Quality of care of patients with type 1 diabetes: Population-based results in a French region

A. Penfornis a,*, E. Personeni a, M. Tiv b, C. Monnier a, L. Meillet a, J. Combes a, C. Mouret c, S. Picard d

a Department of Endocrinology-Metabolism and Diabetology-Nutrition, Jean-Minjoz Hospital, EA 3920, University of Franche-Comté, 25030 Besançon cedex, France
b Service d’épidémiologie et d’hygiène hospitalière, hôpital d’enfants, CHU de Dijon, 14, rue Paul-Gaffarel, BP 77908, 21079 Dijon, France
c Direction régionale du Service Médical de Bourgogne-Franche-Comté, site de proximité de Besançon, Besançon, France
d Point Médical, 21000 Dijon, France

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Abstract

Aim. – Although the incidence of type 1 diabetes (T1D) has been increasing, little is known of its quality of care. Thus, our survey was designed to retrospectively evaluate this issue in French patients.

Methods. – Patients with T1D living in northeastern France were identified thanks to the healthcare system (CPAM) database, and the resulting list reviewed by local diabetes specialists. All of the listed patients and their primary physicians were asked to fill in a questionnaire including clinical data, laboratory results and follow-up habits. The ‘optimized results’ included CPAM-based results plus any specialized care provided during hospitalizations in diabetes and non-diabetes units, according to questionnaire data.

Results. – A total of 227 individuals, for whom CPAM data were available, were identified as having T1D. From these patients, 174 questionnaires were answered, and optimized results (having both CPAM data and a completely filled-in questionnaire) were available for 149 patients. Of the 169 patients who responded, 71.3% reported at least a yearly visit with a diabetologist. This number reached 77.9% when optimized results were considered. Patients who received specialized care were younger, underwent HbA1c tests more often and were more frequently on optimal treatment; however, there was no difference in HbA1c values or in the prevalence of complications. Eye examinations and kidney tests had been performed at least once over the 2-year period in more than 87% of the patients, whereas around 30%, 21% and 23% had an eye exam, creatinine test and urinary albumin excretion measurement, respectively, only once over the same time period.

Conclusion. – This is the first large-scale study of the quality of care in patients with T1DM in France, and it could serve as a preliminary survey for a national study. Although the follow-up was better than previously reported, there is still considerable room for improvement.

Keywords: Type 1 diabetes; Specialist; Quality of care; Survey; General practitioner; Complications; France

Résumé

Qualité des soins dans le diabète de type 1 : résultats d’une enquête de population dans un département de l’est de la France.

Objectif. – L’incidence du diabète de type 1 (DT1) augmente mais peu de données sont disponibles quant à la qualité de soins. De ce fait, nous avons mené une enquête pour évaluer celle-ci chez des patients français.

Méthodes. – Les patients DT1 vivant dans un département du Nord-Est de la France ont été identifiés grâce aux données de la Caisse locale d’assurance maladie (CPAM). La liste a été revue par des spécialistes locaux. Tous ces patients et leurs médecins traitants ont reçu un questionnaire portant sur des données cliniques, biologiques et le suivi. Les consultations spécialisées qui ont pu avoir lieu lors d’hospitalisations en, comme en dehors de la, diabétologie ont été ajoutées aux données de la CPAM, les résultats ainsi obtenus étant appelés résultats «optimisés».
Résultats. – Deux cent vingt-sept patients, dont les données CPAM étaient disponibles, ont été identifiés comme atteints de DT1. Cent soixante-quatorze questionnaires ont été reçus et les résultats optimisés (nécessitant à la fois les données de la CPAM et un questionnaire complet) ont été disponibles pour 149 d’entre eux. Parmi les 169 patients qui ont répondu, 71,3 % ont déclaré avoir eu au moins une visite annuelle auprès d’un diabétologue. Ce chiffre atteignait 77,9 % si l’on considérait les résultats optimisés. Les patients bénéficiant d’un suivi spécialisé étaient plus jeunes, avaient des dosages d’HbA1c plus fréquents et étaient plus souvent sous traitement optimisé ; cependant, il n’y avait aucune différence dans les valeurs d’HbA1c ou la prévalence des complications. Plus de 87 % des patients ont eu au moins un examen ophthalmologique ou des tests rénaux mais 30 %, 21 % et 23 % n’ont eu respectivement qu’une seule fois un fond d’œil, un dosage de créatinine ou de la microalbuminurie sur cette période.

