumstances of death, including the nature of injury. There are no specific guidelines for completing this field. Information for this field is obtained from a variety of sources, including the death certificate, coroner report, and hospital files.

Mortality files for the period 1977-92, which were coded in the range E800-E999 (External causes of injury and poisoning), were electronically searched using the key word "drown".

Results

For the period 1977-92 1913 drownings were recorded under the drowning codes listed above (E830,E832,E910,E954,E964,E984). By searching for the term "drown" we identified 2321 cases. This represents a 21.3% increase in cases. All drowning cases identified by drowning codes had "drown" in the narrative.

Table 1 shows the distribution of the drownings identified by the narrative search according to the E code groupings under which they were classified. The majority (65%) of 408 drownings not coded as such (hereafter referred to as 'hidden' drownings) were coded as E810-E819: Motor vehicle traffic accidents. These incidents represent 11.4% of the drowning problem in New Zealand. The remainder of the hidden drownings were evenly distributed over a range of E code groupings (Table 1)

Table 2 provides greater detail of the classification of the hidden E codes, by listing the most common 3 digit E categories to which they were coded. Three findings are of note. First, single vehicle crashes (E816) accounted for just over half of all cases. They represent 9.4% of all drownings in New Zealand. For the same period there was a total of 2233 single vehicle crashes (E816), drowning was mentioned as an outcome in the free text in 9.8% of these. Second, is the large number of events classified as E957: Suicide and self inflicted injuries by jumping from a high place. The effect of the use of this classification is that reference solely to E954 will underestimate the size of the suicide drowning problem by 7%. Finally, a similar problem, although less significant, arises when seeking to determine the incidence of drownings associated with water transport. The drowning codes in Table 1 suggests there are 511 cases (E830,E832). Reference non drowning codes in Table 1, however, suggests there were an additional 16 cases.

Figure 1 shows that the percentage of drownings which were hidden drownings remained relatively constant from 1977 until the late 1980's, when in 1989 it peaked at 53% then dropped away but has remained at a higher level in the early seventies. Further analyses of the data reveal that this peak is largely attributable to the increasing significance of motor vehicle traffic accidents over time as a contributor to the total drowning burden (Fig 2). Whether there has been a real increase in these drownings or E code classification has changed in recent years is not known.

Discussion

The analyses presented here show that estimates of the prevalence of drowning in New Zealand will be seriously underestimated by reference solely to the specific drowning E codes. It seems likely that this will be the situation in other countries. In some countries this matter will be able to be addressed by reference to the four digit code for the nature of injury, namely: "994.1 Drowning and nonfatal submersion". As previously indicated this, the preferred approach, was not possible in New Zealand as nature of injury is not coded. It would be available in a limited number of countries (e.g. USA) which have multiple cause of death coding.

Not only has the use of free text information enabled a more accurate estimate of the prevalence of drowning but it has also highlighted the significance of specific drowning events, in particular those associated with motor vehicle crashes. Motor vehicle traffic crashes accounted for 11% of all drownings. In the USA the comparable figure is approximately 5% (Baker et al 1992).

We have also shown that free text information is useful in identifying cases where only the underlying cause of death is coded. WHO defines underlying cause as the disease or injury which initiated the train of morbid events which produced fatal injury. Therefore if someone intentionally jumps from a high place and then drowns this incident should be classified as E957. In this context we wish to emphasise that the revised estimate of intentional self drownings (n=116, 4.9%) probably remains an underestimate. For example, some of the single vehicle motor vehicle crashes may be intentionally self-inflicted. Support for this view is provided by a more detailed investigation into drownings in the Auckland area. That study estimated 28% of all adult drownings were intentionally self-inflicted (Cairns et al 1984)

In the absence of specific guidelines on the contents of the free text field, it seems likely that the estimates produced here are underestimates since limited space may have precluded mention of injury diagnosis in some cases. Adding a mandatory diagnostic field that addresses the type of injury causing death would address this problem. Some indication of the potential significance of further hidden drownings is provided by reference to the New Zealand Water Safety Councils estimates. These are produced by reference to a variety of sources throughout New Zealand. For the period 1980-1992, inclusive they estimated, there were 2278 drownings. The comparable figure from our analyses using free text is 1706, 25% fewer. From a national perspective this discrepancy is of considerable concern. Future research in this area should give priority to matching the two data files with a view to producing a more accurate estimate of the prevalence of all drownings and specific drowning types.

Given the foregoing, the proposed ICE drowning study should avoid comparing countries on their total drowning rate but rather compare countries on each of the specific drowning codes within ICD.

References

Baker, S. P., O'Neill, B., Ginsburg, M. J., & Li, G. (1992). The Injury Fact Book: Second Edition. (Second ed.). New York, USA: Oxford University Press.

Cairns, F. J., Koelmeyer, T. D., & Smeeton, W. M. I. (1984). Deaths from drowning. The New Zealand Medical Journal, 97(749), 65-67.

World Health Organisation. *International Classification of Diseases, 1975 Revision.* Geneva: World Health Organisation 1975.

Acknowledgements

The Injury Prevention Research Unit is funded by the Accident Rehabilitation and Compensation Insurance Corporation, and the Health Research Council (HRC) of New Zealand. Dr Langley is a HRC Principal Research Fellow. Dr Gordon Smith was supported by a grant from the Centers for Disease Control and Prevention Center and by a First Award from the National Institute of Alcohol Abuse and Alcoholism (R29AA07700). The New Zealand Health Information Service provided the fatality data files. We wish to thank the Lois Fingerhut of the US National Center for Health Statistics for her encouragement and assistance in preparing this paper. Comments from David Chalmers and Geraldine Whyte on an earlier version of this paper are appreciated.

Table 1: Drowninings in New Zealand 1977-1992
Distrubtion of cases identified by electronic search on the word "drown" according to assigned E code

Assigned E codes	**Freq**	**Percent**
Drowning Codes		
E830: Accident to watercraft causing submersion	412	17.8
E832: Other accidental submersion or drowning in water transport accident	99	4.3
E910: Accidental drowning and submersion	1024	44.1
E954: Suicide and selfinflicted injury by submersion [drowning]	277	11.9
E964: Assault by submersion [drowning]	7	0.3
E984 Submersion [drowning] undetermined whether accidentally or purposely inflicted	94	4.1
Subtotal	**1913**	**82.4**
Non drowing codes		
E810-E819 Motor vehicle traffic accidents	264	11.4
E820-E825 Motor vehicle non traffic accidents	16	0.7
E831, E833-E838 Water transport accidents	16	0.7
E840-E848 Air and space transport accidents	16	0.7
E880-E888 Accidental falls	19	0.8
E900-E909 Accidents due to natural and environmental factors	12	0.5
E950-E953, E955-E959 Suicide and self-inflicted injury	30	1.3
Others	35	1.5
Subtotal	**408**	**17.6**
Total	**2321**	**100.0**

Table 2: **Drowninings in New Zealand 1977-1992**
Distrubtion of hidden drownings by most common 3 digit E codes

Assigned E codes		Freq	Percent
E816	Motor vehicle traffic accident due to loss of control, without collision on the highway	220	53.9
E815	Other motor vehicle traffic accident involving collision on the highway	31	7.6
E957	Suicide and self inflicted injuries by jumping from a high place	22	5.4
E825	Other motor vehicle nontraffic accident of other and unspecified nature	14	3.4
E838	Other and unspecified water transport accident	11	2.7
E884	Other fall from one level to another	11	2.7
E841	Accident to powered aircraft, other and unspecified	10	2.5
Miscellaneous (none greater than n=9)		89	21.8
Total		**408**	**100.0**

Figure 1: Dronings in New Zealand 1977-1994
Percentage of hidden drownings by year

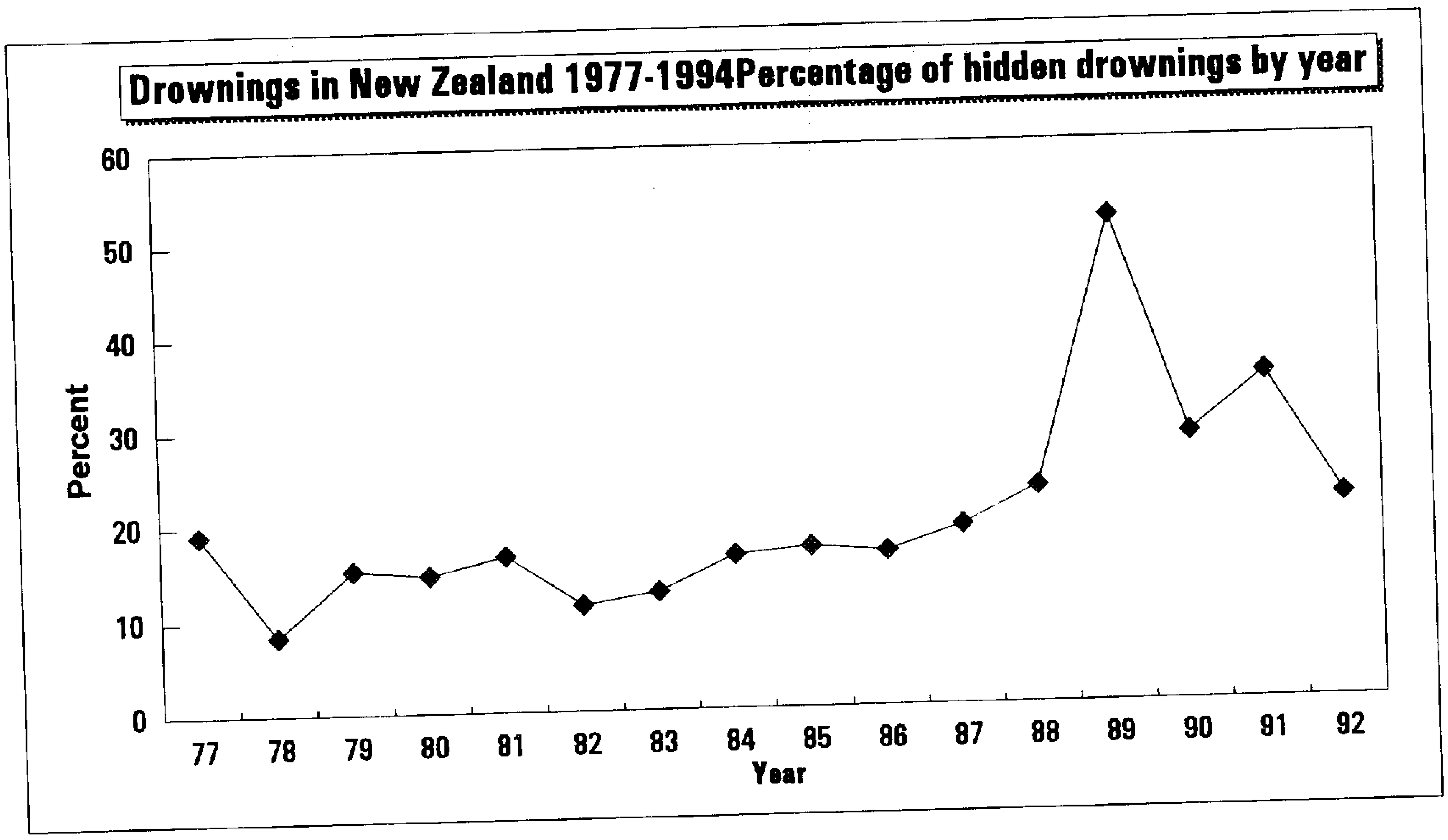
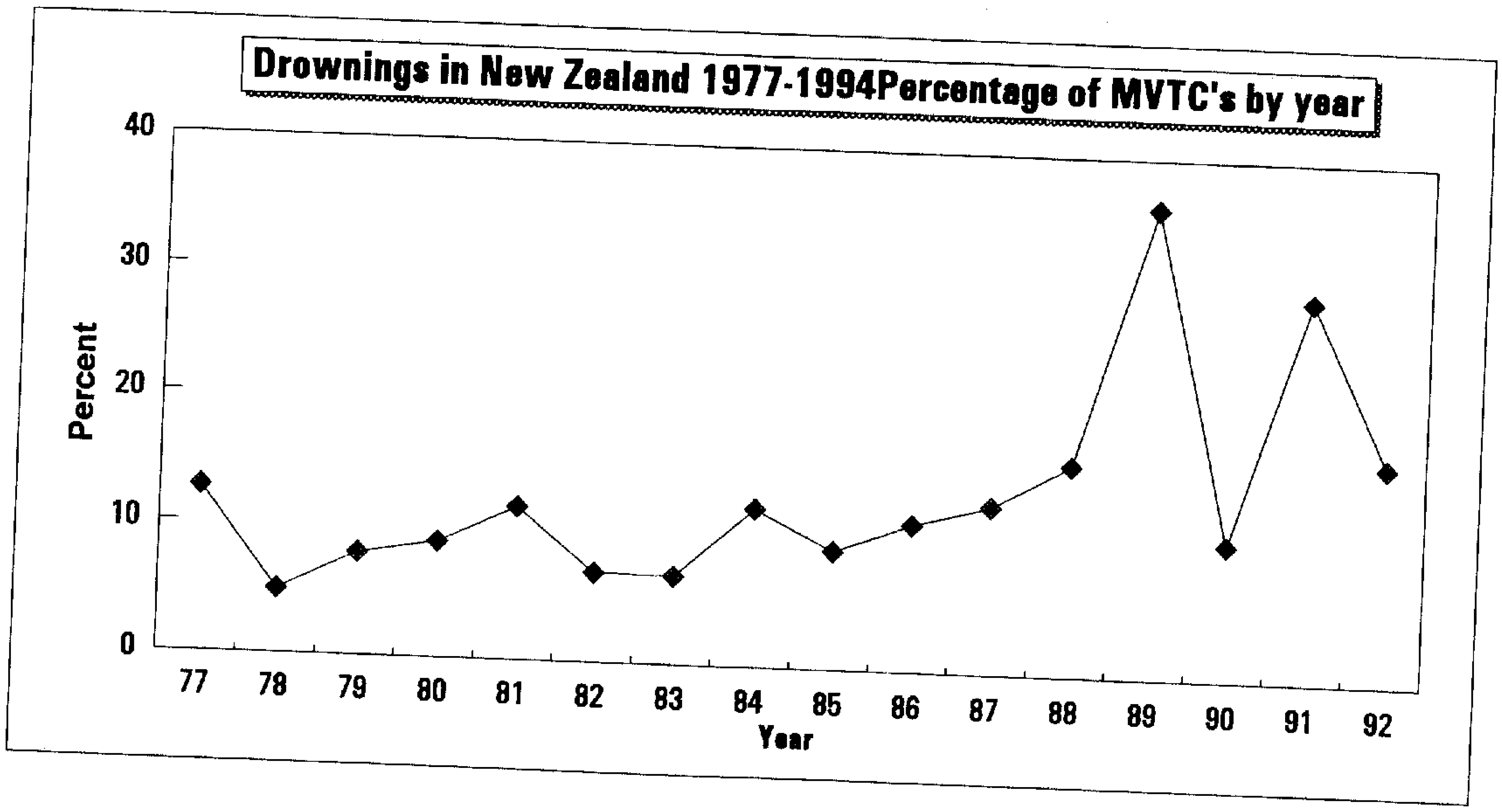


Figure2: Drownings in New Zealand 1977-1994
Percentage of MVTC's by year



International Comparisons of injury mortality databases: evaluation of their usefulness for drowning prevention and surveillance.

Smith GS and the WET ICE collaborative group*

Members of the WET ICE Collaborative Group

Anders Aberg, Sweden
Vita Barell and Pnina Zadka, Israel
Henning Bay-Nielsen, Denmark
Ruth Brenner, USA
Lois Fingerhut, USA
James Harrison, Australia
John Langley, New Zealand
Cleo Rooney, England and Wales
Hidde Toet, The Netherlands
Anne Tursz and Eric Jougla, France
Margaret Warner, USA

Correspondence: Gordon S. Smith
Johns Hopkins Center for Injury Research and Policy
624 N. Broadway, Room 593
Baltimore, MD 21206-1996
Tel: (410) 955-7981 Fax: (410) 614-2797
Email: gsmith@phnet.sph.jhu.edu

Our earlier studies have identified wide variations in injury rates from one country to another and even within countries (Smith, Langlois, Rockett 1994; Rockett, Smith 1987, 1989, a&b, Bacon, Smith, Baker 1989). However these and a number of other studies have raised concerns over whether these differences are real or due to differences in coding practices (Langlois, Smith, Baker, Langley, 1995)

During the International Collaborative Effort (ICE) on Injury Statistics meeting in 1994 and the subsequent follow up working group meeting, a number of issues relating to differences in coding practices and the type of data available in different countries were discussed (Fingerhut, Hartford, 1995). Included in the recommendations for follow-up projects that came out of that meeting was a recommendation to evaluate the comparability and differences in vital statistics data using a specific injury type. Our group proposed to use drowning as such a case study. For want of a better name this project has been called "Wet ICE" Project.

Drownings were chosen for study because unlike most other injuries the external cause of injury codes (E-Codes) for drownings correspond with a specific nature of injury code that describes the type of injury (ICD Code "994.1 drowning and non fatal submersion"). This would facilitate taking advantage of data from those countries that use multiple cause of death coding (Israel et al. 1986). Only burns and poisonings have similar corresponding nature of injury codes.

Initial review of available data for potential collaborating countries from the recent 1993 World Health Statistics Annual (World Health Organization, 1994) found that drownings (defined in their publication as accidental drowning E-910 only) were an important cause of injury death in many countries. As would be expected the number of drowning deaths varied widely from country to country depending both on the population size and underlying injury rate (Table 1). Rates are uniformly higher in males with Finland having the highest rate; England and Wales have the lowest, and they also have the lowest rates for females. Even, when the drowning rates were age adjusted (Figure 1) an earlier publication from Australia showed that the differences in drowning rates were just as dramatic (Harrison et al. 1995). While these data are a useful first step in understanding differences in drowning they do not reflect the true picture of all drownings that occur. Not all drownings are classified as accidental, many are also classified as suicide, and a limited number due to homicide. In Japan for example suicides are an important part of the drowning problem with many deaths being potentially misclassified (Rockett, Smith 1993). It is important to consider all drownings regardless of intent when looking at drownings. This may be especially true when comparing data between countries because of potential differences in how deaths are classified. This is one of the central issues to be explored in the WET ICE.

The aims of the "Wet ICE" Project are to:

(1) Develop a better understanding of what data are available in the vital statistics database in each country and how they differ (e.g. socioeconomic variables, rural/urban codes). We will also examine if there are certain unique features available in particular countries that may be useful to better understand both drowning causes and prevention strategies.

(2) To determine if the exercise of studying one specific injury in detail can lead to improved understanding of injury coding practices and what information is and is not available in each country. Special features in one country's system may also provide important information on areas where other countries could improve their vital statistics data not only for drowning but for all other causes.

(3) To conduct more in-depth studies in the future, such as to evaluate if trends in drowning rates, similar to those in the US, have occurred in other countries and what information is available to help explain these trends. Although we cannot really claim to have proven interventions for drowning, especially outside the toddler age group, but there have been dramatic declines in rates in the U.S.(Brenner, Smith 1994). It is hoped that a more in-depth study of both differences between countries and trends in injury rates may reveal natural experiments that suggest effective prevention strategies.

(4) To foster better links between collaborating countries in order to better understand injury problems, improve data quality, and develop prevention strategies.

The WET ICE project as proposed has multiple components; only the first will be presented here. The first phase includes an attempt to describe and compare rates for each country and compare them for a standard period (i.e. 10 years using the same codes). We also propose to examine similarities and unique features of each system. In subsequent years we propose to do a series of other studies to build on this initial study. This paper describes the preliminary findings from our study of a limited number of countries that were able to provide data in the short time frame of this initial effort. The paper also will serve as a working draft to further develop the work we have outlined, and in its current form only represents the opinions of the first author. Further input into the paper and revisions to improve it are being solicited from WET ICE participants with a view to submitting one or more papers for publication to a peer reviewed journal. It is also hoped that other countries will be able to participate and will be included in future analyses from our group.

Methods

Participating countries and potential collaborators were identified through participants at the ICE meeting in 1994. A standardized questionnaire was sent to each potential collaborator requesting information on a number of different variables relating to coding practices and the structure of their vital statistics system. Data was requested from collaborating countries on drowning deaths for a number of different years, at least since 1979 (when ICD-9 was implemented in most countries). Information on the availability of data far back as countries could easily go on computer or hard copy files was also sought.

The long range goal is get case level detail as a large computer file from each country. However, this would have proven logistically difficult given the limited time available to do the first phase of this study. Information was thus collected on the availability of certain data and a follow up request later asked for specific summary data for preliminary analysis. The availability of data the following variables was sought:

(1) Year: Data on drownings for individual years were requested. We proposed to group data into several years for some analyses, because some countries may have small numbers of drownings in any one year (Table 1). The following ICD-9 E-Codes were used for the basic analyses - E830, E832, E910, E954, E964, and E984 (see Table 2).

(2) Age: Data was requested for the following age groups: less 1, 1-2,3-4,5-9,10-14 and 5 year intervals thereafter to age 75 and over, and the total for all ages.

(3) Gender: male, female, total.

(4) Race/socioeconomic status : Countries all have different methods of coding racial or ethnic differences and information was requested on groups available. A separate question was asked on available data on socioeconomic status. For example are the occupations of parents available for victims of a childhood drowning? In the U.S. race is often used as a proxy for socioeconomic status, and usually presented as white, black, and other (more breakdowns are available on this group).

(5) Population data: Estimates of population size was requested for each year in the same age, gender, race/socioeconomic, and urban/rural categories.

(6) Urban/rural variable: In subsequent studies, we plan to explore if drowning rates have changed more in rural compared to urban areas. Some of the observed decline in drowning rates seen in some countries may be due to population shifts and to decreasing exposure to the outdoors. In the U.S., urban/rural status is based on county of residence. One grouping used by NCHS is: core city, fringe, medium, small (communities) and non metro (= rural). The Injury Fact Book uses central city, metro > 1 million, metro < 1 million, non metro, rural remote (Baker et al. 1992).

(8) Multiple cause data: What multiple cause data was available and how many different codes are recorded?

(9) Unique features of vital statistics database: We were keen to learn what additional data was available that would help us understand injury problems such as drowning. The major problem in looking at drownings is the lack of specific detail in the E-codes with the 4th digit of the ICD code providing little useful information. For example we cannot identify pool drownings or other sites from vital statistics data? We sought to explore the unique data fields that may be available such as place codes, free text descriptions or other coded information that improved the quality and detail of the data available.

Results

Information was received from the following nine countries: Australia, Denmark, England/Wales, France, Israel, the Netherlands, New Zealand, Sweden and the United States. All countries could provide computerized data from 1979 to 1993 with Sweden and the Netherlands having 1994 data accessible. Prior to 1979 most countries had trouble accessing data reliably by computer. France and Israel had data computerized from 1968, while England and Wales could provide data on a diskette as far back as 1901. Providing appropriate gender and age breakdowns was not difficult for any country, except for Australia which had difficulty providing specific age breakdowns by 1 year intervals in ages 1-4. The US uses a number of race categories which are usually summarized as white, black, other. New Zealand uses European, Maori, Pacific Island and several Asian categories, while Australia only uses a variable "aboriginal yes/no" which is considered to be of limited value. Israel uses Jew/non Jew and England and Wales record the country of birth which is useful for recent immigrants only. The only country to have a specific socioeconomic status variable in their data is England and Wales which uses social class variables (I to IV) based on the occupation of the individual or head of household (for children it is available separately for mother and father).

A number of countries (especially Scandinavian ones) said that linkage to census data is possible to obtain some socioeconomic data. No such information is available in the US, New Zealand or Australia, although place of residence may be used as a proxy. Most countries could provide some urban/rural breakdowns but this would usually involve more complex analyses. All countries could provide reliable population data for calculating rates of injury.

Coding

All countries were capable of generating both 3rd and 4th digit level ICD data on drownings, while the US had complete multiple cause data for all years as did England and Wales for 1985 and 1986, and for the period 1993 and 1994 (not available for other years). Denmark, France, Norway, and Sweden have some level of multiple cause codes which appear to only be the single nature of injury code without more extensive multiple cause codes. This point however needs more clarification. Australia, Israel, the Netherlands and New Zealand only code the underlying external cause with no other codes available.

Unique Features

(1) Special Codes: One country, Australia has separate fields that are used specifically for certain types of deaths to provide additional information. For all drownings there is a special two digit code that was originally developed in New South Wales (Figure 2). This code provides extensive information on the place and circumstances of drowning. For example swimming pool drownings can be clearly identified by type of pool and it can also distinguish between falls into water and drownings occurring while swimming. This code also enables drownings coded outside the traditional ICD codes to be identified, such as drownings due to floods and presumably motor vehicle drownings, although there is no specific category for this.

(2) Free text: New Zealand has a separate 96 free character text field in their vital statistics database that can be used to describe the cause of drowning (see Langley, Smith accompanying article). This free text enables drownings from other causes such as railway accidents or motor

vehicle crashes to be identified through word searches such as the word "drown". This unique feature is also available for the hospital discharge data and has been used in a number of studies (Langley 1995).

England and Wales in addition to multiple cause coding for selected years also directly enters the text written on the death certificate into their vital statistics database. All words written in parts I and II of the death certificate are entered verbatim. This would allow free text to be researched for words that mention drown or drowning. Denmark also enters some free text from the death certificate into their computer file and it is available in English for years 1980 - 1985.

Data Analysis

Drowning rates for New Zealand, Australia, and England and Wales were first compared because these countries all have the ability to pick up drownings outside the standard ICD code groupings. This can be done either through full multiple cause coding (U.S. and England and Wales), through special codes (Australia) or free text searches (New Zealand) (see above).

The rates for accidental drowning (E910) vary widely from a high of 22.8 in New Zealand to a low of only 8.0 per million population in England and Wales (Table 2). Similar variations also occur for boating, suicidal and homicidal drownings. An unanticipated finding was that the drowning rates for those of undetermined intent (E984) were much higher in the United Kingdom (7.7 per million population) than they were for the next highest country New Zealand (1.9 per million). When all cause drowning rates regardless of intent were compared the drowning rates for Australia, USA and England and Wales were remarkably similar in marked contrast to the accidental drowning rate which was much lower in England and Wales (almost half that of the other two countries). New Zealand had a high drowning rate in most intent categories.

When the proportional distribution of drownings by intent category are compared (Table 3) it can be seen that 39% of all drownings are coded as due to undetermined intent in England and Wales while only three to five percent were so classified in New Zealand, Australia or the U.S.A. A similarly high proportion of drownings classified to undetermined intent was noted in Sweden (24%) and France (33%), while Denmark and the Netherlands were somewhat lower. A very small proportion of deaths were classified as due to undetermined intent in Israel, with 92% being classified as accidental drowning; much higher than in any other country. It is also of interest to note that the overall drowning rate in different countries tends to cluster into two groups. New Zealand, Sweden, France, and Denmark have rates ranging from 42.5 to 37.1 per million population while rates in the other countries range from 23.2 in Australia to 19.3 in the U.S.A., Israel stands out with a much lower rate of only 15.1 per million population. As would be expected based on population size, the number of drownings in each country also varies considerably from an average of 6,300 annually in the U.S.A. to only 66 in Israel.

Hidden drownings

As mentioned earlier the existence of multiple cause codes or special features of the vital statistics system can pick up a number of additional "hidden" drownings that are not identified by standard ICD drowning codes. As discussed in the accompanying paper by Dr. John Langley (Langley, Smith In press) these drownings occur in a wide variety of situations from railway accidents (drowning due to being knocked off a bridge by a train) to motor vehicles driving into water, and to suicide from jumping from a high place which then results in drowning. In New Zealand from 1977 to 1992 the average annual drowning rate due to hidden drownings was 7.5 per million population (Table 4). These were detected (as discussed earlier) though a free text search for the word "drown". When added to the already high drowning rate of 42.5 per million population their drowning rate is thus much higher then any other country we studied. In Australia the existence of special drowning codes resulted in a hidden drowning rule of 1.7 drownings per million population. The multiple cause data in England and Wales resulted in an increase of the drowning rate by 1.3 drownings per million population. Information on multiple cause data for the U.S. is pending. These hidden drowning rates can increase the true drowning rate considerably. In New Zealand 15.0% of all drownings are "hidden" and not picked up by standard ICD groupings. Even in Australia and England 6.8 and 6.3 percent respectively of all drownings are excluded from the drownings identified by ICD codes (Table 5).

Discussion

This paper presents the first preliminary analyses of data from the WET ICE project. This draft will hopefully serve as the basis for more in-depth analyses of drowning data from different countries and promote discussion among participants. One important finding from this study is that there are marked differences between countries in both the type of data collected by the vital statistics databases and the availability of additional data with which to look at both drownings and other injuries.

While it was expected that drowning rates would vary dramatically by country the most surprising finding was the wide variation in the proportion of drowning deaths classified as of undetermined intent (E984). This is the first study to our knowledge to examine this category of deaths. In England and Wales almost 40% of all drowning deaths are coded as of undetermined intent while less than 1% are so coded in Israel. One possible explanation of the reasons for the high undetermined category in England and Wales is that unlike in many other countries the external cause of death, including intent is determined by the judicial system following a legal inquest. The intent is thus determined by a magistrate and held to higher legal standards of proof that may be different to that required in other countries. It is interesting to note that a number of other countries also have a high proportion of undetermined drowning deaths, including France (33%), Sweden (26%), and Denmark (13%). More work is needed to determine exactly how deaths are certified in each country and to what standards of proof the certifiers of cause are held to. These are similarly wide variations in the proportion of drownings coded as suicide ranging from 56% in the Netherlands to only 7% in Israel. It is unknown at this time whether these charges are real or simply due to differences in coding practices. An interesting follow-up study may be to compare coding practices by country using common case scenarios and also using the same death certificates. When all drownings regardless of intent were compared it was remarkable how similar drowning rates were in some countries compared to wide variations observed when accidental drowning rates (E910) alone were compared (Table 2). There also appeared to be clustering of drowning rates into two broad categories, the high drowning rate countries and the lower drowning rate countries (Table 3). More work is needed to examine if these differences are real or not.

Another important finding from this study is that the standard ICD codes for drownings do not capture all drownings. While this has been known for some time (Baker, et al. 1992) the true extent of this problem has not been examined. The ability to analyze free text such as found in New Zealand is a major advance in our ability to examine all drownings. A full 15% of all drownings were "hidden" from standard analyses using only ICD codes. It is interesting to note that in both Australia, using special a separate coding field, and England, using multiple cause coding, between 6 to 7% of all drownings were not picked up using standard ICD codes. In these same countries if only accidental drownings (E910) were used to compare the drownings between countries only about 40 to 60 percent of drownings would have been considered. This illustrates the fallacy of using one simple code to compare drownings and presumably other injuries between countries.

This study also demonstrates the value of examining all drownings as a group regardless of intent. The method of considering all injuries regardless of intent has proven very valuable to define the true public health impact of firearm injuries (Fingerhut LA, Personal Communication, 1995). Our study of drownings further illustrates this point, particularly when a number of countries have a considerable proportion of their injuries coded as due to intent undetermined. More research is needed as to what these drownings represent and if similar variations are seen for coding other injuries. Our earlier work for example remarked on the much lower injury rates in the United Kingdom for injuries coded as accidental (unintentional for the injury prevention purists) (Rockett, Smith 1989b). Our current study casts doubt as to whether these findings are real, especially given that in almost 40% of drowning deaths the intent was not determined. A valid question to be answered is "Is England and Wales really so safe", or is it just an artifact of differences in injury coding practices. This issue is one of the major reasons to continue the work began by Louis Fingerhut and Bob Hartford when they created this Injury ICE. Our thanks must go to them for making this and future studies possible.

It is proposed that we will continue this work on the WET ICE to better understand both injury coding practices globally and to also gain insights into how drownings can be prevented. Other potential projects could include:

(1) Comparison of drowning trends over time. There have been dramatic declines in recent years in drowning rates for most age groups among children and youth in the U.S. (Brenner, Smith 1994) (Figure 3). We are unable to explain this trend and would very much like to determine if there have been similar trends in other countries such as has been shown in Australia in an analysis by their National Injury Surveillance Unit (1995.b) (Figure 4).

(2) Analysis of hospital discharge data for drowning admissions and calculations of case fatality rates. Our earlier work shows dramatic differences in a fatality by age group, although little is known regarding hospitalized drownings (Smith, Brenner, 1995).

