

Changes in certification of diabetes with cardiovascular diseases increased reported diabetes mortality in Australia and the United States

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Abstract

Objective: This paper seeks to better understand diabetes-related mortality in Australia and the United States through analysis of the impact of certification practices of diabetes as a multiple cause of death, specifically with cardiovascular diseases (CVDs).

Study Design and Setting: Vital registration multiple cause of death data in Australia and the United States since 1999 are used to examine trends in the ratio of diabetes reported in Part I (underlying cause) and Part II (associated cause) of the death certificate, when CVDs are also reported.

Results: Underlying cause of death (UCOD) statistics mask the magnitude of diabetes-related mortality. In both countries, since 1999 there has been an increase in the ratio of diabetes deaths in Part I vs. Part II where CVD deaths, including ischemic heart disease and cerebrovascular diseases, are also reported. In Australia, diabetes reported as an UCOD would be 12% lower in 2006 if the ratio from 1999 was applied.

Conclusion: The increasing likelihood of physicians to report diabetes in Part I reflects the subjectivity of diabetes death certification. There is a need for specific guidelines on death certification of diabetes with cardiovascular conditions, relating to its reporting as an underlying or associated cause. © 2010 Elsevier Inc. All rights reserved.

Keywords: Diabetes; Cardiovascular diseases; Ischemic heart disease; Cerebrovascular diseases; Multiple causes of death; Death certification

1. Introduction

The prevalence of diabetes mellitus is rising throughout the world because of changing food consumption patterns, increasing physical inactivity and obesity, urbanization and aging populations [1,2]. The rising prevalence of diabetes is likely having a direct impact on increased mortality from diabetic ketoacidosis, gangrene, and nephropathy, or indirectly through its association with other conditions such as cardiovascular diseases (CVDs). Understanding of the pathways through which diabetes leads to mortality is necessary to develop interventions to reduce such deaths.

To optimally capture the impact of diabetes-related mortality, and more generally chronic disease mortality [3], analysis should be undertaken of multiple cause of death data. Official statistics commonly report diabetes solely as an underlying cause of death (UCOD), which does not provide a complete picture of diabetes-related mortality, and possibly underestimate its public health importance [4–6]. Multiple cause data are of particular benefit for identifying the contribution of diabetes to CVD mortality, such as ischemic heart disease (IHD)

and stroke. However, there is a lack of previous research that has examined diabetes as a multiple cause of death using official statistics to provide information on the relative frequencies of different pathophysiological pathways leading to death. Cohort studies have been primarily relied upon to analyze diabetes as a multiple cause of death, especially with CVDs [7–9].

This paper uses official mortality registration data from Australia and the United States to assist in understanding the contribution of diabetes and CVD to Australian and U.S. mortality. There is a particular focus on the certification practices of diabetes. Specifically, the objectives of this paper are as follows:

- Provide a descriptive analysis of deaths coded to diabetes as an UCOD.
- Assess differentials in mortality, where diabetes is the UCOD and CVDs are also reported, between Australia and the United States and over time.
- Provide a comparative analysis of certification of diabetes mellitus between Australia and the United States and over time, with specific reference to CVDs as a multiple cause of death.

The impact of certification of diabetes on reported mortality levels is an issue of much interest. According to

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What is new?

- Changing patterns of certification of diabetes as a multiple cause of death with cardiovascular diseases (CVDs) have increased the reporting of diabetes as an underlying cause.
- This is the first comprehensive analysis using official vital registration data of diabetes and CVDs as multiple causes of death.
- This analysis has implications for the collection and analysis of diabetes multiple cause of death data. The priority is to implement clear guidelines for the certification of diabetes when CVDs are also reported.

