Public Use Data File Documentation

Underlying and Multiple Cause of Death, 1999

DOCUMENTATION FOR THE UNDERLYING AND MULTIPLE CAUSE-OF-DEATH PUBLIC-USE DATA FILE, 1999

SPECIAL NOTICE

EFFECTIVE WITH 1999 DATA, CAUSE OF DEATH INFORMATION IS CLASSIFIED ACCORDING TO THE TENTH REVISION OF THE INTERNATIONAL CLASSIFICATION OF DISEASES (ICD-10)

EFFECTIVE WITH 1998 DATA, COMMONWEALTH OF THE NORTHERN MARIANAS RECORDS ARE INCLUDED IN THE TERRITORIES'S PUBLIC USE FILE

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Questions concerning the documentation or general questions concerning the mortality file should be directed to the Systems Programming and Statistical Resources Branch, Division of Vital Statistics, NCHS, 6525 Belcrest Road, Room 888, Hyattsville, MD 20782 (301-458-4420).

Questions concerning the introductory text, Technical Appendix or substantive questions concerning the mortality data should be directed to the Mortality Statistics Branch, Division of Vital Statistics, NCHS, 6525 Belcrest Road, Room 840, Hyattsville, MD 20782 (301-458-4666).

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SYMBOLS USED IN TABLES

Symbol	Explanation
---	Data not available
...	Category not applicable
-	Quantity zero
0.0	Quantity more than 0 but less than 0.05
*	Figure does not meet standards of reliability or precision

Documentation for the Underlying and Multiple Cause-of-Death Public-Use Data File, 1999

I. Introduction

This document provides guidance in accessing and using the underlying and multiple cause-of-death public-use data file for 1999. It also provides information on the classification structure and coding rules used to create each variable on the data file such that the user can readily access information at varying levels of detail to his/her own particular research. Additionally, it presents the characteristics of the underlying and multiple cause data files to guide the user in analyzing and interpreting the data. The user is alerted to certain pitfalls of interpretation. The appropriateness of multiple cause data to given applications is also discussed. Tabular underlying and multiple cause data are provided (Control Total Tables in the back of the documentation) for comparison with user-generated counts for 1999 data.

New variables. Beginning in 1989 a number of variables were added to the data file as a result of the revision of the U.S. Standard Certificate of Death, recommended for State use beginning on January 1, 1989. Among the changes were the addition of a new item on educational attainment and changes to improve the medical certification of cause of death. In addition, for the first time, the U.S. Standard Certificate of Death includes a question on the Hispanic origin of the decedent. Previously a number of States had included an Hispanic-origin identifier on their certificates. A change was also made in the format of the item to obtain information on type of place of death from an open-ended question to a checkbox.

Geographic classification. The Office of Management and Budget revised its designation of metropolitan statistical areas based on figures from the 1990 Census. For the 1990 through 1993 data files, the National Center for Health Statistics (NCHS) has been using these new definitions and codes as indicated in the listing of 320 Metropolitan Statistical Areas (MSAs), Primary Metropolitan Statistical Areas (PMSAs), and New England County Metropolitan Areas (NECMAs) included in the documentation for those years. There are also 20 Consolidated Metropolitan Statistical Areas (CMSAs) which are made up of PMSAs. Because other geographic changes based on the 1990 Census became effective with the 1994 data file, the metropolitan statistical area designations were updated as well. Effective with the 1994 data file, there are 311 MSA’s, PMSA’s, and NECMA’s; and 18 CMSA’s as indicated in the listing included with this documentation.

Data release policy. Effective with vital events occurring in 1989, NCHS implemented a policy on the release of vital statistics unit record data to prevent the inadvertent disclosure of individuals and institutions. As a result, the public-use files for 1989 and later years do not contain the actual day of the death or the date of birth of the

decedent. Geographic detail is also restricted: only counties and cities of 100,000 or more population based on the 1990 census, as well as metropolitan areas of 100,000 or more population based on the 1990 Census are identified.

