Title: **The External Cause of Injury Mortality Matrix**

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Purpose: for discussion and decision

Recommendations:
- **Modify the existing external cause of injury death portion of cause-of-death lists**
- **Adopt External Cause of Injury Matrix as a formal cause-of-death list**

Abstract:

The ICE on Injury Statistics recommends that consideration be given to replacing the external cause portion of the existing cause-of-death lists with ones based solely on intent of injury. The current WHO cause lists are not useful for comparisons of injury mortality because they give disproportionate attention to specific causes of accidental injury deaths compared with deaths resulting from all suicide and all homicide. The current lists ignore deaths coded to intent undetermined. The ICE on Injury Statistics is also requesting that WHO adopt the External Cause of Injury Mortality Matrix as an additional tabulation list for external causes of injury. This ICD-10 based external cause matrix updates the original matrix adopted based on ICD-9 E-codes. Cross-country comparisons would be facilitated if country-specific vital statistics reports used a standard matrix for presentation of injury mortality tables.

The International Collaborative Effort (ICE) on Injury Statistics requests the existing WHO tabular list for external causes of injury death be modified and that WHO adopt the matrix for external causes of injury mortality as an additional tabulation list to improve the international comparability of injury data.

Problem with current lists

The "Special tabulation lists for mortality and morbidity" were adopted by the World Health Assembly in 1990 [1]. These lists have limited and diminishing value for comparisons of injury mortality because they give disproportionate attention to specific causes of unintentional or accidental injury deaths compared with deaths resulting from intentional injuries. These lists are also not compatible with a contemporary and widely used method for summarizing ICD external cause of injury data (referred to as the matrix) that does much to overcome this problem. Furthermore, the current lists ignore deaths coded to intent undetermined.

For example, each of the 4 "Special tabulation lists" as shown in Table 1 recommends tabulating "Accidental poisoning by and exposure to noxious substances" but deaths associated with intentional self-harm due to poisoning are subsumed within the overall category of intentional self-harm, thereby negating the ability to count all poisoning deaths. Likewise, by omitting the category of undetermined intent from these WHO tabulation lists, the contribution of poisoning deaths of undetermined intent to the overall number of poisoning deaths is ignored.

In addition, another ICD-10 tabulation list is used by WHO and is found on the 'web' and used for the WHO Mortality Database (http://www3.who.int/whosis/menu.cfm?path=whosis,mort). This list is different from the above referenced tabulation lists found in the ICD-10 volumes. (See Table 2) The list of external cause codes found on the web list is similar to the recommended Basic Tabulation List (BTL) that was used for ICD-9. The BTL has similar problems as the ICD-10 tabulation lists found in the ICD-10 volumes. It too gives attention to causes of accidental injury deaths with no detail on causes of homicide or suicide.

To illustrate using 2001 mortality data from the United States, the number of accidental poisoning deaths was 14,078. In addition, 5,191 deaths were coded to intentional self-harm from poisoning; 2,909 were coded to poisoning with intent undetermined; and 64 were coded to assault by poisoning. Thus, 37% of poisoning deaths are "hidden" using the existing WHO tabulation lists. Drowning and suffocation (the latter referred to by WHO as "other accidental threats to breathing") data are also illustrative of this same problem.

Proposed Tabulation List Modification:

The ICE on Injury Statistics recommends replacing the injury categories in the current tabulation lists (Tables 1 and 2) with a list based on manner or intent of injury. The proposed list provides a basis for overcoming the problems just described. This recommendation could readily be accomplished by adding two more categories to the tabulation list that was proposed by the "ad hoc group of the WHO-FIC-Network"

(See Table 3). The added categories would be for "all other accidental injuries" and for "legal intervention and operations of war". With these additions, the proposed list of categories in Table 3 could be collapsed into 5 groups "Unintentional," "Suicide," "Homicide," "Undetermined Intent," and "Legal intervention/operations of war". This list would then be consistent with one of the two axes of the external cause matrix. (See below.)

Recommended Additional Tabulation List using the External Cause of Injury Mortality Matrix: See Tables 4-5

For those interested specifically in injury mortality tabulations, the ICE on Injury Statistics recommends using the External Cause of Injury Mortality Matrix in place of the categories of injury in the current tabulation lists. Two levels of detail can be chosen depending on need. Level 1 is based on the mechanism or cause of injury. (Table 4) Level 2 includes each combination of mechanism and intent. (Table 5) The causes in Level 1 can be used to rank order causes of injury as was recently done in a report using 2001 injury mortality data in the United States [2]

Justification for External Cause of Injury Mortality Matrix

Mechanism and Intent have distinct, though related, importance for injury prevention. Statistical tables that treat them as separate axes, or conceptual dimensions, are generally preferable for injury prevention as opposed to ones that merge the two axes (as "forced" by the structure of the ICD). [3]

The external cause of injury mortality matrix presents injury data by both mechanism and intent of the death. The matrix, originally developed using ICD–9 classification schemes, was jointly developed by the Injury Control and Emergency Health Services (ICEHS) section of the American Public Health Association and the International Collaborative Effort (ICE) on Injury Statistics [3].

