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# Technical Notes — Methodology

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*"That, sir, is the good of counting; it brings everything to a certainty, which before floated in the mind indefinitely."*

—Samuel Johnson

## **MORTALITY**

### **Comparability Between ICD-9 and ICD-10 Codes**

The *International Classification of Diseases* (ICD) codes are periodically revised to reflect progress in the identification of diseases.<sup>1</sup> This practice began in 1900 and occurs every 10 to 20 years. Each of these revisions has produced some breaks in the comparability of cause of death statistics.

ICD-10 has many changes from ICD-9, including: considerably greater detail for some causes (and less detail for others); shifts of inclusion in terms and titles from one category, section, or chapter to another; regrouping of diseases; new titles and sections; and modifications in coding rules. As a result, serious breaks occur in comparability for a number of causes of death. Measures of this discontinuity are essential to the interpretation of mortality trends. Comparability ratios between ICD-9 and ICD-10 have been computed for this purpose (please see the table at the end of Appendix B). Note that data tables showing cause of death information for years prior to 1999 are based on the original ICD-9 codes and have not been adjusted using comparability ratios.

Studies of the comparability between revisions of the ICD have been carried out and published since at least the fifth revision. Comparability studies, also called bridge-coding studies, involve the dual classification of a single year of mortality data, that is classifying the underlying cause of death on mortality records by the new revision and the previous revision. The key element of the comparability study is the comparability ratio, which is derived from the dual classification. It is calculated by dividing the number of deaths for a selected cause of death classified by the new revision by the number of deaths classified to the most nearly comparable cause of death using the previous revision (in this case the number of deaths identified as being attributable to a particular cause using ICD-10 codes and rules divided by the number of deaths attributed to the same cause using ICD-9 codes and rules). The resulting ratio represents the net effect of the new revision on statistics for this cause and can be used as a factor to adjust previously calculated mortality statistics.

A comparability ratio of 1.00 indicates that the same number of deaths was assigned to a particular cause or combination of causes, regardless of the revision used. A ratio showing perfect correspondence (1.00) between the two revisions does not necessarily indicate that the cause was unaffected by changes in classification and coding procedures but merely that there was no net change.

A ratio less than 1.00 results from a decrease in assignments of death to a cause in ICD-10 compared with ICD-9. A ratio of more

than 1.00 results from an increase in assignments of deaths to a cause in ICD-10 compared to the corresponding ICD-9 cause.

In regard to the magnitude of coding effects produced by rule changes, that of Rule 3 is among the most prominent. This rule is used to determine the direct sequels of causes. It states "If the conditions selected by the general principle or by Rule I or by Rule 2 is obviously a direct consequence of another reported condition, whether in Part I or Part II [of the medical certification portion of the death certificate], select this primary condition." The cause of death most affected by Rule 3 is pneumonia, which is often the consequence of another condition or injury. In ICD-10 the applicability of Rule 3 to pneumonia is broader than in ICD-9, so pneumonia is considered a consequence of a much wider range of conditions. As a result, pneumonia is much less likely to be selected as the underlying cause of death under ICD-10 than under ICD-9.

The following describes selected leading causes of death affected by changes in classification and underlying cause of death rules.

Heart Disease. The comparability ratio (CR) for this cause is 0.9858, indicating a net decrease of nearly 1.5 percent in the allocation of heart disease as the underlying cause of death when using the ICD-10 classification scheme. This net decrease is a result primarily of shifts away from heart disease to other causes of death due to Rule A; under this rule, certain disorders are considered ill-defined and not reflecting the true underlying cause of death. Cardiac arrest is one such disorder. Thus, it is ignored in the selection of underlying cause of death if another more specific cause is listed on the death certificate.

Malignant Neoplasms. The CR for cancer is 1.0068, indicating considerable comparability in numbers and rates between revisions. Nevertheless, a substantial number of deaths are classified under malignant neoplasms in ICD-10 that were not classified as such under ICD-9. Most of these were classified as pneumonia in ICD-9 and were affected by the change in Rule 3 (described above). In ICD-10, the applicability of Rule 3 to pneumonia is broader than in ICD-9; that is, pneumonia is considered a consequence of a much wider range of conditions. As a result, pneumonia is much less likely to be selected as the underlying cause of death under ICD-10 than under ICD-9. In addition, some deaths shifted out of the malignant neoplasm category due to the revision. Most of these are classified in ICD-10 as HIV or, *in situ* neoplasms, benign neoplasms, and neoplasms of uncertain or unknown behavior.

Nearly all of the specified malignant neoplasm categories show some shifts of deaths into and out of the specified category. For example, because of changes in the rule governing the selection of the primary site, deaths involving cancer of the trachea, bronchus, and lung are a little less likely to be attributed to this cause. (The comparability ratio is 0.9837.) This occurred because ICD-10, in contrast to ICD-9, classifies malignant neoplasms of the lung as secondary to many other cancers. Further, when classifying deaths according to ICD-10, unlike ICD-9, selection of the primary site is not determined by order of entry on the death certificate. Thus, when

two primary sites from different organ systems are listed, the deaths are classified to C97, the category for independent (primary) multiple sites.

Alzheimer's Disease. The CR published in the previously described NCHS publication should not be applied to Oregon data. Unlike the nation, deaths assigned to this category have included both Alzheimer's disease (ICD-9 331.0) and presenile dementia (ICD-9 290.1). A study of deaths coded to ICD-9 290.1 showed that 99 out of 100 were attributable to Alzheimer's dementia and that physicians were using the terms "Alzheimer's disease" and "Alzheimer's dementia" essentially interchangeably. To provide a more realistic measure of the impact of Alzheimer's disease, both diseases were included in Oregon's "Alzheimer's Disease" category. ICD-10 eliminated the separate category for "Alzheimer's dementia"; just one code (G30) is present in the current revision.

