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Mortality attributable to diabetes in 20–79 years old adults, 2019 estimates: Results from the International Diabetes Federation Diabetes Atlas, 9th edition

Pouya Saeedi^{a,*}, Paraskevi Salpea^a, Suvi Karuranga^a, Inga Petersohn^a, Belma Malanda^a, Edward W. Gregg^b, Nigel Unwin^c, Sarah H. Wild^d, Rhys Williams^e

^a International Diabetes Federation, Brussels, Belgium

^b School of Public Health, Imperial College London, United Kingdom

^c MRC Epidemiology Unit, University of Cambridge, United Kingdom

^d Centre for Population Health Sciences, Usher Institute, University of Edinburgh, United Kingdom

^e Diabetes Research Unit Cymru, Swansea University, Swansea, United Kingdom

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ABSTRACT

Aims: To estimate the number of deaths attributable to diabetes in 20–79-year-old adults in 2019.

Methods: The following were used to estimate the number of deaths attributable to diabetes: all-cause mortality estimates from the World Health Organization life table, country level age- and sex-specific estimates of diabetes prevalence in 2019 and relative risks of death in people with diabetes compared to people without diabetes.

Results: An estimated 4.2 million deaths among 20–79-year-old adults are attributable to diabetes. Diabetes is estimated to contribute to 11.3% of deaths globally, ranging from 6.8% (lowest) in the Africa Region to 16.2% (highest) in the Middle East and North Africa. About half (46.2%) of the deaths attributable to diabetes occur in people under the age of 60 years. The Africa Region has the highest (73.1%) proportion of deaths attributable to diabetes in people under the age of 60 years, while the Europe Region has the lowest (31.4%). **Conclusions:** Diabetes is estimated to contribute to one in nine deaths among adults aged 20–79 years. Prevention of diabetes and its complications is essential, particularly in middle-income countries, where the current impact is estimated to be the largest. Contemporary data from diverse populations are needed to validate these estimates.

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1. Introduction

Diabetes is a serious chronic condition associated with diffuse complications and an increased risk of premature death,

imposing enormous financial pressure on national health care systems and national economies. In 2017 (8th edition of the IDF Diabetes Atlas) 4.0 million people were estimated to have died from diabetes and its complications. About half

* Corresponding author.

E-mail address: pouya.saeedi@idf.org (P. Saeedi).

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(46.1%) of these deaths were in adults under the age of 60 years, the working age group [1]. Premature death combined with disability due to diabetes and absenteeism from work and education contribute to a negative economic impact on countries. These indirect costs account for more than one-third of total costs, estimated at USD 1.31 trillion [2].

Diabetes-related mortality estimates are an important measure of a population's health and can provide valuable information when assigning priorities to design and implementation of clinical management and public health prevention strategies. The aim of this study was to provide global and regional updates on the estimated number of deaths attributable to diabetes in 20–79-year-old adults in 2019.

2. Methods

The method used to estimate the number of deaths attributable to diabetes has been described previously [3]. Briefly, Miettinen's formula [4] for the population-attributable fraction was used to calculate the number of deaths attributable to diabetes in adults 20–79 years. World Health Organization (WHO) life tables were used to assess the number of annual deaths from all causes, stratified by age and sex [5]. Country-specific diabetes prevalence, stratified by age and sex from the 9th edition of the IDF Diabetes Atlas [6], and age- and sex-specific relative risks of death for people with diabetes compared to people without diabetes, obtained from cohort studies, similar to those used in the 8th edition of the IDF Diabetes Atlas [1], were also used to estimate the number of deaths attributable to diabetes, by age, sex and IDF Regions.

3. Results

3.1. Global findings

In 2019, it is estimated that 4.2 million adults aged 20–79 years will die from diabetes, accounting for 11.3% of deaths from all causes. This is equivalent to eight deaths every minute. Almost half of these deaths (46.2%, 1.9 million) are estimated to occur in adults younger than 60 years.

3.2. Numbers of deaths attributable to diabetes by age and sex

The number of deaths attributable to diabetes is higher in women (2.3 million) than in men (1.9 million), with the highest number (1.2 million) in adults 60–69 years old. However, age and sex stratification of the estimates shows that the highest diabetes-related mortality in women is in the

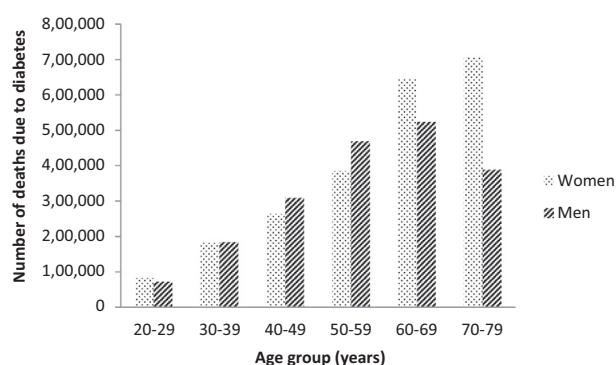


Fig. 1 – Number of deaths attributable to diabetes by age and sex in 2019.