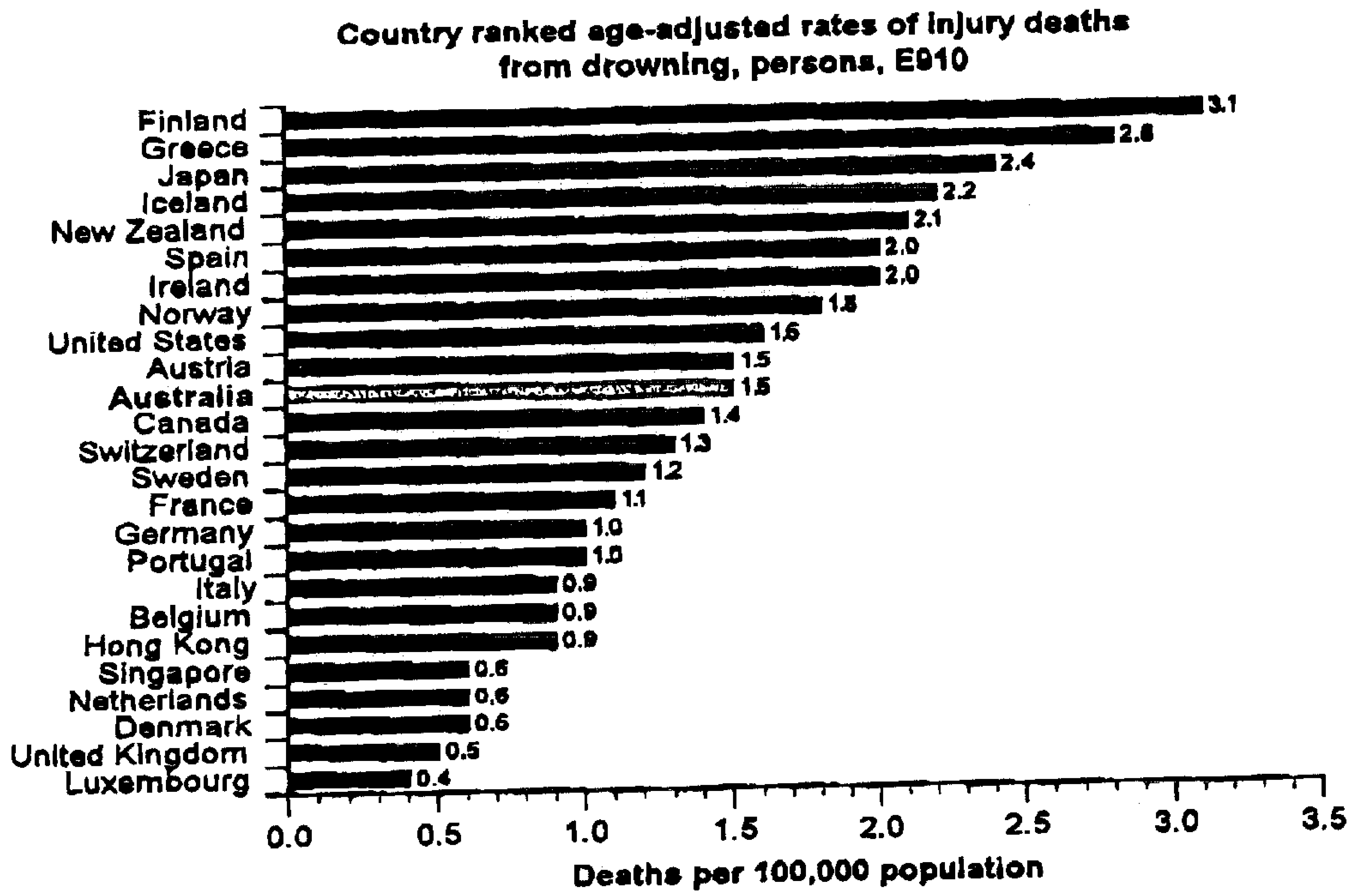
(3) Analysis of emergency department (A & E) visits for drowning using data from different countries and estimation of admission rates.

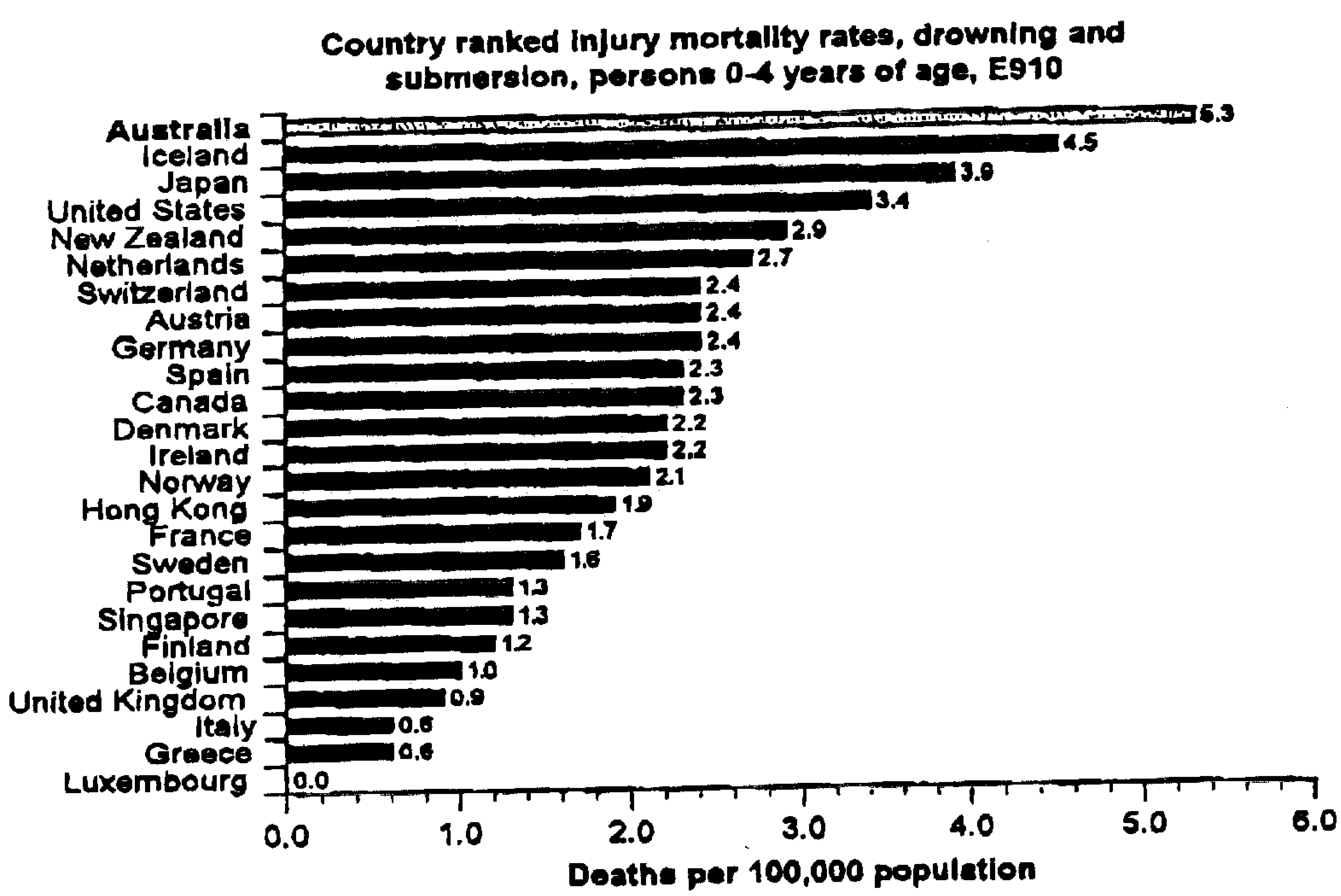
Through such analyses as we have proposed it is hoped that important new insights can be gained regarding differences in injury coding practices between countries. It is also hoped that through such understandings we can improve our own respective injury data sources to better understand the true injury problem. In addition once valid comparisons can be made between countries it is hoped that we will be able to then examine factors that are responsible for the apparent wide variations in drowning and other injury rates between countries. Such studies for other diseases lead to important new hypotheses that then lead to better understanding of etiology and prevention of a number of diseases including heart disease, diet, and cancer (Reid, 1975; Armstrong and Doll, 1975; Schrauzer et al., 1977). It is hoped that similar natural experiments may be going on with drowning and that by examining factors responsible for low drowning rates in some countries such as Israel as compared, for example, to the very high rates in New Zealand may suggest important new areas to reduce the toll of drownings on our society.

Acknowledgments

I would first like to acknowledge all the participants in the WET ICE who participated in this study and shared their countries data. Due to time constraints it has not been possible to get all their comments on this version of the paper and all responsibility for errors and omissions rests with Dr. Smith. This document serves as a draft for future discussions and collaboration on any manuscripts to come from this work. Dr. Smith was supported by a First Award from the National Institute of Alcohol Abuse and Alcoholism (R29AA07700) and by a grant from the Centers for Disease Control and Prevention (R49/CCR302486) to the Johns Hopkins Injury Prevention Center. The encouragement and assistance of the U.S. National Center for Health Statistics, especially Lois Fingerhut and Bob Hartford, and travel support from the National Center for Health Statistics and the National Institute of Child Health made meetings between collaborators possible.

FIGURE 1
Drowning rates (E910) by country for most recent year available
Source: National Injury Surveillance Unit, 1995, a.





Data Source: World Health Statistics Annual 1993. WHO, Geneva 1994.

Part 1: Illustrated country ranks, 1992 or nearest available year

FIGURE 2

Supplemental drowning codes use in Australia based on codes originally developed in New South Wales, Australia.

Source: Personal communication, James Harrison, Adelaide Australia, August 1995.

NSW DROWNING CODES

Swimming, paddling or wading -

Swimming pool -

01 Private
02 Public
03 Other
04 Unspecified
05 **Surfbeach**
06 **Ocean, river, estuary, harbor, bay (i.e. tidal influenced body of water)**
07 **Lake, lagoon, dam, water-hole (i.e. non-tidal bodies of water)**
08 **Irrigation canal, drain, trench**
09 **Other**
10 **Unspecified**

11 **Surfboard riding**
12 **Waterskiing**

Swept off rocks, breakwater -

13 Fishing
14 Other
15 Unspecified

Skin-diving, spear-fishing -

16 Using underwater breathing equipment
17 Other
18 Unspecified

Attempting a rescue -

19 Surf beach
20 Public swimming pool
21 Other
22 Unspecified

Fell or wandered into -

Swimming pool -

23 Private
24 Public
25 Other
26 Unspecified

Fell or Wandered into -

Ocean, river, estuary, harbor, bay (tidal)

27 Fishing
28 Other
29 Unspecified
30 **Lake, lagoon, dam, water-hole (non-tidal)**
31 **Irrigation, canal, drain, trench**
32 **Object containing water or other liquid**
33 **Other**
34 **Unspecified**

35 **Fell from bridge, wharf or other structure**
36 **Drowned in bathtub**

Accident to watercraft causing submersion

Motorized craft -

37 River
38 Estuary, harbor, bay (tidal)
39 Lake, lagoon, dam, water-hole (non-tidal)
40 Ocean
41 Unspecified

Non-motorized craft -

42 River
43 Estuary, harbor, bay (tidal)
44 Lake, lagoon, dam (non-tidal)
45 Ocean
46 Unspecified

Unspecified craft -

47 River
48 Estuary, harbor, bay (tidal)
49 Lake, lagoon, dam (non-tidal)
50 Ocean
51 Unspecified

52 Other accidental submersion in water transport-
53 Drowning caused by cataclysm or other environmental factors
88 Incidental drowning
99 Other unspecified circumstances

FIGURE 3
Unintentional drowning rates among adolescents by age group, U.S., 1979-91.
Source: Smith, Brenner 1995.

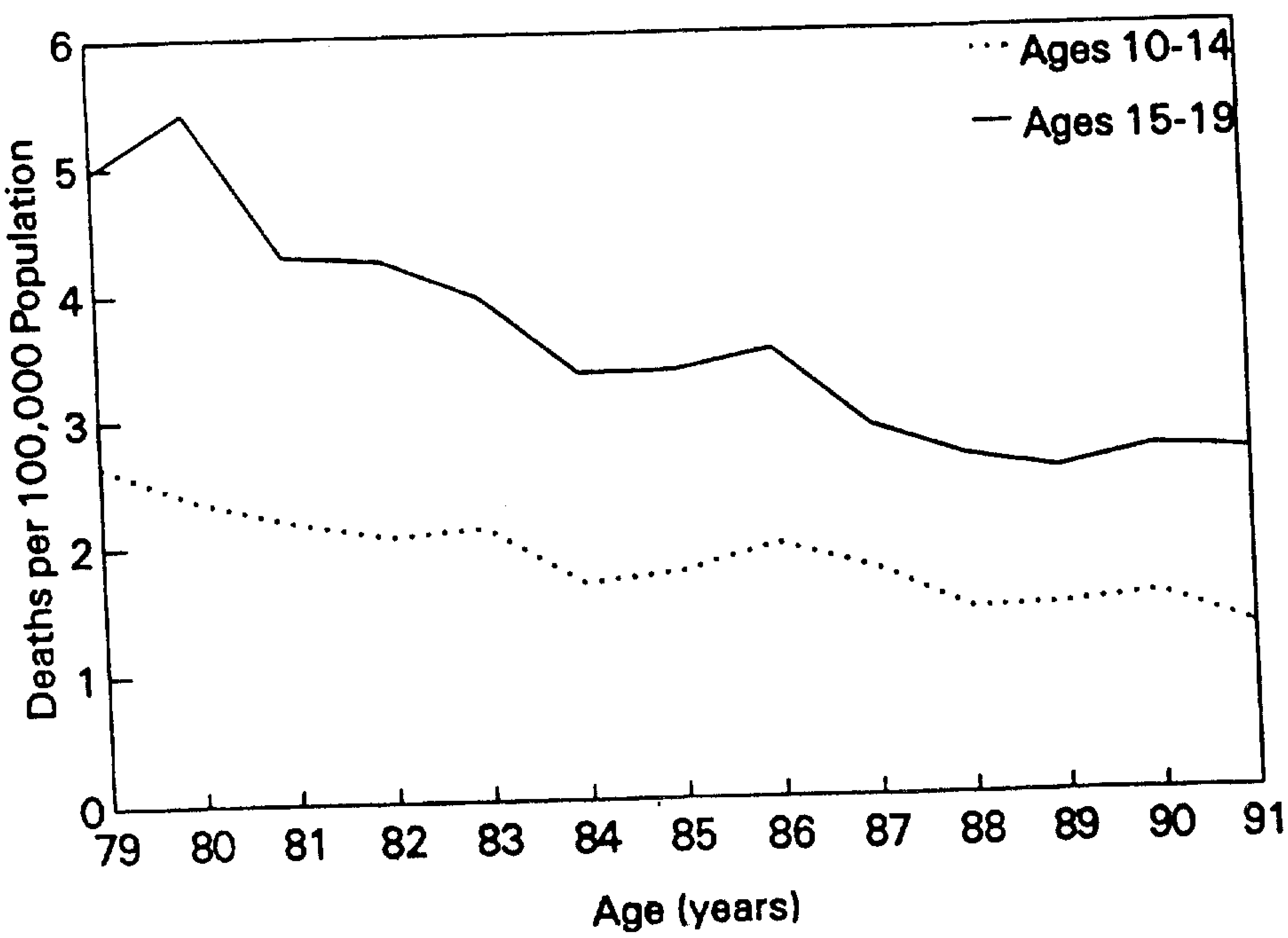
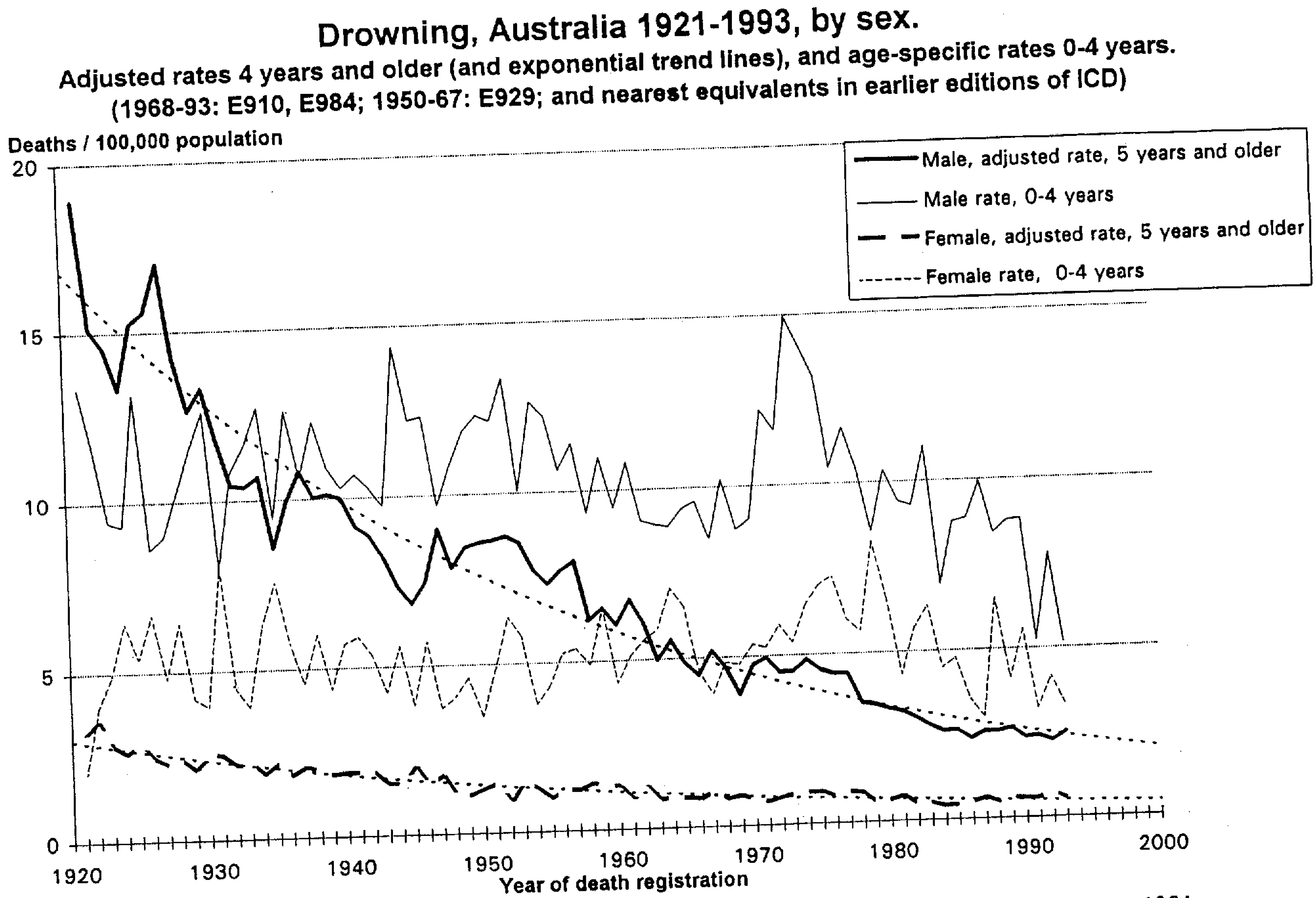


FIGURE 4
Drowning rates in Australia by sex and age group, 1921-1993.
Source: National Injury Surveillance Unit, 1995, b.



Source: AIHW National Injury Surveillance Unit, based on ABS unit record deaths data, and aggregate tables before 1964.
Rates are based on interim ABS population estimates for 1992 and 1993; final estimates were used for earlier years.
Sept. 1995

TABLE 1
Drowning Deaths (E910 only) by country & year.
1993 World Health Statistics Annual

		Number of Deaths			Rate/100,000	
Country	**Year**	**Male**	**Female**	**Total**	**Male**	**Female**
Denmark	1992	25	6	31	1.0	0.2
Finland	1992	139	30	169	5.7	1.2
France	1991	499	158	657	1.8	0.5
Israel	1990	35	12	47	1.5	0.5
Norway	1991	71	13	84	3.4	0.6
Netherlands	1991	65	18	83	0.9	0.2
Sweden	1990	96	25	111	2.3	0.3
UK (total)	1992	237	75	312	0.8	0.3
*Scotland	1992	30	5	35	1.2	0.2
*N. Ireland	1992	14	4	18	1.8	0.5
*England/Wales	1992	193	66	259	0.8	0.3
Australia	1990	216	65	281	2.5	0.8
Japan	1992	2,007	1,262	3,269	3.3	2.0
New Zealand	1990	55	19	74	3.3	1.1
Canada	1991	300	90	390	2.2	0.7
USA	1990	3,203	776	3,979	2.6	0.6

TABLE 2
Drowning Rates Per Million Population for selected countries

E Codes	New Zealand	Australia	England/Wales	USA
Boating E830, 832	11.6	3.1	1.4	2.6
Accident E910	22.8	15.2	8.0	13.8
Suicide E954	5.9	3.8	2.3	1.6
Homicide E964	0.2	0.4	0.1	0.3
Undetermined E984	1.9	0.7	7.7	1.0
TOTAL	42.5	23.2	19.5	19.3

TABLE 3
Distribution of Drowning Deaths by Intent for Participating Countries (%)

E Code	New Zealand	Australia	England/ Wales	USA	Denmark	Netherlands	Sweden	Fran
Boating E830, 832	27	13	7	14	12	4	13	0.8
Accident E910	54	66	41	72	21	33	32	25
Suicide E954	13	16	12	8	54	56	31	41
Homicide E964	0.4	2	0.5	2	--	0.7	0.3	0.2
Undet. E984	5	3	39	5	13	7	24	33
TOTAL	100	100	100	100	100	100	100	10
Av No /Yr	144	454	483	6,300	191	297	354	2,30
Rate/Mill.	42.5	23.2	19.5	19.3	37.1	19.8	41.2	40.

TABLE 4
Drowning Rates Per Million Population by Country, Including "Hidden" Drownings

E Codes	New Zealand	Australia	England/Wales	USA
Boating E830, 832	11.6	3.1	1.4	2.6
Accident E910	22.8	15.2	8.0	13.8
Suicide E954	5.9	3.8	2.3	1.6
Homicide E964	0.2	0.4	0.1	0.3
Undetermined E984	1.9	0.7	7.7	1.0
ALL ICD	42.5	23.2	19.5	19.3
Hidden*	**7.5**	**1.7**	**1.3**	**
NEW TOTAL	50.0	24.9	20.8	**

* Hidden = additional drownings picked up by other means (see text)
** Data not available at this time

TABLE 5
Distribution of Drowning Deaths by Intent Category
(% of Total for selected Countries)

E Code	New Zealand	Australia	England/Wales	USA
Boating E830, 832	23.3	12.4	6.7	13.5
Accident E910	45.7	61.0	38.5	71.5
Suicide E954	11.8	15.3	11.1	8.3
Homicide E964	0.4	1.6	0.5	1.6
Undetermined E985	3.8	2.8	37.0	5.2
ALL ICD	85.0	93.2	93.8	100.0
Hidden*	**15.0**	**6.8**	**6.3**	***
NEW TOTAL	100.0	100.0	100.0**	***

* Hidden = additional drownings picked up by other means (see text)
** Does not add due to rounding error
*** Data not available at this time

References

Armstrong B, Doll R: Environmental factors and cancer incidence and mortality in different countries with special reference to dietary practices. Int J Cancer 1975;15:617-631.

Bacon WE, Smith GS, Baker, SP. Geographic variation in the occurrence of hip fractures among the elderly white US population. American Journal of Public Health 1989;79:1556-8.

Baker SP, O'Neill B, Ginsburg MJ, Li G. The Injury Fact Book (Second Edition). New York: Oxford University Press, 1992.

Brenner, RA, Smith GS, Overpeck MD. Divergent trends in childhood drowning rates, 1971 through 1988. Journal of the American Medical Association 1994;271:1606-8.

Fingerhut LA, Hartford B (eds). 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;13:1-15.

Israel RA, Rosenberg HM, Curtin LR. Analytical potential for multiple cause-of-death data. American Journal of Epidemiology 1986;124:161-181.

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.

Langley J. Experiences using New Zealand's hospital based surveillance system for injury prevention research. In: Proceedings of the International Collaborative Effort on Injury Statistics, Volume 1. National Center for Health Statistics, Hyatts, MD (DHHS Publication No. (PHS) 95-1252), 1995;9:1-8.

Langley JD, Smith GS. Hidden drownings: a New Zealand case study. In: Proceedings of the International Collaborative Efforts on Injury Statistics, Volume 2. National Center for Health Statistics, Hyattsville, MD (DHHS Publication No. (PHS)), 96-in press (1996).

National Injury Surveillance Unit. International Injury Deaths. Injury Surveillance Data Report, December 1995, Adelaide; Australian Institute of Health and Welfare - National Injury Surveillance Unit, 1995, a.

National Injury Surveillance Unit, unpublished figure from personal communication, James Harrison. Australian Institute of Health and Welfare, 1995, b.

National Safety Council. International Accident Facts. Itasca, IL, USA: National Safety Council; 1995.

Reid DD: International studies in epidemiology. American Journal of Epidemiology 1975;102:469-76.

Rockett IRH, Smith GS. Covert suicide among elderly Japanese females: Questioning unintentional drownings. Social Science and Medicine 1993;36:1467-72.

Rockett IRH, Smith GS. Homicide, suicide, motor vehicle crash, and fall mortality: United States' experience in comparative perspective. American Journal of Public Health 1989(a);79:1396-1400.

Rockett IRH, Smith GS. Injuries and the Australian mortality mosaic: a comparison with the United Kingdom and New Zealand. Public Health 1989(b);103:353-61.

Rockett IRH, Smith GS. Injuries in relation to chronic disease: An international view of premature mortality. American Journal of Public Health 1987;77:1345-1346.

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

Rosenberg HM. Improving cause of death statistics. American Journal of Public Health 1989;79:563-4.

Schrauzer GN, White DA, Schneider CJ: Cancer mortality correlation studies, III. Statistical associations with dietary selenium intakes. Bioinorgan Chem 1977;7:23-31.

Smith GS. Drowning prevention in children: the need for new strategies. Injury Prevention (In Press).

Smith GS, Brenner RA. The changing risks of drowning for adolescents in the U.S. and effective control strategies. Adolescent Medicine: State of the Art Reviews 1995;6(2):153-169.

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 Center for Health Statistics, Hyattsville, MD (DHHS Publication No. (PHS) 95-1252), 1995;13:1-15.

Willett WC, MacMahon B: Diet and cancer-an overview. I-II. N Engl J Med 1984;310:633-8 and 697-703.

World Health Organization. World Health Statistics Annual 1993. Geneva, Switzerland: World Health Organization; 1994.

CAUSE OF INJURY CODING RULES AND GUIDELINES IN THE UNITED STATES: THE EFFECT ON INJURY DATA INTEGRITY

by Gerry Berenholz, RRA, MPH, President, Berenholz Consulting Associates, Lexington, Massachusetts

For many years, Berenholz Consulting Associates, (BCA), has been working on a standardized grouping of external cause codes. Today, we will discuss briefly the status of the work, and describe some of the problems in comparing causes of injury and poisoning leading to deaths, hospitalizations, and emergency department care in the United States.

Concern about the lack of comparability of E-code-based studies being reported in the literature, as well as the number and variety of suggested E code groupings which have been in general circulation in the United States was the impetus for the work. As part of a Small Business Innovative Research Grant (SBIR) in 1991-1992, BCA identified 42 references which used ranges of E codes to describe various causes of injury. The references included articles in scientific journals, as well as groupings of E codes that were most frequently referenced. The groupings by cause were compared, and the data were quantified by inserting 1988 National Center for Health Statistics (NCHS) mortality data for each code.

As an example, there were 23 references describing drowning and/or submersion. Ten (10) listed the same three E codes (E830, E832, and E910). Seven (7) listed E910 alone. Two (2) included intentional drownings, two (2) focused on assault by submersion. One listed a range of categories combining submersion with suffocation and other environmental factors. One group was entitled sports and recreation-related drowning and only included specific subcategories of E910. There were a different number of deaths associated with each grouping.

Another example showed eleven (11) references discussing injuries due to foreign bodies. Eight (8) references referred only to E914-E915. These codes describe foreign bodies in an orifice without causing asphyxia. Two papers included inhalation of foreign bodies plus other mechanical suffocation. One paper included drowning and submersion in addition to all of the above. The spread in the number of deaths was enormous.

It was very clear that researchers were using E codes to describe causes of injuries and poisonings, but they were not always comparing the same things. At that time, I began to formulate a detailed E code grouping which would be as accurate as possible in terms of the codes and coding rules and which would be accepted and endorsed by major coding organizations as well as by injury researchers. This would be an important collaboration between people who understood the coding requirements and people who understood the needs of injury research.

My approach was based on the dual axes of the ICD-9 E codes. That is, E codes are arranged according to cause and intent. However, these axes do not apply to all E codes. There are six (6) exceptions. These are:

Adverse effects of drugs in therapeutic use
Medical misadventures
Complications of medicine and surgery
Legal intervention
Operations of war
Place of occurrence

According to the construction of the classification and through strict interpretation by coding groups in the United States, none of these six (6) groups should ever be included with intentional or unintentional injuries. They are and should remain in a class of their own.

In addition to the axes, the distribution of codes in the detailed groupings had to consider ICD coding principles, definitions, rules, and guidelines. When they are consistently applied, they provide the basis for E code assignments for the source document information, as well as the basis for review and analysis of coded data. The groupings needed to take into consideration the differences in the codes, the coding guidelines, and the definitions for mortality and morbidity reporting. Then the distribution of those codes for fatal and non-fatal injuries, poisonings and adverse effects of drugs needed to be examined.

Two of the most basic premises in this type of undertaking are:

a. The definitions used in assigning the codes must be the same definitions used in analyzing the data.
b. You can't judge a code by its title.

There were a number of problems. Primarily these were the definitional differences in using E codes for mortality and for morbidity; and within morbidity, the differences for inpatient and ambulatory coding.

First, we have the differences in diagnoses. In mortality, the underlying cause is of primary importance. This is defined as "the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury." For mortality, an E code can be the underlying cause.

According to nationally approved inpatient coding guidelines, the principal diagnosis is the first listed code, that is, "the condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital for care". And, according to nationally approved ambulatory coding guidelines, the first listed diagnosis is the reason for encounter, "the diagnosis, condition, problem, complaint, or other reason for the encounter/visit shown to be chiefly responsible for the outpatient services provided during the encounter/visit". For morbidity, an E code can never be a principal diagnosis or a reason for encounter. E codes will always be secondary to a nature of injury code.

Morbidity E coding guidelines were approved for implementation on October 1, 1995 and are now being factored into the groupings. The intent of coding guidelines is to clarify coding, to eliminate subjective decisions, and in general, to assist coders in arriving at accurate E codes in a consistent manner. Some of the new guidelines are clearer than others.

It was firmly established that multiple E codes could be assigned and that the first listed E code would be most related to the principal diagnosis for patients admitted for treatment of an injury, poisoning or adverse effect of drugs. If multiple causes are mentioned as part of a chain of events, it was decided that the first E code would be for the proximal cause, not the underlying cause. This is in agreement with the principal diagnosis definition in morbidity.

For both mortality coding and inpatient coding, questionable diagnoses are coded as confirmed. For ambulatory coding, they are never coded as confirmed. The guidelines describe similar coding of questionable intent for inpatients and ambulatory care.

E codes for undetermined intent, E980-E989, are never to be used for morbidity coding according to the E coding guidelines. If the intent is unknown or unspecified, it is to be coded as accidental. This is quite different from mortality coding.

E codes are required for mortality coding, but there is still no national requirement for them for morbidity coding. There are currently about 15 states reporting E codes for inpatients through state law or regulation and two (2) states requiring E codes for ED reporting. These states have different reporting requirements so you cannot compare their data easily.

There are different E codes in ICD and ICD-9-CM. There have always been some differences, but now that E codes in the CM version are being reviewed and expanded, the differences will be more noticeable. There was one new E code added to CM on October 1, 1994, but 24 more were added on October 1, 1995, and even greater expansion is expected next October 1. None of these codes will be added to ICD-9. The new codes will conform as closely as possible with ICD-10.

We are expecting that mortality coding in the U.S. will switch to ICD-10 in 1998 with backcoding of deaths to 1996. We do not expect a change to ICD-10 for morbidity coding before the year 2000, so this will cause further problems.

The draft document of groupings was circulated in July 1995. It consisted of a discussion of the methodology used in grouping the E codes--first in a detailed listing and then into two minimum reporting frameworks, one for morbidity and one for mortality.