ICD-10 coding rules, diabetes can only be assigned as the UCOD if it is reported in Part I of the death certificate. A high proportion of CVD causes are regarded as acute or terminal circulatory diseases according to section 4.2.2 of Volume 2 of ICD-10 [10], and therefore can be accepted as due to diabetes. If diabetes is mentioned in Part II of the certificate as an associated cause, then it cannot be assigned as the underlying cause. The treatment of diabetes as a multiple cause of death with CVD, irrespective of any ambiguities, should be consistent over time, unless there is real epidemiological change. Any inconsistencies in the manner of certification have important implications on the level of diabetes mortality reported by official statistics, and the implications for its usefulness for interventions and policy.

2. Data and methods

This analysis uses unit record vital registration multiple cause of death data from the Australian Bureau of Statistics (ABS) and Centers for Disease Control, USA. Data years used are 1999–2006 (excluding 2005^a) for Australia and 1999–2004 for the United States. ICD-10 codes are used; diabetes mellitus is ICD codes E10–E14, CVDs I10–I69, IHD I20–I25, and cerebrovascular diseases I60–I69.

Firstly, reporting of diabetes in Australia and the United States as an UCOD is presented for each year both as a percentage of all deaths and as an age-standardized death rate (standardized by the 1999 Australian age distribution for both countries, to allow for comparison). To illustrate the utility of diabetes mortality data for providing specific information on the nature of the death, the percentage of diabetes deaths according to the fourth character code for diabetes without complications (i.e., “.9”) are presented for insulin-dependent (“E10”), non-insulin-dependent (“E11”), and unspecified diabetes mellitus (“E14”).

^a The 2005 data did not provide sufficient information on associated causes of death to allow comparison to other years.

Trends and differentials in mortality, where diabetes is the UCOD and CVD is also mentioned in Part I of the death certificate, are then graphed to illustrate the trend in core-reporting of these causes. Next, trends in the reporting of diabetes together with CVDs, specifically IHDs and cerebrovascular diseases, are assessed by showing the ratio of reporting of diabetes in Part I (UCOD) and Part II (associated cause) of the death certificate for each year of data. Specifically, reporting of diabetes mellitus in Part I is defined as where it is the UCOD, and CVD, IHD, or cerebrovascular diseases are also mentioned in Part I of the certificate. Reporting of diabetes mellitus in Part II is presented when CVD, IHD, or cerebrovascular diseases is the UCOD.^b Finally, to demonstrate the impact of any changes in the ratio over time on reported deaths with diabetes as the underlying cause, the ratio for 1999 is applied to the final year of data. This procedure is undertaken for all CVD deaths, and IHD and cerebrovascular disease deaths.

3. Results

Table 1 shows that diabetes has been increasing as a percentage of all deaths in both Australia and the United States since 1999. However, this rise was explained by an aging population, because age-standardized diabetes mortality has remained steady over this period. Age-standardized diabetes mortality rates are approximately 50% higher in the United States compared with Australia.

Table 2 shows that in both Australia and the United States, most diabetes deaths are coded to the fourth character “.9” subdivision, that is, without complications. In both countries, E149 reporting is very common, comprising over half of all diabetes deaths in the United States. Deaths coded to E119, non-insulin-dependent diabetes without complications, are almost twice more common in Australia than in the United States, with a notable increase in each country over the period. There has been a decrease in reported E109 deaths, insulin-dependent diabetes without complications, as a percentage of all diabetes deaths in each country over the period. The reporting of other fourth character codes is most common for diabetes with peripheral circulatory complications (average 15.5% of all diabetes deaths in Australia, 10.8% in the United States, not shown in table). Reported deaths are significantly lower for diabetes with renal complications (3.7% in Australia, 2.4% in the United States), ketoacidosis (1.5% in Australia, 2.6% in the United States), and coma (1.1% in Australia, 0.8% in the United States).

Figure 1 shows that mortality where diabetes is the UCOD and CVD is reported in Part I has been increasing

^b Deaths where CVDs, IHD, or cerebrovascular diseases are mentioned in Part I but not as the UCOD (and diabetes is reported in Part II) are not included, because this paper is analyzing differences between diabetes and CVDs, IHD, or cerebrovascular diseases as the underlying cause.

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