Sample data. With the exception of calendar years 1972, 1981 and 1982, all deaths occurring annually in the United States were processed. In 1972, underlying and multiple cause data were coded and processed for 50 percent of the deaths occurring in each State because of resource constraints. In 1981 and 1982, multiple cause data were coded on a 50-percent sample basis for deaths occurring in 19 registration areas which are identified in the documentation of the 1981 and 1982 files. For the remaining 33 registration areas, multiple cause data were processed on a 100-percent basis. In 1981 and 1982, underlying cause, demographic, and geographic data were processed for every death occurring in every State; however the multiple cause-of-death public-use data file contains only those records where the multiple cause field is also coded. A public-use data file containing underlying cause, demographic, and geographic data for every death in the United States is available but contains no multiple cause data.

Change in cause-of-death classification. For data year 1999, a new classification system for coding causes of death was implemented in the United States: the Tenth Revision of the International Classification of Diseases (ICD-10) (1). Information about the new system can be obtained at the following address: http://www.cdc.gov/nchs/about/major/dvs/icd10des.htm

II. Underlying Cause of Death Data

Mortality statistics by cause of death are compiled from entries on the medical certification portion of the death certificate that follows the WHO format (1). Causes of death include "all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced these injuries" (1). The medical certification of death is divided into two sections. In Part I, the physician is asked to provide the causal chain of morbid conditions that led to death, beginning with the condition most proximate to death on line (a) and working backwards to the initiating condition. The lines (a) through (d) in Part I are connected by the phrase "due to, or as a consequence of." They were designed to encourage the physician to provide the causally related sequence of medical conditions that resulted in death. Thus, the condition on line (a) should be due to the condition on line (b), and the condition on line (b) should be a consequence of the condition on line (c), etc., until the full sequence is described back to the originating or initiating condition. If only one step in the chain of morbid events is recorded, a single entry on line (a) is adequate. Part I of the medical certification is designed to facilitate the selection of the underlying cause of death when two or more causes are recorded on the certificate. The underlying cause of death is defined as "(a) the

disease or injury which initiated the chain of morbid events leading directly to death, or (b) the circumstances of the accident or violence that produced the fatal injury" (1) and is generally considered the most useful cause from a public health standpoint. Part II solicits other conditions that the certifier believed contributed to death, but were not in the causal chain. Figure 1 shows the death certificate. While some details if the death certificate vary by State, all States use the same general format for medical certification outlined in the U.S. Standard Certificate. The U.S. Standard Certificate, in turn, closely follows the format recommended by the WHO.

If the death certificate is properly completed, the disease or condition listed on the lowest used line in Part I is usually accepted as the underlying cause of death. This is an application of "The General Principle" (1). The General Principle is applied unless it is highly improbable that the condition on the lowest line used could have given rise to all of the diseases or conditions listed above it. In some cases, the sequence of morbid events entered on the death certificate is not specified correctly. A variety of errors may occur in completing the medical certification of death. Common problems include the following: The causal chain may be listed in reverse order; the distinction between Part I and Part II may have been ignored so that the causal sequence in Part I is simply extended unbroken into Part II; or the reported underlying cause is unlikely, in an etiological sense, to have caused the condition listed above it. In addition, sometimes the certifier attributes the death to uninformative causes such as cardiac arrest or pulmonary arrest.

To resolve the problems of incorrect or implausible cause-of-death statements, the WHO designed standardized rules to select an underlying cause of death from the information available on the death certificate that is most informative from a public health perspective. The rules for the Tenth Revision as updated by WHO since publication of ICD-10 (1) are described in an NCHS instruction manual (2). Coding rules beyond the General Principle are invoked is the cause-of-death section is completed incorrectly or if their application can improve the specificity and characterization of the cause of death in a manner consistent with the ICD. The rules are applied in two steps: selection of a tentative underlying cause of death, and modification of the tentative underlying cause in view of the other conditions reported on the certificate in either Part I or Part II. Modification involves several considerations by the medical coder: determining whether conditions in Part II could have given rise to the underlying cause, giving preference to specific terms over generalized terms, and creating linkages of conditions that are consistent with the terminology of the ICD.