The data used to examine the distribution of E codes were the 1992 underlying causes of death in the United States from the NCHS mortality data tapes, the 1992 National Hospital Ambulatory Medical Care Survey (NHAMCS) also from the NCHS and hospital discharge data from California, Washington, and New York. These are three of the 15 states requiring E code reporting, and they are the states which have had this requirement for the longest time. Three states were used, since the individual states requiring reporting of E codes do not have the same requirements, and it was important to try to neutralize any state-specific variations.

The percent distribution of E codes according to the detailed groupings was calculated for each data source to give an idea of the magnitude of each of the groupings. It was also used in constructing the minimum reporting framework.

The detailed groupings have been organized according to:

- All injuries of a type
- Unintentional
- Intentional and undetermined
  - Self-inflicted
  - Assault
  - Undetermined
- Legal intervention
- War operations

The purpose of this very detailed grouping was to be able to consider all possible types of injuries that people may want to study and to suggest the codes they should review. The codes in these groups are not mutually exclusive. They are for selective studies. For example, if someone wanted to review all intentional injuries they could select the codes for Assault and Suicide. However, if someone wanted to look at all poisonings, these codes would include intentional and unintentional poisoning codes.

The minimum reporting framework is a shorter form to examine and compare data. It is also organized by cause, with a delineation based on intent, legal intervention, and war operations. The codes in the framework ARE mutually exclusive. The framework needs to be flexible because in certain years, and even in certain countries, it may be necessary to present additional data. This would permit examination of injuries due to cataclysmic events or to operations of war, for example.

The data clearly point out the differences in causes of injuries treated in the ED, in the inpatient setting, or as causes of death. Certain causes seen in great numbers in the ED cause death so rarely, as to be unnecessary in a minimum reporting framework for mortality. Some of these same causes rarely are related to hospital admission. Although the circulated draft included a single minimum framework for morbidity, there is a group are now working on splitting morbidity into separate minimum frameworks for the ED and for inpatients.

The groupings are not to be used for assigning codes. They are for analyzing codes assigned in accordance with coding rules, definitions, and guidelines.

E coded data in the U.S. have certain limitations and cautions. First of all, E codes do not answer all questions about causes of injury, poisoning, and adverse effects of drugs. For example, we are unable to identify accurately sports-related injuries or agricultural injuries. Second, the quality and quantity of the data depends on the documentation in the patient record, the knowledge and experience of the coder, and the jurisdictional requirements for E code reporting. Another limiting factor is the coding knowledge and experience of the data analysts. Many researchers only examine the first listed E code. They are often unaware of coding defaults, definitions, rules, or guidelines which would determine E code assignment and sequencing.

An important result of the work has been the slightly different organization and display of the data for morbidity and mortality. The groups of codes are the same in the minimum reporting frameworks, although the number of groupings is not the same.

As it has been pointed out throughout this discussion, the definitions and procedures for coding morbidity and mortality causes are different. What looks equal in a chart is really not the same in all instances. Comparison of the data will require numerous caveats.

Based on our efforts to date, we have immediate work to complete and on-going issues to consider in order to improve the quality of cause of injury data in the U.S.

IMMEDIATE CONSIDERATIONS

1. Complete a minimum reporting framework for ambulatory data
2. Add the new E codes to the appropriate groupings in the detailed list and the minimum reporting frameworks
3. Review the draft report and the groupings to see the impact of the E coding guidelines on the text or on the codes.
4. Incorporate comments from questionnaire respondents
5. Circulate the groupings to the agencies involved with coding and use of coded data and ask for support and agreement.

FUTURE ISSUES

1. Look for clarification of E coding guidelines.
2. Propose E codes that will meet the needs of some of the respondents to this project.
3. Consider whether ICD-10/ICD-10-CM will be better than ICD-9/ICD-9-CM?

REFERENCES

American Hospital Association. Coding Clinic for ICD-9-CM, Chicago IL. Fourth Quarter 1995

Berenholz G. Accuracy and Compatibility of External Cause Data. SBIR Phase I, Unpublished Report. Lexington MA: Berenholz Consulting Associates. December 1992

Berenholz G. Coding Notes: The Need for Standardization of ICD-9-CM E Code Groupings by Cause and Intent. Journal of AHIMA. February 1995

Berenholz G. Draft Recommendations for Standard E Code Groupings for Morbidity and Mortality Data Systems, Unpublished Report. Lexington MA: Berenholz Consulting Associates. July 1995

U.S. Department of Health and Human Services. International Classification of Diseases, Ninth Revision, Clinical Modification, Fifth Edition. October 1, 1995

U.S. National Center for Health Statistics. Uniform Hospital Discharge Data: Minimum Data Set. Hyattsville MD. April 1980

World Health Organization. Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death. Geneva. 1977

The need for a Classification System of External Causes of Injuries

Dr. Claude Romer (World Health Organization) and Dr. Wim Rogmans (Consumer Safety Institute - WHO-Collaborating Center on Injury Surveillance)

Introduction

Injuries are a most serious health problem in all nations of the world. 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 reproductive 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 caused chain of events leading to the injury event. Therefore, routine scrutiny of the occurrence of injury is an essential component of effective public health injury control. The main purposes of injury surveillance are to:

1 describe injury levels and patterns to provide a basis for broad policy development and to inform communities on their injury experience;
2 identify and describe specific categories of injury and risk factors which are to be subject of control efforts (i.e. priority-setting and target setting);
3 describe and characterise groups of injury cases epidemiologically to generate hypotheses for causal research; and to
4 monitor progress towards these goals and the impact of intervention programmes and identify new emerging hazards timely.

In addition, injury surveillance may facilitate the monitoring of some basic aspects of trauma care and rehabilitation service management.

Only limited information can be obtained through the existing data sources such as coroners records and hospital discharge information systems. Although the virtue of these systems is that they are already in place, they lack precision in information for injury prevention since they are established for other purposes, i.e. population statistics and hospital management.

The World Health Organisation'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 main shortcoming of the E-coding system is that it folds several concepts and dimensions into a single classification (one dimensional). Since that time, 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. independent variables), such as the ethologic agent, event-characteristics, the environmental features or products involved and the intentionality (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);
- in the United States of America and the US-Centres for Disease Control;
- in Australia and New Zealand through the development of Injury Surveillance Information Systems and the designing of 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.

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 the guidance of the SPIC-programme manager at WHO in Geneva.

The structure of ICD-classification

The purpose of the ICD is to permit the systematic recording, analysis, interpretation and comparison of mortality and morbidity data collected in different countries or areas and at different times.
Although the ICD is suitable for many different applications, it does not always allow the inclusion of sufficient detail for some specialities, and sometimes information on different attributes of the classified conditions may be needed.

The main ICD (the three- and four-character classification), covered by the three volumes of ICD-10, can not incorporate all this additional information and remain accessible and relevant to its traditional users. So the idea arose of the "family" of disease and health-related classifications, including volumes published separately from the main ICD, to be used as required (figure 1).

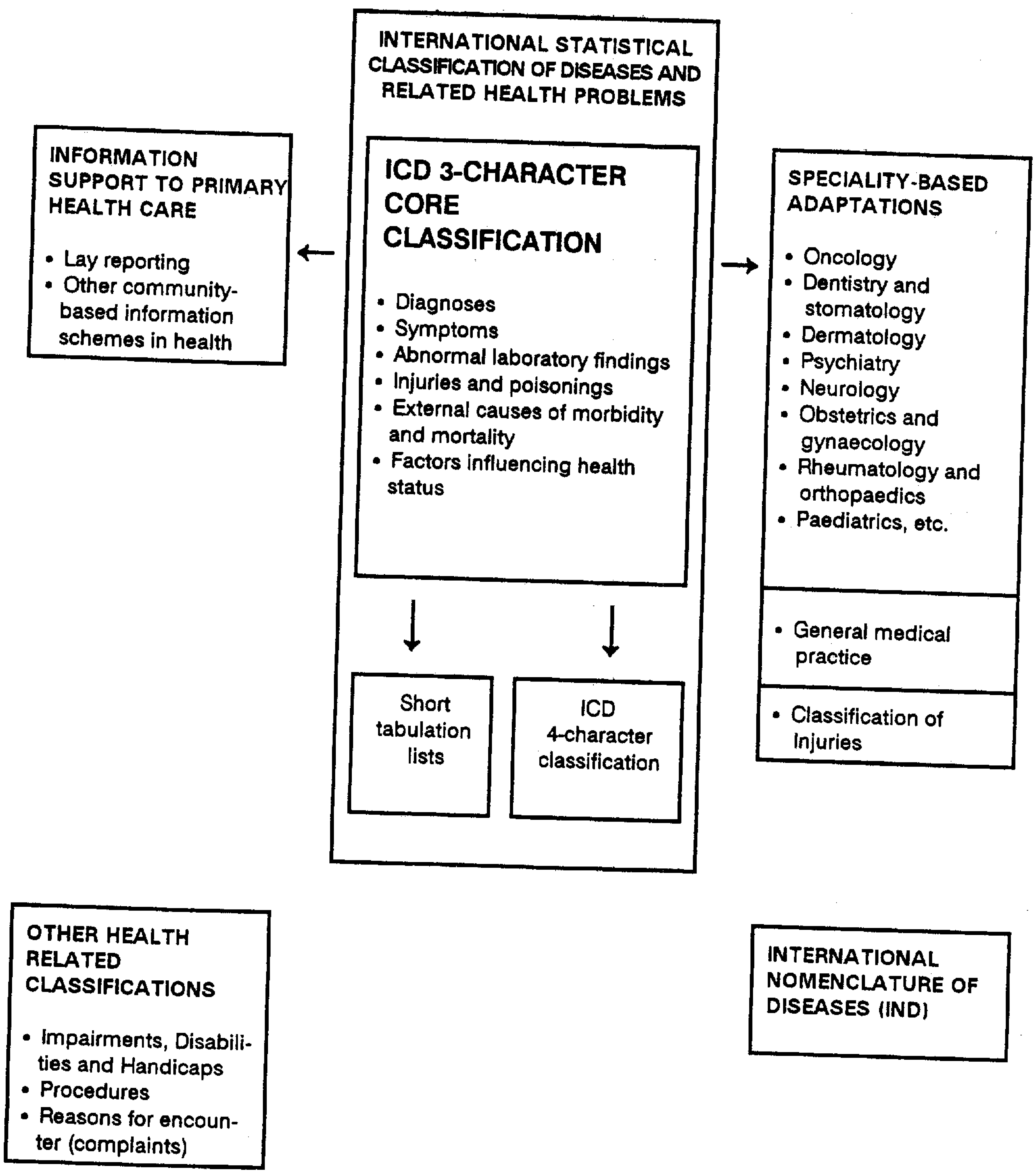
The "core" classification of ICD-10 is the three character code, which is the mandatory level of coding for international reporting to the WHO mortality database and for general international comparisons. The four-character subcategories, while not mandatory for reporting at the international level, 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 expanded lists are used to obtain increased clinical detail as in the speciality-based adaptations. This group also includes classifications complementary to the tabular list, that allow the allocation of diagnoses using a different axis of classification, such as the Classification of External Causes of Injuries which is in progress of development now.

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 ICD family also covers a conceptual framework of definitions, standards, and methods that, although they are not classifications in themselves, have been closely linked to the ICD for a long time. One of these concepts is the development of methods to support the local collection and use of information for primary health care.

Figure 1 **Family of disease and health-related classifications**



Purpose of classification and its applicability

The intent of the new classification is to provide a general instrument for the health sector's routine registration of all types of injuries (transport, occupational, home and leisure, violence and self-harm).

This injury classification has been developed in close collaboration with the sectors inside and outside the health care system, including those responsible for planning and implementation of injury prevention in the respective sectors (consumers agencies, traffic authorities, labour inspections, product safety committees etc).
These sectors' need for injury data to accomplish their assignments has been fully taken into account in selecting the main variables as well as by including the minimum amount of items for each variable.
Furthermore the classification should act as an instrument for management and planning of health services' resources for those injured.

Since it is neither realistic nor expedient that all sectors of the health services are making detailed recordings, the intention was to construct the classification in such a way that it can be used on various levels of detail. The lowest level (the basic data set) has been designed so as to enable staff to have a basic recording of injuries with only a modest investment in human resources and data processing facilities.

The purpose of the classification is to separate contacts due to injuries from contacts due to diseases and to answer the following questions:

- where did the injury occur
- how did the injury occur
- what was the activity at the moment of the injury
- which products were involved in the event
- give a more detailed description of transport accidents including road traffic accidents, work-related accidents, sports accidents, and events characterised by intentional injuries (violence and self-harm).

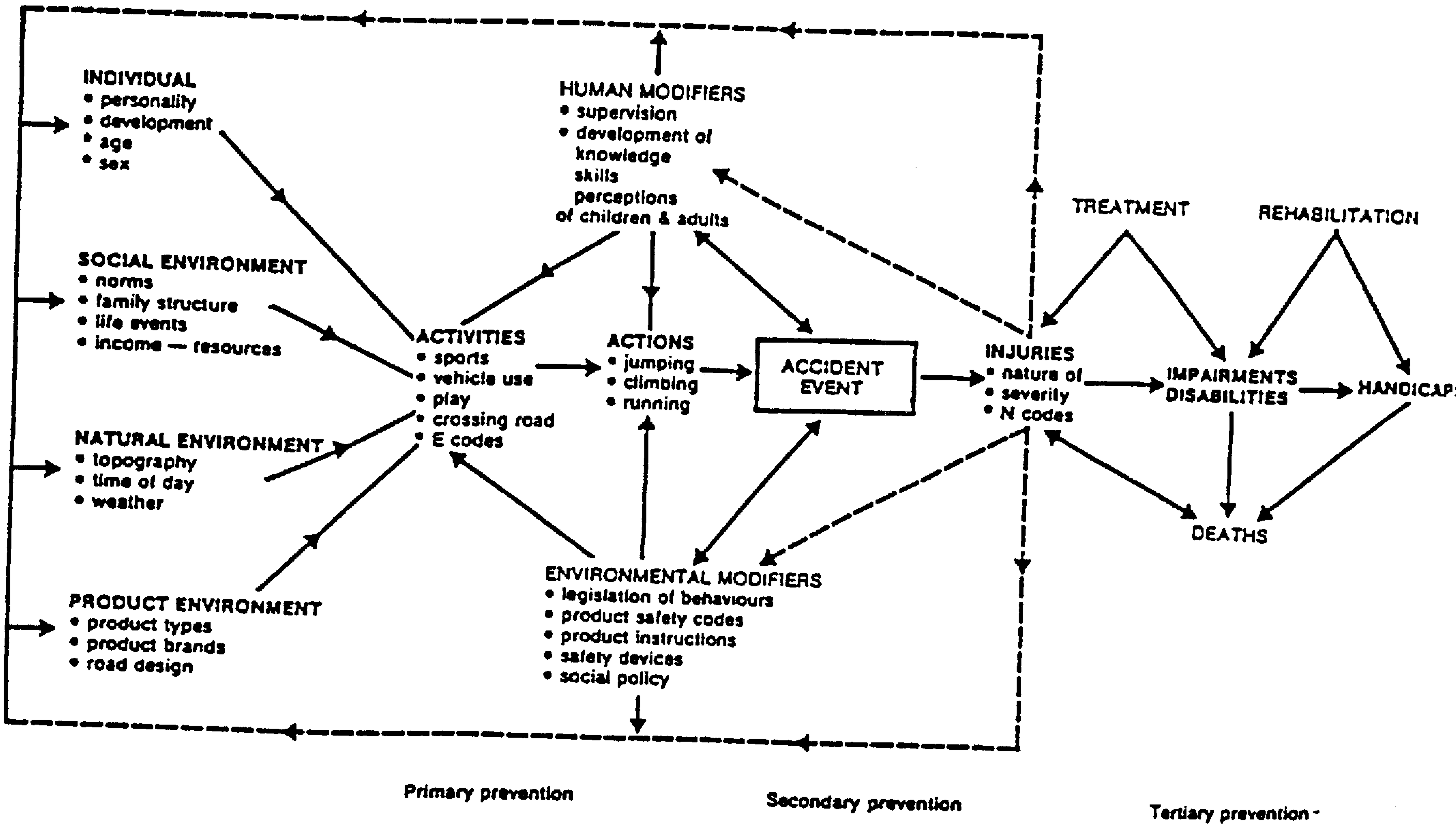
Relevant characteristics of the injury-phenomenon

Over the years many attempts have been made to describe the injury phenomenon, and to identify the major causal factors leading to injuries. Although these descriptive models have severe limitations, as they are supposed to cover such a diverse and heterogeneous phenomenon as accidental and intentional injuries, the basic structure that underlies most of these models is very helpful in conceptualising the injury process and its relevant characteristics. In figure 2 such a descriptive model is presented.

In the Accident/Injury Process-model a myriad of relevant factors involved in the process are put in two perspectives:

- a time sequence perspective (along the horizontal dimension), i.e. factors being involved in the onset of the process by contributing to the building-up of a hazardous situation (for instance a risktaking life style) or factors later involved in the process by triggering the event (for instance the break down of a vital piece of equipment someone is working with) or by aggravating the outcome of the event (for instance the absence of protective equipment or lack of first aid and adequate follow up care);

Figure 2 The Accident/Injury Process



© Jerry Moller

- a categorical perspective (along the vertical dimension), i.e. by making distinction between on the one hand social and behavioural factors such as personal characteristics and socio-economic aspects, and on the other hand physical and environmental characteristics such as road condition, housing condition and products/vehicles involved in the injury process.

The first, time sequence, perspective is clearly related to the classic distinction between primary, secondary and tertiary prevention. In injury-prevention these concepts are commonly understood as:
- primary prevention, being related to the factors that are present before the actual injury event occur or that trigger the injury event; so they may prevent the injury event occurring;
- secondary prevention, being related to factors that respond to the immediate injury event and may contribute to lessen the consequences of the injury event; and
- tertiary prevention, being related to all factors that may help to restore the damage and loss after its occurring by providing appropriate emergency care and rehabilitation, which of course may help to prevent future injury risks as is evident for instance in the case of sport injuries.

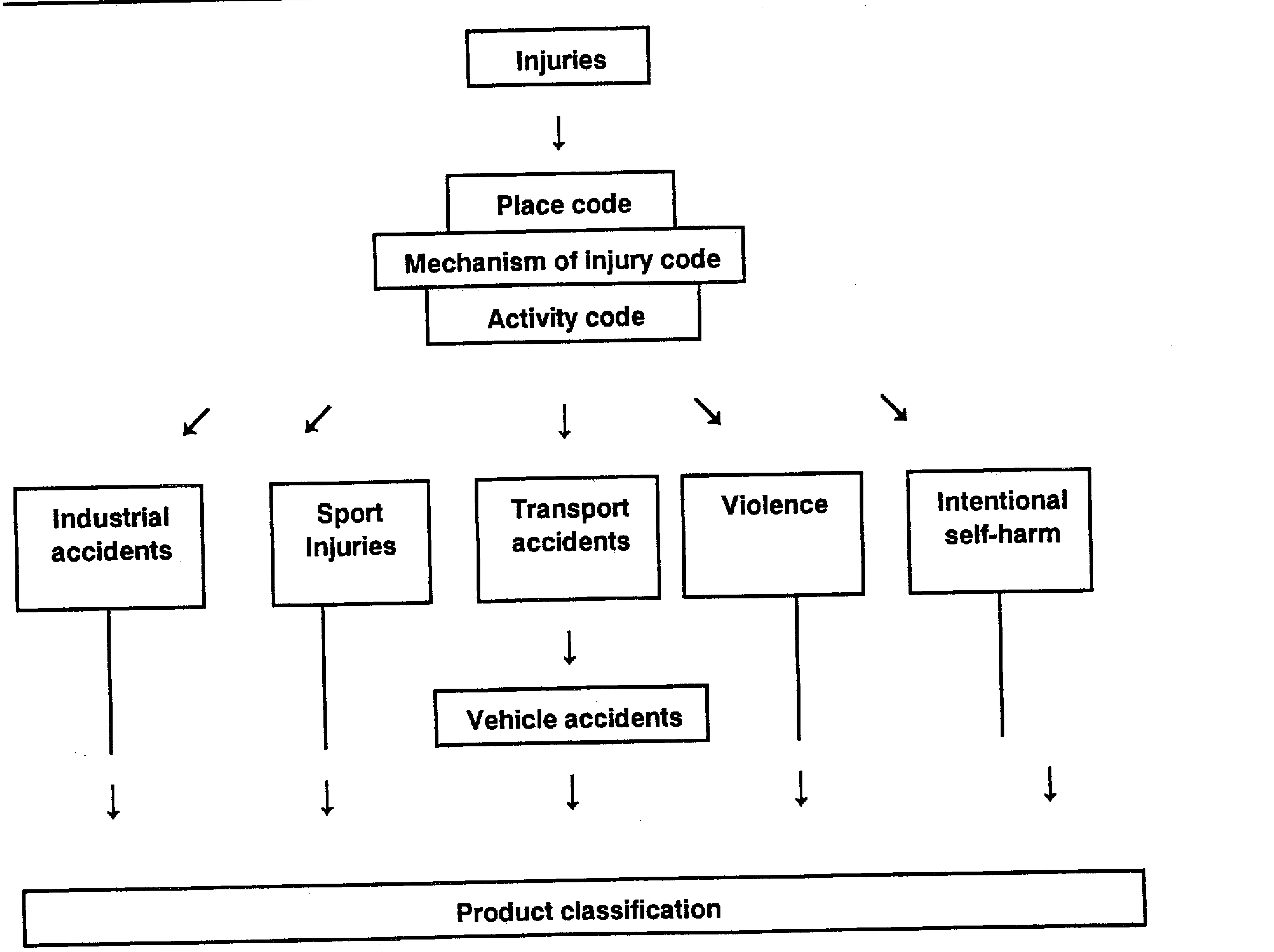
Although these two perspectives may seem theoretical at first sight, they provide an important framework for assessing the completeness of a surveillance and classification system's coverage of factors. It is also a helpful tool in assessing the relevance of information gathered in view of injury prevention. As regards the latter aspect, it is evident that a lot of systems are still focusing on injury outcome characteristics such as the nature and severity of the injury, which is not so relevant for primary and secondary prevention. In developing the WHO-Classification of Injuries, due consideration is given to include at least the basic factors that are relevant for primary, secondary and tertiary prevention.

The structure of the Classification

The classification is to be used in connection with the reason for contact code that sorts out contacts owing to disease from contacts to the health services due to accidents, violence and suicide attempts.

The Injury Classification is constructed with a basic part, following by supplementary classifications for transport accidents, vehicle accidents, occupational accidents, sports accidents, intentional injuries, and products involved in events leading to injuries (figure 3).
The basic classification is built up in axes that one by one describe place of occurrence, mechanism of injury and activity of victim at the time of injury. The individual axes are hierarchical with specifications at the 1st level at a 2nd level.

Figure 3 **Structure of the Classification of External Causes of Injuries**



Annex

Working Group

From its very beginning the Working group consisted of experts from the European Region, Australia/New Zealand and the USA, and of representatives from WHO/PAHO. To date the Working group counts the following members:

- Dr. Wim Rogmans* (chair) & Saakje Mulder*, Consumer Safety Institute, Amsterdam
- Dr. Claude Romer, World Health Organisation, Geneva (co-chair)
- Dr. James Harrison, National Injury Surveillance Unit, Adelaide
- Henning Bay Nielsen* & Birthe Frimodt-Møller*, National Health Council, Copenhagen
- Lois A. Fingerhut, National Center Health Statistics, Washington DC
- Dr. Richard Waxweiler, Center for Injury Epidemiology and Control, Atlanta
- Dr. John Langley, Injury Prevention Research Unit, Dunedin (NZ)
- Dr. Leif Svanström, Karolinska Institute, Stockholm
- Dr. Anne Tursz, International Children's Center, Paris
- Dr. Yvette Holder, PAHO/WHO Caribbean Epidemiology Center, Trinidad
- Mr. André L'Hours, World Health Organisation, Geneva
- Dr. H. Adbul Radjak, Ministry of Health, Indonesia

Four members of the Working group (indicated by an asterix) will act as a core group, working out technical drafts that are to be discussed in the plenary working group sessions before further dissemination among the reference group.

A reference group will consist of experts that contributed to previous discussions in the framework of ICD and experts that expressed a strong interest in Injury Statistics and their improvement (among which participants of the ICE-seminar and the Stockholm-Surveillance-meeting).

The secretariat of the project is at the chairman's office: Consumer Safety Institute, Amsterdam

ICE MEETING
Deaths due to fire and flames
Denmark 1988-1992

Henning Bay-Nielsen
Injury Surveillance Unit
National Board of Health
Amaliegade 13
P.O.Box 2020
1012 Copenhagen K
Denmark
Telephone: +45 3391 1601 * Telefax: +45 3393 1636 * E-mail: vm@sumsus.dk

Purpose

The purpose of this presentation is to demonstrate the usefulness of analyses of the free text area in death certificates to obtain additional information on the external causes of fatal accidents as supplement to the conventional ICD coding. Our Danish experiences could be used as guidance for development of a specific international coding scheme for fatal accidents.

Material

We have retrieved all deaths due to fire and flames (E-codes 890-899) from the Danish Central Death Register from 5 years (1988-1992), i.e. 330 deaths.

The death register is complete and each individual is identified by a PIN-code. All certificates from 1943 and onwards are stored on microfilms. The register is situated in the National Board of Health, Copenhagen. All cases of unexpected death, accidents, suicide or suspicion of crime are subject to a legal inquest. These death certificates contain a description of the accident event in narrative text written by the medical officer and includes results from police investigations. This free text area acts as basis for a supplementary coding using the NOMESCO injury classification for place of occurrence and products involved in the accident process.

Age, sex and incidence rates

Table 1 and figure 1 demonstrate the distribution of number of deceased by age (in 10 year age groups) and sex. The number of deceased is increasing by age until the age of 80 where there is a steep decrease in numbers. Males are dominant with 191 deaths against females with 139 cases (male 58% and female 42%). The age curves for males and females are very similar, with peaks around the age group 40-49 and 80-89.

Table 1. Deaths due to fire and flames by age and sex. Denmark 1988-1992.

	Sex		All
	Male	Female	
Age	N	N	N
00-09	10	6	16
10-19	10	1	11
20-29	20	4	24
30-39	20	5	25
40-49	33	17	50
50-59	16	15	31
60-69	20	16	36
70-79	32	24	56
80-89	26	40	66
90+	4	11	15
All	191	139	330

Table 2 and figure 2 demonstrate the total number of deaths due to fire and flames by each year and the number of deaths per million inhabitants. We had a maximum of deaths in 1992 (14.9 deaths per million) and minimum in 1990 (10.9 deaths per million) and the mean figure for the 5 year period was 12.9 deaths per million inhabitants.

Table 2. Deaths due to fire and flames. Denmark 1988-1992.

	1988	1989	1990	1991	1992	All
Number	66	65	56	66	77	330
Population (mill.)	5,130	5,132	5,140	5,154	5,170	25,726
Per mill. inhab.	12.87	12.67	10.89	12.81	14.89	12.82

Table 3 and figure 3 show the incidence rates calculated as numbers of deceased in 10 year age groups and by the population in 1990.

The incidence rate is below 2 per 100.000 inhabitants below the age of 79. From this age the curve rises steeply and reaches 13.2 per 100.000 inhabitants in the age group 90+.

Table 3. Deaths due to fire and flames. Denmark 1988-1992.

Age	Number	Population 1990	Incidence rate per 100,000 inhab.
00-09	16	558,689	0.6
10-19	11	685,261	0.3
20-29	24	796,234	0.6
30-39	25	740,650	0.7
40-49	50	771,132	1.3
50-59	31	541,001	1.2
60-69	36	486,299	1.5
70-79	56	370,244	3
80-89	66	167,700	7.9
90+	15	22,733	13.2
All years	330	5,139,943	1.3

Nature of injury

The nature of the injuries is described by the diagnoses (N-codes) and demonstrated in table 4. 49% of the deaths were due to burns and 51% was due to carbon monoxide poisonings.

Table 4. Deaths due to fire and flames. Nature of injury. Denmark 1988-1992.

	Burns	CO poisoning	Total
1988	34	32	66
1989	37	28	65
1990	31	25	56
1991	30	36	66
1992	31	46	77
All years	163	167	330
%	49.4	50.6	100

Place of occurrence

The location where the accidents took place is described in table 5 and figure 4. 80% (264) of the cases took place in the home including 42% in living rooms and bedrooms, 11% in kitchens and 27% in unspecified parts of the homes. 10% took place in nursing homes.

Table 5. Deaths due to fire and flames. Denmark 1988-1992.

Place	Number	Percent
Kitchen	37	11
Livingroom/bedroom	138	42
Home unspec.	89	27
Nursing homes	33	10
Other places	33	10
Total	330	100

Products involved in the ignitive process

The products involved in the ignitive process are listed in table 6. The death certificates do not state the origin of the fire in 135 cases (41 %). This is mainly due to the fact that the police investigations have not been completed when the death certificate was issued. We do not have the complete police data in the National Board of Health, but they can be obtained by going through the finalized police reports.

The list in table 6 demonstrates a broad spectrum of household products but the most important product is tobacco as burning cigarettes and cigars. In table 7 we have listed the types of furniture, including wheelchairs, ignited by burning cigarettes and cigars. In 54 % (35 cases) beds, mattresses and bedding were ignited by burning cigarettes and cigars.

Table 6. Deaths due to fire and flames. Product causing fire. Denmark 1988-1992.

Product	Number	Percent
No product stated	135	41
Gas cooker/gas light	16	5
Candle	24	7
Lighter	9	3
Gas oven	2	1
Woodburning stove	2	1
Matches	5	2
Paraffin stove/paraffin heater	1	0
Television set	2	1
Spirit stove	1	0
Refrigerator	1	0
Open fireplace	1	0
Electric cooker	4	1
Deep-fat-frier	6	2
Primus stove	1	0
Straw (open fire)	5	2
Petrol	2	1
Hot-air fan	2	1
Toaster	2	1
Clip lamp	1	0
Diesel oil	1	0
Electric heater	1	0
Smoking tobacco	106	32
Total	330	100

Table 7. Deaths due to fire and flames. Furniture ignited while smoking. Denmark 1988-1992.

Furniture	Number
Chair	9
Upholstered chair	7
Sofa	8
Bed	22
Mattress	4
Bedding	9
Wheel chair	6
Total	65

Influencing factors

By reading the narrative text on the death certificates we became aware of factors probably influencing the course of the accident process. We have isolated 6 important influencing factors (diseases, medicaments, drugs, intoxication, smoking and senility) and the content of each factor is described as:

1. Disease: The deceased suffered a disease which probably influenced his/hers reaction in the situation.
2. Medicaments: It is reasonable to assume that the deceased was under influence of medicaments as neuroleptica, sedatives etc.
3. Drugs: It is reasonable to assume that the deceased was under influence of narcotic drugs.
4. Intoxication: It is reasonable to assume that the deceased was under the influence of alcohol.
5. Smoking: It is reasonable to assume that the fire was ignited by cigarettes/cigars.
6. Senility: Deceased characterized as senile, dement or arteriosclerotic.

Table 8 demonstrates the numbers of these 6 influencing factors. 156 (47%) of the deceased suffered from diseases that probably reduced the victims ability to react in the dangerous situation, and 105 victims were probably under the influence of alcohol with similar consequences. 81 cases without information on influencing factors (24,5%)

Table 8. Deaths due to fire and flames. Denmark 1988-1992.

Influencing factors	Numbers	%
Diseases	156	47
Medicaments	42	13
Drugs	2	1
Intoxication	105	32
Smoking	106	32
Senility	31	9
All cases	330	100

These two factors (diseases and intoxication) are very important as information in the planning of injury control. I am aware of the lack of consistency in these types of influencing factors and present them for discussion.

Diseases, medicaments (pharmaceuticals), drugs, and intoxication are conditions influencing the victims pattern of reaction, while smoking is a different category, a habit.

In a study of drownings (Denmark 1980-85) we made an analysis of death certificates which revealed the following similar list of influencing factors:

Intoxication	31%
Diseases	19%
Senility	1%

The problem of categorizing these obvious important factors is expected to be universal. The value of the information from our death certificates could be enhanced by using a standardized "classification" of these influencing factors.

Our new database on fatal injuries

There is an intensive use of our death register database. The basic information in the base is the E-codes, but most of the questions raised can not be answered by the E-codes. Consequently we decided to recode all fatal accidents. We retrieved all death certificates from 5 years, read the text and recoded them (place of occurrence at 2 digit level, mechanism of injury, activity, and product codes) using the NOMESCO injury classification and included a summary of the accident event in text. Due to the huge public interest in fatalities in childhood we have extended the database with fatal accidents in childhood (0-14 years) for an additional 5 years.

