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The International Classification of Diseases (ICD)

by

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Introduction

The International Classification of Diseases (ICD) is an alphanumeric disease coding system developed by the World Health Organization (WHO). This coding system provides standardized nomenclature and categories to promote comparability of disease classification across different countries. The first ICD was formalized in 1893 as the Bertillon Classification of Causes of Death. A goal has been to revise and update the ICD every ten years, to stay abreast of advances in medical science. Revisions were adopted in 1900, 1909, 1920, 1929, and 1938. After the 5th revision in 1938 there was an increasing emphasis on expanding the classification system to meet the needs of health insurance organizations, hospitals, and other medical providers for coding of non-fatal illnesses (morbidity).

The 6th through the 10th revisions of the ICD were in 1948, 1955, 1965, 1975, and 1992. Implementation of these revisions in North Carolina and other areas often occurred several years later. For example, North Carolina deaths were coded according to the 9th revision of the ICD (ICD-9) beginning in 1979. ICD-10 was implemented for cause-of-death coding in North Carolina in 1999. The release of ICD-10 was delayed in an effort to devise a new and flexible classification system that would not require fundamental revision for many

years. Also, with the widespread adoption of data processing systems, changes to the ICD have become more expensive.

The following table shows the years that the different revisions of the ICD were adopted and used for coding mortality statistics in the United States.

Revision	Adopted	Years in use
1st	1900	1900-1909
2nd	1909	1910-1920
3rd	1920	1921-1929
4th	1929	1930-1938
5th	1938	1939-1948
6th	1948	1949-1957
7th	1955	1958-1967
8th	1965	1968-1978
9th	1975	1979-1998
10th	1992	1999-present

The full name of the ICD-10 publication is the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*.¹ There are three volumes. Volume 1 is the tabular list of all 4-digit ICD-10 codes. Volume 2 is an instruction manual, dealing with coding structure, coding rules, recommendations for statistical presentation, history of the ICD, and other issues. Volume 3 is an alphabetical index of diseases, with the corresponding ICD-10 codes.



The ICD-10 publication can be purchased from the WHO at <http://www.who.int/whosis/icd10/>. The National Center for Health Statistics (NCHS) and the states are using a copy modified and corrected by the NCHS. This version converts English spellings to American spellings and incorporates changes made after the WHO version was published. However, a WHO copyright precludes the NCHS from electronically distributing the ICD-10 version being used in the United States.

For further information from the NCHS about ICD-10 see <http://www.cdc.gov/nchs/about/major/dvs/icd10des.htm>. This report addresses a number of issues related to the ICD, including the change from the 9th to the 10th revision and related issues of comparability.

ICD Coding

The causes of death that are written on the death certificate by the certifying physician are converted to the numeric or alphanumeric codes of the ICD for purposes of categorization and analysis. For example, “acute myocardial infarction” (or heart attack) is coded 410 in the ICD-9 and I21 in the ICD-10. ICD-9 and earlier revisions used numeric codes and ICD-10 uses alphanumeric codes. A fourth digit, preceded by a decimal point, indicates more detail, such as 410.2 for acute myocardial infarction of the inferolateral wall or I21.0 for acute transmural myocardial infarction of the anterior wall. The ICD-9 and ICD-10 codes are frequently not comparable at the three- or four-digit level. In other words, there is no direct code-to-code translation across the two classification systems. Often, .9 is reserved for “unspecified,” such as I21.9 for acute myocardial infarction, unspecified.

Appendix 1 shows the chapters of the ICD-10 system, with the corresponding alphanumeric codes.

Traditionally, trained nosologists (disease classification specialists) have converted the written causes of death listed on the death certificate into the appropriate ICD codes. Often, there are multiple causes listed, such as cardiac arrest *due to* arteriosclerosis *due to* diabetes. The NCHS has strict rules about determining which of the listed causes of death is classified as the “underlying” (primary) cause. In the above-mentioned case, diabetes would be the underlying cause of death, since it was the condition that initiated the chain of events leading to death. Health statistics are most often tabulated by the underlying cause of death. However, all of the listed causes (multiple causes of death) are coded

and kept in the vital statistics data files to be available for tabulation and analysis.