70–79 years age group (708,300), while in men is in the 60–69 years age group (523,700). In addition, between the ages of 30 and 59 years, there are a larger number of deaths attributable to diabetes among men than women (Fig. 1).

3.3. Number of deaths attributable to diabetes by World Bank income classification

Diabetes-related mortality differs significantly by World Bank income classification. The proportion of deaths attributable to diabetes in relation to all-cause mortality is highest in middle-income countries (12.0%) and lowest (6.6%) in low-income countries (Table 1). Middle-income countries have the highest death rate per 100,000 population (Table 1).

3.4. Regional findings

In the IDF Middle East and North Africa (MENA) Region deaths attributable to diabetes accounted for 16.2% of all deaths, the highest proportion globally. The lowest proportion was in the IDF Africa (AFR) Region, where 6.8% of all deaths are attributable to diabetes. Almost the same pattern was evident for the proportion of all-cause deaths attributable to diabetes in people younger than 60 years (Table 2).

3.4.1. Number of deaths attributable to diabetes by age in each IDF Region

In 2019, the AFR Region had the highest estimate of the proportion of diabetes-related deaths under the age of 60 years (73.1%), while the EUR Region had the lowest (31.4%) (Table 3). As shown in Fig. 2, except for the IDF AFR Region, the highest number of deaths attributable to diabetes within each Region was in adults aged 60 years and older. In the AFR Region the

Table 1 – Number of deaths attributable to diabetes in adults 20–79 years by income group classification.

Income group classification	Number of deaths attributable to diabetes	Number of adults with diabetes	Total population of adults	Proportion of all-cause deaths attributable to diabetes	Death rate per 100,000 population
High-income countries	553,812	92,588,359	883,320,420	10.4	62.7
Middle-income countries	3,424,512	353,130,268	3,706,096,900	12.0	92.4
Low-income countries	232,953	14,453,521	363,568,710	6.6	64.1

Table 2 – Number and proportion of deaths attributable to diabetes in IDF Regions, ranked by the proportion of all-cause deaths attributable to diabetes in adults 20–79 years.

IDF Region	Proportion of all-cause deaths attributable to diabetes (20–79 years) (%) ⁱ	Number of deaths attributable to diabetes (20–79 years)	Proportion of all-cause deaths attributable to diabetes in people younger than 60 years old (%) ⁱ
MENA	16.2	418,866	18.8
SEA	14.1	1,150,344	16.1
NAC	13.8	301,699	17.9
SACA	12.5	243,175	12.6
WP	11.0	1,265,051	12.6
EUR	8.5	465,916	9.1
AFR	6.8	366,227	7.6

AFR: Africa; EUR: Europe; MENA: Middle East and North Africa; NAC: North America and Caribbean; SACA: South and Central America; SEA: South-East Asia; WP: Western Pacific; IDF: International Diabetes Federation.

ⁱ Number of deaths attributable to diabetes divided by number of all-cause mortality.

Table 3 – Proportion of adults (20–79 years) who died from diabetes in 2019 before the age of 60 years, globally and by IDF Region, ranked by the proportion of death attributable to diabetes before the age of 60 years.

IDF Region	Proportion of deaths attributable to diabetes occurring before the age of 60 years (%) ⁱ	Number of deaths attributable to diabetes before the age of 60 years
World	46.2	1,945,076 (1,528,636–2,525,388) ⁱ
AFR	73.1	267,616 (157,425–461,847)
MENA	53.3	223,349 (131,002–281,104)
SEA	51.5	592,325 (499,463–713,520)
NAC	44.0	132,650 (106,401–151,129)
SACA	43.5	105,830 (90,554–126,787)
WP	37.7	477,095 (428,311–590,699)
EUR	31.4	146,211 (115,479–200,303)

AFR: Africa; EUR: Europe; MENA: Middle East and North Africa; NAC: North America and Caribbean; SACA: South and Central America; SEA: South-East Asia; WP: Western Pacific; IDF: International Diabetes Federation.

ⁱ Number of deaths in 20–59 years age group divided by number of deaths in 20–79 years age group.

highest number of diabetes-related deaths occurred in adults 30–39 years old.

4. Discussion

In 2019, we estimated that more than four million adults died of diabetes and its complications – 11.3% of all-cause mortality. About half (46.2%, 1.9 million) of the deaths attributable to diabetes occurred in those younger than 60 years, the working age group. There are more deaths associated with diabetes in women than men (2.3 million vs. 1.9 million). People with diabetes mainly die because of diabetes-related complications rather than diabetes per se [7]. Excess glucose has been shown to be associated with about 15% of all deaths due to CVD, kidney disease, and diabetes [8], indicating a large number of these premature deaths can be potentially prevented through prevention or early detection of type 2 diabetes

mellitus and improved management of all forms of diabetes and these complications. Furthermore, 3.4 million deaths in middle-income countries are attributable to diabetes, which is more than the total number of deaths attributable to diabetes in both low- and high-income countries (786,800). The larger population size and higher proportion of people with diabetes in middle-income countries (76.3%) compared with low- and high-income countries (23.7%) can contribute to this finding. The highest proportion of all-cause deaths attributable to diabetes in adults 20–79 years in 2019 is in the MENA Region (16.2%) and the lowest is in the AFR Region (6.8%).