Recommendations

In my opinion it would be very valuable to develop a necessary addendum to the WHO death certification containing the most supplementary information in case of fatal accidents. By obvious reasons for optional use. It would enhance our knowledge of the external causes of fatal accidents and facilitate international comparisons. The existence of an international (WHO?) addendum to the death certificate could be a valuable support in national negotiations on expansion of the data in death certificates needed for injury control.

Conclusions

* Fire and flames are one of the important external causes of fatal injuries.
* Death certificates are the most important source of information.
* We want to enhance the information from death certificates by questions on specific location, products involved, and influencing factors.
* I propose the development of a specific WHO death certificate for fatal injuries and for optional use.

We have all data on a diskette including the free text in an abbreviated form (due to lack of resources for translation). The diskette is available on request for further analyses.

Utilization of a multiaxial classification in planning, implementing and evaluating injury prevention

Birthe Frimodt-Møller
Injury Surveillance Unit
National Board of Health
Amaliegade 13
P.O.Box 2020
1012 Copenhagen K
Denmark
Telephone: +45 3391 1601 * Telefax: +45 3393 1636 * E-mail: vm@sumsus.dk

Introduction

The "5-Community-Project" in Denmark was carried out in 1990-1992 as a demonstration of the community intervention model. The demonstration project was initiated by the National Board of Health in support of the Danish Government´s National Health Promotion Programme. This programme gives priority to accident prevention by strengthening the intersectoral efforts to prevent traffic accidents, work-related accidents, and home and leisure accidents.

Community Intervention

is today recognized as a model for making prevention and health promotion gain
1. impetus in the population. Prevention of injuries holds potential for tangible results in
foreseeable time, compared to prevention of cancer or vascular diseases where the pay-off may be remote in time. Politicians and other decision-makers want quick rewards for their investment, and injury prevention may thus be a lever for the local community´s engagement in community intervention.

Injury prevention is, furthermore, truly a challenge for the local community, since the task requires intersectoral and interdisciplinary collaboration. The
2. process is facilitated by the stepwise organization of the community´s efforts - as also
featured by the WHO Safe Community Programme.

A prerequisite for stimulating and motivating the local community to engage in planning and implementing injury prevention is knowledge about the local injury pattern. Equally important is the feasibility to set priorities for targeted intervention.

Method

In the "5-Community-Project" local injury data were fed back to the 5 project
3. areas from the 5 hospitals which have participated in extended injury registration since
1989. The catchment areas of these hospitals cover a total of 38 municipalities, including the 5 project areas. This population (748,000 inhabitants) is a representative sample of the Danish population.

The extended injury registration is a supplement to the National Patient Register which collects a basic data set on injuries recorded in all Danish hospitals.

The NOMESCO Classification of external causes of injuries, is used routinely for injury registration in Danish hospitals. The project focused on prevention of
4. injuries following accidents of any type, cf. the objectives of the project.

The multiaxial structure of the Classification allows for analyses of data in virtually any desired combinations. As an example, an event can be coded as
5. exercising sports for the victim´s activity; the event can be further described by the type of sports, place of occurrence, injury mechanism, and by products involved. Any of the variables can be the starting point for a working group who wishes to delimit a specific target group in order to decide on preventive action
6. accordingly. This step in the intervention process has occasioned both professionals and citizens in the local community to become involved in the actions.

The evaluation was carried out by use of injury data. Data in intervention and
7. control areas have been compared both before (1989-90) and after the intervention period (1991-92). The continued injury registration (prospective data collection) facilitates follow-up of the first evaluation performed in 1993. The follow-up evaluation (1995) has focused on the same target groups as in the first evaluation. The Poisson Regression method has been used for statistical analyses. This method can estimate the expected frequency of injuries in a target population defined by sex, age, period, geographical area, intervention/non-intervention and population size. The result is the "relative risk" which can express the increase or decrease of injury risk in relation to an index=1, indicating the risk level before intervention. In the following examples the "relative risk" is the result of the comparison of the intervention and control area for a specific target group.

Results

The importance of using a multiaxial classification to narrow down the injury data to a specific target group is illustrated by the following examples.
8. In one project area the distribution of home and leisure accidents by age clearly indicated the need to study the injury pattern among children.

9. The incidence of injuries due to home and leisure accidents in the age group 6-18 yrs. was high at the start of the project period - and shows an increasing trend.

10. The analyses of injury data and assessment of local demographic and socio-cultural features led to local priorities regarding prevention of injuries in this age group. Sports injuries was one priority, and among the sports handball played in certain localities was targeted for preventive action.

11. When evaluating the outcome of intervention, the incidence of sports injuries appears to be unchanged. Comparison of the intervention and control area shows that the relative risk was non-significantly reduced by 6%.

12. However, the statistical analysis of handball injuries shows a significant reduction of the relative risk in the follow-up evaluation (1995). This result may be interpreted as a delayed effect of the intervention and may motivate the community to continue its efforts.

In the second example, the project workers focused on traffic injuries, and among these especially bicycle injuries in the age-group 6-16 yrs. The trend in
13. incidence of traffic injuries shows a reduction of relative risk (-23,4% (NS)) following intervention, but the effect is diminishing in the follow-up period (3,1%).

The reduction of bicycle injuries in children was a success story for this project area (in 1993), as the relative risk was significantly reduced by 54%. The trend now appears to go in the "wrong" direction. In this particular project area the prevention programme was discontinued after conclusion of the project, and time will show how this will affect the incidence of injuries.

The last example illustrates yet another specified target group, i.e. falls among
14. the elderly in specified locations. The follow-up evaluation shows that the initial positive result has been sustained, but the aim to reduce the incidence of injuries further has not yet been fulfilled. The community has therefore been motivated to intensify its efforts towards this target group. Again, time will show whether the continued prevention programme reaches its goal.

Conclusions

The motivation of local communities to plan and implement injury prevention is strengthened, when the target group is well defined. Evaluation of the targeted intervention should similarly be based on the specified level rather than the
15. aggregate level of injury data. Obviously, the successful outcome of intervention will sustain the motivation in the local community to focus on injury prevention. As an instrument to instigate community intervention, the multiaxial classification of external causes of injuries by far supersedes the one-dimensional structure of the ICD (the International Classification of Diseases). Promotion of the community intervention method would not be feasible by use of chapter XX in the ICD-10.

Community Intervention

A process to:

- Increase awareness of health problems
- Take action to solve the problems
- Involve local community in actions
- Maintain strategy for prevention and health promotion

MELBOURNE 1996

Community Organization

- Utilize local injury data
- Prioritize target groups
- Implement targeted intervention through working groups and community participation
- Evaluate results of intervention

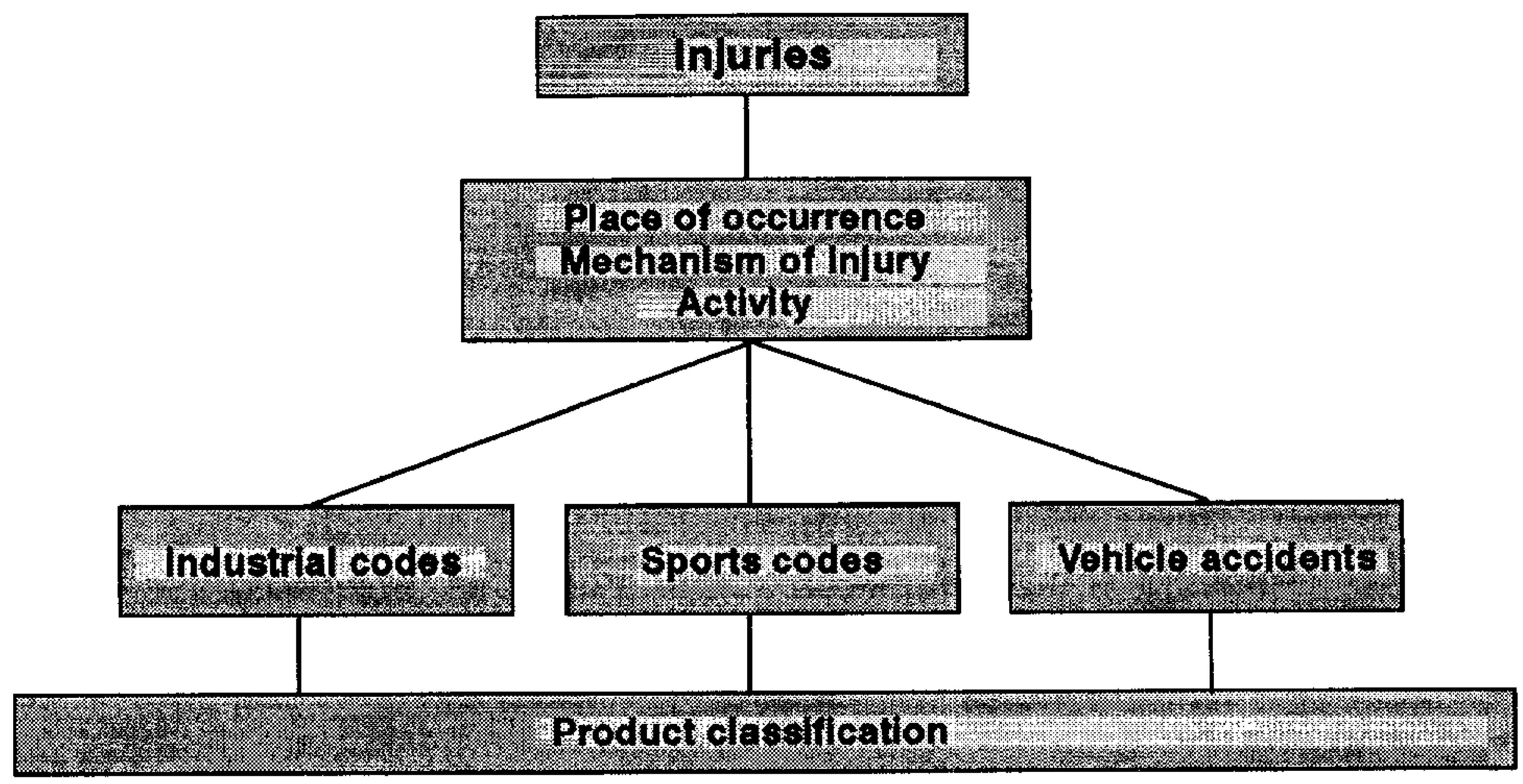
MELBOURNE 1996

"5-Community-Project" objectives:

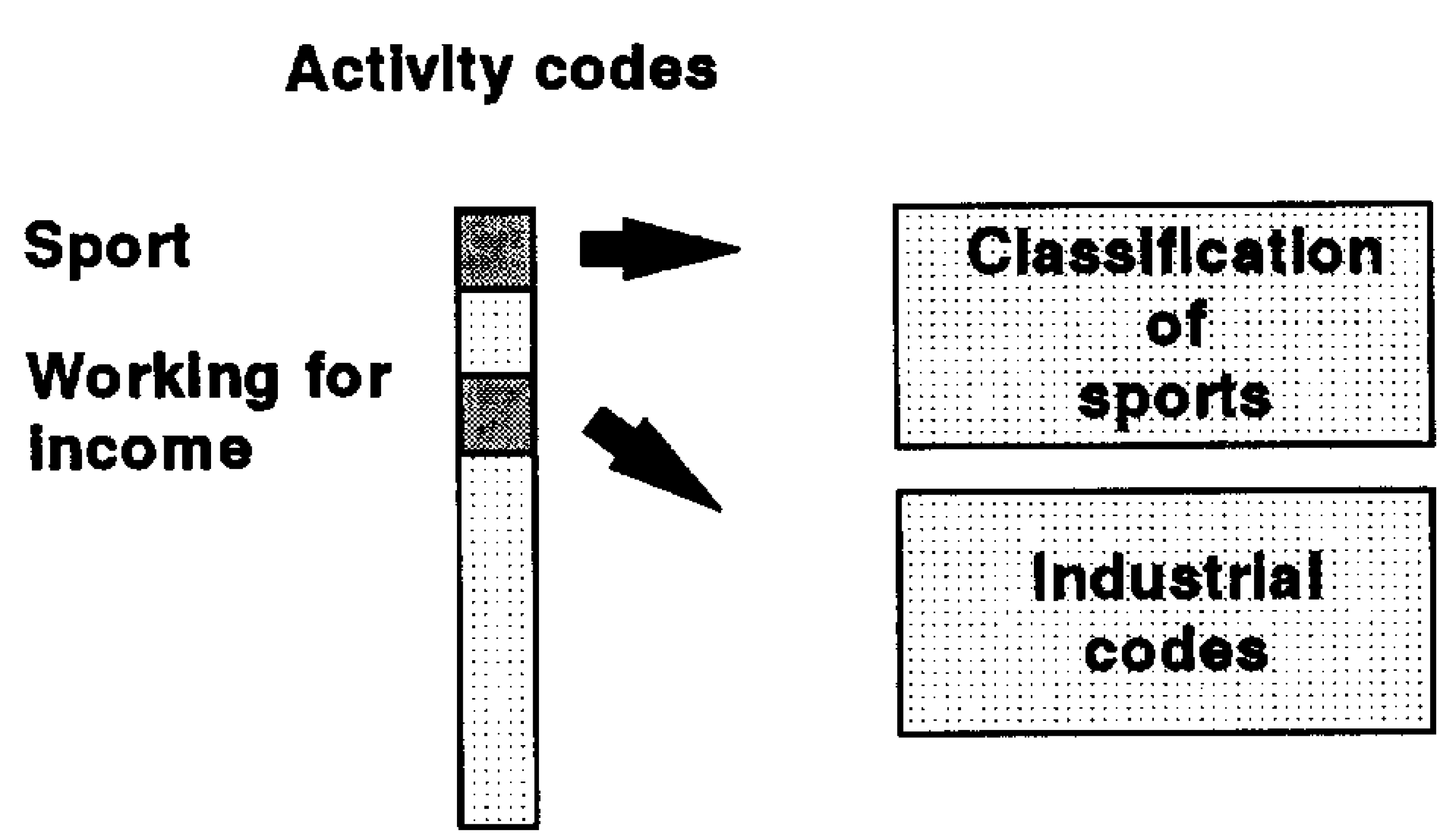
- Reduce incidence of injuries due to home, leisure, occupational, and traffic accidents
- Strengthen intersectoral and interdisciplinary collaboration

MELBOURNE 1996

MULTIAXIAL STRUCTURE
NOMESCO's Classification of external causes of injuries



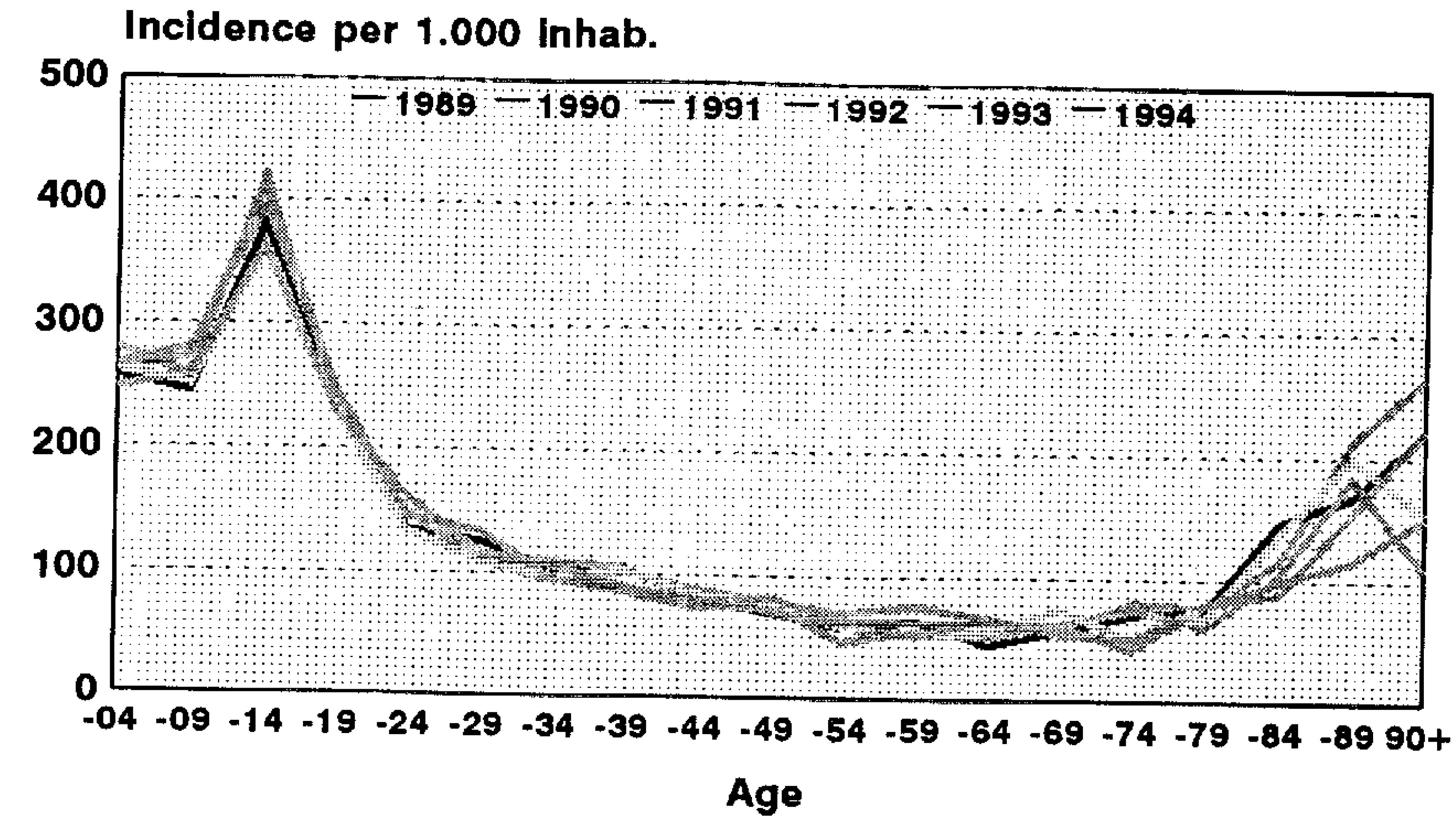
ACTIVITY



Evaluation

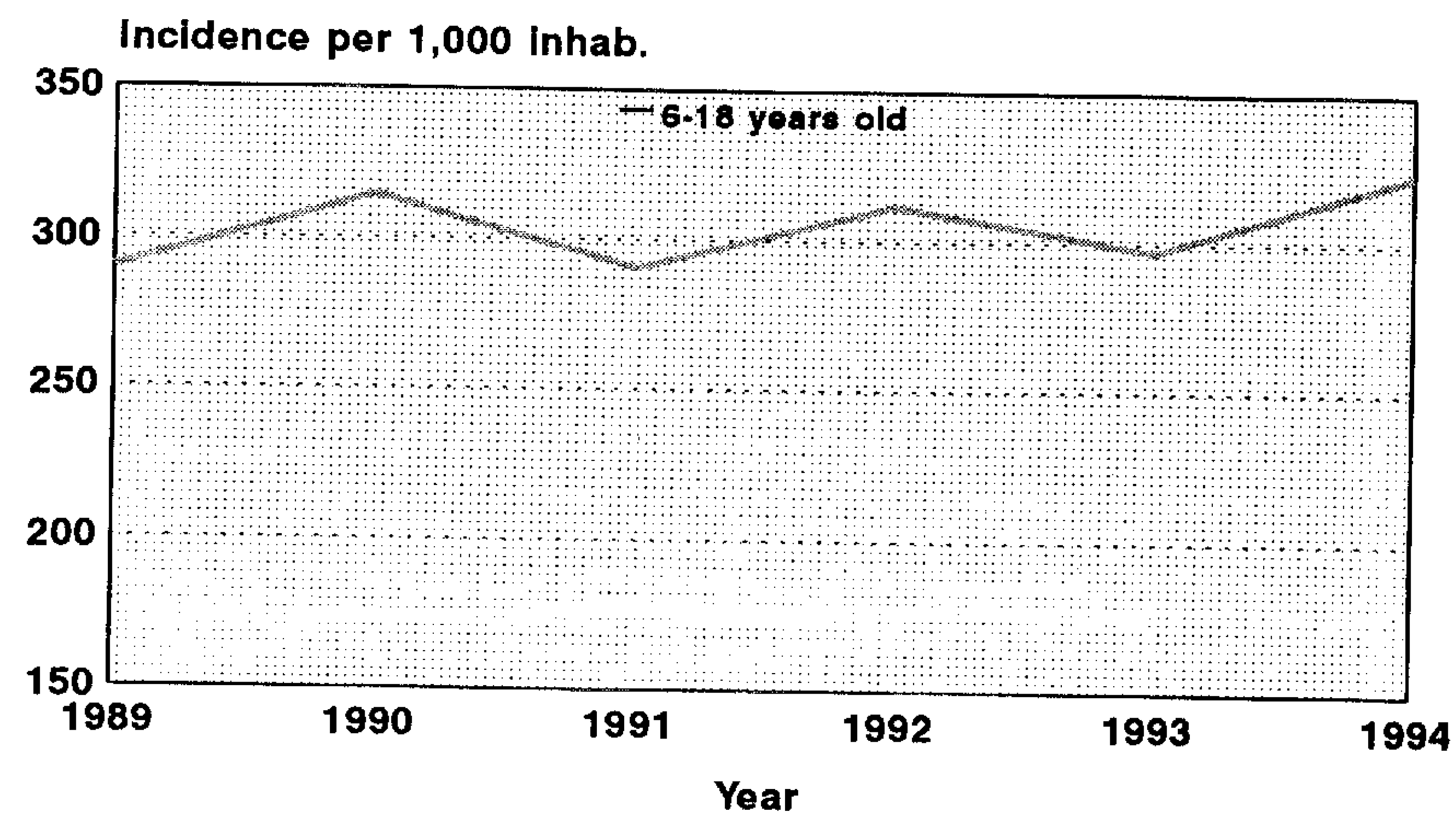
- Evaluation by injury data:
  - Comparison of intervention and control areas
  - Comparison of data before and after intervention
  - Follow-up (contd. injury registration)
- Assessment of changes in knowledge, attitudes and behaviour
- Cost-benefit analysis

Glostrup municipality 1989-1994
Home and leisure accidents



MELBOURNE 1996

Glostrup municipality 1989-1994
Home and leisure accidents. Age group 6-18 yrs.



MELBOURNE 1996

Specifying the target group:

Home and leisure accidents

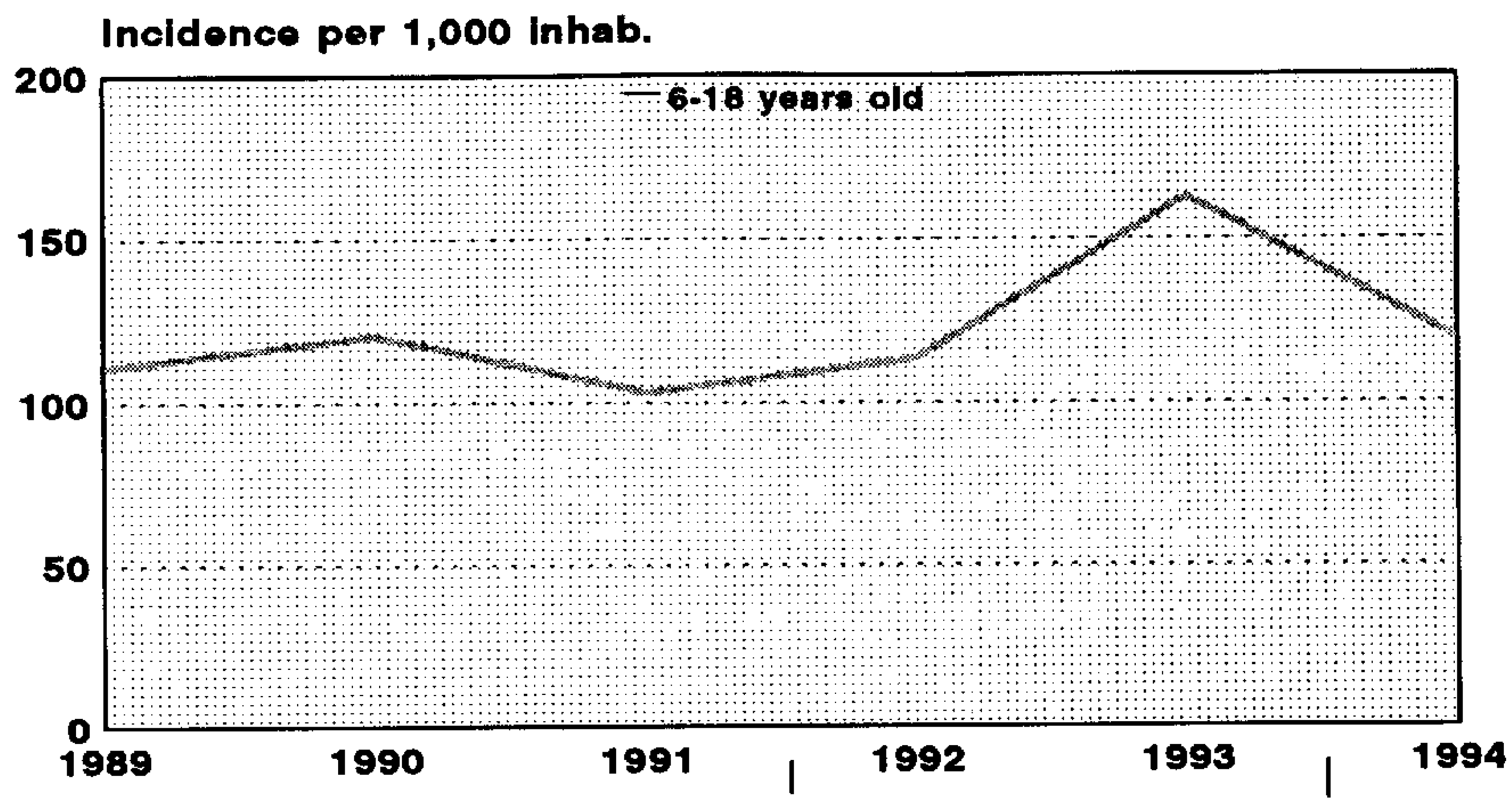
→ Home and leisure accidents Age group 6-18 yrs.

→ Sports injuries

→ Handball injuries

MELBOURNE 1996

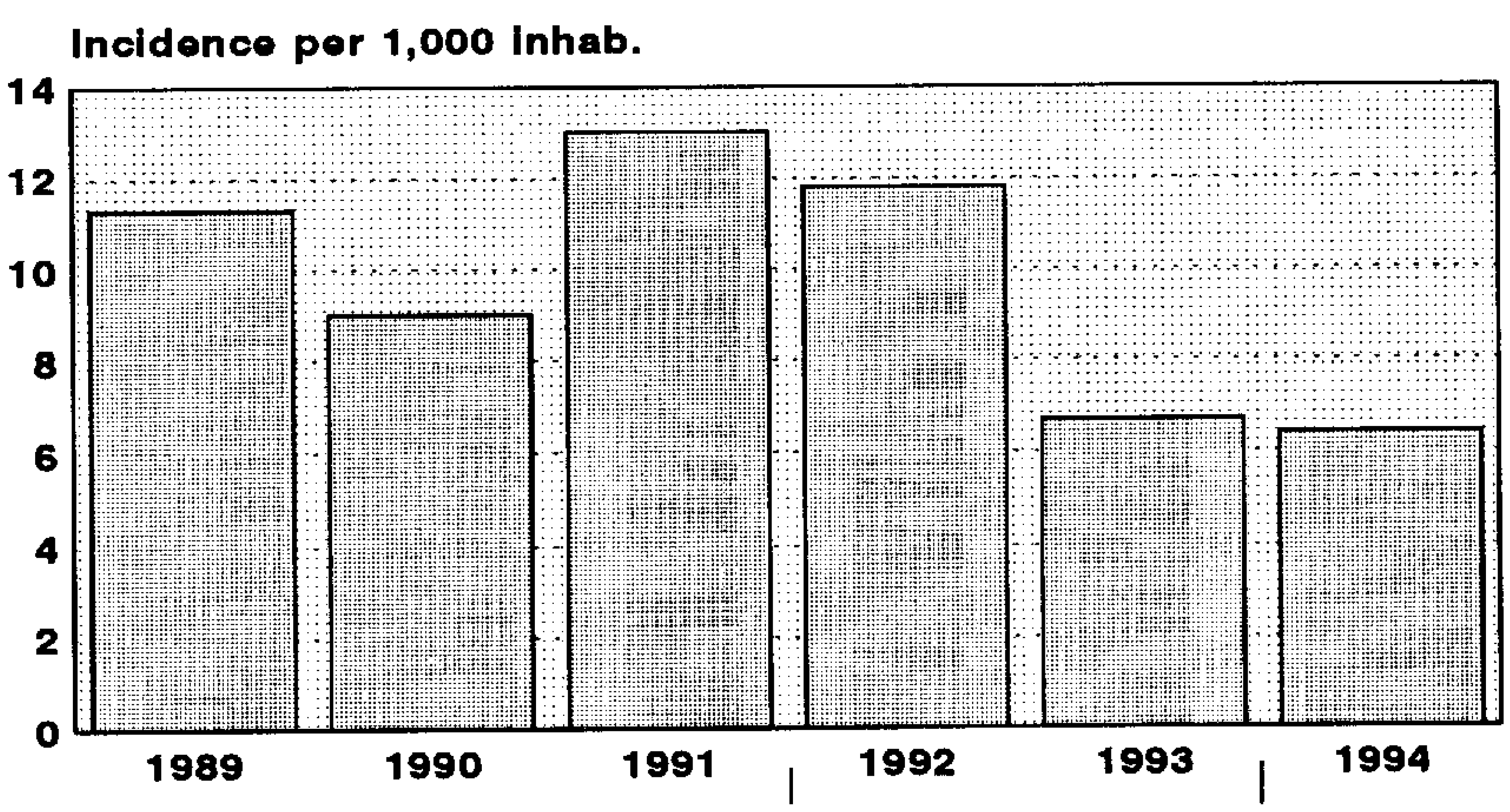
Glostrup municipality 1989-1994
Sports injuries. Age group 6-18 yrs.



Relative risk (%): -5,8 -5,8

MELBOURNE 1996

Glostrup municipality 1989-1994
Handball injuries. Age group 6-18 yrs.

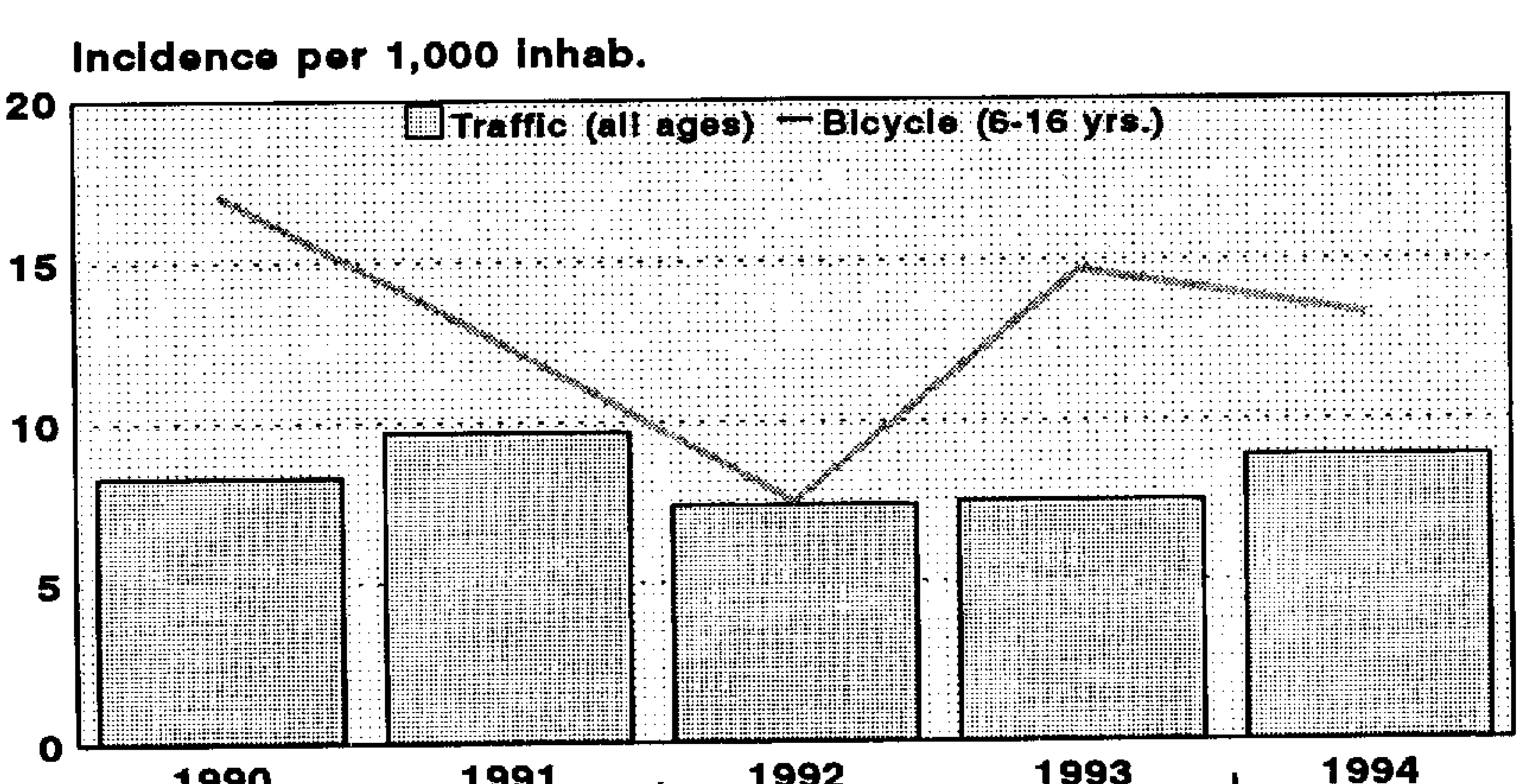


Relative risk (%): +17,4 -37,5 *

* Significant

MELBOURNE 1996

Nørhald municipality 1990-1994
Traffic injuries (all ages). Bicycle injuries (6-16 yrs.)