In recent years, computer programs have automated some of the work of nosologists. The NCHS has developed a program called MICAR (Medical Indexing, Classification, and Retrieval) where a person enters the text of the cause of death from the death certificate and MICAR returns the alphanumeric ICD-10 code. Of course, sometimes what is entered does not match an entry in the MICAR dictionary, and so many codes have to be manually resolved by a nosologist.

There is also a program called ACME (Automated Classification of Medical Entities). ACME takes all of the causes listed on a death certificate (after conversion to ICD codes), including information on the hierarchy of the codes on the certificate, and employs a complex set of rules to determine the underlying cause of death. This program is used across the United States to ensure consistent rules for selecting the underlying cause of death. Here, too, there are sometimes rejects that have to be manually resolved.

Finally, the NCHS has developed a computer program called TRANSAX (Translation of Axis) that “cleans up” the multiple cause of death codes, eliminating redundancies and contradictions. The result is a data file that can be used for consistent analyses of multiple cause of death data across the United States. Multiple cause of death analysis reveals, for example, that diabetes is mentioned on death certificates as a contributing cause of death nearly three times as often as it is selected as the underlying cause of death.

In the mortality data files maintained by the State Center for Health Statistics (SCHS), the decimal points are not included. Thus the ICD-10 data value for acute myocardial infarction, unspecified would be I219. The public use data files prepared by the SCHS (available at <http://www.irss.unc.edu/ncvital>) contain only the underlying cause of death. Detailed mortality files kept by the SCHS include the underlying cause of death and up to 20 additional causes of death listed on the death certificate (output from TRANSAX), as well as name of decedent and other personal information.

Comparability of ICD-9 and ICD-10

In doing trend analyses of causes of death, one must consider the change from ICD-9 to ICD-10. The adoption of the ICD-10 cause-of-death coding in 1999 created a discontinuity in North Carolina’s mortality

data. ICD-9 was used for 20 years, from 1979 through 1998. (For 20-year ICD-9 mortality trend data, see <http://www.schs.state.nc.us/SCHS/healthstats/deaths/volume2.html>.) As mentioned before, there is no direct code-to-code translation across the two classification systems. However, for cause-of-death *groupings*, the National Center for Health Statistics has developed “comparability ratios” to help bridge the systems.

The comparability ratio is an adjustment factor (multiplier) that is applied to the number of deaths coded to a cause-of-death category under ICD-9 to make the number more comparable to the number coded under ICD-10. The comparability ratio could also be applied to a population-based death rate. This ratio indicates the extent of discontinuity in cause-of-death trends resulting just from the implementation of ICD-10 (the net effect of the new classification system). A large sample of 1996 United States deaths were classified by both ICD-9 and ICD-10 to develop the comparability ratios. The comparability ratio is the number of deaths in the 1996 sample in an ICD-10 cause-of-death category divided by the number of deaths in the sample in the same category as coded under ICD-9.

The comparability ratios for major causes of death that are routinely tabulated by the SCHS are shown in Appendix 2. An in-depth explanation of issues related to comparability between ICD-9 and ICD-10, and also comparability ratios for much more detailed cause-of-death categories, can be found in a 2001 publication of the NCHS,² which is available online at http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_02.pdf.

For further information from the NCHS about comparability of cause of death between ICD revisions, including ICD-8 to ICD-9 and earlier transitions, see <http://www.cdc.gov/nchs/datawh/statab/unpubd/comp.htm>.