Use of multiple cause data requires an understanding of the content and structure of the death certificate (Figure 1). The cause-of-death section (Items 27 through 30f) provides the underlying cause of death, coded according to the ICD, and the multiple causes of death coded according to the algorithm developed by NCHS.

For a given death, the underlying cause is selected from the condition or conditions recorded by the certifier in the cause-of-death section of the death certificate. NCHS is

bound by international agreement to make the selection of the underlying cause through the use of the ICD-10 classification structure, and the selection and modification rules contained in this revision of the ICD. These rules are contained in a computer software program called ACME (Automated Classification of Medical Entities). ACME does exactly what a coder would do to select the underlying cause of death. The ACME program has been used for final mortality data since 1968.

The WHO selection rules take into account the certifier's ordering of conditions and their causal relationships to systematically identify the underlying cause of death. The intent of these rules is to improve the usefulness of mortality statistics by giving preference to certain classification categories over others and consolidating two or more conditions on the certificate into a single classification category. Additional information on the history of cause-of-death statistics can be found in Hetzel (3).

III. Multiple Cause of Death Data

The limitations of the underlying cause concept and the need for more comprehensive data suggested the need for coding and tabulating all conditions listed on the death certificate. Coding all listed conditions on the death certificate was designed with two objectives in mind. First, to facilitate studies of the relationships among conditions reported on the death certificate, which require presenting each condition and its location on the death certificate in the exact manner given by the certifier. Secondly, the coding needed to be carried out in a manner by which the underlying cause-of-death could be assigned using the WHO coding rules. Thus, the approach in developing multiple cause data was to provide two fields: 1) entity axis and 2) record axis. For entity axis, NCHS suspends the provisions of the ICD that create linkages between conditions for the purpose of coding each individual condition, or entity, with minimum regard to other conditions present on the death certificate.

Record axis is designed for the generation of person-based multiple cause statistics. Person-based analysis requires that each condition be coded within the context of every other condition on the same death certificate and modified or linked to such conditions as provided by ICD-10. By definition, the entity data cannot meet this requirement since the linkage provisions modify the character and placement of the information originally recorded by the certifier. Essentially, the axis of the classification has been converted from a entity basis to a record (or person) basis. The record axis codes are assigned in terms of the set of codes that best describe the overall medical certification portion of the death certificate.

This translation is accomplished by a computer system called TRANSAX (Translation of Axis). TRANSAX selectively uses the traditional linkage and modification rules for mortality coding. Underlying cause linkages which simply prefer one code over another for purposes of underlying cause selection are not included. Each entity code on the

record is examined and modified or deleted as necessary to create a set of codes that are free of contradictions and are the most precise within the constraints of ICD-10 and medical information on the record. Repetitive codes are deleted. The process may 1) combine two entity axis categories together to a new category thereby eliminating a contradiction or standardizing the data; or 2) eliminate one category in favor of another to promote specificity of the data or resolve contradictions. The following examples from ICD-10 illustrate the effect of this translation:

Case 1: When reported on the same record as separate entities, cirrhosis of liver and alcoholism are coded to K74.6 (Other and unspecified cirrhosis of liver) and F10.2 (Mental and behavioral disorders due to use of alcohol; dependence syndrome), respectively. Tabulation of records with K74.6 would imply that such records had no mention of alcohol. A preferable code would be K70.3 (Alcoholic cirrhosis of liver) in lieu of both K74.6 and F10.2.

Case 2: If “gastric ulcer” and “bleeding gastric ulcer” are reported on a record they are coded to K25.9 (Gastric ulcer, unspecified as acute or chronic, without mention of hemorrhage or perforation) and K25.4 (Gastric ulcer, chronic or unspecified with hemorrhage), respectively. A more concise code is K25.4 which shows both the gastric ulcer and the bleeding.

A. Entity Axis Codes

The original conditions coded for selection of the underlying cause-of-death are reformatted and edited prior to creating the public-use data file. The following paragraphs describe the format and application of entity axis data.

1. Format. Each entity-axis code is displayed as an overall seven byte code with subcomponents as follows:

1. Line indicator: The first byte represents the line of the death certificate on which the code appears. Six lines (1-6) are allowable with the fourth and fifth denoting one or two written in “due to”s beyond the three lines provided in Part I of the U.S. standard death certificate. Line “6" represents Part II of the death certificate.