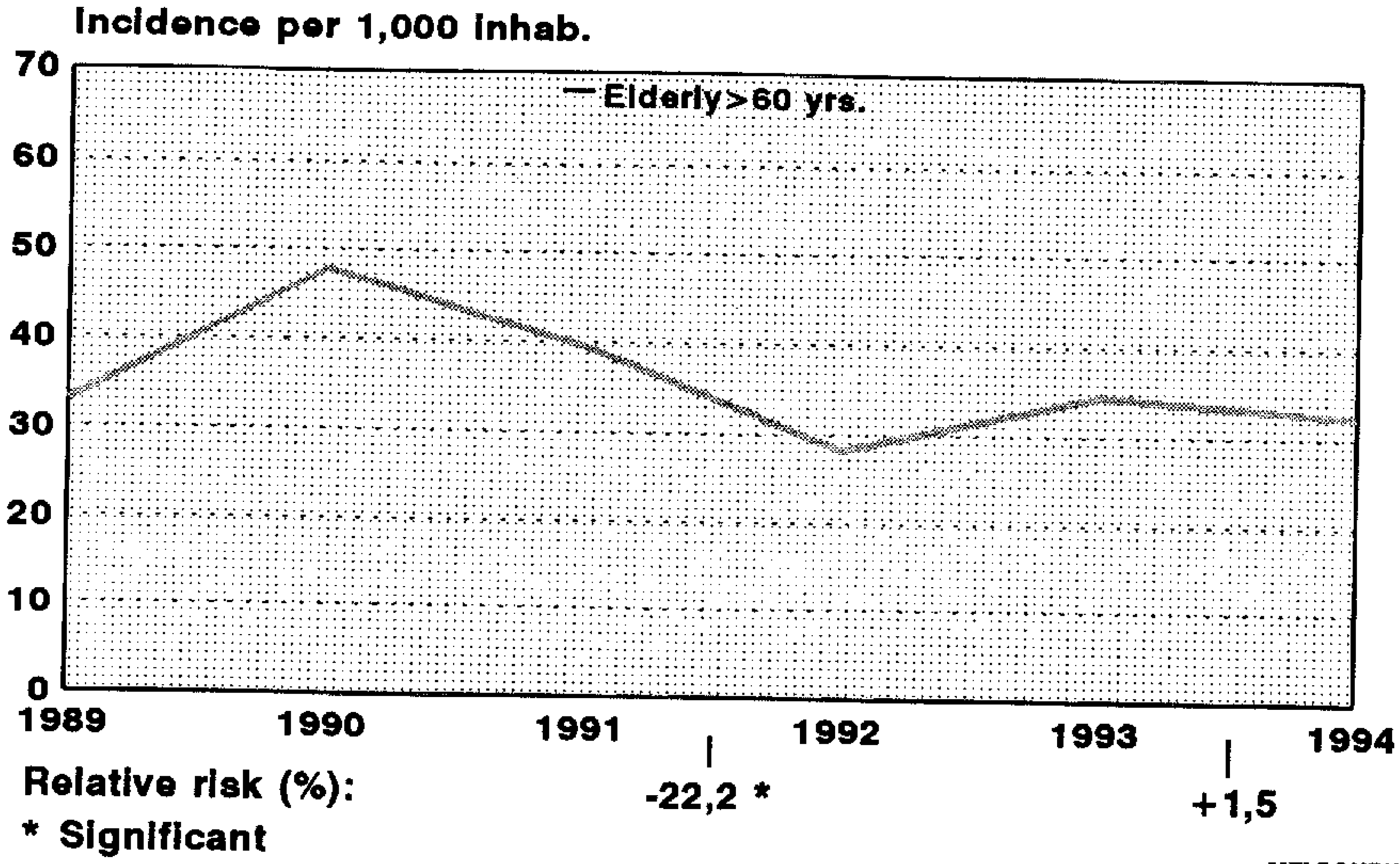
Relative risk (%): -53,7 * +57,0

(bicycle inj.)

* Significant

MELBOURNE 1996

Frederikssund municipality 1989-1994
Elderly>60 yrs., injuries due to falls in homes, nursing homes, streets



MELBOURNE 1996

Conclusions

- A multiaxial classification of external causes of injuries is the instrument of choice for targeted injury prevention
- Injury prevention is strengthened, when target groups are specified
- Successful outcome of targeted prevention sustains community participation
- Injury prevention facilitates the community intervention strategy

MELBOURNE 1996

European Home and Leisure Accident Surveillance System: Evaluation of the classification and reporting system

Saakje Mulder, Head of the Surveillance Unit, Consumer Safety Institute, Amsterdam, The Netherlands

The European Commission (EC) has created a harmonised system of information on home and leisure injuries. This system is called European Home and Leisure Accident Surveillance System, EHLASS. First of all I will go into the way EHLASS operates. After that, I will tell you about a study to evaluate EHLASS. This study has been conducted by the CSI and Statistics Netherlands.

1 EHLASS

About fifteen years ago, in 1981, the Council of Ministers of the European Union (EU) adopted a proposal to launch a pilot study to implement a data collection system for home and leisure injuries at Accident and Emergency (A&E) departments in all Member States. In 1986 the data collection started.

Information is collected on home and leisure injuries for which medical treatment is given. For most EU Member States the basic data is collected at A&E departments of a selected number of hospitals. Germany, Spain and Luxemburg collect the information by means of household surveys.

The variables included in EHLASS in all Member States are the same since the start in 1986:

- country code
- patient identification number
- sex of the patient
- age of the patient
- follow-up treatment
- number of days of admittance
- accident mechanism
- activity at the time of the accident
- hour of attendance
- date of attendance
- location of the accident
- type of injury
- part of body
- product causing the accident
- product causing the injury
- other products involved
- accident description.

The classification and related codes are harmonised and laid down in the official EHLASS coding manual.

The number of cases reported every year differs a lot per Member State. In 1994 information on about 350,000 home and leisure injuries treated at the A&E departments of 54 hospitals was recorded by EHLASS (see Table 1). At present the total number of hospitals participating in EHLASS is 65.

Table 1 Number of reported accidents in 1994 and number of participating hospitals

Member State	Number of reported accident (rounded figures)	Number of hospitals
Luxemburg	(900)	-
Ireland	10,000	2
Denmark	69,000	5
Greece	7,000	2
Belgium	14,000	4
Portugal	30,000	9
Netherlands	58,000	7
Spain	(3,200)	-
France	42,000	7
United Kingdom	114,000	11
Italy	12,000	7
Germany	(2,000)	-
Total		54

In 1995 three countries joined the EU: Austria, Finland and Sweden. They also planned to collect information on A&E departments.

The actual procedures for recording at A&E departments differ from one country to another. This is mainly due to differences in the organisation of the health care system. As well medical and nursing staff as specialised administrative clerks interview the victim. Usually the coding of the information is performed at the hospitals. Data are then sent to the national coordinating body.

Up to some years ago, the Member States sended the data collected on magnetic tape to the EC. The Commission was responsible for managing and analysing the data. However, the data accumulated without being used effectively. The databank was only accessible to EC staff.

In 1993 the EC decided that every year the Member States had to submit to the EC an annual report containing standardised information instead of having a central database. The EC summarised all national reports of 1990-1992 into a report at community level.

The EU provides financial support for the collection of data from A&E departments of selected hospitals in the Member States. This support is available up to 1997. In 1996 the EC needs to have finished an evaluation report, including new rules for the classification and the definitions of the data collected, and the presentation of the national reports. Based on this report, the EC has to decide in 1996 on the continuation of the project.

2 The evaluation study

Since the start of EHLASS in 1986 the classification has not changed. And as we all know, a classification is not a static product, but should be the result of a dynamic process. Products that are introduced into the market, new trends in activities, may give birth to the introduction of new codes. So, it is really time to update the classification.

As I already told you, the data is presented to the Commission by means of national annual reports, because a centralised database didn't work out. An important complaint, especially from the Commission, is that the specific information they need, is often not included in the reports. So, the Commission wanted to find out how the annual reports could meet more to their requirements.

This led to the evaluation of EHLASS, which has two objectives:
- to suggest new rules concerning the classification of EHLASS; and
- new rules for the presentation of the national annual reports.

The method consisted of five phases:
1. A questionnaire was sent to all 15 EHLASS project leaders, to get to know more about their experiences.
2. An inventory of standard classifications concerning injuries which could be useful for the EHLASS classification.
3. Interviews with relevant people of the EC to get insight in their experiences and wishes.
4. A study of the annual EHLASS reports of the Member States.
5. Meeting of EHLASS experts to discuss proposals.

3 The new classification

We have drafted a new EHLASS classification scheme including a manual and definitions. General features of the new classification are:

- it is primarily developed for recording home and leisure injuries, but is also applicable for other types of accidents. The general scope of EHLASS is home and leisure injuries. However, in some countries information is collected on more accident categories. So, it is wise to link up with such developments.

- it is closely linked up with relevant international developments, like ICD-10 and the new WHO classification of external causes of injuries which is being developed at the moment.

- it is first of all meant for data collection at A&E departments and only at a later stage for household surveys.

- it has a hierarchical structure, which makes it easier to add new codes in a logical position.

- it meets the general demands for determining classifications, such as being aware of the information needed by (potential) users and the information available at A&E departments, the use of a coding manual, compatibility with the old EHLASS codes

We concluded that sharpenings of the formal definition of a home and leisure accident are necessary to improve the comparability. We have drafted a decision tree which lends a helping hand.

We concluded that all current variables should be maintained and extended with two new variables: 'date of the accident' and 'time of the accident'.

Another recommendation is to change the variable accident mechanism into injury mechanism. The variables place of occurrence, mechanism of injury, type of sports and products involved should be changed quite drastically. Other variables should be changed slightly or not at all.

The way the new classification is implemented and maintained is very important. Subjects that should be taken care of are for instance the formal acceptance of the classification, the translation into the different languages, and conversion tables.

It should be tried to have all Member States implement the new EHLASS classification from the 1st of January 1997.

As already mentioned, a classification is not a static product. The changes need thorough co-ordination. Efficient procedures and a corresponding infrastructure are necessary for the maintenance of the classification. Explicit recommendations are formulated.

4 The national annual reports

Although there are several ways to make EHLASS data accessible to the public and (potential) interested organisations the national annual reports are at the moment and in the near future the most appropriate way. There is a publication with standard rules for the creation of and annual report. This was an important step forwards to harmonising and uniforming the national reports. Unfortunately, we found out that almost no country sticks to these rules. Usually it is not because the information is not available.

It should be realised that an annual report of a database as large and diverse as the EHLASS database, can hardly contain information on issues with a relatively low frequency. For specific information the database needs to be consulted, or the individual Member States need to deliver extra (ad hoc) information. In our opinion, the national annual reports should be regarded as a kind of 'appetizer' for everybody (potentially) interested.

We advise the following global contents for the national reports:

- basic demographic information;
- basic information on all EHLASS variables;
- background information on the design of the national surveillance system;
- general information about the organisation of the health care system which is relevant for the interpretation of the data;
- information about other data sources containing information on injuries including the most relevant figures;
- information on the national use of EHLASS data;
- more detailed information about at least one selection of accident; and
- an appendix with detailed information.

These contents are laid down in explicit guidelines.

An important recommendation is that the Commission should exert more pressure on the project leaders to follow the guidelines more strictly than so far.

Beside the annual reports, the accessibility of EHLASS should be improved. For example to disclose EHLASS information on Internet and other data transmission networks. It is also recommendable to have a standard procedure for getting information from individual Member States. It is difficult to get fast responses from the Member States.

Information technology is advancing, so the possibilities for an integrated database are improved and will improve in the future. We recommend to map the conditions for setting up a central database in which EHLASS information from all Member States is stored.

5 Co-ordination needs
EHLASS has a considerable potential to make a substantial contribution to consumer safety in Europe. The previous conclusions and recommendations certainly underline the needs for co-ordination and support towards both the EC and the Member States .

From experience in the past ten years, it is evident that these co-ordination tasks can not be left to spontaneous initiatives of partners involved. Such co-ordination efforts need a clear structure and a budget. The co-ordination tasks should be entrusted to a secretariat established by the EC. This could be either inside the Commission's services or outside, for instance by establishing a clearinghouse in Brussels or in one of the Member States. One of the most important requirements is that the secretariat should be lean and mean, i.e.:

1. acting as a focal point for all information and expertise made available by the Member States under the contract with the EC;
2. ensuring full commitment of the project leaders and assisting them in increasing the system's agility and flexibility; and
3. carrying out the necessary technical work on behalf of the EC and in close collaboration with the project leaders.

This co-ordinating secretariat is urgently needed in order to fill the vacuum between EC and Member States that is present since the launch of EHLASS in 1986. These tasks easily fit into and European Agency for consumer safety.

Basic Data Set for Accidental Injuries for In-Patients in Norway

ICE-meeting, Melbourne 23.2.96
Johan Lund, Norwegian Safety Forum

Injuries in Norway

Persons with injuries are treated in the health sector, which then is an important data source for injuries. The collection of data is an important role of the health sector. It is, however, also necessary to communicate these data to other sectors of the society, the sectors working with or having responsibility for prevention of different groups of injuries.

There are to important purposes for the use of accident and injury data:
1) To make statistics and trend analyses, to enable priorities to be set.
2) To analyse the data to find preventive measures.

The content of the data used for statistics and for prevention are different. Data for making statistics are general indicators, while data for finding preventive measures are mostly case stories.

To collect data in the health sector is not always an easy task. In Norway, there are no special persons designated in the hospital responsible for data collection. It is the normal personel who register data in their dayly routines: doctors, nurses and receptionist.

Up to now, there has been poor statistics from hospitals in their routine registration, due to too detailed classification (E-code), no personell responsible for the data collection and poor quality control.

In Norway (4,3 million inhabitants), we have on the basis of two important registration systems calculated the number of injuries per 100 000 of the population for the different injury types and severities to be:

Table 1 Number of injuries in Norway by injury type and severities

Injury types	Treated by medical doctor 1)	In-patients 1)	Fatalities 2)
Accidental	ab. 10 500	ab. 1 370	41
Intentional self-harm	ab. 200	ab. 160	14
Assault	ab. 500	ab. 90	1
Total	ab. 11 200	ab. 1 620	56

1) National Injury Register at the National Institute for Public Health, a sample register based on special financed registration hospitals and emergency wards in four cities. This give data from ab. 10% of the in- and out- injurypatients treated by a medical doctor in Norway
2) Death Register at Statistics Norway. 100% of the fatalities are registered.

Different data sets in the injuryregistration in the health sector

At the ICE-seminar in Washington in 1994, a working group presented a figure showing different types of datasets and the differences between them (see table 2). According to the working group, we might divide the data sets in three groups:

1 A Basic Data Set (BDS). The variables in this BDS ought to be very general case indicators. The purposes for collecting a BDS are for policy setting, for identyfing "hot spots", to follow trends on the main accident/injury types locally, regionally and centrally and for international comparisons. For being able to follow trends, the collection of a BDS ought to be as close to 100% as possible in the group and in the area we want to monitor. It should therefore also be collected during the normal routines of the health system, without special economic or personell resources.

A Minimum Basic Data Set (MBDS) is the absolutely minimum of indicators that should be collected from the health system in the dayly routines for monitoring. A MBDS should be internationally agreed upon, to enable international comparisions.

2 A Standard Data Set (SDS) consists of more detailed indicators, and eventually a free text (case story). The data set collected in most of the existing hospitalbased injury surveillance and registration systems in the world today might be a SDS: NEISS in USA, NOMESCO in the Nordic countries, EHLASS in many European countries, PORS in the Netherlands, HASS in United Kingdom. Mostly extra resources are necessary to enable collection of these data in the health system. All the systems mentioned here are sample registers, as it would be very costly to collect all these data from all injuries treated in the health system.

We might consider the chapters XIX in the ICD-10 also to be a SDS, since the level of information in that chapter is rather detailed. I have to admit that in my country we doubt that it is possible to collect the complete chapter XX in ICD-10 from our hospitals in a routine system, with a quality good enough to enable us to make good and reliable statistics.

Chapter XIX (injury diagnosis - medically terms) is more likely to be collected in a routine system in the health system with reasonable good quality, as diagnosis are well known to the medical profession.

A SDS is collected for defining more detailed "hot spots", to identify some preventive means, and for making some research. However, to really get information which makes it possible to understand why the accident/injury happened, and hence will give us possibilities to propose efficient preventive means, we have to go to the third level of details:

3 Expanded Data Set (EDS) contains more or less case stories from the different accidents/injuries. There might be modules or detailed questionaires created for the accident/injury types you want to investigate, for instance traffic accidents, burns, bicycle accidents, accidents with special products, spinal cord injuries etc. To collect case stories

with enough information for prevention work is quite costly, and is not possible to do in the health system in the dayly work. Often on-site investigations are required.

Table 2 **Different data sets for collecting data on unintentional injuries with regard to the level of detail of the information and the purpose of collecting the data set.**

Level of detail of information	**Different data sets**	**The purpose of collecting the data set**
General case indicators	**Basic data set (BDS)** Minimum Basic Data Set (MBDS) the absolutely minimum to be collected, should be internationally agreed upon. Routine registration - 100%	Policy Setting Identify "hot spots" Follow trends International comparisions
More detailed indicators + evt. free text	**Standard data set (SDS)** ICD - 10, chapter XX NEISS, NOMESCO, EHLASS, HASS, PORS Special registration - often samples	Identify more detailed "hot spots" Identify preventive means (Research, to some extent)
Case stories	**Expanded data sets (EDS)** Modules on: Traffic, Burns, Falls, Products etc. Special data collections - selected cases	Identify preventive means Research

One very important characteristic with these data sets is that the cost for collecting the information will increase the more downwards to the bottom of the table you get.

Introduction of ICD-10 in Norway and a Basic Data Set for injuries

ICD-10 will be introduced in the health system in Norway from 1997, and for death statistics from 1996. Based on the knowledge that the Chapter XX: " External causes of morbidity and mortality" is too detailed for morbidity registration in Norway, the health authorities decided to make a Basic Data Set (BDS) for injuries, compatible with the ICD-10 Chapter XX. The purpose with this Basic Data Set is to create a running routine registration of injuries for in-patients which can be used as a basic statistical system to serve the different authorities with relevant overview of "their" injury area, and to serve as a base for collecting information from registers for sick-leave, rehabilitation and handicaps by using the personal birth number to connect the information from the different registers. This later proposal, called the SYNPAS-proposal, comes from a report made by the Norwegian Safety Forum.

A working group was established, and Norwegian Safety Froum was asked to chair it. In the woorking group were members with 10-15 years of experience with colleting a Standard Data Set from hopitals, knowing quite well the problems and possibilities with collecting injury data from norwegian hospitals. The working group has created a BDS with the dataelements as shown below. For some of the dataelements comments are given to give the reason why the dataelement is included.

1. ***Demographic data:*** Age, sex, residence. Residence (adress) is included to enable calculation of incidences.

2. ***Municipality where injury happened.*** This is included to enable the authorities to count the accident/injuries which occur within the boundaries of their municipality.

3. ***Main injury type:***

- Accidental
- Intentional selfharm
- Assault
- Legal intervention and operation of war
- Undetermined intent.

3.1 ***Accidental injuries***

For the accidental injuries, or accidents, as they will be called from now on, some special dataelements will be registered. The most important design criteria was to give the different authorities involved in prevention of accidents a number of "their" accidents. Some of these authorities are having registers on accident data based on other sources than the health system. As an example, the traffic safety authorities have a register for traffic accidents based on police reports. Investigations have shown, however, a vast underreporting of traffic accidents compared with registration of traffic accidents in the health system.

This is the main underlying reason for creating this BDS. The health system should be able to give the different authorities information about the number of accidents happening in or on their responsibility areas.

In Norway, we have found the different authorities with responsibility or interests for the different accident types. It is not always that there is so much preventive activities in those authorities, anyhow, the numbers of the accidents occuring in their areas of interest or reponsibility should be given them. The list of the main accident types and the relevant authorities in Norway having responsibility or interest is given below.

- Traffic - Directorate of Road and Traffic
- Other accidents on the roads: Directorate of Road and Traffic
- Occupational
    - Landbased (also agricultural)- Directorate of Labour Inspection
    - Off-shore - Directorate of Oil

- Fishing at sea - Directorate of Fisheries
- Seatransport - The Maritim Directorate
- Airtransport - The Aviation Directorate
- In Military service: The Directorate of Defense

- Home - The National Authorities on Buildings
- Educational - The Ministry of Education
- Sports - The Ministry of Culture
- Kindergarten and playgrounds: The Ministry of Children and Family Affairs
- Nursing home, home for sick: The Ministry of Health and Social Affairs

These are the accident types which we want to count through a MBDS. In addition, some other areas turned up during the discussion with the different authorities with wishes to be monitored in a BDS:

- Accident in hospitals
- Accidents in the police, law and order activities.

Based on this division of the accident area, we designed the place of occurence and the activity of the injured person when injury happened.

4. Place of occurence

- Residential area (exclusive playground)
- Road traffic accident (moving vehicle is included, also single bicycle accident)
- Other accident on street/road
- Kindergarten/playground
- School and schoolyard, highschool etc. (exclusive sportsarea, in and out)
- Hospital, somatic and psychiatric
- Sports and athletics area, in or out, also at school and institution
- Open countryside, sea, lake, river, air
- Other place, as production area, farm, shop, park, restaurant etc.

5. Activity of the injured person at the time the event occurred

- Working for income. This is divided in the branch where the injured person worked, to enable the different occupational accidents to be counted:
  - Manufacturing and mining
  - Construction
  - Working off-shore (exclusiiive sea- and airtransport)
  - Agriculture and forestry
  - Fishing
  - Defense activities (exclusive compulsory enlisted)
  - Police, law and order activities (exclusive prisoner)
  - Other branch: Trade, tranport, repair, hotel, restaurant, public and private services etc.
  - Branch not known.

- Education, as pupil, student
- Compulsory enlisted
- Athletics, sports, exercise in education
- Other athletics, sports and exercise
- Other activity as unpaid work, vital activity, play and other leisure activity.

6. *Transport accident, transport role for the injured*

In a transport accident at least one vehicle (bike, car, tractor, horse, snowscooter, train, tram etc.), vessel or other transportmean must be included.

- Pedestrian, (incl. on sleigh, ski, tricycle, rollerskates, etc.) i contact with/pressed by vehicle, animal, person
- Bicycle, driver/passenger
- Motorcycle, driver/passenger
- Moped, driver/passenger
- Car, taxi etc. driver/passenger
- Van, combicar, pick-up truck, driver/passenger
- Heavy transport vehicle, driver/passenger
- Bus, driver/passenger
- Rider, animaldrawn vehicle, driver/passenger
- Train, tram, driver/passenger
- Driver/passenger in other vehicle, as: in industry, in agriculture, (tractor)

- Vehicleaccident, unknown transportrole for the injured
- Seatransport, inclusive leisure time
- Airtransport, inclusive leisure time
- Other transport as lift in building, cableway, skilift, etc.

7. *Other external cause of accidental injury*

- Falls, all types
- Struck, hit by object (no machine, tool, animal, person)
- Caught, crushed, jammed in or between objects (no machine, tool, animal, person)
- Cut, hit, caught, jammed by machine, tool, weapon, explosion), incl. cut by glas
- High-pressure jet, vibration, noise
- Foreign body in eye, orifice, skin
- Bit, struck, kicked, bitten by person,animal, plant
- Drowning and neardrowning, suffocation and nearsuffocation
- Electricity, radiation, air pressure
- Smoke, fire, flames
- Hot liquid, gas, surface
- Venomous plant/animal/incect, ext. contact
- Natural heat, cold, natural forces
- Poisoning, noxious substances
- Overextertion, lack of food and water

Other factor

How to use this BDS in Norway

A combination of "Place", "Activity" and "Transport" (4, 5 and 6 above) will give the 13 different national authorities (mentioned before) and the local authorities involved in accident prevention a number of "their" accidents, and some of the external factors involved (from 7 above). The traffic and transport authorities will get some more details about "their" accidents (from 6 above).

When utilising the National Injury Register at the National institute for Public Health (10 % sample) in addition to this BDS, more details of these accidenta can be obtained on a national level. These two registers will also act as qualitycontrol-registers for each other, as the in-patients will be registered by both of these two registers at four hospitals.

A one-page form is developed to be filled in by personell in ambulances and in the reception at the hospitals (enclosed). In addition, the doctors will register the diagnosis (Ch. XIX, ICD-10). This BDS is accepted by the Norwegian health authorities, and will be made obligatory for all injured in-patients in hospitals all around Norway from 1.1.97, instead of the more detailed Chapter XX in ICD-10.

It will be essential for the success of the implementation of this BDS for in-patients in Norwegian hospitals, if there will be given resources to training of hospital personell in the coding of the injuries and accidents, and that there will be established a system for statisitics production and quality control.

A MBDS to be collected in Norway and internationally?

The BDS shown above it a data set which has been constructed for a system with registration resources and tradition at a certain level. It has also been constructed to be compatible with ICD-10. It could be that also this Norwegian BDS might be difficult to register.

If we should design a data set as the absolutely minimum to enable the relevant preventive authorities to monitor the developmenmt of "their" accident, following MBDS would have been proposed for implementation:

Item 1, 2 and 3 as above.

4. Place of occurence

- Residential area (ex. playground)
- Road traffic accident (moving vehicle is included, also single bicycle accident)
- Other accident on street/road
- Kindergarten/playground
- School and schoolyard, highschool etc. (ex. sportsarea, in and out)

- Sports and athletics area, in or out, also at school and institution
- Sea transport accident in sea, lake, river, inclusive leisure time
- Air transport accident (inclusive leisure time)
- Other accident in open countryside, sea, lake, river, air
- Other place, as production area, farm, shop, park, restaurant etc.

5. ***Activity of the injured person at the time the event occurred***

Working for income.

- Manufacturing and mining
- Construction
- Working off-shore (ex. sea- and airtransport)
- Agriculture and forestry
- Fishing
- Defense activities (ex. compulsory enlisted)
- Police, law and order activities (ex prisoner)
- Other branch: Trade, tranport, repair, hotel, restaurant, public and private services etc.
- Branch not known.

- Education, as pupil, student
- Compulsory enlisted
- Athletics, sports, exercise in education and as compulsory enlisted
- Other athletics, sports and exercise
- Other activity as unpaid work, vital activity, play and other leisure activity.

The MBDS might also be used by general practioners in Norway, to broaden the picture of the accidental injuries treated by medical doctors in Norway. Than comparisions between the different municipalities and counties could be done.

This MBDS is designed to give the relevant authorities in Norway a number of "their " accidents treated in the health system. The list above contains some accident types which are used in many countries. It might be possible to agree on a list which could be used internationally, and to establish definitions of the different main accident types. If that was done, international comparisions could be made with a higher level of accuracy than to day.
Also, a MBDS could be proposed for use in areas where there are very small registation resources, and where a BDS. The challenge is to define a MBDS for international comparisions. It should be a task for World Health Organisation.

Edition12.2.96 Norwegian workinggroup for coding og classification of accidental injuries

Injury record

Check one code in item 3-7, only one in each

1. Name/identification of the injured:	**2. Municipality where injury happened:**

3. Injurytype (check one):

	Accidental (fill in 4 - 5, and 6 or 7)	Y1n	Undetermined intent (fill in 4 and 5)
_____	<--(write code from 6 or 7)		
X6n	Intentional selfharm (fill in 4)	Y3n	Legal intervention and operation of war (fill in 4)
X8n	Assault (fill in 4 og 5)		

4. Place of occurence (check one):

a	Residential area (ex. playground)	f	Hospital, somatic and psychiatric
b	Roadtrafficcaccident (moving vehicle is included, also single bicycle-acc.)	g	Nursing home, home for sick
		h	Sports and athletics area, in or out, also at school and institution
c	Other accident on street/road		
d	Kindergarten/playground	i	Open countryside, sea, lake, river
e	School, -yard, highschool, etc. (ex. sportsarea, in and out)	x	Other place as production area, farm, shop, park, restaurant etc.__________

5. Activity/branch/businesess of the injured person when injury happened (check one):

If injury happened when injured person worked for income, mark the branch where he/she worked:

a	Manufacturing and mining	f	Defence activities (ex compulsory enlisted)
b	Construction	g	Police, law and order activites (ex prisoner)
c	Working offshore (ex. sea-/airtransp.)	h	Other branch: Trade, transport,repair, hotel, restaurant, public/priv. service, etc.:______
d	Agriculture and forestry		
e	Fishing	i	Branch/business not known

If injury happened when the injured did not work for income, mark one of the alternatives below:

j	Education (as pupil, student etc)	m	Other athletics, sports, exercise
k	Compulsory enlisted	x	Other activity as unpaid work, vital activity play and ind other leisure act.:__________
l	Athletics, sports, exercise in education		

If injury happens during transport (in work and leisure time), only 6 to be checked. In a transport accident at least one vehicle (bike, car, tractor, horse, snowscooter, train, tram etc.), vessel or other transportmean must be included. If the event is no transport accident, only 7 to be checked. The code from 6 or 7 to be transferred to open space in item 3: Injurytype

6. If transportaccident the role of the injured (check one):

V0n	Pedestrian, (incl. on sleigh, ski, tricycle, rollerskates, etc.) i contact with/pressed by vehicle
V1n	Bicycle, driver/passenger
V2a	Motorcycle, driver/passenger
V2b	Moped, driver/passenger
V4n	Car, taxi etc. driver/passenger
V5n	Van, combicar, pick-up truck, d/pass.
V6n	Heavy transport vehicle, driver/pass.
V7n	Bus, driver/passenger
V80	Rider, animaldrawn vehicle d/pass.
V8a	Train, tram, driver/passenger
V8b	Driver/passenger in other vehicle, as: in industry, in agriculture, (tractor)
V89	Vehicleaccident, unknown transport-role for the injured
V9a	Seatransport, incl. leisure time
V9b	Airtransport, incl. leisure time
V98	Other transport as lift in building cableway, skilift, etc:__________

7. If other accident than transportacc., contributing factors (check one):

W0n	Falls, all types
W2a	Struck, hit by object (no machine, tool, animal, person)
W23	Caught, crushed, jammed in or between objects (no machine, tool, animal, person)
W2b	Cut, hit, caught, jammed by machine, tool, weapon, explosion), incl. cut by glas
W4a	High-pressure jet, vibration, noise
W4b	Foreign body in eye, orifice, skin
W5a	Hit, struck, kicked, bitten by person,animal, plant (Venomous plant, animal, insect:X2n)
W6a	Drowning and neardrowning, suffication and nearsuffocation
W8a	Electricity, radiation, air pressure
X0n	Smoke, fire, flames
X1n	Hot liquid, gas, surface
X2n	Venomous plant/animal/incect, ext. contact
X3n	Natural heat, cold, natural forces
X4n	Poisoning, noxious substances
X5a	Overextertion, lack og food and water
X5b	Other factor:__________

National Injury Sample Register of Norway

Johannes Wiik and Branko Kopjar

National Institute of Public Health
Geitmyrsveien 75, 0462 Oslo, Norway
phone. (+47) 22 04 22 00facsimile. (+47) 22 56 44 35

The objective of this presentation is to describe shortly the types of injury classification systems and data in use by the Norwegian National Injury Register.

