Original article

Type 2 diabetes mellitus in France in 2012: Results from the ObEpi survey

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Abstract

Aim. – This analysis estimates the prevalence of type 2 diabetes mellitus (T2DM) in French adults participating in the ObEpi (obesity epidemiology) 2012 survey and also proposes a description of that population, according to comorbidities, treatments and sociodemographic factors related to the disease.

Methods. – A self-administered questionnaire was posted to 20,000 households from the Kantar Health panel. In total, 25,714 adults aged ≥ 18 years and representative of the French population completed the survey during January and March 2012.

Results. – The prevalence of T2DM was 5.5 ± 0.3% (95% CI) in this representative sample of the adult French population. Average age of patients was 65.9 years; 55% were men. Mean body mass index was 29.9 kg/m² (men: 29.4 kg/m², women: 30.6 kg/m²; P < 0.01); the prevalence of obesity was 43.1% (men: 39.9%, women: 47.1%; P < 0.01). Patient-reported treatments for comorbidities were frequent: high blood pressure, 59.1%; dyslipidaemia, 59.9%; myocardial infarction/angina pectoris, 9.7%; revascularization, 7.8%; heart failure, 7.4%; sleep apnoea, 8.3%; and osteoarthritis, 10.7%. With regards to known treatments, 81.4% of patients were taking oral antidiabetic drugs (OADs), and 15.3% were using insulin therapy. Also, 18.8% of diabetic respondents reported financial hardship.

Conclusion. – T2DM remains a disease of major concern: compared with the non-diabetic population, all parameters surveyed showed unfavourable ratings, particularly for women.

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Keywords: Type 2 diabetes mellitus; Epidemiology; Prevalence; Comorbidity; Treatment

1. Introduction

The global prevalence of diabetes has seen a constant increase over recent decades. The number of people worldwide with the disorder has almost doubled, from 153 million in 1980 to 347 million in 2008 [1]. In 2011, diabetes became the leading long-term disease in France, with 1,885,382 cases, exceeding the 1,861,113 cases of cancers. This was the largest increase seen in 2010 (+6.5%), ahead of that for cardiovascular diseases (+5.3%) [2].

The vast majority of cases of diabetes mellitus are type 2 (T2DM). This is a result of the increasing prevalence of obesity [3–5] due to changes in lifestyle [6] and diet [7]. A sound understanding of the epidemiology of T2DM is therefore required, as this metabolic disorder can benefit from public policies of prevention.

Different approaches have been used to provide regular updates of the prevalence of diabetes, with analyses of its comorbidities and context of evolution. The public-health dimension of the disease has been the main concern of several campaigns in France conducted by the national health insurance fund (Caisse primaire d’assurance maladie des travailleurs salariés,
A number of epidemiological studies have addressed different issues, such as quality of care and management of associated cardiovascular risks [11], complications of diabetes [12], and patients’ perception of the disease and its impact on daily life [13]. The obesity epidemiology (ObEpi) surveys comprise six datasets recording the prevalence of obesity in the French population between 1997 and 2012. The data were collected every 3 years using the same methodology. In the ObEpi 2012 survey, the questionnaire included new questions regarding ongoing treatments for cardiovascular disease, dyslipidaemia and diabetes, and revealed that the prevalence of known T2DM is 2.2% in people of normal weight, 6.9% in overweight people and 16.0% in the obese population [14]. Detailed analyses of these data for the treatment of diabetes is of interest in light of the recent position statement of the American Diabetes Association (ADA) and European Association for the Study of Diabetes (EASD) [15].

The primary objective of the present analysis was to estimate the prevalence of known T2DM in the general adult French population. Secondary objectives were to describe the associated comorbidities, treatments and sociodemographic factors related to the disease.

2. Methods

The ObEpi epidemiological surveys evaluated the prevalence of overweight and obesity in the French population every 3 years since 1997. The present analysis describes the population participating in the ObEpi 2012 survey (conducted in France between January and March 2012) that was treated for T2DM with hygiene and dietary measures and/or medical treatment.

2.1. Study sample

The Kantar Health polling institute mailed out questionnaires to a sample of 20,000 households from its permanent database (TNS Sofres). A household was defined as family members living under the same roof or people living on their own. Those living in residential institutions and homeless people were excluded. The sample population was determined using the quota-sampling method after double stratification by region/residence and was representative of the French population, based on the distribution of the closest national references for age, gender, occupational class, region and size of city of residence from the National Institute of Statistics and Economic Studies (Institut national de la statistique et des études économiques, INSEE). The permanent sample was adjusted by the inclusion of 550 new households each month to replace 550 households withdrawn because of repeated non-responses (75%), lack of willingness of participants (17%) or exceeding the 10-year lifetime limit in the sample (8%). The study sample was made up of volunteers who agreed to answer a number of questions.

