IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045

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ABSTRACT

Introduction: Since the year 2000, IDF has been measuring the prevalence of diabetes nationally, regionally and globally.
Aim: To produce estimates of the global burden of diabetes and its impact for 2017 and projections for 2045.
Methods: A systematic literature review was conducted to identify published studies on the prevalence of diabetes, impaired glucose tolerance and hyperglycaemia in pregnancy in the period from 1990 to 2016. The highest quality studies on diabetes prevalence were selected for each country. A logistic regression model was used to generate age-specific prevalence estimates or each country. Estimates for countries without data were extrapolated from similar countries.
Results: It was estimated that in 2017 there are 451 million (age 18–99 years) people with diabetes worldwide. These figures were expected to increase to 693 million) by 2045. It was estimated that almost half of all people (49.7%) living with diabetes are undiagnosed. Moreover, there was an estimated 374 million people with impaired glucose tolerance (IGT) and it was projected that almost 21.3 million live births to women were affected by some form of hyperglycaemia in pregnancy. In 2017, approximately 5 million deaths worldwide were attributable to diabetes in the 20–99 years age range. The global healthcare expenditure on people with diabetes was estimated to be USD 850 billion in 2017.
Conclusion: The new estimates of diabetes prevalence, deaths attributable to diabetes and healthcare expenditure due to diabetes present a large social, financial and health system burden across the world.

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1. Introduction

Diabetes mellitus (DM) describes a group of metabolic disorders characterised by high blood glucose levels. People with diabetes have an increased risk of developing a number of serious life-threatening health problems resulting in higher medical care costs, reduced quality of life and increased mortality. [1]. Persistently high blood glucose levels cause generalized vascular damage affecting the heart, eyes, kidneys and nerves and resulting in various complications [2].

The global prevalence of diabetes and impaired glucose tolerance in adults has been increasing over recent decades [3–6]. The pace of change in diabetes prevalence in many countries and regions has been boosted by rapid urbanisation and dramatic changes towards sedentary lifestyle [7]. Accurate estimates of the current and future burden of diabetes are necessary for allocating community and health resources, and to create strategies to counteract these rising trends.

In 1980, the World Health Organization (WHO) estimated that there were 108 million people living with diabetes and this number increased fourfold in 2014 estimates [8]. The International Diabetes Federation (IDF) estimated the global prevalence to be 151 million in 2000 [9], 194 million in 2003 [10], 246 million in 2006 [11], 285 million in 2009 [12], 366 million in 2011 [13], 382 million in 2013 [14] and 415 million in 2015 [15]. Each estimate was based on the latest data available. This paper provides estimates of the worldwide and regional impact of diabetes for 2017 and 2045, based on the most recent epidemiological data.

2. Methodology

2.1. Study selection

A literature search of PubMed and Google Scholar for data sources reporting the age-specific prevalence of diabetes was conducted from 1990 to 2016 using the search terms: 'diabetes' OR 'impaired glucose tolerance' AND 'prevalence' AND ⟨country name⟩ OR ⟨region/continent⟩.

In addition, data sources were gathered from national health surveys conducted by governments, or international organisations including reports from the WHO Stepwise approach to Surveillance (STEPS studies). Relevant citations from published literature were also reviewed, and investigators within the IDF network were consulted to identify additional data sources. If the identified studies did not contain at least three age-groups for adults, enquiries were sent to corresponding authors with a request to provide additional information or they were excluded.

Diabetes researchers in each of the seven IDF regions were also contacted and requested to provide information on the prevalence of diabetes for countries within their region. The seven IDF Regions (Africa; Europe; Middle East and North Africa; North America and the Caribbean; South and Central America; South-East Asia; and the Western Pacific) were based on the six WHO Member States groups, however, the America WHO region is divided into two parts: North America and Caribbean Region and South and Central America Region. In addition, information was obtained through the IDF volunteer network and member associations.

After extracting the methodological information from studies, they were classified according to the following criteria: method of diagnosis (e.g. fasting blood glucose, oral glucose tolerance tests, glycated haemoglobin (HbA1c), self-report, medical record, random blood glucose, glycosuria); sample size; representation (e.g. nationally representative, regionally representative, single city or village, single ethnic group or cohort); year of the survey; and type of publication (e.g. peer-reviewed publication, national health survey, STEPS studies, personal communication).

Studies were excluded if they (i) did not include sufficient methodological information for characterisation, (ii) did not provide enough data on age-specific prevalence of diabetes, (iii) were based only on pharmacologically-treated diabetes, (iv) were conducted in hospital or clinic-based settings, or (v) were conducted before 1990. Furthermore, studies reporting only the prevalence of type 1 diabetes, or newly diagnosed diabetes were also excluded.

A scoring system was developed using the Analytic Hierarchy Process [16], which allows the comparison of different parameters (e.g. study type versus type of publication) to create a system of weights, whereby each criterion for characterisation receives a corresponding score reflecting the quality of the study (Fig. 1). Experts from the IDF network were asked to complete preferences charts, and these preferences were used to assign a value for each pairwise comparison (e.g. age of the data source vs method of diagnosis). When there was disagreement among respondents, a median value was used. Those pairwise comparisons were then inserted into a comparison matrix and assigned a priority weight using matrix algebra for each study characteristic. The new weights of each study characteristic were calculated on this basis using the Analytic Hierarchy Process, each study was given a score, with higher scores indicating better quality.

The histogram of the scores of all studies show that 60% of all studies have a score above 0.29, and 50% of all studies are above score 0.33. The value of 0.29 was chosen as a threshold for inclusion in order to include more than half of the studies (60%). [17]. All data sources scoring below this threshold of 0.29 were rejected. The highest scoring study for each country was selected together with other studies within 0.1 score range from the highest scoring study, and the rest of the studies beyond 0.1 score range were excluded.

In countries where more than one study was selected, the age-specific prevalence of diabetes was calculated as the weighted average of the contributing studies, with each study's contribution being weighted by its quality score from the analytic hierarchy process.

If no suitable studies were available for a country or territory, estimates were based on available data from countries matched by geographic location, World Bank income group, ethnicity, language and IDF Region. Income groups were taken from the updated World Bank's 2017 classification of the world's economies [18] and clustered into three groups (low income countries; middle income countries; and high income countries), based on estimates of gross national income per capita for the previous calendar year. Data on languages and ethnicities were derived from the Central Intelligence Agency World Factbook [19].