The Norwegian National Injury Register represents a principal source of information about occurrence of injuries in Norway. The register has been extensively used for providing epidemiologic information about occurrence of specific types of injuries among the population and for in-depth research studies.

The National Institute of Public Health's (NIPH) register of injuries began as a pilot project in 1985 and became a permanent, non-profit, public monitoring/research activity in 1990. The activity is financed by the Ministry of Social Affairs and Health. The register consists of two co-ordinated activities, the registration and the research. The registration part consists of remote registration units, the coding and quality assurance team, and the data management team. The research part represents research fellows and students.

The following data files are in use by the Norwegian National Injury Register:
C. The National Register of Deaths
C. The National Hospital Discharge Register
C. The National Injury Sample Register
C. Other data files (research and projects)

<u>The National Register of Deaths</u>

The National Register of Deaths is maintained by the Central Bureau of Statistics. The register collects information according to the internationally recognized WHO Death Certificate. Annually, approximately 2,600 deaths occur due to unintentional injuries, violence and suicide, or approximately 60 per 100,000. Standard type annual statistics on deaths due to injuries are presented in the annual reports from the Bureau.

<u>The National Hospital Discharge Register</u>

National Hospital Discharge Register is a large data set representing all discharges from Norwegian hospitals. Norway runs a single payer health care system and vast majority of hospitals are publicly run. Approximately 650,000 discharges are represented annually. Of these, approximately 60,000 represent hospitalisations for injury (defined by ICD-9 codes 800-995, but codes 905-909). These 60,000 hospitalisations occur among 55,000 people. This register offers minimum data set consisting of demographic data, ICD-9 medical diagnosis, E-codes, outcome codes, length-of-stay, procedures, and some administrative information. Unfortunately, the quality of E-coding is low.

Norwegian Injury Sample Register

Norwegian National Injury Sample Register represents a main primarily collected data file. The data are collected prospectively, according to the NOMESCO classification of injuries common for Nordic countries. The harmonisation of this classification and the classification used in the European Home and Leisure Accident Classification System is under way.

The registration covers hospitals and emergency clinics in Harstad (northern Norway), Trondheim (central west coast), Stavanger (south-west coast) and Drammen (eastern coast). Approximately 45,000 injuries (8,000 inpatients and 37,000 outpatients) are reported annually from these four registration units. These represent approximately 14% of all hospitalized and approximately 9% of all non-hospitalized injuries treated by hospitals and emergency clinics in the country. The registration covers defined populations allowing for reliable population-based estimates.

The injury registration is based on the self-administrated registration form filled in by all people presenting for the diagnoses with ICD-9 codes from 800 to 995 (except late consequences of injuries, codes 905-909). Injury events are registered only once, repeated visits are disregard. Specially trained administrators maintain the coverage and the registration routines, code the information after the Norwegian version of the Nordic Medico-Statistical Committee Classification for Accident Monitoring, and input data into the local data base. Data are transferred to the NIPH in short intervals. The local register is person-identifiable and the central register is pseudo-anonymous (the code is kept locally).

The data elements at the register are age, sex, community of residence, date, time, place, and activity at the moment of the accident, accident mechanism, injury mechanism, transport vehicle(s) involved (if applicable), commodity codes, diagnose(s), AIS codes, type of treatment, and short narrative description of the accident.

The National Injury Sample Register represent the most important and recognized source of information about occurrence of injuries in Norway. The most important users of the register is the NIPH itself, government departments (e.g. departments of health, transport, environment, child and family), product and environmental safety authorities, local authorities, research institutes, the Research Council, media, insurance companies, and others.

Other data files (research and projects)

Several data files arose from registration and research projects run by the unit. These files contain information that vary according to objectives of the respective projects.

Our experiences are that a central register of injuries represents important source of information for strategic planning, follow-up of injury control measures, and research. It encourages and improves the quality of local registration. The Norwegian register represents national centre of competence for injury prevention and research. It is necessarily to stress an importance of research commitment for the success of injury registration. Without research activities it is difficult to maintain a data quality, and to make maximum use of the information available in the register.
Information in the register allow us to produce statistics about various topics important for injury prevention in a short time and with marginal additional resources. Thus we believe the Norwegian National Injury register represents a cost-effective solution for injury registration.

Concerning the data classification issues, our experience is that NOMESCO classification provides useful standard information for injury surveillance that provides much better portrayal of injuries than the E-codes only. This classification offers important information for various types of agencies interested or responsible for injury prevention, like traffic safety bodies, children safety agencies, nursing homes, school authorities, occupational safety agencies, consumer product safety authorities, and others. The data collected by this classification offer reasonable starting point for the in-depth studies.
It needs to be emphasised that collection of data according to the protocol used by the Norwegian Sample Injury Register requires additional efforts and is associated by resource use. It is unlikely to see this type of the registration running on the routine basis without extra resource investment.

ELIMINATING INJURY: AN INTERNATIONAL LIFE TABLE ANALYSIS

Ian R. H. Rockett, PhD, MPH
Exercise Science and Community Health Research Group
University of Tennessee, Knoxville

The author would like to thank Dr. Odile Frank of the World Health Organization for providing access to the data and to Alice Beauchene for assisting with data extraction.

Life tables generate the leading single summary index of population health status; namely, life expectancy at birth. Their origins may be traced back to the Romans, who created a table with five-year life expectancy projections for adults.[1] However, the first life table is generally attributed to John Graunt. His rudimentary table numbered among a series of seminal contributions to epidemiology and demography that were published in 1662.[2] Some 30 years later Edmond Halley, the celebrated astronomer, markedly advanced the concept.[3] The first complete single decrement life table appeared in 1815.

Multiple decrement life tables go beyond the single decrement procedure by distinguishing and incorporating causes of death. Life table analysis becomes especially applicable to public health and preventive medicine when these two techniques are used conjointly with a cause-elimination/modification technique. Collectively, they provide the mechanism in this study to address a series of survival questions concerning injury mortality. These questions are examined within a comparative international context.

Each ensuing survival question assumes the hypothetical and total elimination of injury mortality. First, what is the impact of this modified mortality regime upon population life expectancy at birth? Secondly, how would it affect the *saved* segment of the population - those who would directly benefit from the injury elimination? Thirdly, how does eliminating injury mortality affect the probability that a 15 year old will die between ages 15 and 65? All three questions are sex-specific, and have implications for shaping health policy and planning and evaluating targeted interventions.

DATA AND METHODS

Disaggregated by sex, age and underlying cause, the mortality data cover 10 industrialized countries: Australia, Canada, France, Germany, Italy, Japan, The Netherlands, Spain, the United Kingdom and United States. Cause of death was precoded according to the Basic Tabulation List of ICD-9 with injury classified by external cause (E470-E561). The source for the mortality and related population data was the World Health Organization (WHO). Data for the United States, Italy and Spain are for 1991* and for the other countries, 1992. In addition to data availability, criteria for country selection were combined respective minimums of population 15 million, gross national product per capita of US $13,000, and population life expectancy of 75 years.[4] The population selection criterion induces data stability, and remaining criteria improve the likelihood that the mortality data are of high quality.

Aside from the technique used to calculate life expectancy for the saved,[5,6] techniques used in this computer simulation are conventional life table procedures.[7,8] The former technique can be expressed in the following formula:

$$\Delta e_{saved} = (e_o^* - e_o) \times (l_o / i\,l_o)$$

where Δe_{saved} = gain in life expectancy for group hypothetically saved from injury mortality;

e_o^* = population life expectancy at birth in absence of injury mortality;
e_o = population life expectancy at birth;
l_o = life table radix (birth cohort); and
il_o = projected injury deaths among birth cohort assuming persistence of the prevailing mortality regime.

LIFETIME, a personal computer software program developed at Macquarie University in Australia under the sponsorship of WHO, was used to perform the primary analyses.[9] A spreadsheet was used for complementary calculations. As a prelude to the life table results, unadjusted and age-adjusted injury death rates are presented. These rates were adjusted by means of direct standardization, using as the referent a European male population provided in the LIFETIME package. Like this direct standardization procedure, life table techniques facilitate fair comparison through controlling the potentially confounding effects of variation in population age composition. Except for the hypothetical injury modification, all life table calculations in this study assume a constant mortality regime.

Choice of an age floor of 15 years and a ceiling of 65 for the conditional probability survival question is arbitrary. But this floor closely coincides with the demographic take-off point for sharply elevated injury mortality rates.[10-12] The ceiling duplicates that frequently used in indexing premature mortality by rates of years of potential life lost.[13-15]

RESULTS

French males manifest the highest crude injury death rates and Spanish and British females the lowest rates (Table 1). Within nations, the male injury rate invariably exceeds the corresponding female rate. The sex differential is frequently two-fold. This reaches three-fold in the Spanish case and approaches it for the United States. Cross-national comparisons reveal rates for Dutch and

British males approximately 30 percent lower than the rate for the peak risk female population, the French.

Adjusting injury death rates for age expands the sex differentials. Moreover, French female rates fall below male rates regardless of country. Injury accounts for about 10 percent of all male deaths in France and the United States. At the other end of the continuum, it produces less than 5 percent of Dutch and British male deaths. The range for females extends from 2 percent in the British case to 7 percent for the French. Respective injury contributions to total mortality for French, Japanese, Canadian, and Italian females exceed that for British males. However, within nations the proportional injury share of male mortality consistently surpasses that of female mortality.

Assuming complete elimination of injury mortality, US males would have 2.15 years added to their life expectancy at birth (Table 2). French males would gain 2.08 years. Among males, the Dutch would receive the smallest gain with 0.88 years. Among females, the French would be the leading beneficiaries with an extended life expectancy of 1.09 years (Table 3). This is twice the projected gain for the smallest beneficiaries, Dutch females. French females would even gain more additional life through elimination of injury fatalities than would Dutch and British males. Generally within nations, male gains would be more than double corresponding female gains. By far the smallest national sex differential occurs among the Dutch. But the projected gain for Dutch females exceeds the projection for British females, and approximates that of their Spanish and Italian counterparts.

With the hypothetical elimination of injury mortality, the combination of suicide, homicide, unintentional motor vehicle crashes and falls are associated with between 64 percent and 81 percent of the projected male life expectancy gains by country (Table 4). The corresponding female range is 62 percent and 80 percent (Table 5). Elimination of either motor vehicle traffic crash fatalities (E471) or suicides (E54) would commonly exercise a greater impact upon projected life expectancy gains than would elimination of fatal falls (E50) or homicides (E55). Disaggregating gains in terms of these four external injury causes, within an international comparative context, highlights certain national injury problems. Motor vehicle crashes stand out as an injury category for Spain and Italy, as does homicides for the United States. More evident in the female case, elimination of homicide in the United States would produce proportionally larger gains in life expectancy than would elimination of suicide. Also prominent in these international comparisons is the fall category for Italian females. Only in Japan and Spain is intentional injury mortality, that is, suicide and homicide combined, proportionally less significant for males than females.

When the study focus shifts to the saved population, the group hypothetically spared through injury mortality elimination, the largest projected gains are found to accrue to US, Spanish and Australian males (Table 6). Italian, Dutch and French females would receive the smallest gains. US males register the largest individual gain with a projected 32 additional years of life. US females would be the top beneficiaries among their sex with an additional 28 years of life. A stark contrast is provided by Italian females, whose gain would be 14 years. Within nations, sex differentials range from 11 years among Italians to 4 years among Japanese and Americans.

Table 7 shows country-specific probabilities for males exact age 15 years dying between exact ages 15 and 65. With injury mortality eliminated, the most substantial risk reduction would occur among French and Japanese males. Canadian, US, Australian and Spanish males exhibit similar gains. The smallest gains would accrue to Dutch and British males. The projected range extends from 9 percent for Dutch males to 17 percent for French males.

Decline in the probability of a female exact age 15 years dying between ages 15 and 65, after elimination of injury mortality, typically is much smaller than for a corresponding male (Table 8). Australian, Canadian, Italian, British and US females exhibit approximately 60 percent of the risk reduction projected for their male counterparts. By contrast, French and Japanese females would attain nearly 90 percent and 80 percent of the risk reduction projected for their male opposites, respectively.

DISCUSSION AND CONCLUSION

Life expectancy is an intuitive and readily interpretable measure. This life table parameter is useful for summarizing and assessing population health status and associated change.[16,17] Reflecting their large injury mortality burdens, the French and US populations would gain the longest extension of life if injury mortality were eliminated. This pertains irrespective of sex. The Dutch and British provide the greatest contrast. Nevertheless, relative benefits associated with injury elimination vary considerably cross-nationally according to which life table analysis is performed. For example, although British males represent a low risk group for injury mortality, they rank high as potential beneficiaries in the saved calculations.

This cross-national research will be extended. Survival questions of the type addressed here concerning injury will be posed in regard to major chronic and communicable diseases. Also of interest are the specific roles of these diseases and injury in secular changes in life expectancy.

The l_x life table function is used to model survival at the population level. However, this mortality survival curve limits attention to quantity of life. Germane to quality of life, there are two other survival curves that potentially could be generated. Respectively they model morbidity and disability.[18] But there is a caveat regarding their utility in cross-national comparisons. As documented, international cause-of-death comparisons could be diminished if not invalidated by differences in case ascertainment and coding practices.[11,19] Comparisons based also on disability and morbidity are all the more susceptible to such discrepancies.

Attaining high quality and uniform morbidity and disability data, and then integrating them into a composite life table measure like health expectancy,[20-23] will necessitate a high degree of international consultation and cooperation. Indeed, some progress in forging such links has been reported.[24] Relevant questions, where possible, could be embodied in ongoing national probability surveys, exemplified by the US National Health Interview Survey.[22] Although greatly magnifying cost, self-reporting of health status ideally should be augmented by a mental and physical examination to assess health and functionality more objectively. Finally, refined life table approaches must allow for the fact that morbidity and disability, unlike death, can be transitory. This requires multistate as opposed to unistate analyses.[23,25]

REFERENCES

1. Trenerry CF. **The Origin and Early History of Insurance, Including the Contract of Bottomry**. London: Ps King and Son, 1926.

2. Graunt J. Natural and political observations mentioned in a following index, and made upon the bills of mortality. Pp. 314-431 in W Petty, **The Economic Writings of Sir W Petty**, Vol.2, ed. CH Hull. New York: Augustus M. Kelly, 1964 (Reprint).

3. Halley E. First life insurance tables. Pp. 1437-47 in **The World of Mathematics**, Vol. 3 , ed. JR Newman. New York: Simon and Schuster, 1956.

4. Haub C, Yanagishita M. **1995 World Population Data Sheet**. Washington, DC: Population Reference Bureau, 1995.

5. Manton KG, Patrick C H, Stallard E. Population impact of mortality reduction: the effects of elimination of major causes of death on the *saved* population. **International Journal of Epidemiology** 1980; 9: 111-20.

6. Manton KG, Stallard E. **Recent Trends in Mortality Analysis**. Orlando, Fla: Academic Press, 1984.

7. Chiang CL. **The Life Table and Its Applications**. Malabar, Fla: Krieger, 1984.

8. Namboodiri K, Suchindran CM. **Life Table Techniques and Their Applications**. Orlando, Fla: Academic Press, 1987.

9. Hohn C, Pollard J. Mortality in the two Germanies in 1986 and trends 1976-1986. **European Journal of Population** 1991; 7:1-28

10. Rockett IRH, Smith GS. Injuries and the Australian mortality mosaic: a comparison with the United Kingdom and New Zealand. **Public Health** 1989; 103: 353-61.

11. Rockett IRH, Smith GS. Homicide, suicide, motor vehicle crash and fall mortality: United States' experience in comparative perspective. **American Journal of Public Health** 1989; 79: 1396-1400.

12. Baker SP, O'Neill B, Ginsburg MJ, Li G. **The Injury Fact Book**, 2d ed. New York: Oxford University Press, 1992.

13. Meade MS. Potential years of life lost in countries of Southeast Asia. **Social Science and Medicine** 14D; 1980: 277-81.

14 Rockett IRH, Smith GS. Injury in relation to chronic disease: an international view of premature mortality. **American Journal of Public Health** 77; 1987: 1345-6.

15. Centers for Disease Control. Cigarette smoking-attributable mortality and years of potential life lost--United States, 1990. **Morbidity and Mortality Weekly Report** 42; 1993: 645-9.

16. Stoto MA, Durch JS. National Health Objectives for the Year 2000: the demographic impact of health promotion and disease prevention. **American Journal of Public Health** 1991; 81: 1456-65.

17 Rockett IRH, Pollard JH. Life table analysis of the United States' Year 2000 Mortality Objectives. **International Journal of Epidemiology** 1995; 24: 547-551.

18 Manton KG, Soldo BJ. Dynamics of health changes in the oldest old: new perspectives and evidence. **Milbank Memorial Fund Quarterly/Health and Society** 1985; 63: 206-85.

19. Kelson M, Farebrother M. The effect of inaccuracies in death certification and coding practices in the European Economic Community (EEC) on international cancer mortality statistics. **International Journal of Epidemiology** 1987; 16: 411-4.

20. Katz S, Branch LG, Branson MH et al. Active life expectancy. **New England Journal of Medicine** 1982: 309: 1218-24.

21. Crimmins EM, Saito Y, Ingegneri D. Changes in life expectancy and disability- free life expectancy in the United States. **Population and Development Review** 1989; 15: 235-67.

22. Patrick DL, Erickson P. **Health Status and Health Policy: Quality of Life in Health Care Evaluation and Resource Allocation**. New York: Oxford University Press, 1993.

23. Barendregt J J, Bonneux L, Van Der Maas PJ. Health expectancy: an indicator for change? **Journal of Epidemiology and Community Health** 1994; 48: 482-7.

24. Robine J-M, Mathers CD, Bucquet D. Distinguishing health expectancies and health-adjusted life expectancies from quality-adjusted life years. **American Journal of Public Health** 1993;83: 797-8

25. Rogers R G, Rogers A, Belanger A. Active life among the elderly in the United States: multistate life-table estimates and population projections. **Milbank Quarterly** 1990; 67: 370-411.

Table 1. Injury Death Rates Unadjusted and Age-Adjusted by Sex and Country, 1992 *

	Unadjusted Rate		Adjusted Rate**		Injury Deaths as % of All Deaths	
	M	F	M	F	M	F
Australia	58.7	24.99	59.55	22.46	7.8	3.8
Canada	64.25	28.32	64.61	24.46	8.5	4.5
France	101.13	62.08	95.69	38.80	10.4	7.3
Germany	69.59	42.32	66.62	27.82	6.6	3.7
Italy +	68.51	37.80	63.88	24.48	6.6	4.2
Japan	64.84	31.27	63.52	25.40	8.4	5.0
Netherlands	41.58	29.99	41.44	21.49	4.7	3.6
Spain +	71.97	23.93	69.47	20.23	8.3	3.0
UK	44.74	24.05	43.47	17.53	4.1	2.2
USA +	87.00	32.62	86.31	28.86	9.5	4.0

* Rates expressed per 100,000 population.

** Adjusted through direct standardization using the LIFETIME computer package's European male population as the referent.

+ 1991 data.

Table 2. Life Expectancy at Birth with and without Injury Mortality by Country: Males, 1992

	e_0 **Injury Present**	e_0 **Injury Absent**	**Added Years**
Australia	74.56	76.06	1.50
Canada	74.77	76.38	1.61
France	73.65	75.73	2.08
Germany	72.58	73.98	1.40
Italy*	73.58	74.96	1.38
Japan	76.15	77.56	1.41
Netherlands	74.27	75.15	0.88
Spain*	73.29	74.99	1.70
United Kingdom	73.58	74.61	1.03
United States*	72.00	74.15	2.15

* 1991 data.

Table 3. Life Expectancy at Birth with and without Injury Mortality by Country: Females, 1992

	e_0 **Injury Present**	e_0 **Injury Absent**	**Added Years**
Australia	80.54	81.19	0.65
Canada	81.16	81.88	0.72
France	82.10	83.19	1.09
Germany	79.19	79.85	0.66
Italy*	80.31	80.87	0.56
Japan	82.58	83.28	0.70
Netherlands	80.34	80.87	0.53
Spain*	80.52	81.09	0.57
United Kingdom	79.14	79.59	0.45
United States*	79.01	79.86	0.85

* 1991 data.

Table 4. Percentage Contribution to Life Expectancy Gains through Injury Elimination by Country and Cause: Males, 1992

	Motor Vehicle Crash	Falls	Suicide	Homicide	Other Injury
Australia	28.7	4.7	33.3	4.0	29.3
Canada	27.3	6.2	32.3	4.3	29.9
France	29.3	6.7	28.8	1.9	33.3
Germany	35.0	8.6	30.0	2.9	23.5
Italy*	44.9	9.4	14.5	9.4	21.7
Japan	30.5	5.7	32.6	1.4	29.8
Netherlands	34.1	7.9	32.9	5.7	19.4
Spain*	45.9	3.5	12.9	1.8	35.9
United Kingdom	29.1	6.8	28.1	2.9	33.1
United States*	28.8	3.7	20.9	21.4	25.2

* 1991 data.

Table 5. Percentage Contribution to Life Expectancy Gains through Injury Elimination by Country and Cause: Females, 1992

	Motor Vehicle Crash	Falls	Suicide	Homicide	Other Injury
Australia	33.9	10.8	23.1	6.1	26.1
Canada	31.9	15.3	22.2	5.5	25.1
France	22.0	16.5	23.8	2.7	35.0
Germany	28.8	18.2	27.3	4.5	21.2
Italy*	33.9	28.6	14.3	3.6	19.6
Japan	22.9	4.3	37.1	2.9	32.8
Netherlands	24.5	20.7	32.1	5.7	17.0
Spain*	43.9	5.3	14.0	1.7	35.1
United Kingdom	26.7	13.3	17.8	4.4	37.8
United States*	36.5	5.9	14.1	17.6	25.9

* 1991 data.

Table 6. Gains in Life Expectancy* for those Saved from Injury Mortality by Sex and Country, 1992

	Δe_o **Male**	Δe_o **Female**	**Sex Difference**
Australia	30.28	23.24	7.04
Canada	28.76	20.75	8.01
France	23.94	16.10	7.84
Germany	25.96	18.29	7.67
Italy**	25.05	13.84	11.21
Japan	23.19	18.86	4.35
Netherlands	24.20	15.99	8.21
Spain**	30.58	24.79	5.79
United Kingdom	29.85	21.71	8.14
United States**	31.63	27.55	4.13

* Expressed in years.

** 1991 data.

Table 7. Probability of Dying between Exact Ages 15 and 65 years if Exact Age 15 by Country with and without Injury Mortality Elimination: Males, 1992

	Probability		
	Injury Present	**Injury Absent**	**% Decline**
Australia	0.1813	0.1541	15.0
Canada	0.1883	0.1591	15.5
France	0.2250	0.1870	16.9
Germany	0.2310	0.2040	11.9
Italy*	0.2022	0.1766	12.6
Japan	0.1642	0.1381	15.9
Netherlands	0.1801	0.1646	8.6
Spain*	0.2121	0.1808	14.8
United Kingdom	0.1973	0.1776	10.0
United States*	0.2458	0.2083	15.3

* 1991 data.

Table 8. Probability of Dying between Exact Ages 15 and 65 years if Exact Age 15 by country with and without Injury Mortality Elimination: Females, 1992

	Probability		
	Injury Present	**Injury Absent**	**% Decline**
Australia	0.1007	0.0915	9.2
Canada	0.1059	0.0959	9.4
France	0.0937	0.0797	15.0
Germany	0.1133	0.1038	8.4
Italy*	0.0945	0.0874	7.5
Japan	0.0792	0.0698	11.9
Netherlands	0.1049	0.0977	6.8
Spain*	0.0891	0.0808	9.4
United Kingdom	0.1208	0.1140	5.7
United States*	0.1377	0.1254	9.0

* 1991 data.

DIFFERENCES IN THE CODING OF INJURY DEATHS IN ENGLAND AND WALES AND THE UNITED STATES.

Cleo Rooney
Population and Health
Office for National statistics
10 Kingsway
London WC2B 6JP
England

All deaths registered in England and Wales are processed centrally at the Office of Population, Censuses and Surveys (OPCS) which produces national mortality statistics[1] . Until the end of 1992 coding was done by cause coders trained in OPCS to use ICD-9 codes and rules[1]. From the beginning of 1993 the coding was done using an automated cause coding system (ACCS) which includes the software (MICAR, ACME & TRANSAX) developed by NCHS for processing US mortality data[2,3,4]. Despite the fact that this software also embodies the codes and rules of ICD-9, our mortality statistics for 1993 showed large, unexpected falls in deaths due to external causes. These were particularly marked in suicides, injuries of undetermined intent, and motor vehicle traffic accidents (MVTAs)[5].

Nearly all external cause deaths in E&W are certified following a coroner's inquest which delivers a legal verdict (Fig 1 and Table 1)[6,7]. Comparisons of OPCS data for 1993 with independently collected figures indicated that the apparent falls in the number of deaths coded to suicide were greater than those seen in suicide verdicts by coroners reported to the Home Office (Fig 2)[8], and that OPCS deaths from MVTAs had fallen more than road deaths published by the Department of

[1] Please note, from the 1 April 1996 OPCS will merge with the Central Statistical Office to form the new Office for National Statistics, **ONS**.

Transport[9] for comparable periods. Suicide and MVTAs are the focus of considerable public health attention in England and Wales. Mortality rates which are comparable from year to year are essential for monitoring public health and assessing the impact of changes in policy on risk. It appeared that there must be significant differences in the coding of underlying cause of death (UCD) by ACCS compared to previous practice in England and Wales, and that this produced statistics for deaths from external causes which were not comparable to earlier years. We have investigated the differences in coding which gave rise to these artefacts by using the multiple cause codes and verdict (manner of death) codes produced by ACCS and stored in the OPCS mortality database, to select certificates which were then independently coded by nosologists in E&W and the USA.

Methods

Information on deaths occurring since January 1993 is held in a dynamic database which is continually updated and corrected. The 'uncorrected' data presented here are what was on the database at the end of may 1995. 'Corrected' data refers to the database in January 1996. Using the uncorrected data, we cross tabulated verdict by underlying cause of death, to identify and attempt to quantify discrepancies between these variables. We then identified all deaths which occurred in 1993 for which either 1) there was a manner of death (verdict) which was not natural (accident, suicide, homicide etc) **or** 2) there was a code in the multiple cause fields for any injury or external cause, **and** 3) the underlying cause from ACCS was not an external cause (Ecode).

We copied the original cause text, and other information from the database as well as from stored copies of the coroners descriptions of 'how the accident occurred' (page B of coroners form 99: see appendix a). After eliminating virtually identical certificates, we sorted these into groups by causes mentioned. From these, we selected a sample to represent the whole range of injuries and external causes found, and of the amount and quality of information available from the certificates. This sample was **not** representative of the numbers of such deaths on the database. Using these extracts, OPCS cause coders coded these deaths, as they would have done before automation and without knowledge of the ACCS codes.

This identified a range of deaths which would have been coded to external causes by the coders, but were given natural underlying causes by ACCS. We then tried to ascertain the reasons for the differences. Some errors in the operation of the system were identified, which resulted in incomplete or different information being available to MICAR and ACME. However, we also identified a range of deaths in which a different underlying cause was selected manually than automatically, from identical input information. A sample of 60 of these death certificates was selected to illustrate the types of certificates in which there appeared to be differences in how the underlying cause was selected. These were then coded independently by nosologists at NCHS, North Carolina, according to their standard procedure. The results were compared with the coding produced by the OPCS automated system and cause coders. Coders in both countries stated what rules they applied in each case.

Results

Table 2 shows the cross tabulation of verdict by cause. 6,569 deaths with an UCD in the range E800-E999 did not have a verdict. This is because deaths coded manually by cause coders did not always have the verdict entered on the database in initial processing (this has been corrected). The diagonal figures in bold show agreement between verdict and cause. There is never exact equivalence between open verdicts and deaths from injury of undetermined intent. In most years about 75% of open verdicts are coded to this range, and the remainder mostly to various natural causes or unknown cause (7999). No other verdict may be coded to this range (OPCS internal coding manual). This leaves a minimum of 1,770 and a maximum of 2,307 deaths for which UCD did not agree with verdict out of a total of 15,615 deaths with a verdict on the database at that time.

From these deaths, some were found to be due to errors in the computer systems or interfaces. For example, the 14 deaths coded to homicide with a verdict of suicide were due to an error in MICAR, which has since been corrected (Donna Glenn, NCHS,RTP personal communication). About 30 were found to have a verdict code of accident or suicide in error without having had an inquest. The reason for this is not clear, but it does not happen in current processing. Twenty of the 25 deaths coded to accident with a homicide verdict were found to have been coded correctly. These were motor vehicle collisions in which a driver was found guilty of manslaughter or reckless driving. ICD-9 codes all motor vehicle incidents to the accidental range[1]. From the remainder we extracted all the suicide, homicide, and open verdicts coded outside their ranges, and a sample of the accidents.

Manual coding in OPCS resulted in all the remaining suicide verdicts being coded to E950-E959, and all the remaining homicides to E960-E969 but only a quarter of the open verdicts were re-coded to E980-E989, most of the rest being 7999 (unknown cause).

Table 3 compares the coding of 37 certificates with a mention of suicide, homicide, undetermined or accidents not involving motor vehicles by E&W coders with coding in the USA and by the OPCS ACCS. Coders in the USA coded fewer of the sample to external causes as UCD, with 12 of the 37 going to natural causes. Coding by ACCS was very similar to US practice in this respect. The natural causes selected were predominantly vague conditions or terminal events, such as heart failure, or cardiorespiratory arrest. There was a much larger number coded to undetermined in the USA, with correspondingly fewer to suicide, or accident. ACCS was between US and E&W practice in this respect. Seven of the 23 certificates coded to MVTAs in E&W were coded to natural causes in the USA, and none to any external cause other

than MVTA. ACCS coding was similar, except that 1 death was coded to another E-code (Table 4).
Appendix b gives details of 8 certificates coded differently in the USA and E&W, which illustrate the reasons for the differences. The first thing to note about the certificates that were coded differently is that they are badly completed. Properly completed certificates which follow WHO guidelines are easy to code because:

the underlying cause is written on the last completed line of part I of the death certificate

the condition or event selected from the last completed line can cause all of the sequence of conditions listed in the lines above it

and so, the WHO general principal can be applied to select the underlying cause unequivocally.

When the certificate is badly completed, the WHO selection and modification rules have to be used. Differences in the interpretation and application of the rules between coders can give rise to artefactual differences in statistics. The examples in appendix b show several basic errors in certification, such as:

only a mode of dying in part I, for example cardiac arrest in certificates 3 and 4 and organ failure in certificates 1 and 6. The condition or event which led to this terminal event is often mentioned in part II or elsewhere on the certificate. However it is not always possible to select the initiating event with certainty.

unacceptable sequences, for example a fracture causing ischaemic heart disease in certificate 7.

two causes on one line, with no sequence indicated. In certificate 1, heart and liver failure are listed on line Ia. There is no acceptable sequence given which would lead to the first mentioned condition, heart failure, which is therefore selected as the UCD in the USA. If the two conditions had been written in reverse order, the UCD in both countries would have been the overdose.

These data show that underlying cause is selected differently in E&W and the USA when selection rules have to be applied to overcome poor certification. In particular, verdict is given more weight than the likelihood of a sequence or the WHO rules in selecting the underlying cause of deaths certified after inquest in E&W. This alone appears to account for every instance in which a different condition on the certificate was selected as the underlying cause. In addition, when the same condition is selected, as in certificate 2, the precise code assigned to indicate intent is different. 'Killed himself' is taken as suicide in E&W but as undetermined intent in the USA.

Discussion

Poor quality death certification can affect the coding and so the statistics for all causes of death. There are, however, additional problems with certification and coding that are specific to external causes of death. Coding these deaths requires information on the nature and site of injury, details of the event in which the injury was sustained and the intent behind that event. The way in which this information is collected varies from country to country, depending on their legal and medical systems. The processes surrounding investigation and certification of injury deaths probably differ more than the medical certification of most lethal diseases.