Unintentional Injuries. With a comparability ratio of 1.0303, deaths were slightly more likely to be attributed to unintentional injuries than previously. Virtually all of this increase involves shifts from natural causes in ICD-9 to unintentional injuries in ICD-10. Most of these deaths were classified as pneumonia or cardiac arrest in ICD-9 but were coded to unintentional injuries as a consequence of the changes in Rule 3 and Rule A, respectively. The CR for the largest subset in this group, motor vehicles, is 0.9754, but the specific category with the largest difference (CR = 0.8409) is falls. This 16 percent decrease is the result of the change in the classification of unspecified fractures. In ICD-9, if the term "fracture" was listed on the death certificate without mention of an external cause, the death was classified to "Fracture, cause unspecified" (E887) within the greater "Accidental Falls" (E880-888) category. In ICD-10, a fall is not assumed to be responsible for an unspecified fracture, and the death is classified to "Exposure to Unspecified Factor," (X59), which is classified as an unintentional injury, but in a residual category, not a fall.

Intentional Self-Harm. This category (i.e., suicide) has a comparability ratio of 0.9962. The slight decline may have resulted from records pending amendment that were unable to be identified at the time of the study. Some changes in coding categories have resulted in less specific data. For example, the type of firearm used in suicide (and all other external cause categories) is no longer distinguished other than handgun vs. long gun; previously, rifles, shotguns, and military (assault) weapons were categorized individually. Further, suffocation suicides involving plastic bags are no longer identified (The number of deaths in this category was typically about the same as the number resulting from cutting and piercing injuries).

Assault. Like suicide, this category (i.e., homicide) showed little difference between ICD-9 and ICD-10 coding; the comparability ratio was 0.9983. The reader is cautioned that this CR is applicable only to prior years' categories based on ICD-9 codes E960-E969. Under the ICD-9 classification, legal intervention (E970-E979) deaths were included in the leading cause of death category "Homicide."

They no longer are. Further, NCHS has not published a comparability ratio for legal intervention deaths because the figure calculated did not meet standards of reliability or precision.

### **Super MICAR**

Beginning in 1993, the underlying cause of death was determined by using Super MICAR, software distributed by the National Center for Health Statistics. In the past, the underlying cause of death was determined by a nosologist using information provided on death certificates by physicians. Super MICAR applies a set of algorithms to all the causes listed on a death certificate to arrive at the underlying cause of death.

This software is being used because the number of deaths among Oregonians has increased substantially during recent years, but has not been accompanied by an increase in staff. Consequently, data availability became increasingly untimely during recent years. Instituting the Super MICAR system is resulting in more timely data.

An advantage of the Super Micar system is that all causes recorded on the death certificate are now included in the data file. We will be able to report, for example, not only the number of Oregonians who died from Alzheimer's Disease but the number of Oregonians who had the disease at the time of their death (provided it was mentioned on the certificate).

### **Age-adjusted Rates**

The death rates in this report are not age-adjusted. (However, age- and sex-specific death rates are presented in addition to crude death rates.) Age-adjusted death rates permit the comparison of populations with disparate age structures as if the populations had similar distributions. Age-adjusted rates should be used when comparing subsets (e.g., counties and races). See the formulas section of this Appendix for instructions on calculating age-adjusted rates. Rates may also be computed on-line at the federal Centers for Disease Control (CDC) site <http://wonder.cdc.gov>.

We ordinarily publish age-adjusted death rates for the U.S. and Oregon (by cause) in this report, but 1999 data were unavailable from the CDC at the time of publication.

### **Tobacco-linked Deaths**

The number of Oregonians whose deaths were linked to tobacco use are presented in the mortality section. However, the number is artificially low. This is because the role of tobacco, if any, is not routinely noted on the death certificates of Oregonians who died out-of-state. (The footnotes in the tables describe the question on the Oregon death certificate regarding tobacco use.) The potential for undercount is greatest for Oregon residents who live in counties bordering other states. A more detailed discussion can be found in *Tobacco and Oregon: A Legacy of Illness and Death*, published in 1992.

## YOUTH SUICIDE ATTEMPTS

Unlike previous years, beginning in 1999 youth who threatened to commit suicide but made no physical act were not included in the total number of attempts, but are shown in a separate table (Table 8-14). Previously they had been identified in the method of attempt tables. Had they been included in the total for 1999, the count would have been 785, a new high.

Data in the youth suicide attempts section were compiled from teen suicide attempt reports and death certifications files with the Oregon Department of Human Services' Center for Health Statistics. Attempt rates are age-specific and are expressed per 100,000 of the population at risk per year. The Center for Population Research and Census was the source of the population data. Methods of attempts are classified according to the International Classification of Diseases (ICD). The name of the attempter is not recorded on attempts reported to the Center for Health Statistics.

Several problems are apparent with the data. The first is that the total number of attempts reported is low. Because Oregon is the only state to require that adolescent suicide attempts be reported, when Oregon adolescents attempt suicide in another state, the event is not reported. More significantly, although required by law, the data suggest that not all hospitals are fully cooperating with the program. It is uncertain whether reporting hospitals are using the same criteria in determining whether the patient attempted suicide. Finally, a few data items are poorly reported.

## ENDNOTE

1. This description is drawn from *National Vital Statistics Report*, Vol. 49, No. 2, June 26, 2001, which includes additional detail not included here. The document is available online at:  
<http://www.cdc.gov/nchs/products/pubs/pubd/nvsr/49/49-pre.htm>