2.2. Data collection

In addition to major questions pertaining to gender, age, profession and income, respondents were asked to specify their weight, height and ongoing medical treatment for diabetes, high blood pressure and dyslipidaemia (excess cholesterol and/or triglycerides). The issue of the perceived household financial situation was also addressed. Respondents were any members of the household aged ≥18 years.

Detailed illustrated instructions were provided to explain how to measure height (the subject should stand against a wall and be helped by another member of the household wherever possible). Respondents were asked to weigh themselves on bathroom scales immediately prior to answering the questionnaires.

Weight and height were used to calculate body mass index (BMI = weight, kg/height, m²). Overweight and obesity were defined as BMI ≥ 25 kg/m² but < 30 kg/m² and BMI ≥ 30 kg/m², respectively.

Respondents were asked about ongoing treatments for diabetes; if confirmed, the nature of the treatment [insulin, oral antidiabetic drugs (OADs), diet only] was reported. Information on antidiabetic treatments was patient-reported on the basis of an exhaustive list of all available treatments at the time of the study. Brand names and internationally recognized active ingredients of the treatments were also included. Respondents were asked to identify those being used. They were also asked to specify the duration of the illness and, if relevant, the duration of insulin treatment. From these answers, the type of diabetes (1 or 2) was determined according to the following algorithm: respondents with type 1 diabetes (T1DM) were those declaring treatment by insulin alone, age < 45 years when diagnosed, and a maximum of 2 years between diagnosis and beginning their insulin treatment. All other cases were considered as T2DM: age ≥ 45 at diagnosis, treatment with OADs with or without insulin, or controlled by diet.

The completed questionnaires underwent systematic proofreading to reject those that were not suitable for analysis. Double data entry was performed to minimize the risk of errors.

2.3. Response rate

Of the 20,000 questionnaires sent, 14,705 households responded, giving a response rate of 73.5%. From these households, questionnaires from 25,714 individuals aged ≥18 years (in mainland France) had complete data for weight and height (65.0% of submitted questionnaires).

2.4. Statistical analysis

Statistical analysis of the ObEpi data has been described in detail elsewhere [16]. For purposes of comparison, data from the non-diabetic population were adjusted for age and gender (or age only) to match levels in the T2DM population. The greater proportion of the T2DM population was, in fact, male and elderly patients. Percentages were compared using the chi-square test, or t tests for independent samples. All tests were two-sided and a probability level of $P < 0.05$ was considered statistically
significant. Prevalence levels were calculated with a 95% confidence interval (CI).

3. Results

3.1. Prevalence of T2DM

Of the 25,714 respondents aged ≥ 18 years, 14,866 (5.8%; 95% CI: 5.5–6.1) reported ongoing treatment for diabetes (although treatment data for 135 people were not documented). This represents an estimated 2,860,000 cases of diabetes in France when extrapolated to the entire French population aged ≥ 18 years, according to the official 2010 French population data [17]. T1DM was reported by 71 individuals (4.8% of diabetes patients) and T2DM by 1415 respondents, corresponding to 95.2% of all diabetes patients. This included T2DM controlled by diet alone (n = 79, or 5.3% of all T2DM patients for a prevalence of 0.3%).

Several geographical disparities are evident: the prevalence of T2DM ranged from 4.3% in the southwest of France to 9.0% in the northernmost region (Fig. 1). In addition, T2DM was more frequent in men than in women (6.7% vs 4.9%, P < 0.01), while the prevalence of diabetes increased with age, from 0.5% in individuals aged 18 to 24 years to 14.2% in those aged ≥ 65 years. Steepening of the trend was observed in the 45- to 54-year-olds, with an increase from 3.4% to 10.8% in women and a sharper rise in men, from 4.4% to 18.4% (Fig. 2).

3.2. Demographic and clinical features

Table 1 presents the demographic and clinical features of the T2DM patients (n = 1415) and non-diabetic population (n = 24,093). Mean age at the time of diagnosis was 56.0 ± 0.3 years. The prevalence of diabetes was highest in the 65- to 74-year age group, and the majority of those affected were men (55%, 95% CI: 52.4–57.6). After adjusting the data for age and gender, the average BMI in the T2DM population...
was 29.9 kg/m² compared with 26.0 kg/m² in the general population; overweight and obese subjects represented 38.4% and 43.1% of the T2DM population, respectively, compared with 40.4% and 15.5%, respectively, of the non-diabetic population.