Even the coding of the injuries varies between these two countries. In the USA these conditions appear only in the multiple cause codes, but in E&W a single nature of injury code is derived for each death following WHO guidelines[1], and published routinely as 'secondary cause'[7,10]. There were two additional questions on the E&W coroners certificates until 1992, asking for a list of injuries, and of parts of the body injured. The amount of detail available on injuries appears to have fallen since the introduction of the new forms, and we are investigating this.

Accurate coding of the external underlying cause (E-code) of these deaths requires information about how injuries were sustained, for example in a motor vehicle accident on the highway or in a fall down stairs at home, and about the intent (verdict or manner of death). This information is not often written in the cause part of the death certificate, but is obtained from additional questions which may be included on all death certificates (USA)[11] or special coroner's certificates (E&W: appendix a). Because these external causes appear outside the cause section, it is difficult to apply the WHO ICD-9 mortality selection rules to them directly. In the USA the rules are applied as far as possible to the injuries and external causes mentioned on the certificate, as to other diseases or conditions. If an injury is certified as initiating the sequence leading to death, and this sequence is an acceptable one, then a link is made to the external cause of this injury which becomes the underlying cause, wherever it is mentioned on the certificate. This is illustrated in the following certificates:

A: Ia. cerebral contusion
b. fractured skull
c.
II
How injury occurred: pedestrian crossing road struck by motor vehicle
manner of death; accidental
UCD **E8147** (motor vehicle traffic accident involving collision with pedestrian - pedestrian killed).

B: Ia. cardiac arrest

b. haemorrhagic shock

c. multiple injuries of chest and abdomen

II

How injury occurred: driver of car in collision with train

manner of death: accident

UCD **E8100**

In addition, the WHO selection and modification rules may be used to select an injury from part II if there is an unequivocal sequence. For example, 'tylenol (paracetomol) poisoning' in part II could be assumed to have caused 'liver failure' but not 'heart failure' (see certificate 1 in appendix b).

In England and Wales all deaths involving injury or external causes must by law be referred to the coroner, who is a legal officer. Nearly all are certified by coroners following a inquest at which a legal verdict is delivered, usually by a jury (Table 1). No homicides or injuries of undetermined intent are certified without an inquest, and virtually no suicides. Only 7% of external cause deaths are certified without a legal inquest. Of these, 70% are due to accidental falls and fractures (E880-E888), mainly in the elderly. The very small number of MVTAs certified without inquest were all coded to 'late effects'. It appears that the only circumstances in which coroners do not hold an inquest on an injury death referred to them is when the intent is definitely accidental, and the type of accident is considered 'minor', or occurred a long time before the death.

Until 1993 the coroner's certificates, unlike the medical certificate of cause of death, were not laid out in the internationally recommended format. The cause of death could be written in any style or format and was usually copied directly from the pathologists's report of the post mortem carried out before the inquest. The information on any one coroner's certificate after inquest effectively comes from two different certifiers: the pathologist for the diseases and injuries; and the coroner for the verdict and circumstances of how the injury was sustained based on the findings of the legal inquest which is usually held after the post mortem. This may lie behind the obvious conflicts between the certified cause(s) and the legal verdict seen in some of these certificates, eg certificate 5, an accidental death apparently due to bronchopneumonia. WHO recommends that the certifier's opinion as to the cause be respected unless there is very good reason to overrule it[1]. However, it is very difficult to know what the certifier meant when the verdict contradicts the certified cause.

Because of the non-stard certification of these deaths, OPCS coders used the coroner's legal verdict as a guide to which of the causes mentioned he regarded as having led directly to the death. Certificate 7 in appendix b is a clear example of different coding because of the different weight given to verdict. The USA do not accept the sequence of fractured neck of femur causing ischaemic heart disease, and select the latter (ICD-9 4149) as the underlying cause. If the verdict in this case had been 'natural causes', then the death would have been coded to 4149 in E&W as well. This was the reason for virtually all the examples in which an external cause was selected in E&W and a natural cause in the USA as shown in appendix b.

In most States, these deaths are certified using the normal death certificate which includes a tick box for manner of death and a section on 'how injury occurred'. The whole certificate will be completed either by the decedent's doctor or by the medical examiner or coroner, depending on the laws of the State. This is likely to lead to greater agreement between manner of death and underlying cause. However, special research would be needed to investigate this because manner of death is not routinely computerised in the USA. In both automated and manual coding in the USA, the manner of death affects the precise E-code assigned to a mentioned cause, but not the selection of the underlying cause. For example the open verdict in certificate one converts the poisoning code from accidental (E8502), the MICAR default, to undetermined (E9800), but does not affect the underlying cause. Even here there are differences between these countries. In the US, certificate 2 is coded to undetermined, whereas it is suicide in E&W. Despite this, E&W have more deaths coded to the undetermined range than is the case in many countries[12,13]. This apparent paradox is due to differences in who can certify these deaths and how. The statement 'killed himself' was assumed in the US to have been written by the certifying doctor, and to indicate that the act was self inflicted, but not to give any proof of intent. If the certifier had ticked the suicide box on the US certificate, the death would have been coded as in E&W. In E&W this phrase can only come from the text of the coroner's legal verdict. Coroners require proof beyond a reasonable doubt to give verdict of suicide or 'killed himself'/ 'took his own life' etc. If sufficient evidence is not available the verdict is 'open'. Because of this, all these phrases in the verdict are coded to suicide. Most, but not all, 'open verdicts' which are coded to undetermined injury are 'open' as to whether the death was suicide or accident, rather than any other potential intent. In addition deaths registered when an inquest is adjourned for further legal proceedings, for which no verdict is available until the legal processes are complete, are coded temporarily to E9888. This code is ammended whenever final information is received. Annual mortality statistics by cause usually include 250-450 deaths each year for which final information has not is not available in time for publication. These are identified in the relevant tables[7,10]. Corrected figures for verdicts received late are published the following year in an appendix to the publication on deaths from injury and poisoning. Most of these are eventually assigned to homicide (see table 1) [7,14].

Implications for mortality statistics in England and & Wales

Though the coroner's certificates are now in the format recommended by WHO, we still find that there are often conflicts between the certified causes and the verdict, and information from outside the cause section is still essential for coding. In order to produce data comparable to past years for use in monitoring time trends, we have had to go back to coding these certificates manually, using the verdict as before. The effect of these corrections is illustrated in Figure 2, where the corrected OPCS figures are closer to the Home Office verdicts than the original data was. We have begun a project to educate coroners and pathologists to improve the quality of certification. If we are successful at this, it may be possible to bring the coding of these deaths closer into line with internationally recommended practice in future. We have also started a program to improve the quality of the coded data. New checks we have introduced are validation of certification (coroner, with or without inquest, or doctor) against cause, and verdict against both certification and cause. We plan to compare our data with independent sources such as Home Office and Dept of Transport figures in more detail in the future.

Implications for the ICE on Injury

The results of this study cannot be used to adjust comparisons between these countries for several reasons. This comparison was not based on a statistically representative sample of potential injury deaths in E&W, or even of those for which the coding differed in the two countries; we have looked only at discrepancies in one direction; there may be other deaths which would be coded to external causes in the USA and to natural causes in E&W. In addition, it does not say anything about the accuracy of the coding of US certificates, which were not examined. It is likely that the coding developed in the USA and the software which incorporatesit is adapted to the certification practice seen there.

However, this study does show that there are real differences in the coding of UCD which may bias comparisons of injury deaths. These are not minor discrepancies in 4th digit codes, but in broad groups of causes such as MVTAs, suicides, or even external or natural causes. The coding reflects underlying differences in medico-legal requirements and in certification practice as well as in interpretation of ICD-9 rules. The ICE on injury is an excellent forum for further research to clarify and quantify these differences.

Further studies of coding differences, extending these to several countries are recomended including coding a representative sample from each country by a single reference centre to quantify variation in local coding; and having a sample of typical histories certified in several countries, then coded locally and centrally to separate the effects of certification and of coding[15]. Causes of particular interest were discussed at the ICE meeting in Melbourne. These include drowning[13], adverse effects of medical and surgical treatment[12], poisoning by drugs and medicaments, and injury of undetermined intent.

In exploring the changes in our data, the usefulness of both internal (verdict by cause) and external (Home office, Dept of Transport) checks on cause of death data was clear. International comparisons of mortality statistics with independent sources of data on injury deaths (eg justice or transport department statistics) would increase our understanding of the reliablity and comparability of mortality staistics. In countries which code and store verdict or manner of death, comparisons of deaths assigned to various categories by ICD code and by verdict would also be useful.
In countries which code all the certified causes (muliple cause coding), such as the USA, some additional analyses could be done; the total numbers of deaths for which injury or external causes of interest are mentioned, and the ratio of these mentions to UCD. This gives a measure of the degree of selection occurring in coding, and could be compared across countries.

Acknowledgements
I would like to thank the staff of the London WHO Collaborating Centre for the Classification of diseases for their help in identifying relevant death records for this study and explaing ACCS; the nosologists and coders in NCHS and OPCS for coding the certificates and explaining the coding rules to me; the co-chairs of the ICE on Injury Statistics for inviting me to present this paper in Melbourne, and all the ICE participants for the knowledge and insight they shared.

References

1. World Health Organisation. International Classification of Diseases, Ninth Revision. Geneva, WHO. 1977.

2. National Centre for Health Statistics. Instruction manual part 2a; Instructions for classifying the underlying cause of death. Hyattesville, 1992.

3. National Centre for Health Statistics. Instruction manual part 2c; ICD-9 ACME decision tables for classifying the underlying cause of death. Hyattesville, 1992.

4. Birch, D. Automatic coding of causes of death. Pop Trends **73**;36-38.1993.

5. OPCS. Mortality statistics: Cause 1993, Series DH2 no. 20. HMSO (London) 1995.

6. OPCS. Mortality statistics: General 1991, Series DH1 no.26, HMSO (London) 1993.

7. OPCS. Mortality statistics: Injury and poisoning 1991, Series DH4 no.17, HMSO (London) 1993.

8. Home Office statistical bulletin. Statistics of deaths reported to coroners: England and Wales 1994. London, Government Statistical Service, 1995.

9. Department of Transport. Road Accidents in Great Britain, 1994. London, Government Statistical Service, 1995.

10. OPCS. Mortality statistics: Cause 1984 to 1992, Series DH2 nos. 11 to 19, HMSO (London) 1985 to 1993.

11. Rosenberg H, and Kochenak K. The death certificate as a source of injury data. Proceedings of the International Collaborative Effort on Injury Statistics:vI. CDC/NDHS, Hyattesville, Maryland 1995.

12. Barell V, Injury Data Definitions- Need for Standards. presented at third ICE on Injury statistics, Melbourne 1996.

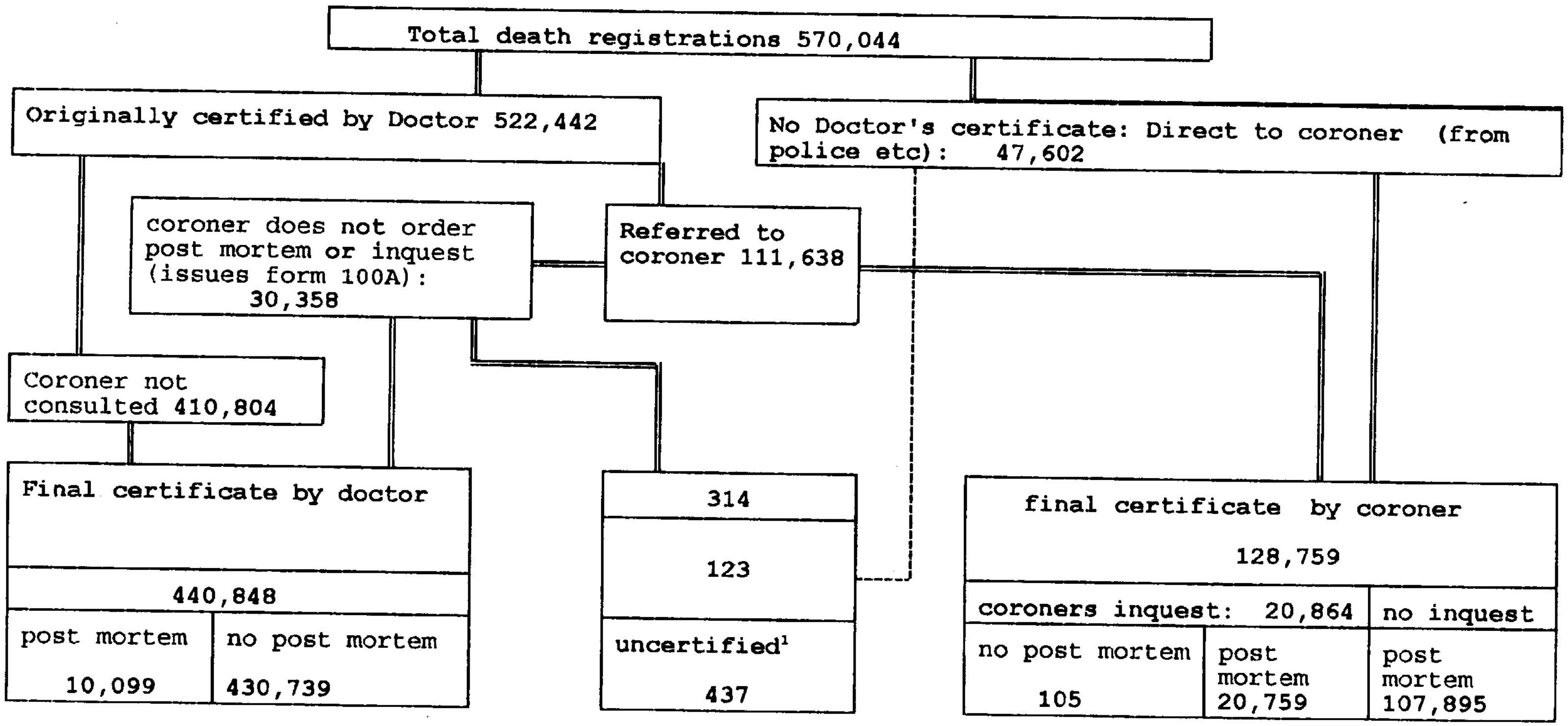
13. Smith G, International comparisons of injury mortality databases: evaluation of their usefulness for drowning prevention and surveillance. Presented at third ICE on Injury statistics, Melbourne 1996.

14. Noble B, and Charlton J. Homicdes in England and Wales. Pop Trends 1994;75:26-29.

15. Jougla, E et al. Death certification coding practices related to

diabetes in European countries - the EURODIAB Subarea C study. Int J Epid **21**, 2:343-351. 1992.

Figure 1. Process of death certification and coroner consultation: all deaths registered in England and Wales in 1991.



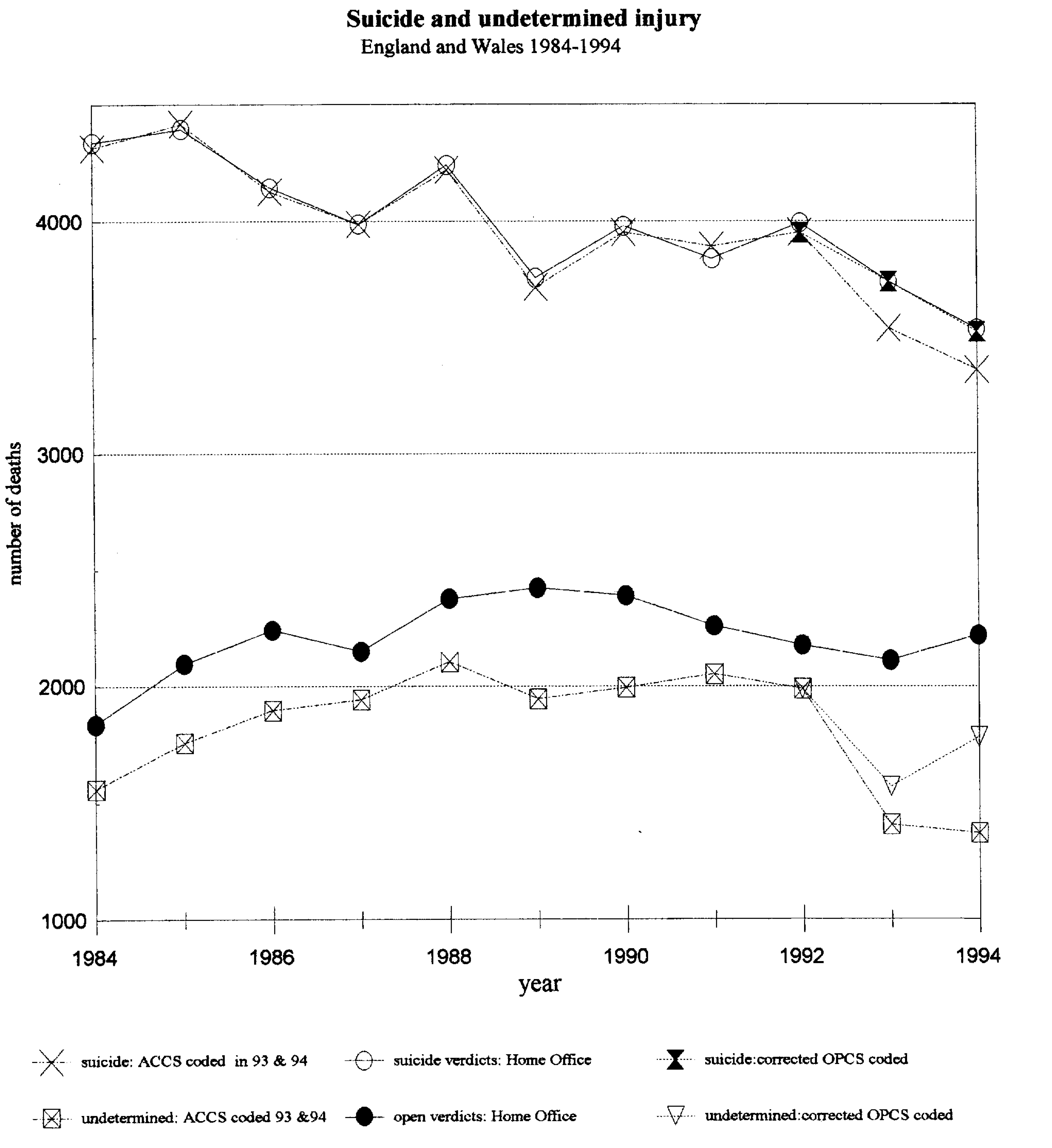
Adapted from tables 9 and 10 in OPCS series DH1 no 26[7]

[1] Uncertified deaths: OPCS did receive copies of death certificates for these deaths, which are coded as normal. They are regarded as uncertified for legal purposes for one of the following reasons:

1) the death is of a member of foreign military services serving on a foreign military base in E&W.

2) there is no doctor available to give a certificate or the certifying doctor is not legally qualified to do so (must have attended the deceased in his/her last illness and have seen deceased either within 14 days before death or seen the body after death), and the coroner has carried out neither a post mortem nor an inquest.

Fig 2. comparison of numbers of coroners verdicts from the Home Office with numbers of registered deaths coded by OPCS.



OPCS coded data is shown both as originally coded using ACCS and after manual correction of all deaths registered after inquest.

Table 1. Numbers and percentages of registrations of deaths from natural and external causes in England and Wales in 1991 by method of certification.

Underlying cause	ICD9 code		Coroner's Inquest		Coroner: no Inquest		Doctor		Uncertified	
		Total	n	%	n	%	n	%	n	%
Accidents	E800-949	11066	9704	87.69	429	3.88	930	8.40	3	0.03
MVTAs	E810-819	4408	4401	99.84	5	0.11	2	0.05	0	0.00
Falls	E880-889	3381	2431	71.90	267	7.90	683	20.20	0	0.00
Suicide	E950-959	3893	3892	99.97	0	0.00	1	0.00	0	0.00
Homicide*	E960-969	552	552	100.00	0	0.00	0	0.00	0	0.00
legal intervention	E970-979	2	2	100.00	0	0.00	0	0.00	0	0.00
Undetermined*	E980-989	1771	1770	99.95	1	0.05	0	0.00	0	0.00
War	E990-999	2	2	100.00	0	0.00	0	0.00	0	0.00
All external causes	E800-999	17286	15921	92.10	431	2.49	931	5.38	3	0.02
Natural causes	010-799	552758	4943	0.89	107464	19.44	439917	79.59	434	0.01
All causes		570044	20864	3.66	107897	18.93	440848	77.37	437	0.08

* Undetermined includes 140 deaths (coded to E9888) registered during 1991 when an inquest was adjourned for further legal proceedings, and for which no verdict ha been received up to April 1993. The 283 'acceleralerated registrations' for which a verdict was received were all recoded to homicide, and are included as such in the tabl (adapted from tables 10 and 11 in OPCS series DH1 no 26 and appendix A series DH4 no 17[6,7]).

Table 2. Verdict by underlying cause of death for deaths which occurred in 1993 as they appeared on the OPCS deaths database in May 1995 before recoding of inquest deaths. Includes only deaths which had either a cause in the range E800-E999 or a verdict, or both.

ICD-9 code	Legal verdict						
	Natural	Accident	Suicide	Homicide	Open	Verdict Missing[1]	Verdict wrong for cause
010-799	**4092**	1,389	85	8	537	na[2]	from 1,482 to 2,019[3]
E800-E949	126	**6,403**	17	25	87	3,890	255
E950-E959	0	3	**1,964**	2	0	1,655	5
E960-E969	0	2	14	**150**	10	343	26
E980-E989	0	0	2	0	**796**	681	2
Total	4,218	7,698	2,082	185	1432	6,561[4]	from 1,770 to 2,307

[1] during initial processing of 1993 deaths verdict after inquest was not always enterred onto the database when deaths were coded manually on line. This has been corrected in current processing **and** retrospectively. In these data, verdict should always be present if the cause coded automatically.

[2] Deaths certified without an inquest have no verdict. This includes 99% of deaths from natural causes, see table 1. This table is restricted to deaths with a verdict, an external cause, or both.

[3] each year about 75% of deaths with an open verdict after inquest are coded to E980-e989 (injury of undetermined intent). The remainder are coded to 7999 (cause unknown) or to a variety of natural cause codes.

[4] see note 1

Table 3. Underlying cause of death as coded manually in England and Wales and the USA and by the ACCS for 37 certificates with a mention of self harm and/or poisoning or abuse of drugs.

	E800-E949 accident	E950-E959 suicide	E960-E969 homicide	E980-E989 undetermined	304-305 drug abuse	010-799 natural causes
E&W	16	17	1	1	1	1
ACCS	8	14	2	1	1	11
USA	8	5	1	11	0	12

Table 4. Underlying cause of death as coded manually in England and Wales and the USA and by the ACCS for 23 certificates with a mention of a motor vehicle incident.

	E810-819 MVTA	OTHER ECODE	010-799 NATURAL CAUSES
E&W	23	0	0
ACCS	14	1	7
USA	15	0	7

Appendix a.

CORONER'S CERTIFICATE AFTER INQUEST
furnished under section 11(7) of the Coroner's Act 1988

To be completed by Registrar	
Register No.	
Entry No.	

To the ______________________ Registrar of Births and Deaths

Inquest held on
at
Was a post-mortem held?

PART I PARTICULARS OF DECEASED (Not still born - see separate Form 99A)

1 Date and place of death

2 Name and surname

3 Sex

4 Maiden surname of woman who has married

5 Date and place of birth

6 Occupation and usual address

EXAMPLE

Cause of death I(a)

(b)

(c)

II

Verdict

PART II VISITING FORCES
The inquest was adjourned on { *under section 7 of the Visiting Forces Act 1952 / *and has not been resumed }

PART III BURIAL/CREMATION †Enter Order for Burial/Certificate E for Cremation
I have issued†
on
to
of

PART IV MARITAL CONDITION etc. All persons aged 16 and over
Insert appropriate number in box. 1 Single 2 Married 3 Widowed 4 Divorced 5 Not Known

If married enter date of birth of surviving spouse

Day		Month		Year	

I certify that the findings of the inquest were as above.

Date Signed

Name

Appointment

Jurisdiction

*Delete as necessary

Form 99(REV)A
SB17/2a 1/93

Name and surname of deceased

To be completed by Registrar	
District & SD Nos.	
Register No.	
Entry No.	

PART V ACCIDENT OR MISADVENTURE (including deaths from neglect or from anaesthetics)

1. Place where accident occurred†
   0. Home
   1. Farm
   2. Mine or quarry
   3. Industrial place or premises
   4. Place of recreation or sport
   5. Street or highway
   6. Public building
   7. Resident institution
   8. Other specified place
   9. Place not known

2. To be completed for all persons aged 16 and over
   When injury was received deceased was†
   1. On way to, or from work
   2. At work
   3. Elsewhere

EXAMPLE

3. Details of how accident happened:

4. If motor vehicle incident, deceased was†
   0. Driver of motor vehicle other than motor cycle
   1. Passenger in motor vehicle other than motor cycle
   2. Motor cyclist
   3. Passenger on motor cycle
   4. Occupant of tram car
   5. Rider of animal; occupant of animal-drawn vehicle
   6. Pedal cyclist
   7. Pedestrian
   8. Other specified person
   9. Not known

5. Interval between injury and death†
   1. Less than one year
   2. One year or more

†Please insert appropriate number in box

Form 99(REV)B
SB17/2b 1/93

Appendix b. Examples of death certificates for which the underlying cause of death (UCD) was coded differently in the USA and England & Wales.

1.Ia. heart and liver failure
b.
c.

II. took an overdose of paracetamol

Verdict: open

UCD E&W: E9800 **USA:** 4289

2.Ia. carbon monoxide poisoning
b. inhalation of car exhaust
c.

II.

Verdict: killed herself

UCD E&W: E9520 **USA:** E9820

3.Ia. cardiac arrest
b.
c.

II.

Verdict: took her own life while the balance of her mind was disturbed

UCD E&W: E9589 **USA:** 4275

4.Ia. cardiac arrest
b.
c.

II. inhalation of fumes from fire in private dwelling

Verdict: accidental death

UCD E&W: E8913 **USA:** 4275

5.Ia. bronchopneumonia
b.
c.

II.
Details of accident:driver of motor vehicle in collision with another on the highway

Verdict: accidental death

UCD E&W: E8120 **USA:** 485

6.Ia. heart failure
b.
c.

II.
Details of accident; pedestrian struck by motor vehicle
Verdict: manslaughter

UCD E&W:E8147 **USA:** 4289

7.Ia.left ventricular failure
b.ischaemic heart disease
c.fractured neck of femur due to fall in hospital

II.

Verdict:accidental death

UCD E&W: E887 **USA:** 4149

8.Ia. bronchopneumonia
b.
c.

II. accidental overdose of tranquillizers

Verdict:

UCD E&W: E8539 **USA:** 485

Injury Data Definitions - The Need for Standards

Vita Barell, Health Services Research Unit, Ministry of Health, Tel Hashomer, Israel
Pnina Zadka, Central Bureau of Statistics, Jerusalem

Abstract

The wide variation in injury mortality rates from one country to another dictates the necessity of analyzing these differences. Potential biases which must be taken into account when considering cross-national injury mortality rates may lie in different coding conventions, variation in recording external causes on death certificates, artifacts in registration of deaths or in grouping causes. A number of local examples of misinterpretation will be presented to illustrate the importance of standard injury data definitions and groupings.

Investigation of the reported finding that Israeli females had among the highest rates in the industrialized world for unintentional injuries other than motor vehicle crashes, led to clarification of <u>classification disparities</u> and to the discovery that almost all the excess mortality came from incorrect inclusion of iatrogenic effects. Corrected inter-country comparison of the mortality rates associated with other types of unintentional injury led to the detection of excessive fatal falls among Israeli women aged 75 and over.

differences in defining and registering the <u>intent</u> of injury can also blur vital information, and were found to contribute to distortion of the national rates for suicide and for unintentional firearm mortality among young Jewish males. Another critical factor is the definition of the <u>population at risk</u>. In Israel, data relating to accidental or intentional injuries among military personnel are included in hospitalization and mortality statistics, while in the US these are excluded from the national samples. Comparison of rates of injuries requiring hospital visits will therefore lead to misleading conclusions about their relative frequency among the military service age-groups.

Internationally accepted guidelines and standards for case and data element definitions, groupings of cause of injury and analytic strategies should be developed. These might be appropriately disseminated as Internet tutorials.

Introduction

The need for world-wide collaborative approaches and data-driven preventive efforts to reduce injuries has been noted by many, as well as the need to improve the quality, reliability and comparability of international injury statistics. The wide variation in injury mortality rates from one country to another suggest that there may be cases for preventive action in individual countries, as well as important new areas of etiologic research. However, differences in injury data definitions and the lack of standards may be a major cause of disparities.

Potential biases which must be taken into account when considering cross-national injury mortality rates include different coding conventions, variation in registration or recording of external causes on death certificates, or artifacts caused by inappropriate grouping of causes. A number of local examples of misinterpretation will be presented to illustrate the importance of standard injury data definitions and groupings.

Inappropriate classification

In 1994, the National Center for Health Statistics published an International Mortality Chartbook (Levels and Trends, 1955-91); a fascinating, well-designed booklet comparing country rankings and trends for selected causes of death and variations in patterns of mortality in the US and 40 industrialized countries. Included among these are data for Israel, which we perused with great interest, in particular for intentional and unintentional injuries (figure 1). To our surprise and chagrin, we found that Israeli females had among the highest rates in the industrialized world for unintentional injuries other than motor vehicle crashes.

Since this collapsed cause group included codes E-800-807 and E826-E949, a grouping which we had never previously used, we spent considerable time trying to figure out what could be causing this huge disparity in rates between Israeli females and those in other countries. We previously had an indication that elderly women had a high rate of fatal falls, but nothing had suggested that we were so far out of line with the experience of other countries.

We attempted to access the individual E-codes in order to determine where the excess mortality was: whether Israeli females had high rates in all unintentional causes or in one or two specific categories, information which would enable us to proceed with strategic planning for intervention. However, as the grouping had been done early in the analysis, more detailed code groups were unavailable.

We accessed two national mortality data files through the CDC-WONDER network: the NCHS US Compressed Mortality File and the England and Wales Population/ Mortality data set. These data were down-loaded and compared with the locally available Israeli mortality data in order to identify and explain the markedly divergent unintentional injury rates among the countries. The first step was to try to duplicate the Chartbook findings.

In order to facilitate detailed comparison between the three national data sets, a number of arbitrary decisions were made:

1. Due to technical limitations in the England/Wales data set (available on WONDER only through 1989; only 10yr grouping from 25 on), information for 1987-89 was accessed and the English age-distribution was used.

2. Since we were not concerned with motor vehicle crashes, or in fact with other transport injuries, E800-849 was grouped into one category - transport injuries. After the event, we realized that we were also constructing an unconventional grouping, particularly since some water-transport codes (E830,832) are often included in an analysis of drowning mortality.

3. The WHO world population was used as the standard population (as had been used in the International Mortality chartbook).

As can be seen in figure 2, the overall picture is essentially the same, with the rate for Israeli females more than twice the rate for US females and 2.6 times the rate for England and Wales. After disaggregation and inspecting separate categories among the three populations (figure 3), the large excess mortality rates for transport-associated fatalities among US females was observed. We also observe extremely high rates among Israeli women for iatrogenic conditions (surgical and medical complications and adverse effects), with more than a 10-fold difference between Israeli and US women, and an Israeli rate 36 times greater than the rate in England and Wales. When inspecting the combined rate for other unintentional injury fatalities, there is no real difference between the Israeli and US age-adjusted rates, while the English have slightly lower mortality in this group.

If we plot the mortality rates for complications/adverse effects jointly with that of the other unintentional injuries (figure 4), it can clearly be seen that almost all the excess mortality came from inclusion of complications and adverse effects together with other non-transport unintentional injuries. We believe that the inclusion of iatrogenic causes together with unintentional injuries is incorrect, although we in Israel must seriously evaluate the causes for and implications of the differences in the lethal complication rate. However, this is a different story altogether and leads to a different type of investigation, including the relative effect of anticipated malpractice/negligence suits on reporting practices.

Inter-country comparison of the mortality rates associated with other types of unintentional injury (figure 5) bring the problems of Israeli females back into proportion: there is a clear excess of fatal falls which is firmly associated with women aged 75 and over (figure 6). It remains to be seen whether registration or coding artifacts are affecting the results or whether different etiologic factors or fall hazards are present among elderly Israeli women.

Intent

This is one example of how inappropriate grouping of cause of death codes can hamper understanding of injury differences between countries. An additional example of potential error in classification is that of incorrect or inconsistent recording or interpretation of the intent of injury or 'manner of death'. The method of recording intent may vary in different countries, as can be seen by this comparison of the US and Israeli death certificate (figure 7).