Conclusion. – Il s’agit de la première grande étude sur la qualité de soins au cours du DT1 en France. Même si le suivi est meilleur qu’attendu, il peut encore être amélioré.
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Mots clés : Diabète de type 1 ; Spécialiste ; Qualité des soins ; Audit ; Médecin généraliste ; Complications ; France

1. Introduction

Alors que moindre fréquent than type 2 diabetes (T2D), type 1 diabetes (T1D) continues to be a social and economic burden. In France, the most recent epidemiological survey confirmed that TID represents 6.6% of the overall annual prevalence of diabetes among adults over 18 years of age [1]. The true prevalence of T1D is difficult to assess, as most of the data relates to the prevalence of T1D in either adults or children. Nevertheless, each year, about 76,000 children under the age of 15 years develop T1D worldwide [2]. The incidence of T1D in children is increasing by about 3.3% annually [3], doubling every 30 years, with the even steeper increase in younger children. Such an increase in the incidence of T1D in young children has been observed all over Europe [4,5].

Several studies have looked at the management of patients with T2D in France [6], including an evaluation of clinical practices for patients with diabetes (ENTRED; Representative National Cohort of Diabetic Patients) [7], but the latter did not look specifically at patients with T1D as regards diabetes management. Guidelines have been published worldwide on T1D management in adults and in children [8–12], but it is not clear if such recommendations are being implemented in France as data are missing. Thus, the present survey was designed to retrospectively evaluate the quality of care in patients with T1D living in a region in northeast France. This survey could serve as a preliminary study leading to the creation of a national survey to look at the management of patients with T1D across France.

2. Research design and methods

Participants were identified from the local section database of the primary health insurance fund (CPAM; Caisse primaire d’assurance maladie) with the consent of the National Commission for Data Processing and Individual Liberties (CNIL; Commission nationale informatique et libertés, No. 1188088). This local section of CPAM was situated at Vesoul, Haute-Saône, in northeast France, and covered most of the population of the area (164,208 individuals, or 75.9% of the local population), the rest of the population being insured by specific job-related insurers. The survey was designed as an observational cohort study of patients with T1D in 2007–2008.

2.1. Patient selection

The CPAM database identified all individuals who had filled an insulin prescription between January and March 2007. Patients were then selected according to the following criteria, using the ENTRED definition of T1D (diagnosis before age 45 and insulin treatment started less than 2 years after diagnosis), but excluding all individuals over 49 years of age who had not filled an insulin prescription each trimester for the previous 2 years. CPAM application forms for exemption of diabetes care co-payment, when available, were examined for age at diagnosis and date of insulin treatment initiation, thus leading to further patients being excluded. Finally, a committee of nine diabetes specialists (eight diabetologists and one internist), representing all diabetes specialists practising in the area, reviewed the list of names and made corrections, validating patients known to have T1D while excluding others known to not have T1D, based on their personal knowledge of the patients.