The matrix was developed as a standard framework specifically to facilitate national and international comparability in the presentation of injury mortality statistics. The two essential dimensions of the ICD external cause codes for injuries form the basis for this framework: the mechanism of the injury and the manner or intent of the injury. The mechanism describes the vector that transfers the energy to the body (e.g., fall, motor vehicle traffic accident, and poisoning). The intent of the injury describes whether the injury was inflicted purposefully or not (in some cases, intent cannot be determined) and, when purposefully, whether the injury was self-inflicted (suicide and/or self harm) or inflicted upon another person (homicide and/or assault).

The revised matrix is based on ICD-10 external cause codes. [4] The matrix has been used in many reports from the participating countries, [see list below] and in 1998 Injury ICE researchers published a report comparing injury mortality among participating countries. [5] A cross-country comparison would be facilitated if country-specific vital statistics reports used a standard matrix for presentation of injury mortality tables. WHO can play a key role in providing this standard.

External Cause Matrix and ICECI

A related and particularly useful function served by the matrix is to serve as a bridge between the International Classification of External Causes of Injury (ICECI), recently adopted as a related member of the WHO Family of International Classifications, and ICD-10 Chapter XX [6]. The conceptual scope of several ICECI items, namely Intent, Mechanism and the Transport module, overlaps with the scope of ICD-10 Chapter XX.

A major factor underlying the development of the ICECI was the dissatisfaction with some aspects of the ICD External Causes chapter for certain purposes related to injury prevention. Thus, it was not possible to develop a version of ICECI which mapped directly to categories in the External Causes chapter without forcing the ICECI to take on the problematic characteristics of the External Causes chapter. However, it was recognized by the ICECI development group that maximal comparability with ICD was a necessary design criterion. The solution arrived at was to specify mapping between ICECI and ICD at the level of the External Cause Matrix as shown in Figure 1 as the 'bridge' between ICECI and ICD.

Figure 1. Relationship of ICECI and ICD-10 Chapter XX.
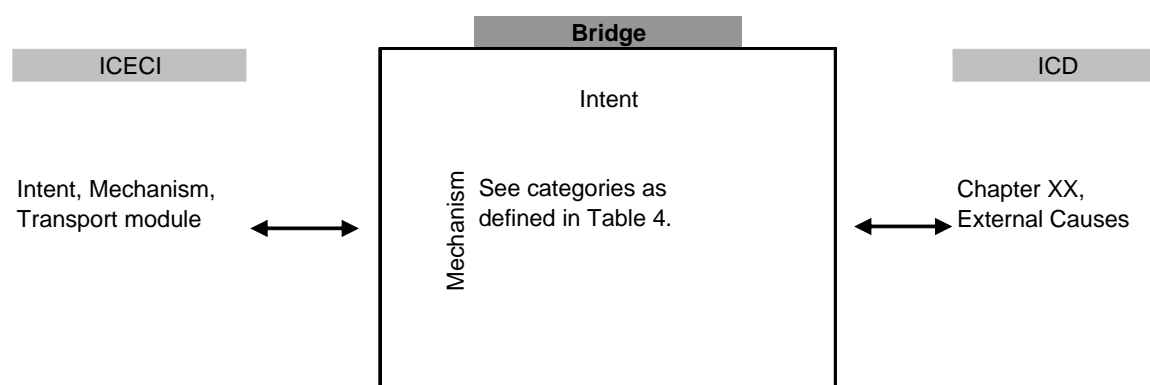
References

1. WHO, ICD-10, Vol. 1, pages 1207-1220 and in Vol. 2, pages 14 and 125-126.
2. Deaths Injuries: 2001NVSR 2004
3. Centers for Disease Control and Prevention. Recommended framework for presenting injury mortality data. MMWR 1997;46(No.RR-14)
4. ICE website http://www.cdc.gov/nchs/about/otheract/ice/matrix10.htm
5. Fingerhut LA, Cox CS, Warner M, et al. International comparative analysis of injury mortality: Findings from the ICE on Injury Statistics. Advance data from vital and health statistics; no. 303. Hyattsville, Maryland: NCHS. 1998.
6. ICECI Coordination and Maintenance Group (2004). International Classification of External Causes of Injuries (ICECI) version 1.2. Consumer Safety Institute, Amsterdam and AIHW National Injury Surveillance Unit, Adelaide.