Cause-of-Death Lists for Tabulating Mortality Statistics

To promote comparability across states and other geographic areas, the NCHS has developed standard cause-of-death categories for tabulating mortality statistics. The intent was to identify cause-of-death groupings that are relatively homogeneous and of public health and medical importance. These lists are useful especially when ranking causes of death. Without standardized categories, three- or four-digit ICD codes could be grouped in any manner to produce widely varying cause-of death rankings. The ICD-10 lists

developed by the NCHS include a detailed list of 358 selected causes of death, a condensed list of 113 causes of death, a more condensed list of 39 causes of death, and a specialized list of 130 causes of infant death. The list of 113 causes is most often used to rank the leading causes of death. It presents conditions that are of major public health interest, in broad summary categories like heart disease and cancer. The 113 cause list is collapsed into the 39 cause list for presentation of cause of death statistics for smaller geographic areas, such as counties. A complete description of these cause-of-death lists can be found at http://www.cdc.gov/nchs/data/dvs/im9_2002.pdf.

The SCHS uses an adaptation of these NCHS lists when ranking causes of death in our publication *Leading Causes of Death: North Carolina Vital Statistics, Volume 2*. The 2001 edition of this publication, which includes cause-of-death rankings by age, race, gender, and ethnicity, can be accessed at <http://www.schs.state.nc.us/SCHS/healthstats/deaths/lcd2001/>. See Tables A-D and Appendixes C and D.

Morbidity vs. Mortality Coding

Morbidity is sickness or disease, which may or may not result in death. There is an adaptation of the ICD that is used extensively for morbidity coding. It is called the *International Classification of Diseases, 9th Revision, Clinical Modification*,³ or ICD-9-CM. A clinical modification of the ICD-10 is not yet completed. The ICD-9-CM is currently used by hospitals, clinics, and other health care providers to code diagnoses related to medical encounters. The ICD-9-CM is required for reporting diagnoses and diseases to all U.S. Public Health Service and CMS (Center for Medicare and Medicaid Services) programs. It is also used extensively in billing private insurance carriers for medical services. The ICD-9-CM publication can be purchased from Practice Management Information Corporation at <http://pmiconline.com>.

The ICD-9-CM is directly comparable to the ICD-9 at the three-digit level, and usually also at the four-digit level. With ICD-9-CM, a fifth digit is often added for more diagnostic specificity. For example, for acute myocardial infarction, there is a fifth digit that specifies the “episode of care” (series of health services provided for one episode of the condition): 0 is episode of care, unspecified; 1 designates the initial episode of care for a newly diagnosed myocardial infarction; and 2 designates a subsequent episode of care. For example, 410.21

would indicate an acute myocardial infarction of the inferolateral wall, initial episode of care. Another example is ICD-9 code 482.8, which is pneumonia due to other specified bacteria. The ICD-9-CM adds fifth digits as follows to indicate the type of bacteria: 482.81 for anaerobes, 482.82 for E. coli, 482.83 for other gram-negative bacteria, 282.84 for Legionnaires' disease, and 482.89 for other specified bacteria.

In morbidity coding, the primary diagnosis (parallel to the underlying cause in mortality coding) is the main condition treated or investigated during the episode of health care. In addition to the primary diagnosis, other diagnoses that were treated or that complicated the patient's main condition are often coded on the medical records. The SCHS uses two major data bases that involve ICD-9-CM diagnostic coding: inpatient hospital discharge records and Medicaid paid claims data.

Volume 3 of the ICD-9-CM is a list of surgical and other procedures performed in a medical setting. These codes range from 00 to 99. For example, 37.2 is the code for diagnostic procedures on the heart and pericardium, and 37.22 is left heart cardiac catheterization. These codes are used by hospitals and clinics in billing for medical procedures. The CPT (Current Procedural Terminology) is another coding system used frequently by physicians in billing for medical procedures.

Diagnoses Related to Injury, Poisoning, and Violence

There is a dual coding system for diagnoses related to injury, poisoning, and violence. As seen in Appendix 1, chapter XX of the ICD-10 (codes V01-Y98) is for the *external causes* of morbidity and mortality, while chapter XIX (codes S00-T98) is for the *consequences* of injury, poisoning, and other external causes. For example, if a death certificate showed that the driver of a car died from a concussion sustained in a collision with another automobile, two ICD-10 diagnoses would be coded: S06.0 for the concussion (consequence) and V43.5 for the collision (external cause).