2. Position indicator: The next byte indicates the position of the code on the line, i.e., it is the first (1), second (2), third (3) .... eighth (8) code on the line.

3. Cause category: The next four bytes represent the ICD-10 cause code.

4. The last byte is blank.

A maximum of 20 of these seven byte codes are captured on a record for multiple cause purposes. This may consist of a maximum of 8 codes on any given line with up to 20 codes distributed across three or more lines depending on where the subject conditions are located on the certificate. Codes may be omitted from one or more lines, e.g., line 1 with one or more codes, line 2 with no codes, line 3 with one or more codes.

In writing out these codes, they are ordered as follows: line 1 first code, line 1 second code, etc. ----- line 2 first code, line 2 second code, etc. ----- line 3 ---- line 4 ----- line 5 ----- line 6. Any space remaining in the field is left blank. The specifics of locations are contained in the record layout given later in this document.

2. Edit. The original conditions are edited to remove invalid codes, reverify the coding of certain rare causes of death, and assure age/cause and sex/cause compatibility. Detailed information relating to the edit criteria and the sets of cause codes which are valid to underlying cause coding and multiple cause coding are provided in Part 11 of the NCHS Vital Statistics Instruction Manual Series, Computer Edits for Mortality Data, Effective 1999 (4). Control Total Table 1, Number of Resident Deaths Tabulated by Mention of an Underlying Cause, Record Axis Multiple Cause, or Entity Axis Multiple Cause-of-Death by ICD-10 Category, provides a summary list of valid underlying and multiple cause of death codes.

3. Entity Axis Applications. The entity axis multiple cause data file is appropriate for analyses that require that each condition be coded as a stand alone entity without linkage to other conditions and/or require information on the placement of such conditions in the death certificate. Within this framework, the entity data are appropriate to examine relationships among conditions and the validity of traditional assumptions in underlying cause selection. Additionally, the entity data provide in certain categories a more detailed code assignment that could be excluded in creating record axis data. Where such detail is needed for a study, the user should use entity data. Finally, the researcher may not wish to be bound by the assumptions used in the axis translation process.

The main limitation of entity axis data is that it does not necessarily reflect the best code for a condition when considered within the context of the medical certification as a whole. As a result, certain entity codes can be misleading or even contradict other codes in the record. For example, category K80.2 is titled “Calculus of gallbladder without cholecystitis.” Within the framework of entity codes this is interpreted to mean that the codable entity itself contained no mention of cholecystitis rather than that cholecystitis was not mentioned anywhere on the record. Tabulation of records with a “K80.2" as a count of persons having Calculus of gallbladder without cholecystitis would therefore be erroneous. This illustrates the fact that under entity coding the ICD-10 titles cannot be taken literally. The user should study the rules for entity coding as they relate to his/her research prior to use of entity data. The user is further cautioned that the inclusion notes in ICD-10 that relate to modifying and combining categories are seldom applicable to entity coding (except where provided in Part 2b of the Instruction Manual

Series) (5).

In tabulating the entity axis data, one may count codes with an individual code representing the number of times the condition(s) appears in the file. In this kind of tabulation of morbid conditions, the counts among categories may be added together to produce counts for groups of codes. Alternatively, subject to the limitations given above, one may count persons having mention of the disease represented by a code or codes. In this instance it is not correct to add counts for individual codes to create person counts for groups of codes. Since more than one code in the researcher's interest may appear together on the certificate, totaling must account for higher order interactions among codes. Up to 20 codes may be assigned on a record; therefore, a 20-way interaction is theoretically possible. All totaling must be based on mention of one or more of the categories under investigation.

B. Record Axis Codes

The following paragraphs describe the format and application of record-axis data. Part 2f of the Instruction Manual Series (ICD-10 TRANSAX Disease Reference Tables for classifying Multiple Causes-of-Death, 1999) (6) describes the TRANSAX process for creating record axis data from entity axis data.

