



# Cause-of-Death Trends for Diabetes Mellitus over 20 Years

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## Background

Mortality has steadily declined in Korea since the mid-1950s. Despite the favorable trend in the overall mortality, however, understanding cause-specific death rates and their temporal trends would shed some light on the areas for improvement in developing health care and disease prevention programs. Recently, diabetic mortality is lower than ever before, likely due to dramatic improvements in diabetes care. This study set to analyze changes in the cause of death in type 2 diabetes mellitus (T2DM) in the past 20 years.

## Methods

All subjects were T2DM patients over the age of 30 whose death certificates were issued at six hospitals in the Busan metropolitan area from 2010 to 2014. The patients were excluded if they had been clinically diagnosed with significant tuberculosis, liver, thyroid, renal, connective tissue diseases and cancers, prior to T2DM diagnosis. The causes of death were retrospectively determined based on the information from attending physicians or death certificates. We classified the cause of death into eight categories: (1) cardiovascular disease (CVD), (2) congestive heart failure (CHF), (3) infectious disease, (4) DM, (5) liver disease, (6) malignancy, (7) renal disease, and (8) others. The results were compared with our published data on the period from 1990 to 1994 and 2000 to 2004.

## Results

The study comprised 680 patients of which 61.7% were male. The average age of death was 66.5 years. **Table 1** summarizes the cause-specific death rates for Korean patients with T2DM from 2010 to 2014. The most common cause of death was malignancy (47.7%), followed by renal disease (14.0%), infectious disease (10.6%), and CVD (8.5%). Among fatal cancers, hepatocellular carcinoma was the most frequent (21.4%). Among the fatal infections, sepsis was the most frequent (44%), followed by pneumonia (32%).

**Table 1.** The proportion of cause of death in the subjects from 2010 through 2014

Cause of Death (N=680)	Total (numbers)	Percent (%)
<b>CVD</b>	58	<b>8.5</b>
CVA	29	4.3
ICH	15	2.1
Cerebral infarction	14	2.1
IHD	29	4.3
<b>CHF</b>	29	4.3
<b>Infectious disease</b>	72	<b>10.6</b>
<b>Diabetes mellitus</b>	11	1.7
<b>Liver disease</b>	32	4.7
<b>Malignancy</b>	325	<b>47.7</b>
<b>Renal disease</b>	95	<b>14.0</b>
<b>Others</b>	58	8.5
<b>Total</b>	680	100

Data are presented as numbers and percent. CVD, cardiovascular disease; CVA, Cerebrovascular accident; ICH, Intracerebral hemorrhage; IHD, Ischemic heart disease; CHF, congestive heart failure.

**Table 2** depicts the trends in overall and cause-specific death rates for Korean patients with T2DM from 1990 to 2014. Compared with previous study, cancer became the most common cause of death in T2DM patients, while cardiovascular disease and infectious disease significantly decreased in the rank. The age-standardized death rate (ASR) from hypertensive diseases, heart diseases and cerebrovascular diseases decreased significantly during the study period. Especially, ASRs from heart diseases in Korea had been steadily decreasing. Similarly, a steady and marked decline in death rates from heart diseases was also observed in the United States since 1970 in tandem with continuously improved control of hypertension, a major risk factor for cardiovascular disease, and due in part to the use of effective medical and surgical treatments. Markedly declining death rates from coronary heart diseases since the 1970s were also observed in Latin America and Europe. Death rates from cerebrovascular diseases have also decreased consistently and markedly in many countries around the world since the 1960s, which was attributed improvement in developing health care and disease prevention programs.

**Table 2.** The comparison of causes of death in the subjects between 1990-1994 and 2010-2014

Cause of Death	1990-1994	2000-2004	2010-2014
<b>CVD</b>	<b>37.6</b>	<b>30.6</b>	<b>8.5</b>
CVA	24.8	15.0	4.3
ICH	8.0	9.1	2.1
Cerebral infarction	16.8	5.9	2.1
IHD	12.8	15.6	4.3
<b>CHF</b>	9.4	7.1	4.3
<b>Infectious disease</b>	<b>24.2</b>	<b>25.3</b>	<b>10.6</b>
<b>Diabetes mellitus</b>	6.0	1.9	1.7
<b>Liver disease</b>	5.4	2.7	4.7
<b>Malignancy</b>	<b>4.7</b>	<b>21.9</b>	<b>47.7</b>
<b>Renal disease</b>	<b>3.3</b>	<b>4.7</b>	<b>14.0</b>
<b>Others</b>	9.4	5.9	8.5
<b>Total (%)</b>	100	100	100

Data are presented as percent. CVD, cardiovascular disease; CVA, Cerebrovascular accident; ICH, Intracerebral hemorrhage; IHD, Ischemic heart disease; CHF, congestive heart failure.

## Conclusion

**Over the 20 years, death by cancer in T2DM patients was is rising steeply.** Diabetes and cancer represent common health concerns, and they often coexist in the same individuals. Besides its role as an independent risk factor for the development of several tumors, DM can also have impact on cancer prognosis. Several studies have documented increased cancer mortality in subjects with DM. Preventive strategies to promote primary prevention and early detection of malignancies are urgently needed to reduce this excess mortality.