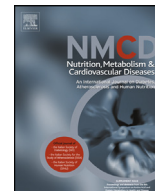


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Prevalence of and secular trends in diagnosed diabetes in Italy: 1980–2013

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Italy**Abstract** *Background and aims:* The aim of this research was to examine the prevalence of diabetes in Italy over a 34-year period.*Methods and results:* Self-reported diabetes was assessed in eight health interview surveys of representative samples of Italian population aged 20 years and over. Crude and standardised prevalence were calculated by age, sex, educational level and area of residence. Logistic models were fitted to calculate the contribution of age and BMI to the trend in prevalence. In 2013 nearly 3.4 million Italians had a diagnosis of diabetes, more than twice as many as in 1980. The crude prevalence of diabetes in men rose from 3.3% in 1980 to 7.1% in 2013 (+115%), and from 4.7% to 6.8% in women (+45%). The prevalence was almost stable during the eighties, and started to rise from the beginning of the nineties. One third of the increase in men and two thirds in women is due to the ageing of the population, since the age-standardised prevalence increased by 79% in men and 14% in women. The prevalence of overweight and obesity increased less steeply than diabetes, and their contribution to the trend in diabetes is less relevant than age. Prevalence rose more in the elderly, in low-educated men, and in high-educated women.*Conclusion:* Given that the ageing population plays a considerable role in explaining the trend, and that the number of people in the oldest age groups will continue to grow, the rise in the number of individuals with diabetes will represent a severe challenge for the national health system.

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Introduction

The number of people with diabetes is increasing worldwide, especially in developing countries, and will continue to rise in the next decades; however, there are large inter-country differences both in the prevalence of diabetes and in its growth dynamics [1–4]. According to the Italian

Institute of Statistics (ISTAT) the crude prevalence of diabetes in Italy in 2011 was 4.9%. In 2011 there were 800,000 more people with diabetes than in 2000 and age-adjusted prevalence increased by 18% in the same period. There is a North–South gradient in the prevalence of diabetes, the Southern regions being more disadvantaged. Furthermore, diabetes prevalence is higher among people with a lower level of education, in particular among women [5,6]. The time trend in prevalence of a disease is related to the time trends in incidence and survival. The incidence of type 2 diabetes, which accounts for more than 90% of cases, is

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related, other than to increasing age, to well-known risk factors such as adiposity, physical inactivity, and cigarette smoking [3], while increasing survival of people with diabetes is related to improvements in the management of the disease [1,4]. Data on the trend in prevalence report different patterns in different countries [7]. In the last 20 years, in the US, diabetes prevalence has increased by a similar magnitude across all age groups [2], while, in Canada, prevalence has increased to a greater extent among the younger population [4]; unfortunately, similar data encompassing a long time trend are scarce in Europe [1,3], and, as for Italy, the time trend in prevalence has not been studied extensively or has only involved limited geographical areas [8,9]. Using data from the Italian Health Interview Surveys, we describe the secular trend in the prevalence of self-reported diabetes in representative samples of the Italian population over a 34-year period.

Methods

Study population

The study population comprised nationally representative samples of non-institutionalised people aged ≥ 20 years who took part in the Italian Health Interview Surveys (HIS) conducted by the National Institute of Statistics (ISTAT) in the years 1980, 1983, 1987, 1990, 1994, 2000, 2005, 2013. Since 1994 the HIS has been part of a Multipurpose Surveys System to represent the Italian non-institutionalised population and families on different topics of everyday life. The HIS uses a complex multistage stratified sampling design with appropriate design variables and a system of weights, aimed to provide region-specific estimates of the prevalence of health-related behaviours, chronic diseases and health service utilisation [10]. The surveys are based on a structured questionnaire with standardised questions and items on health status; the questions regarding diabetes and other variables used in this study did not change in any of the surveys.

Measurements

Diabetes status was assessed by asking respondents aged 20 years and over "have you ever been told you have diabetes?"; the questionnaire did not distinguish between type 1 and type 2 diabetes, or gestational diabetes. Body Mass Index (BMI) was calculated as weight (kilograms) divided by height (metres) squared based on self-reported weight and height. People were considered as overweight if their BMI was between 25.0 and 29.9, or obese if their BMI was ≥ 30.0 . Data on weight and height were not collected in the 1980 and 1987 surveys.

Age was analysed as a categorical variable, grouped into three classes (20–49, 50–64, and ≥ 65).

Educational level was classified according to three levels: high (university/high school, i.e. ≥ 13 years of education), medium (middle school, i.e. up to 12 years of education), and low (primary school/no formal education, i.e. < 8 years of education).

Area of residence was grouped into three classes: North, Centre, South.

Statistical analysis

Prevalence estimates were calculated using survey-specific weighting factors provided by the National Institute of Statistics (ISTAT) [10]. We calculated crude and age-standardised prevalence of diabetes and overweight/obesity with 95% confidence intervals, stratified by year, sex and geographical area of residence. Age and sex distribution of the Italian population in 2001 (national census) was used as the standard population.

Multivariate logistic regression models were fitted to evaluate the independent contribution of year of survey, age and BMI on diabetes, using 1983 as a reference. We first built the base model for prevalence as a function of survey year; next, we added age categorised in 5-year intervals (20–25, ... ≥ 85), then, in a third model, we added BMI categorised as normal, overweight, and obesity. A further model including educational level was tested, but was excluded from the final tables as the results did not change. We calculated Odds Ratios (OR) and 95% confidence intervals. The log-likelihood ratio test was used to compare the goodness of fit of the models. All analyses were conducted using SAS System, Version 9.3.

Results

Trends in characteristics of the samples between 1980 and 2013 are shown in Table 1. Across the eight surveys, the percentage of people aged 65 and over, of those with a high educational level and those who were overweight/obese increased, while the percentage of participants from the different areas of Italy remained almost constant.

Between 1980 and 2013 the total number of adults with known diabetes more than doubled, rising from 1,601,063 to 3,394,039 (Table 2). The crude prevalence of diabetes in men increased from 3.3% in 1980 to 7.1% in 2013 (+115%) and from 4.7% to 6.8% in women (+45%). The prevalence did not increase linearly during the period: it remained almost stable during the eighties (around 3.5% in men and 4.5% in women), and then started to increase from the beginning of the nineties, reaching 7% in 2013 in both genders.

Diabetes prevalence increased in men and women, across all ages, educational levels, and areas of Italy, but with different patterns. The highest increase was among men aged 65 years and over (18% in 2013), and those with a lower educational level, while, for women, the prevalence increased more among those with a higher level of education compared to those with lower levels of education, as well as those in the oldest age group, but at a lower rate than among men, reflecting the smaller increase in prevalence shown by women.

In 2013, the standardised prevalence of diabetes was higher in men compared to women, in individuals with a low educational level compared to those with a high level of education and in Southern regions of Italy compared to

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