How has the external cause of injury mortality matrix been used?

WISQARS for reporting fatal and nonfatal injuries in the United States-
http://www.cdc.gov/ncipc/wisqars/default.htm

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Pnina Zadka & Batja Halperin, (2002) Injuries in Israel, Chapter 1 in the book : Injuries in Israel, Vita Barell and Joshua Shemer (Editors). Magness Press [in Hebrew]

Batja Halperin (2002) Chartbook - "Injury Deaths - Intent and Mechanism" 1987-1996. [in Hebrew]

Children and youth deaths due to injuries - a special report submitted to the Parliament by "BETERM" (NGO - prevention of injuries in children and youth) . [in Hebrew]

Ermakov S.P, Smith G.S, Notzon S, Gribanova T.N., Nevolin N.I., Kondrashov D.L, Bouchko N.M Injury mortality in Russia: how to get better data and make valid international comparisons. World Injury Conference Vienna, June 2004. Abstract number 1813

Kreisfeld R, Newson R, Harrison J. (in press) Injury deaths, Australia 2002. Injury Research and Statistics Series Number 23. Adelaide: AIHW (AIHW cat no. INJCAT 65).

Table 1. Current Special Tabulation Lists

		General (all ages)		Infant&Child	
		Condensed	Selected	Condensed	Selected
	ICD-10 codes	List 1	List 2	List 3	List 4
			list numbers		
External causes of morbidity and mortality	**V01-Y89**	**1-095**		**3-060**	
Transport accidents	V01-V99	1-096	2-073	3-061	4-045
Falls	W00-W19	1-097	2-074		
Accidental drowning and submersion	W65-W74	1-098	2-075	3-062	4-046
Other accidental threats to breathing	W75-W84			3-063	4-047
Exposure to smoke, fire and flames	X00-X09	1-099	2-076	3-064	4-048
Accidental poisoning by and exposure to noxious substances	X40-X49	1-100	2-077	3-065	4-049
Intentional self-harm	X60-X84	1-101	2-078		
Assault	X85-X09	1-102	2-079	3-066	4-050
All other external causes		1-103	2-080	3-067	4-051

Table 2. WHO tabulation list as it appears on the World Wide Web

Table 1. Number of registered deaths, by cause, sex and age

V01-X59, Y40-Y86, Y88	Accidents and adverse effects
V02-V04, V09, V12-V14, V19-V79, V86-V89	Motor vehicle traffic accidents
V01, V05-V06, V10, V11, V15-V18, V80-V85, V90-V99	Other transport accidents
X40-X49	Accidental poisoning
W00-W19	Accidental falls
X00-X09	Accidents caused by fire and flames
W65-W74	Accidental drowning and submersion
W32-W34	Accidents caused by firearm missile
W20-W23, W35-W64, W75-W99, X10-X39, X50-X59, Y85, Y86	All other accidents, including late effects
Y40-Y84, Y88	Drugs, medicaments causing adverse effects in therapeutic use
X60-X84	Suicide and self- inflicted injury
X85-Y09	Homicide and injury purposely inflicted by other persons
Y10-Y36, Y87, Y89	Other external causes

http://www3.who.int/whosis/mort/table1.cfm?path=whosis,mort,mort_table1&language=english

Table 3. Modified list based on list proposed by ad-hoc group

LIST FOR RANKING LEADING CAUSES OF DEATH AS PROPOSED BY AD HOC COMMITTEE

LC-57	Land transport accidents (V00-V89)
LC-58	Accidental falls (W00-W19)
LC-59	Nonintentional firearm discharge (W32-W34)
LC-60	Accidental drowning and submersion (W65-W74)
LC-61	Accidental threats to breathing (W75-W84)
LC-62	Accidental poisoning (X40-X49)
*LC-62a	All other accidents
LC-63	Intentional self-harm (suicide) (X60-X84)
LC-64	Assault (homicide) (X85-Y09)
LC-65	Event of undetermined intent (Y10-Y34)
*LC-66	Legal intervention/operations of war (Y35-36, Y89 (.0,.1)

* Suggested additions to list.

Allowance for a category of "all other" external causes should be made when categories are not applicable or not used, for example, "intentional self harm" would not be applicable for the infant and child age group (0-4 years); and the legal intervention and operations of war codes might not be used in some countries.