3.3. BMI distribution according to gender

In the T2DM population, the mean BMI was 29.4 kg/m² in men and 30.6 kg/m² in women ($P < 0.01$). The prevalence of overweight (BMI ≥ 25 kg/m² but < 30 kg/m²) was comparable, on one hand, between diabetic and non-diabetic men and, on the other, between diabetic and non-diabetic women, whereas obesity (BMI ≥ 30 kg/m²) was reported by 39.9% of men and 47.1% of women with T2DM. While men were more frequently overweight (43.0% vs 32.7% for women) or moderately obese (class I, 26.5% vs 22.7% for women), women were strikingly more often severely (class II, 16.1% vs 10.0% for men) or very severely (class III, 8.3% vs 3.4% for men) obese (Fig. 3). Among T2DM patients, the age-standardized distribution of BMI between men and women was highly significant ($P < 10^{-5}$).

3.4. Cardiovascular comorbidities and other complications

Respondents were also asked to report any ongoing treatment for high blood pressure and dyslipidemia, and such comorbidities for which respondents were being treated were all more frequent in the T2DM population compared with the non-diabetic population, after adjustment for age and gender. In particular, treatments for high blood pressure (59.1% vs 33.2%, respectively) and dyslipidemia (59.9% vs 28.3%, respectively) were about twice as common in the diabetic population as in the non-diabetic population (Fig. 4).

3.5. Diabetes treatments

OADs were the most commonly used treatments (81.4%; Table 2). Insulin therapy was prescribed in 15.3% of patients, and this was slightly more frequently combined with an OAD or glucagon-like peptide (GLP)-1 agonist (9.2% of cases) than used alone (6.2%; Table 2). Overall, 69.9% of treated patients reported taking at least one biguanide and 43.9% at least one sulphonylurea or glinide. Newer drug classes, such as GLP-1 or dipeptidyl peptidase (DPP)-4 inhibitors, were used in combination with another agent in 4.4% and 22.4% of cases, respectively.

3.6. Socioeconomic aspects

The prevalence of diabetes was higher among individuals with lower levels of education (Table 1). In addition, diabetics were less likely to report having a comfortable financial status (35.0% compared with 48.0% in the non-diabetic population, Table 1). This trend was not observed for other risk factors such as dyslipidemia or cardiovascular diseases (data not shown).

Women with T2DM were more frequently apt to see their financial status unfavourably than did men. They were more likely to define their economic situation as ‘tight’ (46.8%), ‘difficult’ (19.5%) or ‘cannot avoid debts’ (4.0%) than did men (45.7%, 12.9% and 2.0%, respectively), and stated being

Table 2
Known ongoing pharmacological treatments reported by the type 2 diabetes mellitus (T2DM) population (excluding 79 patients using dietary measures only).

<table>
<thead>
<tr>
<th>Reported known ongoing treatments ($n = 1278$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3 or more OADs(^{a})</td>
</tr>
<tr>
<td>1 OAD</td>
</tr>
<tr>
<td>2 OAD</td>
</tr>
<tr>
<td>≥ 3 OAD</td>
</tr>
<tr>
<td>Insulin</td>
</tr>
<tr>
<td>Insulin alone</td>
</tr>
<tr>
<td>Insulin + OAD</td>
</tr>
<tr>
<td>Insulin + GLP-1</td>
</tr>
<tr>
<td>GLP-1 alone or + OAD</td>
</tr>
</tbody>
</table>


\(^{a}\) Pharmacological treatments not known for 58 patients.

\(^{b}\) For details of different classes of OADs, see main text.
‘comfortable’ less frequently, too (29.7% vs 39.4% for men, $P < 10^{-3}$). In addition, more female respondents lived alone (35.8% vs 25.7% for men, $P < 10^{-3}$) and had lower levels of education than men (23.7% had a primary-school level and 15.8% had higher education vs 17.1% and 20.5%, respectively, for men, $P < 0.01$).

### 4. Discussion

This ObEpi survey estimated a prevalence of 5.8% for diabetes and 5.5% for known T2DM in 2012 in France; it also provided a description of the associated comorbidities, ongoing treatments and sociodemographic characteristics of the population with T2DM.

The prevalence estimated in the present analysis is in line with the most recently published data [18]. Reported prevalence rates for treated diabetes were 4.6% in 2006 [19], 3.95% in 2007 [20] and 4.4% in 2009 [10] for all types of diabetes. Also, the reported rates of treated T2DM were 4.57% in 2006 [12], while 0.6% of diagnosed diabetes cases were treated non-pharmacologically [19].