Diabetes prevalence has increased during the past 13 years. The estimated number of people with diabetes has increased by 88%, from 246 million in 2006 (the 3rd edition of the IDF Diabetes Atlas) [9] to 463 million in 2019 [10]. As diabetes estimates are used for producing mortality estimates attributable to diabetes, it should be noted that about one third of

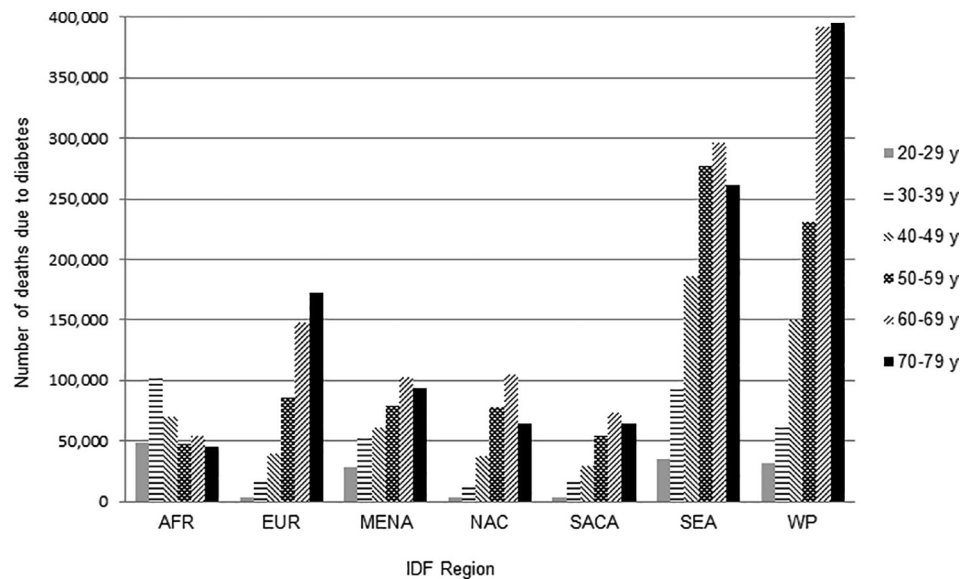


Fig. 2 – Number of deaths attributable to diabetes in IDF Regions by age group.

countries (35%) still do not have high-quality in-country data sources for estimating diabetes prevalence. Whenever this was the case, diabetes estimates for those countries have been extrapolated from countries deemed to be similar, considering geographical proximity, language, ethnicity and their income group, based on the World Bank classification.

Furthermore, country-specific data on relative risk of mortality associated with diabetes are sparse and we had to assume that age- and sex-specific relative risks of mortality are consistent by country which seems unlikely. Older estimates of relative risks may over-estimate current relative risks in developed countries and relative risks in less developed countries may be underestimated. In addition, uncertainty estimates were not included. Further variation in relative risk of mortality associated with diabetes beyond that associated with age is known to exist by sex and socio-economic status [11] and more accurate estimates could have been obtained had these data been available.

In addition, it should be also noted that, the upper age limitation of 79 years may lead to a slight underestimation of the total number of deaths. Although relative risks are likely to be lower above the age of 80 years, large numbers of deaths occur in developed countries in those aged 80 years and above. Thus, diabetes-related mortality estimates must be interpreted with caution and further high-quality nationally representative data are required for many countries.

Furthermore, there are frequent errors in recording diabetes as the cause of death in death certification, particularly in developing countries. Thus, other approaches are required to avoid misclassifying the underlying causes of death, as the misclassification can undermine precise monitoring of the cause and consequently can affect disease prevention and management [12].

Reductions in diabetes-related mortality are particularly important in middle-income countries, where the current economic and societal impact is the largest partly as a consequence of the fact that the largest proportion of the world's population lives in middle-income countries. Diabetes

contributes substantially to the number of deaths in the world each year and statistics on deaths attributable to diabetes, especially on premature death can help health professionals and authorities to prioritise their public health actions and support effective approaches to prevention of diabetes and its complications.

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Author contribution

Conception and design: BM, EWG, NU, SW, RW, SK, PS; Analysis of data: PS; drafting the article or revising it critically: PS, PS, SK, IP, BM, EWG, NU, SW, RW; final approval of the version to be submitted: PS, PS, SK, IP, BM, EWG, NU, SW, RW.

Author disclosures

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