Table 4. Recommended ICD-10 codes for tabulating external cause of injury mortality (level 1)

	Mechanism of Injury	ICD-10 codes
	All injury	V01-Y36, Y85-Y87, Y89
#	Cut/pierce	W25-W29, W45, X78, X99, Y28, Y35.4
#	Drowning	W65-W74, X71, X92, Y21
#	Fall	W00-W19, X80, Y01, Y30
#	Fire/hot object or substance	X00-X19, X76-X77, X97-X98, Y26-Y27, Y36.3
	Fire/flame	X00-X09, X76, X97, Y26
	Hot object/substance	X10-X19, X77, X98, Y27
#	Firearm	W32-W34,X72-X74,X93-X95,Y22-Y24,Y35.0
#	Machinery	W24, W30-W31
	All transport	V01-V99, X82, Y03, Y32, Y36.1
#	Motor vehicle traffic	V02-V04[.1,.9], V09.2, V12-V14[.3-.9], V19[.4-.6], V20-V28[.3-.9], V29-V79[.4-.9], V80[.3-.5], V81.1, V82.1, V83-V86[.0-.3], V87[.0-.8], V89.2
	Occupant	V30-V79[.4-.9], V83-V86[.0-.3]
	Motorcyclist	V20-V28[.3-.9], V29[.4-.9]
	Pedal cyclist	V12-V14[.3-.9], V19[.4-.6]
	Pedestrian	V02-V04[.1,.9], V09.2
	Other	V80[.3-.5], V81.1, V82.1
	Unspecified	V87[.0-.8], V89.2
#	Pedal cyclist, other	V10-V11, V12-V14[.0-.2], V15-V18, V19[.0-.3,.8,.9]
#	Pedestrian, other	V01, V02-V04[.0], V05, V06, V09[.0,.1,.3,.9]
	Other land transport	V20-V28[.0-.2], V29-V79[.0-.3], V80[.0-.2,.6-.9], V81-V82[.0,.2-.9], V83-V86[.4-.9], V87.9, V88[.0-.9], V89[.0,.1,.3,.9], X82, Y03, Y32
	Other transport	V90-V99,Y36.1
#	Natural/environmental	W42-W43, W53-W64, W92-W99, X20-X39, X51-X57
#	Overexertion	X50
#	Poisoning	X40-X49, X60-X69, X85-X90, Y10-Y19, Y35.2
#	Struck by or against	W20-W22,W50-W52,X79,Y00,Y04,Y29,Y35.3
#	Suffocation	W75-W84,X70,X91,Y20
	Other specified, classifiable	W23, W35-W41, W44, W49, W85-W91, X75, X81, X96, Y02, Y05-Y07, Y25, Y31, Y35[.1,.5], Y36[.0,.2,.4-.8], Y85
	Other specified, not elsewhere classified	X58,X83,Y08,Y33,Y35.6,Y86-Y87,Y89[.0-.1]
	Unspecified	X59, X84,Y09, Y34, Y35.7, Y36.9, Y89.9

NOTE: The causes designated by # are ranked to determine leading mechanisms of injury.

Table 5. Recommended ICD-10 codes for tabulating external cause of injury mortality (level 2)