1. Format. Each record (or person) axis code is displayed in five bytes. Location information is not relevant. The Code consists of the following components:

1. Cause category: The first four bytes represent the ICD-10 cause code.

2. The last byte is blank.

Again, a maximum of 20 codes are captured on a record for multiple cause purposes. The codes are written in a 100-byte field in ascending code number (5 bytes) order with any unused bytes left blank.

2. Edit. The record axis codes are edited for rare causes and age/cause and sex/cause compatibility. Likewise, individual code validity is checked. The valid code set for record axis coding is the same as that for entity coding.

3. Record Axis Applications. The record axis multiple cause data are the basis for NCHS core multiple cause tabulations. Location of codes is not relevant to this data, and conditions have been linked into the most meaningful categories for the certification. The most immediate consequence for the user is that the codes on the record already represent mention of a disease assignable to that particular ICD-10 category. This is in contrast to the entity code which is assigned each time such a disease is reported on different lines of the certification. Secondly, the linkage implies that within the constraints of ICD-10 the most meaningful code has been assigned. The translation process creates for the user a data file that is edited for contradictions,

duplicate codes, and imprecisions. In contrast to entity axis data, record axis data are classified in a manner comparable to underlying cause of death classification thereby facilitating joint analysis of these variables. A potential disadvantage of record axis data is that some detail is sacrificed in a number of the linkages.

The user can take the record axis codes as literally representing the information conveyed in ICD-10 category titles. While knowledge of the rules for combining and linking and coding conditions is useful, it is not a prerequisite to meaningful analysis of the data as long as one is willing to accept the assumptions of the axis translation process. The user is cautioned, however, that due to special rules in mortality coding, not all linkage notes in ICD-10 are used. (See Part 2f of the Instruction Manual Series) (6).

The user should proceed with caution in using record axis data to count conditions as opposed to people with conditions, since linkages have been invoked and duplicate codes have been eliminated. As with entity data, person-based tabulations that combine individual cause categories must take into account the possible interaction of up to 20 codes on a single certificate.

IV. Data File Characteristics

Each record on the annual data file contains underlying cause (coded using ICD-10), demographic, geographic detail and two multiple cause-of-death fields which have been coded using ICD-10. The data files contain the complete level of detail coded by NCHS except where precluded by confidentiality restrictions or lack of data reliability. Specifications for the 1999 data files are as follows:

File Organization:	Multiple files
Record Type:	Blocked, fixed format
Record Length:	440
Blocksize:	26400

U.S. DATA SET:

1. Record count:		
2. Data counts:	a. By occurrence:	2,394,871
	b. By residence:	2,391,399
	c. To foreign residents:	3,472

PUERTO RICO, VIRGIN ISLANDS, GUAM, AMERICAN SAMOA AND NORTHERN MARIANAS DATA SET:

1. Record count: 30,931

PUERTO RICO:

2. Data counts:	a. By occurrence:	29,145
	b. By residence:	28,967

VIRGIN ISLANDS:

2. Data counts:	a. By occurrence:	654
	b. By residence:	659

GUAM:

2. Data Counts:	a. By occurrence:	724
	b. By residence:	693

AMERICAN SAMOA:

2. Data Counts:	a. By occurrence:	246
	b. By residence:	246

NORTHERN MARIANAS:

2. Data Counts:	a. By occurrence:	162
	b. By residence:	162

1. The data were processed using the PL/1 language on an IBM 3090-200J.

2. The last block for the data year may be a short block.

3. The data are recorded in IBM/EBCDIC 8-bit code for each character.

4. Codes may be numeric, alphabetic, or blank (Hex 40).

5. A code “z” is the EBCDIC code for the letter “z”.

6. A code “&” is the EBCDIC code for an ampersand (a punched card code 12).

V. Tape Format and Variable Definition

The attached record layout provides documentation of variables, variable categories, and variable location on the underlying and multiple cause-of-death public-use data files. It is noted that the following material, while used in the processing of mortality data, is not included in this package:

> International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) (1)
>
> NCHS Instruction Manual Part 2a, Instructions for Classifying the Underlying

Cause-of-Death, 1999 (2)

NCHS Instruction Manual Part 2b, Instructions for Classifying Multiple Cause-of-Death, 1999 (5)