It is important to realize that mortality and morbidity coding are different for injuries. In **mortality** coding, the **external cause** of mortality is *always* selected as the underlying cause of death. So in the case above, V43.5

would be the underlying cause of death and S06.0 (the type of injury) would be listed as an additional diagnosis. For public health interventions, it is more important to know the cause of the injury than the nature of the injury. Thus, ICD-10 codes S00-T98 will *never* appear as the underlying cause of death in mortality data files.

In **morbidity** coding, the **consequence** of the injury is *always* selected as the primary diagnosis. In the case above, if the person was admitted to a hospital because of a concussion from an automobile collision, the concussion would be the primary cause of hospital admission, and the automobile collision would be listed as an additional diagnosis. In a medical setting, the type of injury that is treated (and billed for) is the most important consideration. If a concussion was due to a fall (the external cause of injury) then the concussion would still be the primary diagnosis for the hospitalization, and the fall would be listed as an additional diagnosis.

Since hospitals are still using the clinical modification of ICD-9 for coding diagnoses, the morbidity coding in the case above would use ICD-9-CM while the mortality coding would use ICD-10. ICD-9 is a numeric coding system and so both the external causes of injury and the consequences of injury are coded in parallel classifications, both in the 800 to 999 numerical range. However, the external cause of injury codes are preceded by an "E" to distinguish them. Under ICD-9-CM, the primary diagnosis of concussion might be coded as 850.2 (with the .2 indicating moderate loss of consciousness) and the additional diagnosis of automobile collision with the driver injured would be coded as E812.0. This is the origin of the term "E-code" (*external* cause of injury code) in contrast to an "N-code" (*nature* of injury code).

To complicate things a little further, the "E" is omitted from the cause of death codes in the mortality data files produced by the SCHS for the years 1979 through 1998, when the ICD-9 was used for cause-of-death coding. Thus, whenever a code between 800.0 and 999.9 is encountered in the underlying cause of death field of these data files, it is always an E code. (The four-digit data values will be from 8000 to 9999.) In the more detailed 1979-1998 mortality files maintained at the SCHS, a "nature of injury flag" field is used to tell whether a code in the 800-999 range in the multiple cause-of-death portion of the record is an E-code or an N-code.

Other Health-Related Classification Systems

There are a number of specialized disease classification systems in addition to the ICD. In this report, just a few of the major ones are mentioned. The *International Classification of Diseases for Oncology*⁴ (ICD-O) is based on the ICD-10 but has more detail for the coding of neoplasms. It is used principally in tumor or cancer registries. Oncologists have recognized that knowledge solely of the site of a tumor is not sufficient for planning treatment or conducting research. Therefore, the ICD-O has a dual coding system. In addition to specifying the site (or topology) of a tumor, as in ICD-10, the ICD-O also classifies the histologic type of the tumor (morphology).

The *International Classification of Functioning, Disability, and Health*⁵ (ICF) is a new system that is replacing the *International Classification of Impairments, Disabilities, and Handicaps* (ICIDH, published by the WHO in 1980). The ICF is intended to complement the ICD-10. Information on disease diagnosis plus functioning provides a broader picture of health. The ICF describes: 1) body functions and structures, 2) activities and participation, and 3) environmental factors. It can be used in clinical settings or for health surveys and research. A goal of the ICF is to promote international comparisons of functioning and disability. For further information from the WHO on the ICF see <http://www3.who.int/icf/icftemplate.cfm>.

The fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders*⁶ (DSM-IV) is frequently used for the classification of mental and behavioral conditions. The codes are nearly identical to those in the mental disorders chapter of the ICD-9-CM, but the DSM-IV also has a set of diagnostic criteria and a descriptive text for each disorder. ICD-9-CM is employed for billing for mental health services. For further information from the American Psychiatric Association on DSM-IV see http://www.psych.org/clin_res/dsm/index.cfm.