Mechanism of death	Intent of death					
	All injury	Unintentional	Suicide	Homicide	Undetermined	Legal intervention/war
All injury	*U01-*U03, V01-Y36, Y85-Y87, Y89	V01-X59, Y85-Y86	*U03, X60-X84, Y87.0	*U01-*U02, X85-Y09, Y87.1	Y10-Y34, Y87.2, Y89.9	Y35-Y36, Y89[.0,.1]
# Cut/pierce	W25-W29, W45, X78, X99, Y28, Y35.4	W25-W29, W45	X78	X99	Y28	Y35.4
# Drowning	W65-W74, X71, X92, Y21	W65-W74	X71	X92	Y21	---
# Fall	W00-W19, X80, Y01, Y30	W00-W19	X80	Y01	Y30	---
# Fire/hot object or substance	*U01.3, X00-X19, X76-X77, X97-X98, Y26-Y27, Y36.3	X00-X19	X76-X77	*U01.3, X97-X98	Y26-Y27	Y36.3
Fire/flame	X00-X09, X76, X97, Y26	X00-X09	X76	X97	Y26	---
Hot object/substance	X10-X19, X77, X98, Y27	X10-X19	X77	X98	Y27	---
# Firearm	*U01.4, W32-W34, X72-X74, X93-X95, Y22-Y24, Y35.0	W32-W34	X72-X74	*U01.4, X93-X95	Y22-Y24	Y35.0
# Machinery	W24, W30-W31	W24, W30-W31	---	---	---	---
All transport	*U01.1, V01-V99, X82, Y03, Y32, Y36.1	V01-V99	X82	*U01.1, Y03	Y32	Y36.1
# Motor vehicle traffic	V02-V04[.1,.9], V09.2, V12-V14[.3-.9], V19[.4-.6], V20-V28[.3-.9], V29-V79[.4-.9], V80[.3-.5], V81.1, V82.1, V83-V86[.0-.3], V87[.0-.8], V89.2	V02-V04[.1,.9], V09.2, V12-V14[.3-.9], V19[.4-.6], V20-V28[.3-.9], V29-V79[.4-.9], V80[.3-.5], V81.1, V82.1, V83-V86[.0-.3], V87[.0-.8], V89.2	---	---	---	---
Occupant	V30-V79[.4-.9], V83-V86[.0-.3]	V30-V79[.4-.9], V83-V86[.0-.3]	---	---	---	---
Motorcyclist	V20-V28[.3-.9], V29[.4-.9]	V20-V28[.3-.9], V29[.4-.9]	---	---	---	---
Pedal cyclist	V12-V14[.3-.9], V19[.4-.6]	V12-V14[.3-.9], V19[.4-.6]	---	---	---	---
Pedestrian	V02-V04[.1,.9], V09.2	V02-V04[.1,.9], V09.	---	---	---	---
Other	V80[.3-.5], V81.1, V82.1	V80[.3-.5], V81.1, V82.1	---	---	---	---
Unspecified	V87[.0-.8], V89.2	V87[.0-.8], V89.2	---	---	---	---
# Pedal cyclist, other	V10-V11, V12-V14[.0-.2], V15-V18, V19[.0-.3,.8,.9]	V10-V11, V12-V14[.0-.2], V15-V18, V19[.0-.3,.8,.9]	---	---	---	---
# Pedestrian, other	V01, V02-V04[.0], V05, V06, V09[.0,.1,.3,.9]	V01, V02-V04[.0], V05, V06, V09[.0,.1,.3,.9]	---	---	---	---
Other land transport	V20-V28[.0-.2], V29-V79[.0-.3], V80[.0-.2,.6-.9], V81-V82[.0,.2-.9], V83-V86[.4-.9], V87.9, V88[.0-.9], V89[.0,.1,.3,.9], X82, Y03, Y32	V20-V28[.0-.2], V29-V79[.0-.3], V80(.0-.2,.6-.9), V81-V82[.0,.2-.9], V83-V86[.4-.9], V87.9, V88[.0-.9], V89[.0,.1,.3,.9]	X82	Y03	Y32	---
Other transport	*U01.1, V90-V99, Y36.1	V90-V99	*U01.1	---	---	Y36.1
# Natural/environmental	W42-W43, W53-W64, W92-W99, X20-X39, X51-X57	W42-W43, W53-W64, W92-W99, X20-X39, X51-X57	---	---	---	---
# Overexertion	X50	X50	---	---	---	---
# Poisoning	*U01[.6-.7], X40-X49, X60-X69, X85-X90, Y10-Y19, Y35.2	X40-X49	X60-X69	*U01[.6-.7], X85-X90	Y10-Y19	Y35.2
# Struck by or against	W20-W22, W50-W52, X79, Y00, Y04, Y29, Y35.3	W20-W22, W50-W52	X79	Y00, Y04	Y29	Y35.3
# Suffocation	W75-W84, X70, X91, Y20	W75-W84	X70	X91	Y20	---
Other specified, classifiable	*U01[.0,.2,.5], *U03.0, W23, W35-W41, W44, W49, W85-W91, X75, X81, X96, Y02, Y05-Y07, Y25, Y31, Y35[.1,.5], Y36[.0,.2,.4-.8], Y85	W23, W35-W41, W44, W49, W85-W91, Y85	*U03.0, X75, X81	*U01[.0,.2,.5], X96, Y02, Y05-Y07	Y25, Y31	Y35[.1,.5], Y36[.0,.2,.4-.8]
Other specified, not elsewhere classified	*U01.8, *U02, X58, X83, Y08, Y33, Y35.6, Y86-Y87, Y89[.0-.1]	X58, Y86	X83, Y87.0	*U01.8, *U02, Y08, Y87.1	Y33, Y87.2	Y35.6, Y89[.0,.1]
Unspecified	*U01.9, *U03.9, X59, X84, Y09, Y34, Y35.7, Y36.9, Y89.9	X59	*U03.9, X84	*U01.9, Y09	Y34, Y89.9	Y35.7, Y36.9

--- Category not applicable
U' codes are optional; they have been used in the United States to designate deaths due to terrorism.
NOTE: The causes designated by # are ranked to determine leading mechanisms of injury.

Appendix Tables