According to the 2013 Diabetes Atlas published by the International Diabetes Federation [21], the French comparative prevalence of diabetes was 5.42% (adjusted for the age profile of the rest of the world). This placed France slightly below the European comparative prevalence of diabetes (6.8%) and at a similar rate to the United Kingdom (4.92%), Italy (5.13%) and Switzerland (5.86%), but far below Germany (8.27%), Spain (8.15%) and Portugal (9.57%). The comparable prevalence of the disease is estimated to be 8.3% worldwide, but reaching nearly 11% in Middle Eastern/North African regions.

In the present study, the prevalence of overweight was similar in both the T2DM population and general population, whereas obesity was significantly more frequent in the T2DM (43.0%) than general population (16.0%). The ObEpi data also highlight the fact that, in the T2DM population, men were more often overweight while women were more often obese, a finding also observed, albeit to a lesser extent, in the non-diabetic population. In addition, it is well-established that obesity and insulin resistance are correlated [22,23], and the association between age and BMI has been reported by other authors. Furthermore, men appear to develop diabetes at lower levels of fat mass [24–27] and are also more prone to insulin resistance because of their central fat distribution, and probably also the lack of oestrogen, which increases their level of insulin resistance for any given level of fat mass [28].

The prevalence of dyslipidaemia, which affected nearly 60% of the T2DM population, remains significantly higher than in the non-diabetic population (≤ 30%). The present analysis also showed that the occurrence of associated comorbidities, including high blood pressure, myocardial infarction, angina pectoris and revascularization, remained twice as high in the T2DM population as in the general population. These features, as demonstrated by the ObEpi survey, are consistent with the large-scale ENTRED study launched in 2006 [11,20]. The latter showed a significant improvement in control of cardiovascular risk factors between 2001 and 2006, thanks to the more extensive use of anti-hypertensive therapy [11]. Nevertheless, the treatment of T2DM remains a subject of major concern because of its increasing prevalence and the complex management of its associated comorbidities, which are strongly interdependent [29].

Data show that the majority of diabetic patients are treated with OADs, mostly biguanides, followed by sulphonylureas. This is consistent with the most recent recommendations from the French health authority (Haute Autorité de santé, HAS) [30]. It is also noteworthy that more than one in five patients are treated with gliptins (DPP-4 inhibitors) and, to a lesser extent, GLP-1 analogues (4.4%). These two classes represent a novel therapeutic approach by acting on the incretin pathway [31]. Incretins have only been available since 2007 and are therefore among the most recent group of drugs available for the treatment of T2DM. International guidelines suggest they should be introduced as second-line therapy in association with a first-line biguanide, or as third-line therapy in combination with a biguanide and a sulphonylurea [15]. Recent French guidelines [30] explicitly state that they should not be recommended (and therefore not reimbursed) as first-line treatment. Instead, incretins should be indicated as a treatment of last resort. The rationale behind this precaution is the higher cost and unknown long-term impact of DPP-4 inhibitors.

One limitation to the interpretation of our present results is that the ObEpi survey was based on patient-reported questionnaires, and so have a possible reporting bias [16]. In addition, the survey population included neither individuals living in residential institutions nor homeless people because such populations require a specific screening approach. In fact, according to the published literature, had they been included, a number of minor changes would very likely have been necessary [32]. For example, it could be extrapolated that the financial hardship associated with diabetes was slightly underestimated in the ObEpi survey. However, the strength of the survey is that it was based on a large national population-based sample and provides recent data on the status of T2DM in France.

In conclusion, the present study has provided the most recent data on the prevalence of known T2DM in the French population, together with specific features related to social and demographic aspects and associated comorbidities. These findings highlight the fact that the diabetic population is characterized by a high prevalence of overweight and obesity (> 80%). Also, at the time of the survey, the unexpectedly high patient-reported use of incretins appeared to indicate that these agents were being prescribed earlier than as a third-line treatment, thus corresponding to the most current guidelines.

Nevertheless, T2DM remains a matter of great concern: compared with the non-diabetic population, all the surveyed parameters showed unfavourable ratings, and especially so for women. As pharmacological treatments are not known to be gender-specific, lifestyle factors such as weight management, dietary control and physical activity need to be considered more carefully in future decisions regarding the prevention of diabetes, with specific considerations for the female population.
Disclosure of interest

E. Eschwege: member of advisory board and speaker engagements for Novo Nordisk, Novartis and Roche. Consultation for the Institut national de Veille Sanitaire (National Institute of Public Health Surveillance) HAS/Commission de la transparence (Transparency Commission)/Groupe d’intérêt de santé publique (Public Health Interest Group).

A. Basdevant was a member of the advisory board for the ObEpi surveys for Roche; he received no remuneration.

Christine Moisan, MD, was an employee of Roche at the time of the study; she is now an employee of MSD.

Crine and M.-A. Charles declare that they have no conflicts of interest concerning this article.

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