How Do We Know If We Are Making Progress in Reducing the Public Health Burden of Stroke?

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See related article, p. 2207.

Much of the description of the differential burden of specific diseases and temporal changes in these burdens is based on mortality data. Stroke mortality rates have declined dramatically in the 20th century and into the new millennium. This has been acclaimed as one of the top 10 public health achievements of these eras. In 1999, the age-adjusted stroke death rate was 61.6 per 100,000, but it decreased by 37% in only 11 years to 38.9 per 100,000 in 2009 (most recent year available). Stroke has been stable as the third leading cause of death throughout most of the 20th century but in 2008, it declined to the fourth leading cause of death in the United States. Preliminary mortality data for 2009 and 2010 show that although stroke remains the fourth leading cause of death, the age-adjusted stroke death rates for stroke continue to decrease, specifically by 4.3% between 2008 and 2009 and by 1.5% between 2009 and 2010.

This dramatic and sustained decline in stroke mortality is indeed remarkable and raises questions regarding the underlying causes of the decline, including the possibility that it could be an artifact of the classification system for causes of death.

What define disease-specific causes of death are codes on death certificates related to “underlying cause of death” (UCOD). In this issue of Stroke, Burke and colleagues report on their examination of 2000 to 2008 death certificate data of both UCOD and “any mention cause of death” to investigate whether systematic changes in the processes of mortality assignment could be driving this decline in stroke mortality rates. Using the Centers for Disease Control and Prevention multicause mortality files, they examined the assignment of stroke and the other 5 most common organ- and disease-specific causes of death from 2000 to 2008. Because the outcome after stroke can include sequelae that subsequently lead to death, the coding of the single UCOD is challenging, requires judgment, and is potentially fraught with error and changes over time (although as noted by the authors, the algorithm is complex and annually re-evaluated) Burke and colleagues have made the clever observation that the any mention cause of death, in which there can be multiple entries of diseases and conditions contributing to death, may not be as subject to these challenges. They note that for both any mention cause of death and UCOD, the age-adjusted stroke mortality rates declined by a similar 33%, making the important suggestion that changes in the approaches for coding the single UCOD are less likely to contribute to these observed declines in stroke mortality rates.

Although revisions of International Classification of Diseases can result in discontinuities in cause of death trends, the 10th Revision (International Classification of Diseases, Tenth Revision) was in use for the entire period examined by Burke and colleagues (2000–2008). Although a second edition of International Classification of Diseases, Tenth Revision was adopted in 2004, the changes did not impact coding of stroke (but could have affected some of the other diseases in the report). However, the report of Burke and colleagues must also be interpreted within the context of a much longer-term decline in stroke mortality that has been nearly monotonic since 1900 and covers all 10 editions of International Classification of Diseases coding. Importantly, although the coding of the UCOD is unlikely to contribute to recent declines in stroke mortality, the report does not offer insights to the longer-term pattern.

This work by Burke and colleagues also provides an excellent summary of the processes by which disease-specific mortality data are compiled in the United States. Doctors are rarely, if ever, trained in how to fill out death certificates and thus death certificate data should always be viewed with caution because the input data may be suboptimal. Furthermore, concern exists as to whether there are biases by race–ethnic group or region. Prior studies have suggested this is not the case, but validation studies have not been reported that looked for recent changes. Regardless, the process for coding disease-specific causes of mortality takes the death certificate data and applies a continuously reviewed and updated algorithm to assign the most likely cause. The authors note that for some diseases (including stroke and diabetes), it can be difficult to determine the UCOD. In persons with stroke, this may be due to substantial long-term survival, for example. Burke and colleagues conclude that the combination of these declines in national mortality, lesser declines in regional stroke incidence, and a slight increase in regional case fatality as documented in the Greater Cincinnati/Northern Kentucky Stroke Study during a similar time period is “challenging to explain.” There are other issues that should be considered in reviewing the results of Burke and colleagues and others examining stroke’s changing rank as a cause of death. In the technical notes section of the
release of death statistics for 2008 and 2009, caution is expressed related to changes in coding rules implemented in 2008 that impact comparability for selected causes of death between 2007 and 2008.\(^4\) One of those impacted is cerebrovascular diseases (International Classification of Diseases, Tenth Revision codes I60–I69.) Some of the deaths that would have been coded as subarachnoid hemorrhage (I60) in 2007 were coded as vascular dementia (F01) in 2008. At the same time, coding rules changed for the subcategory of chronic obstructive pulmonary disease with acute lower respiratory infection, resulting in an increase in deaths assigned to the larger category of chronic lower respiratory diseases. The combination of these 2 changes likely then has contributed to chronic lower respiratory disease being identified as the third leading cause of death in 2008 and stroke moving to fourth. This does not diminish the main point of this work, which is to show that coding is not a primary contributor to the decline in stroke mortality.

The major strength of using mortality data to evaluate the burden of stroke is the mandatory reporting of deaths. This allows calculation of stroke mortality rates at regional (eg, county or state) and national levels, by demographic factors (eg, age, race/ethnicity, sex), and allows for monitoring trends over time. Although we celebrate that stroke mortality has declined overall, it has not declined equally across all race–ethnic groups and regions of the country.\(^1,4,15\) Unfortunately, coding stroke as arising from nonspecific causes (I64) implies that we know little about stroke mortality across race–ethnic groups and regions of the country.\(^1,4,15\) The Tenth Revision of the International Classification of Diseases (ICD-10) expands the category to include subtypes of ischemic stroke (I63), hemorrhagic stroke (I64), and unspecified (I65–I67) stroke.

**Disclosures**

Dr Howard was the founding chair of the American Heart Association/American Stroke Association Stroke Statistics Committee of the CVD Epidemiology and Prevention Council and is a current member of the Committee. Dr Kissela is current chair of the Stroke Statistics Committee.

**References**


**Key Words:** cause of death, epidemiology, stroke, stroke mortality
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*Stroke*. 2012;43:2033-2034; originally published online July 3, 2012;
doi: 10.1161/STROKEAHA.112.663237

*Stroke* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://stroke.ahajournals.org/content/43/8/2033

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