The U.S. death certificate, clearly delineates the manner of death: natural causes, accident, suicide, homicide, pending investigation or could not be determined.The Israeli death certificate, however, is ambiguous, and leaves no room for stating that the manner of death is pending investigation or could not be determined. Since autopsied medical examiner cases are rare in Israel, and police often waive their option for autopsy when there are no external signs of violence, the manner of death is often left blank altogether.

These factors contributed to distortion of the national rates for suicide and for unintentional firearm deaths among young Jewish males. Reported mortality from unintentional firearm wounds (ICD-9 922) among 18-19 year old Jewish males was considerably higher than the comparable rate among white US males (12.4 per 100,000 in Israel as compared to 2.1 in the United States). This differential, of paramount importance if substantiated, indicated either substantial bias in registration or in coding of deaths or a significant public health problem. After receiving appropriate clearance from official sources, we attempted to identify the nature of the differential.

We found (table 1) that more than half of the death certificates among Jewish males 18-21 for whom the coded cause of death had been unintentional firearm wound were, in fact, suicides on the basis of internal investigation. Furthermore, it turned out that more than half (23 out of 41) of the death certificates coded to 'firearms, intent undetermined' were also suicides.

These clarifications change the suicide and unintentional firearm mortality rates accordingly. The corrected suicide rate in this specific population group (19.8 per 100,000) is more than double the officially reported rate. The unintentional firearm mortality rate decreases from 13.4 to 5.6 per 100,000, a 58% reduction. It must be stated, however, that this corrected rate is still more than two and a half times greater than the reported US rate for white males in the same age group, and is probably related to the high availability of firearms in Israel and near-universal active and reserve military service.

Clearly, not only methods of recording intent should be standard, but, in addition, methods should also be promoted for updating death or other injury certificates after civilian or military police investigation.

Another example of ambiguity due to differential registration of intent lies in the following comparison of drowning mortality in the US, England/Wales and Israel (figure 8). The US has the highest age-adjusted unintentional drowning mortality rate (1.7/100,000) and England the lowest (0.5 per 100,000). While the overall drowning mortality rate is similar in Israel and in England/Wales (1.45 per 100,000), the internal distribution of intent varies considerably. In England, unintentional drowning accounts for only about a third of all deaths, whereas in Israel they are over 90 % . In Israel, the bias appears to be in the direction of calling all drownings accidents, while in England/Wales, judgment is withheld . How should these data be compared?

For this purpose, a mechanism/intent matrix for presenting E-coded data similar to that proposed by McLoughlin, Fingerhut et al seems most appropriate (figure 9), with one major exception: In our view, 'other intentional' should be separated out and should include military operations occurring after the cessation of hostilities. Although deaths occurring during wartime are excluded from the mortality rate (numerators) and subsequently from the population, all other deaths and hospitalizations occurring to soldiers, or associated with military operations, are included in the injury statistics. Thus, deaths occurring to soldiers or citizens during the Intifada, or as a result of terrorist attacks are all included in national morbidity and mortality statistics. A special extension of the 6th digit of E-code 998 has been assigned in Israel for injury incurred during terrorist attacks.

Data relating to accidental or intentional injuries among military personnel represent an extension of the same problem. In Israel, these are all included in hospitalization and mortality statistics. In the United States, to the best of our understanding, military personnel are by and large treated in federal, military or VA hospitals and these are excluded from the national samples on hospitalization and emergency room visits. Comparison of rates of injuries requiring hospital visits will therefore lead to misleading conclusions about the relative frequency of injuries among the military service age-groups.

Additional questions arise of which countries have mandatory military service and at what age; where injuries among those serving are treated (military hospitals?) and whether these are reported together with national data. We are not suggesting standardization of these reporting procedures among the military in different countries; there are, of course, widely differing needs. But systematic information on whether these are included or excluded in the relevant age groups would be valuable for international comparisons.

Summary

A number of local misinterpretations of injury data have been presented. On the basis of these, we suggest the following:

Develop internationally accepted guidelines and standards for case and data element definitions.

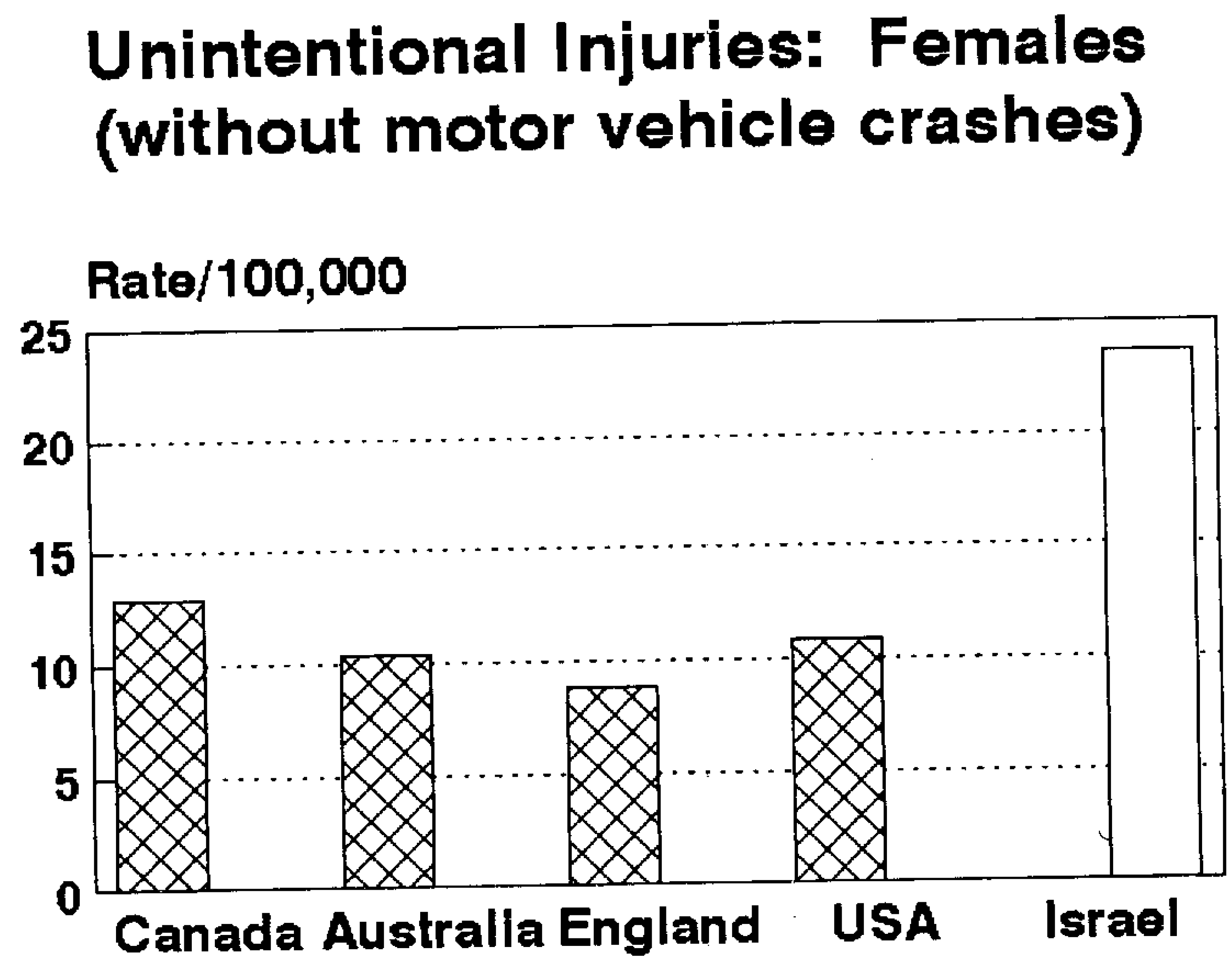
Standardize, or at least suggest, groupings of codes for particular analytic purposes. Everyone seems to come up with their own grouping making it extremely difficult to interpret cross-national data.

Teach clinicians documentation skills, questions to ask and what information to collect (who, what, when, where, why and how).

Make coding and cause grouping clinics, or tutorials, internationally available, perhaps on Internet, backed jointly by WHO, NCHS and CDC.

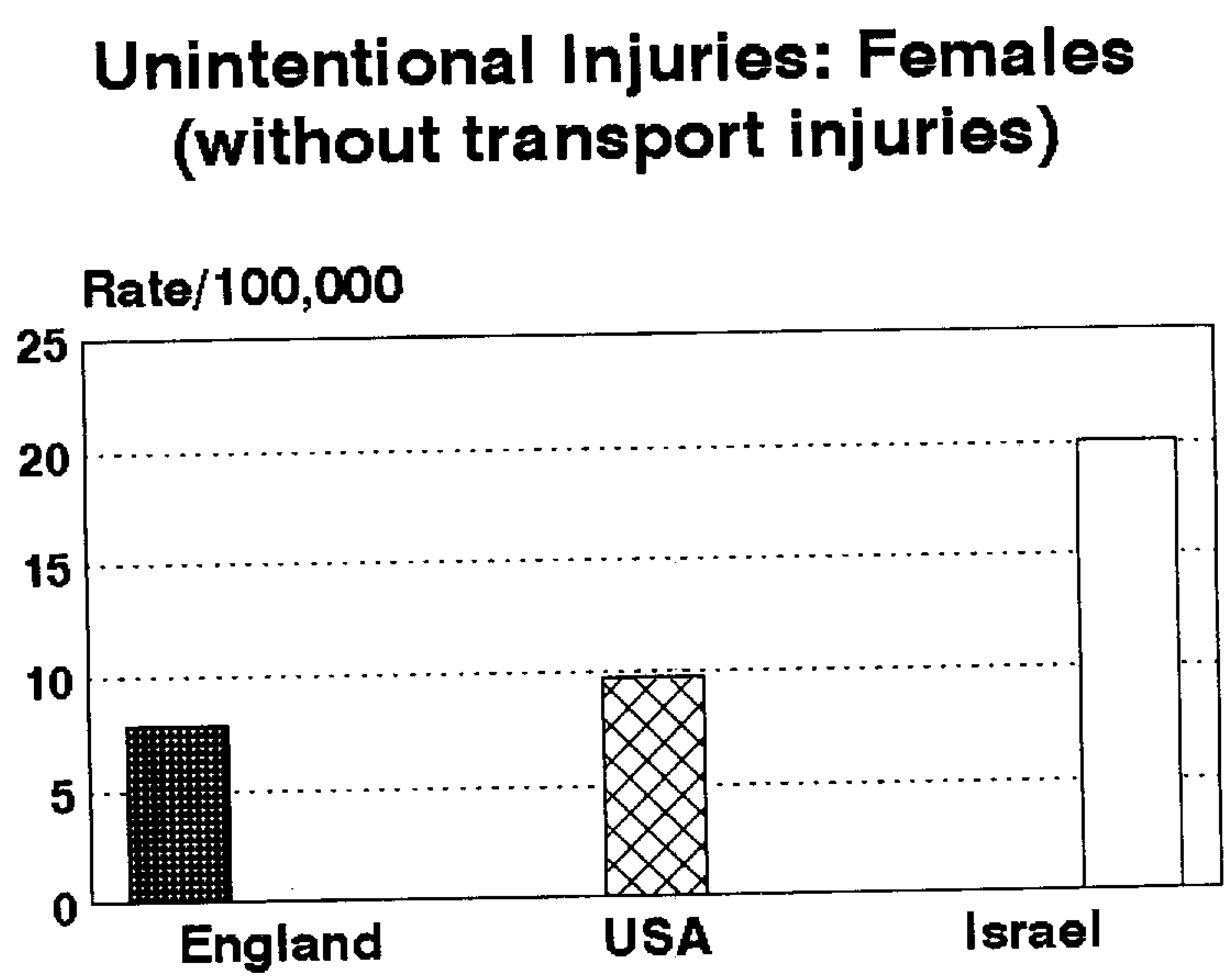
Develop grouping and analysis methodologies which promote preventive actions and reduce artifactual biases in cross-national evaluation of injury patterns.

FIGURE 1



1985-89 Age-adjusted (E800-E807, E826-E949)
International Mortality Chartbook

FIGURE 2



1987-89 Age-adjusted (E850-E949)
WONDER; Israel mortality data

FIGURE 3

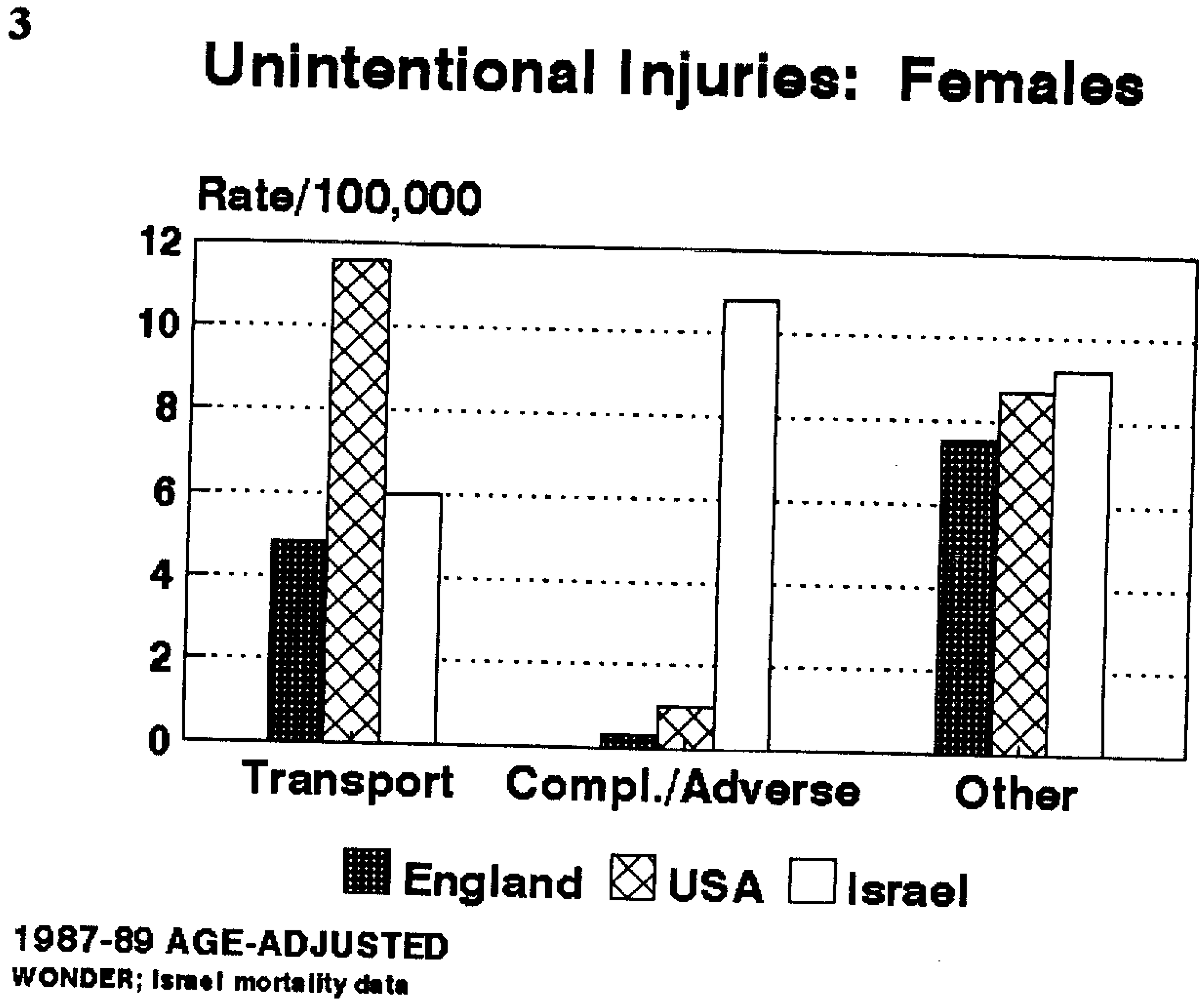


FIGURE 4

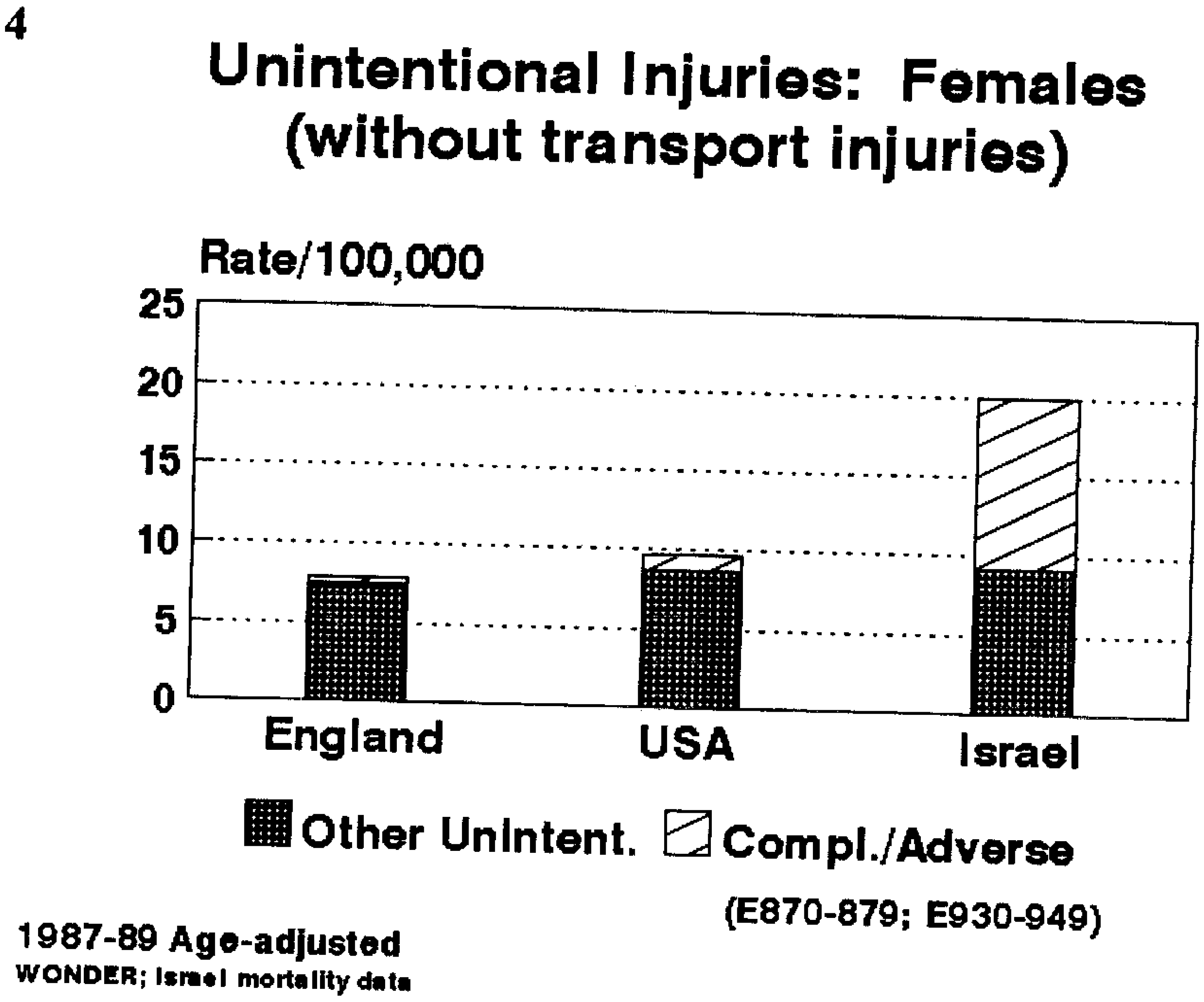


FIGURE 5

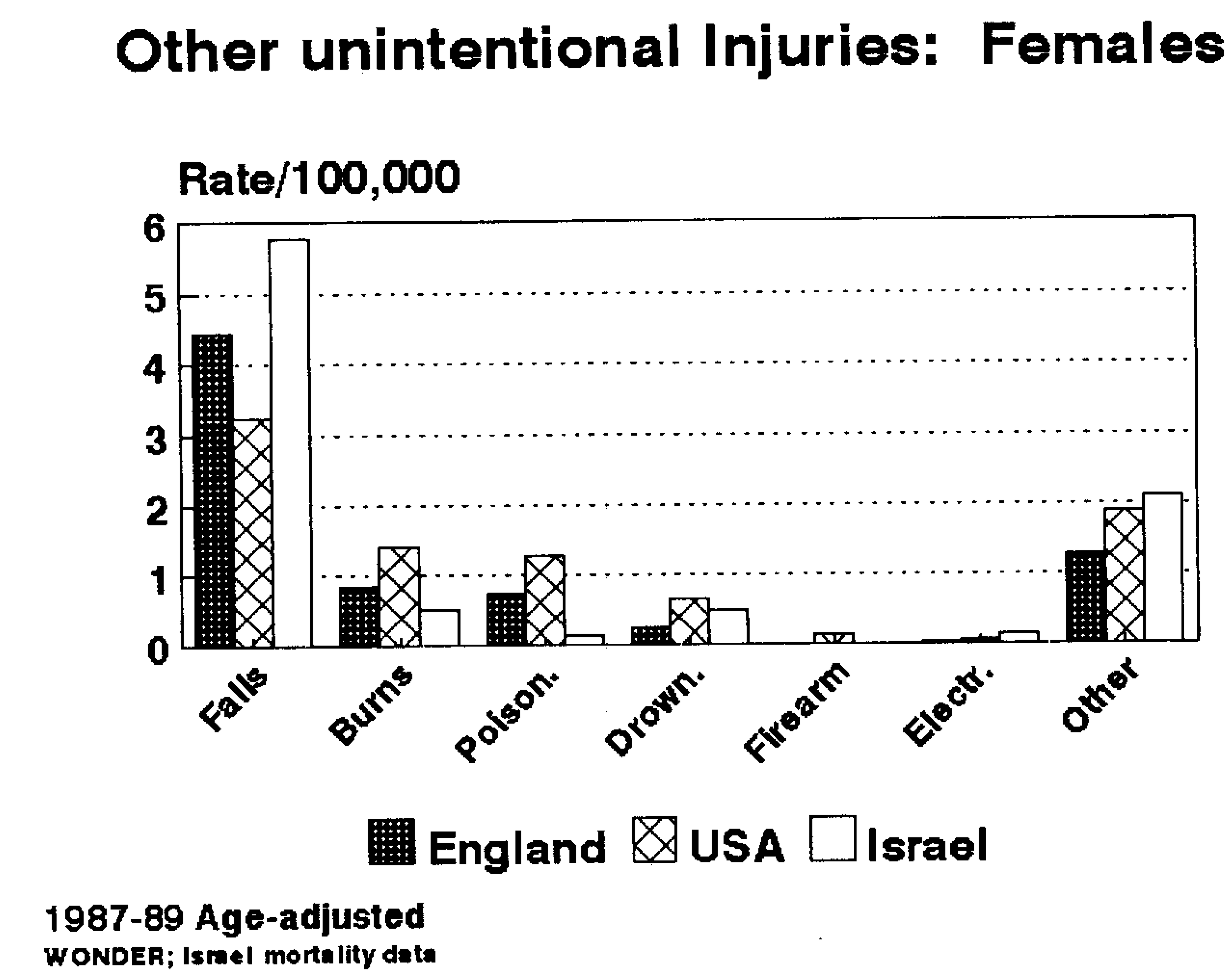


FIGURE 6

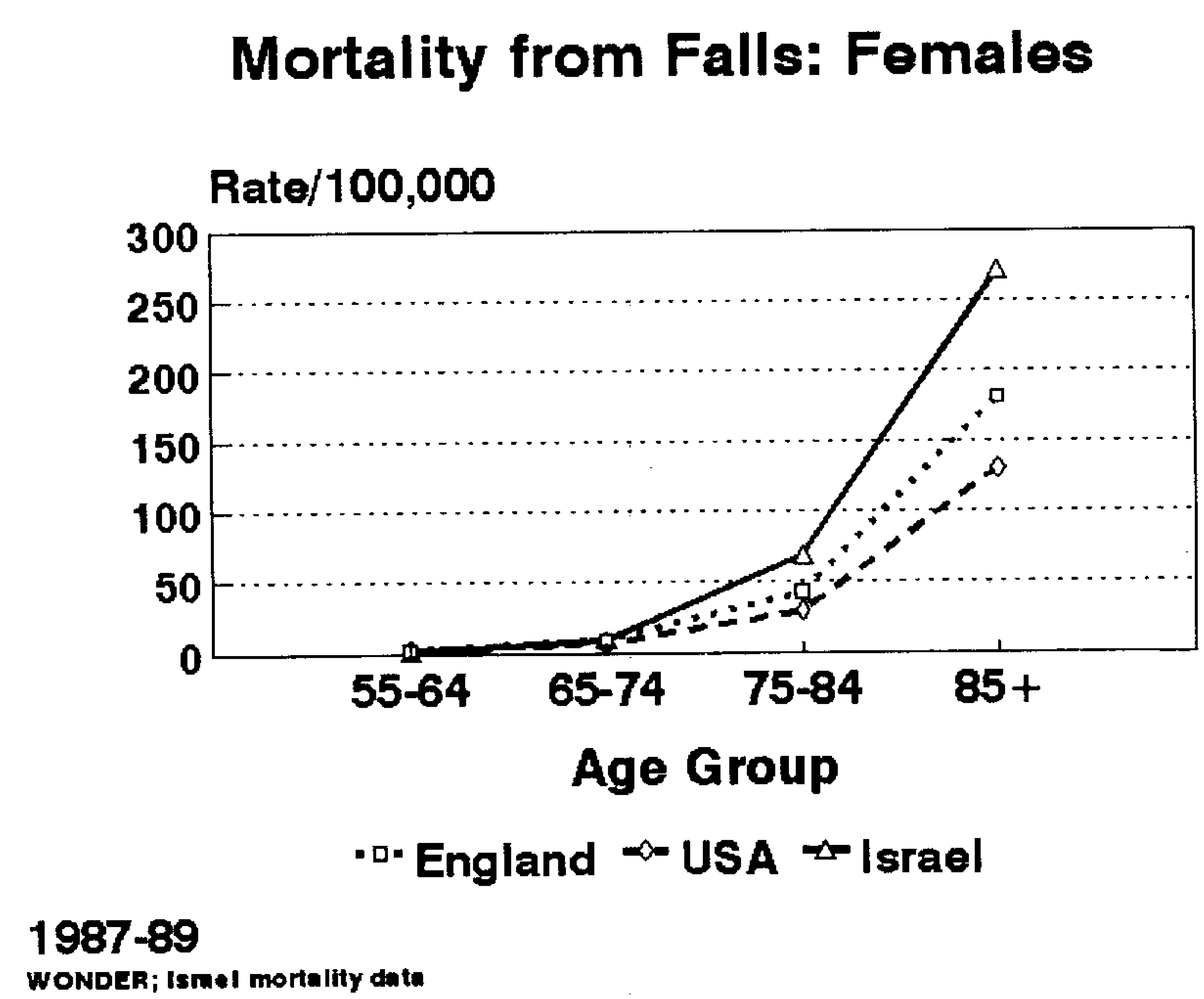


FIGURE 7

MANNER OF DEATH

☐ NATURAL	☐ PENDING INVESTIGATION
☐ ACCIDENT	☐ COULD NOT BE DETERMINED
☐ SUICIDE	
☐ HOMICIDE	

FROM U.S. DEATH CERTIFICATE

MANNER OF DEATH

☐ SUSPECTED HOMICIDE	☐ WORK ACCIDENT
☐ SUSPECTED SUICIDE	☐ MOTOR VEHICLE ACCIDENT
☐ OTHER ACCIDENT	

FROM ISRAELI DEATH CERTIFICATE

FIGURE 8

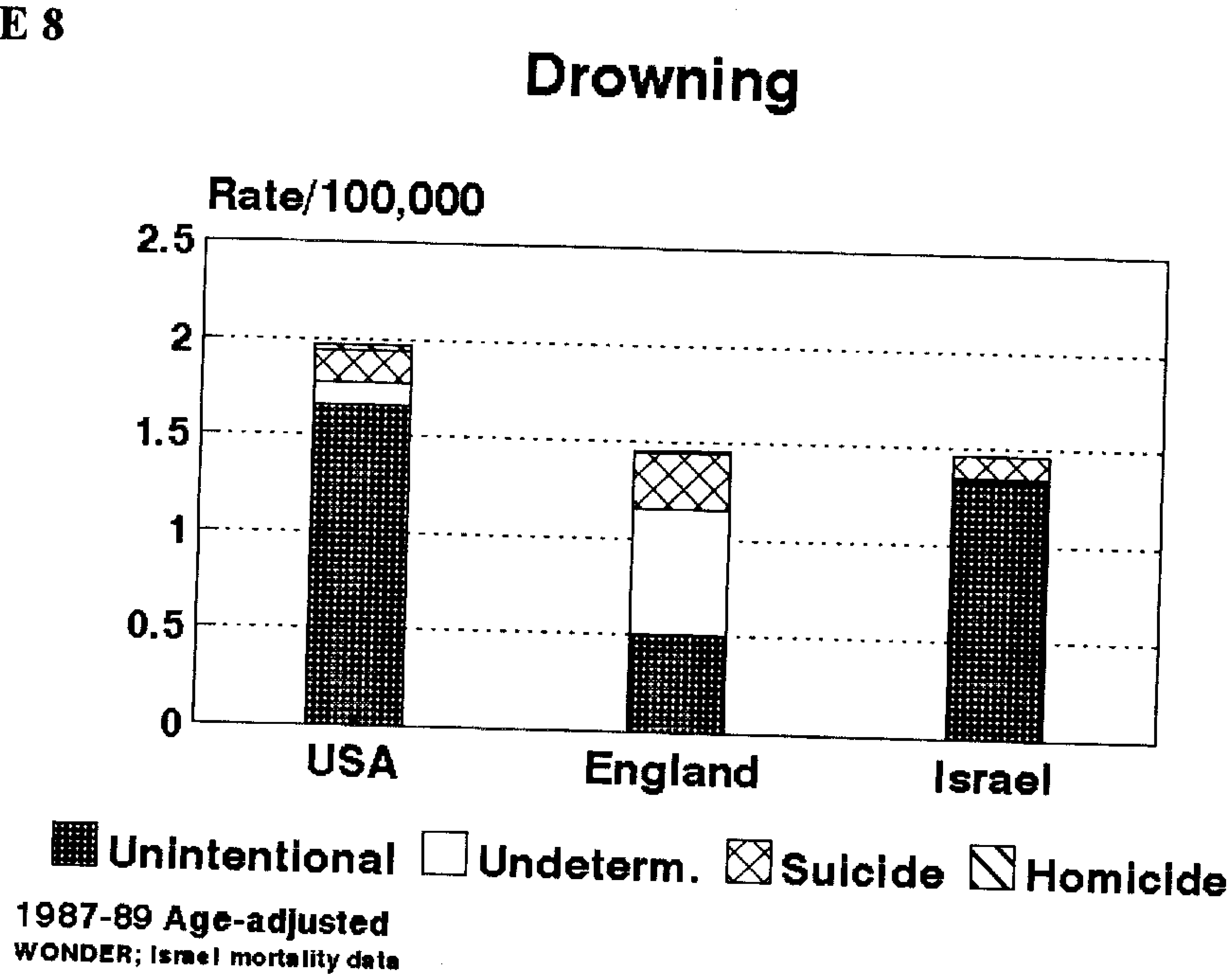


FIGURE 9

MECHANISM	TOTAL	INTENT				
		UNINTENT.	SUICIDE	HOMICIDE	OTHER INTENT.	UNDETERM.
MV-TRAFFIC OTHER TRANSPORT FIREARMS POISON FALLS SUFFOCATION SUBMERSION FIRE CUT/PIERCE STRUCK BY,AGAINST OTHER						

based on Intent/Mechanism Matrix

TABLE 1

OFFICIAL AND CORRECTED MORTALITY
JEWISH MALES 18-24

1987-1989

CAUSE OF DEATH by age group		RATE/100,000 OFFICIAL	CORRECTED
SUICIDE	18-21	9.5	19.8
	22-24	10.4	11.6
FIREARMS:			
UNINTENTIONAL			
	18-21	13.4	5.6
	22-24	1.5	0.4
UNDETERMINED			
	18-21	5.3	2.8
	22-24	4.6	4.6

HSRU,MOH

*U.S. GOVERNMENT PRINTING OFFICE:1996-723-005/83301