NCHS Instruction Manual Part 2c, ICD-10 ACME Decision Tables for Classifying Underlying Causes-of-Death, 1999 (7)

NCHS Instruction Manual Part 2d, NCHS Procedures for Mortality Medical Data System File Preparation and Maintenance, Effective 1999 (8)

NCHS Instruction Manual Part 2f, ICD-10 TRANSAX Disease Reference Tables for Classifying Multiple Causes-of-Death, 1999 (6)

NCHS Instruction Manual Part 4, Demographic Classification and Coding Instructions for Death Records, 1999 (9)

NCHS Instruction Manual Part 11, Computer Edits for Mortality Data, Effective 1999 (4)

These documents describe in detail the rules employed for demographic and medical classification on death records. Volumes 1, 2 and 3 of the ICD-10 may be purchased from the World Health Organization (WHO) Publication Center USA, 49 Sheridan Avenue, Albany, New York, 12210 (http://www.who.int/whosis/icd10/index.html) The remaining documents, while not absolutely essential to the proper interpretation of the data for a number of general applications, should nevertheless be studied carefully prior to any detailed analysis of demographic or medical data variables. In particular, there are a number of exceptions to the ICD rules in multiple cause-of-death coding which, if not treated properly, may result in faulty analysis of the data.

Users who do not already have access to these documents may request them from the Chief, Mortality Medical Classification Branch, Division of Vital Statistics, National Center for Health Statistics, 4105 Hopson Road, Research Triangle Park, North Carolina 27709.

In addition, the user should refer to the Technical Appendices of the Vital Statistics of the United States for information on the source of data, coding procedures, quality of the data, etc. Technical Appendix information is enclosed and can also be found at the following address: http://www.cdc.gov/nchs/about/major/dvs/mortdata.htm

VI. Additional Information

In using the NCHS multiple cause data files, the user is urged to review the information

in this document and its references. The instructional material does change from year to year and ICD revision to ICD revision. The user is cautioned that coding of specific ICD-10 categories should be checked in the appropriate instruction manual. What may appear on the surface to be the correct code by ICD-10 may in fact not be correct as given in the instruction manuals.

If on the surface it is not obvious whether entity axis or record axis data should be employed in a given application, detailed examination of Part 2f of the Instruction Manual Series and its attachments will probably provide the necessary information to make a decision. It allows the user to determine the extent of the trade-offs between the two sets of data in terms of specific categories and the assumption of axis translation. In certain situations, a combination of entity and record axis data may be the more appropriate alternative.

Several basic tabulations of data from selected variables contained on this file have been produced and are included with this document as an aid to the user in determining if his/her own tabulations are correct. For verification of multiple cause-of-death data at the "each cause" level of detail, Control Total Table 1 provides counts of the number of deaths on which a given ICD-10 category is mentioned as the underlying cause-of-death, a record axis multiple cause-of-death, and an entity axis multiple cause-of-death, respectively. The counts for the record axis multiple cause-of-death field are divided into two distinct subtotals: 1) "total mention" and 2) "secondary". Secondary is defined as any code which is present in the record axis field but is not the underlying cause-of-death. Control Total Tables 2-7 provide additional control totals for the three cause-of-death fields by age, race, and sex. Control Total Tables 8-10 ignore cause-of-death and provide control totals based on age, race, sex, State of residence, State of occurrence, and month. Control Total Tables 1-9 are based on resident deaths in the United States (excludes deaths to non-residents). Control Total Table 10 is based upon deaths occurring in the United States (includes deaths to foreign residents).

For help with questions concerning multiple cause-of-death analysis, please refer to references 10-13.

When further analytical assistance is needed, contact the Mortality Statistics Branch, Division of Vital Statistics, NCHS, 6525 Belcrest Road, Room 820, Hyattsville, Maryland 20782, Telephone (301) 458-4666. For technical assistance pertaining to the creation of the multiple cause-of-death file, contact Chief, Mortality Medical Classification Branch, Division of Vital Statistics, NCHS, 4105 Hopson Road, Research Triangle Park, North Carolina 27709.

VII. References

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