CONUNDRUMS IN CARE

Type 2 diabetes: An epidemic or not, and why it is happening

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Summary   This article reviews several aspects of the epidemiology of type 2 diabetes, and the evidence suggesting its occurrence. There is considerable evidence for a rising epidemic of diabetes in many countries of the world, with projected numbers of affected persons, and national prevalences likely to rise. Some of the increase in prevalence may relate to improved medical management of the condition, but the major risk factors—reduced physical activity, and increased obesity are likely to be increasing. This also seems to be causing the appearance of type 2 diabetes in new groups, such as children and adolescents, although the older population remains the most affected.

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Diabetes epidemiology: epidemic or not

A number of reports and reviews have been written concerning the rise in diabetes prevalence worldwide. The World Health Organisation (WHO) has estimated that the global prevalence (for all age groups) would rise from 2.8% in 2000 to 4.4% in 2030 [1], more than doubling the number of persons affected, from 171 million to 366 million. The International Diabetes Federation (IDF) produced similar estimates, with predicted numbers among adults (20 years and over) increasing from 194 million in 2003 to 333 million by 2025 [2]. For the 20—79 age group the prevalence change, predicted by the IDF, will be from 5.1 to 6.3%.

Both of these reports were based on applying the age-specific data from the most current national or regional surveys to the national population distributions of each country for the relevant years. Thus, the changes in prevalence and numbers of individuals

with diabetes over time are dependent only on demographic changes in the populations — the increasing size and the ageing of the populations — and urbanization. Urbanization is reflective of a variety of lifestyle changes, which are associated with higher diabetes prevalences in developing countries, and is accounted for in these estimates by applying higher prevalences to the urban component of a population than to the rural component (for developing, but not for developing countries). As more and more of a country's population moves from rural to urban settings, the numbers of individuals with diabetes increases.

The most current United Nations demographic statistics highlight the worldwide ageing. The proportion of the population aged over 65 years is anticipated to increase from 7.4% for 2006 to 10.2% by 2025, and this change is occurring in almost all countries [3]. Of 192 countries listed in the UN 2004 statistics, only 10 (all in Africa) are not expected to increase the population proportion aged over 65 years, and the median increase is 40%. Between

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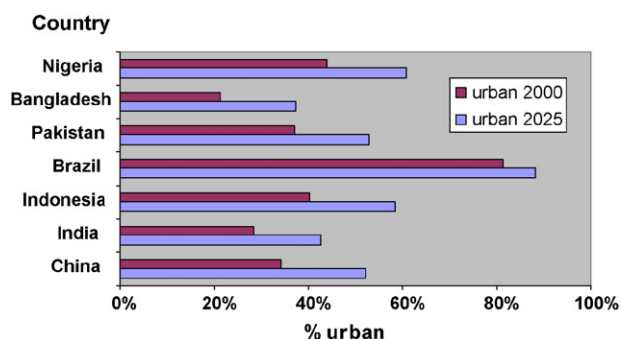
Country

Figure 1 The percentage of the population living in urban settings in the years 2000 and 2025 for the seven largest developing countries.

2006 and 2025 the median proportion aged over 65 years, for the 192 countries, is anticipated to rise from 5.2 to 8.5%. Similarly, the proportion aged over 50 years worldwide is expected to rise by 33% during the same period [3].

The other major factor affecting estimates for developing countries is the proportion of the population living in urban areas. Worldwide, this proportion is estimated to increase from 49 to 58% between 2005 and 2025, and for developing countries from 43 to 54% [4]. Since many studies in developing countries indicate that the prevalence of diabetes is higher in urban than rural populations, urbanization will increase the prevalence of diabetes, with some of this effect attributable to a more sedentary lifestyle, and increased obesity. The anticipated changes in the proportion of the population living in urban settings for the seven developing countries with the highest total populations (China, India, Indonesia, Brazil, Pakistan, Bangladesh and Nigeria) are shown in Fig. 1. Over 50% of the world's population is living in these countries.

It should be recognized that these estimates of national prevalence are likely to be conservative, in that no adjustment to the age-specific prevalence rates published in the various studies were made. Thus, other changes in a population's risk factor profiles — most importantly obesity and exercise pattern — were not considered other than what may be implicit via urbanization. The underlying assumption in these estimates is that an individual of a particular age will have the same risk of having diabetes in 2025, as they did in 2003. Since most studies indicate a rising risk over time, these estimates are likely to be conservative.

Specific comparative prevalence data

Comparable data, derived from different surveys, conducted in the same populations, several years

apart, provide the strongest evidence for an increasing prevalence of type 2, and there are a number of populations for which such data are available.

The National Health and Nutrition Examination Surveys (NHANES) have been conducted in the USA for several decades, using questionnaires and blood screening among representative samples of the national population. The national prevalence among 40—74 year olds was compared between those participating in NHANES III (1988—1994) and those in NHANES II (1976—1980) [5]. The national prevalence had increased from 8.9 to 12.3% (using American Diabetes Association (ADA) 1997 diagnostic criteria [6]), or from 11.4 to 14.3% (using WHO 1985 criteria [7]), and the increases had occurred for both non-Hispanic whites (surveyed in both) and Mexican Americans, who were surveyed in NHANES III and the 1980—1982 Hispanic HANES [8]. More recently, NHANES 1999—2002 has documented the changes since NHANES III [9]. The total prevalence (standardized to the 2000 US population, ADA criteria) had increased significantly ($p < 0.05$ males). When stratified by ethnicity, there was a significant increase for non-Hispanic blacks (12.3 to 14.6%, $p < 0.05$), a non-significant increase for non-Hispanic whites (7.4 to 7.8%) and a non-significant decrease among Mexican Americans (14.0 to 13.5%). Although there have been several changes in the diagnostic criteria being used in clinical practice, these analyses were all based on using the same criteria, like other direct comparisons that have been published, and demonstrate the real increases in prevalence of diabetes that have occurred over time.

Two different Danish cohorts of 60-year-old residents of Copenhagen were assessed 22 years apart, in 1974/5 and in 1996/7 [10]. The prevalence of type 2 diabetes (WHO 1999 criteria [11]) increased by 58% in men, and 21% in women. The secular increase in body mass index (BMI) (women, 1.3 kg/m^2; men, 2.1 kg/m^2) seemed to explain the increase.

The results of the Australian National Diabetes Survey, AusDiab, of 1999—2000 [12] were compared with those from a study conducted in the Australian town of Busselton, in 1981 [13], and showed a doubling in diabetes prevalence over that interval, from 3.4 to 7.4%, when based on the same criteria, with increases having occurred across age groups.

A series of three surveys conducted in the Indian Ocean island of Mauritius has shown the prevalence of diabetes to have risen from 12.8% in 1987 to 15.2% in 1992, and 17.9% in 1998 [14].

National surveys have been performed in China in 1994 and 2000/1 [15,16]. Notwithstanding that they had markedly different sample sizes, and different diagnostic criteria, there were increases in age-specific prevalence across each of the three