Conclusion

This report introduces the International Classification of Diseases and related issues. The references and web links contain much more information on these topics. Readers may contact the author for questions or further information: (919) 715-4478 or paul.buescher@ncmail.net.

References

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4. World Health Organization, *International classification of diseases for oncology*. Third edition, U.S. interim version. Geneva, 2000.
5. World Health Organization, *International classification of functioning, disability, and health*. Geneva, 2001.
6. American Psychiatric Association, *Diagnostic and statistical manual of mental disorders*. Fourth edition. Washington DC, 1994.

Appendix 1: Chapters of ICD-10 with the Corresponding Alphanumeric Codes

I	Certain infectious and parasitic diseases	A00-B99
II	Neoplasms	C00-D48
III	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	D50-D89
IV	Endocrine, nutritional, and metabolic diseases	E00-E90
V	Mental and behavioural disorders	F00-F99
VI	Diseases of the nervous system	G00-G99
VII	Diseases of the eye and adnexa	H00-H59
VIII	Diseases of the ear and mastoid process	H60-H95
IX	Diseases of the circulatory system	I00-I99
X	Diseases of the respiratory system	J00-J99
XI	Diseases of the digestive system	K00-K93
XII	Diseases of the skin and subcutaneous tissue	L00-L99
XIII	Diseases of the musculoskeletal system and connective tissue	M00-M99
XIV	Diseases of the genitourinary system	N00-N99
XV	Pregnancy, childbirth, and the puerperium	O00-O99
XVI	Certain conditions originating in the perinatal period	P00-P96
XVII	Congenital malformations, deformations, and chromosomal abnormalities	Q00-Q99
XVIII	Symptoms, signs, and abnormal clinical, and laboratory findings, not elsewhere classified	R00-R99
XIX	Injury, poisoning, and certain other consequences of external causes	S00-T98
XX	External causes of morbidity and mortality	V01-Y98
XXI	Factors influencing health status and contact with health services	Z00-Z99

**Appendix 2: ICD-9 to ICD-10 Comparability Ratios and Corresponding Codes
for Major Cause-of-Death Categories (from reference no. 2)**

Cause of Death	Comparability Ratio	ICD-10 Codes	ICD-9 Codes
Deaths from all causes	1.00	All	All
Heart disease	0.99	I00-I09,I11,I13,I20-I51	390-398,402,404,410-429
Cerebrovascular disease (stroke)	1.06	I60-I69	430-434,436-438
Cancer	1.01	C00-C97	140-208
Cancer of colon, rectum, and anus	1.00	C18-C21	153-154
Cancer of trachea, bronchus, and lung	0.98	C33-C34	162
Cancer of breast	1.01	C50	174-175
Cancer of prostate	1.01	C61	185
HIV disease	1.14	B20-B24	042-044
Septicemia	1.19	A40-A41	038
Diabetes mellitus	1.01	E10-E14	250
Pneumonia and influenza	0.70	J10-J18	480-487
Chronic lower respiratory diseases	1.05	J40-J47	490-494,496
Chronic liver disease and cirrhosis	1.04	K70,K73-K74	571
Nephritis, nephrotic syndrome, and nephrosis	1.23	N00-N07,N17-N19,N25-N27	580-589
Alzheimer's disease	1.55	G30	331.0
Intentional self-harm (suicide)	1.00	X60-X84,Y87.0	E950-E959
Assault (homicide)	1.00	X85-Y09,Y87.1	E960-E969
Unintentional motor vehicle injuries	0.85	V02-V04,V09.0,V09.2,V12-V14, V19.0-V19.2,V19.4-V19.6, V20-V79,V80.3-V80.5, V81.0-V81.1,V82.0-V82.1, V83-V86,V87.0-V87.8, V88.0-V88.8,V89.0,V89.2	E810-E825



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