2.2. Patients’ questionnaire

All patients still on the list were asked to fill in a questionnaire either by telephone or by post if their phone number was unavailable in the white pages. If neither phone number nor address was available, the questionnaire was sent to the patient’s primary-care physician with a return envelope. The questionnaire was made up of three parts: clinical data (year of diabetes onset and insulin initiation, allowing the T1D diagnosis to be confirmed or the exclusion of more patients, height, weight and smoking habits); laboratory results going back 2 years (HbA1c, creatinine, microalbuminuria); and data on follow-up [healthcare providers, frequency of visits with a diabetologist (as either inpatient or outpatient) and date of last visit, frequency of diabetes-related visits with a general practitioner (GP), frequency of hospitalizations and contact information for the local laboratory]. An open question addressed to individuals who only saw a GP and no diabetologist aimed to clarify the reason. Each patient’s local laboratory, using the contact information given by the patient, provided the biological results for the previous 15 months (January 2007 to April 2008).

For each patient, the CPAM database also provided the frequency of hospitalizations and, on an outpatient basis only, the
number of reimbursed visits with a GP or specialists (diabetologist, internist, paediatrician, ophthalmologist), the frequency of measurement of HbA1c, creatinine and microalbuminuria, and the type of reimbursed prescription drugs (such as insulin and cardiovascular drugs) used during the previous 2 years.

2.3. Optimized results

Hospitalization in a department of endocrinology was systematically taken into account for the ‘optimized results’. Given the possibility that some patients were seen by a diabetologist while hospitalized in another department (such as surgery or cardiology) and that such visits did not appear in the CPAM data, the number of such visits was assessed by the number of visits reported in the questionnaire minus the number of endocrinologist visits reimbursed according to CPAM, provided that hospitalization was recorded during the period. Optimized results therefore included the CPAM-based data plus any other self-reported specialized care. This method was applied to physician visits as well as HbA1c, creatinine and urinary albumin excretion (UAE) evaluations, assuming that, in such conditions, the diabetologist had asked for these tests if they had not been performed recently. This defined the optimized results for the maximum number of patients who did or did not have visits or tests.

2.4. Laboratory results

The number of tests was recorded for all biological assessments (HbA1c, creatinine, UAE). The reported HbA1c level was the mean of all HbA1c values, which was classified as either low (<7.5%), medium (7.5–9.0%) or high (>9.0%). The most recent creatinine value was used to calculate creatinine clearance, using the modification of diet in renal disease (MDRD) formula; estimated glomerular filtration rate (eGFR) was defined as normal (>90 mL/min), medium (60–90 mL/min), low (>30 to 60 mL/min) or very low (≤30 mL/min), excluding dialysis patients from the analysis. The most recent UAE value was used to divide patients into normo-, micro- and macroalbuminuria groups (<30 mg/24 h or <20 mg/L, 30–300 mg/24 h or 20–200 mg/L and >300 mg/24 h or >200 mg/L, respectively).

2.5. Statistical analyses

Patient-reported and laboratory-reported data were analyzed separately. As per the method used in the ENTRED study, percentages were expressed as percentages for the total population without subtraction of the missing data.

3. Results

3.1. Number of patients

A total of 1138 patients with a diagnosis of diabetes before the age of 45 who had filled insulin prescriptions every trimester during the previous 2 years were identified by the CPAM database. However, as some of these patients may have had T2D, the CPAM application forms for co-payment exemptions were analyzed and the list reviewed by diabetologists, thereby reducing the number down to 446. Of these 446 patients, 90 (20.2%) could not be contacted, 15 (3.4%) refused to answer, 21 (4.7%) were dead, 12 (2.7%) had an unusable questionnaire and 81 (18.2%) had another type of diabetes. Thus, 227 individuals, for whom CPAM data were available, were identified as having T1D. A total of 174 (76.7%) questionnaires were obtained by either phone (n = 116; 66.7%) or post (n = 24; 13.8%), or by contacting their GP (n = 32; 18.4%) or through hospital records (n = 2; 1.1%). Optimized results were obtained for 149 patients (85.6%) whose data were provided by CPAM and who had filled in our questionnaire.

Thus, our reference population was 227 patients from the CPAM database, 174 according to the questionnaire and laboratory analyses, and 149 for optimized results (requiring both CPAM data and a completely filled-in questionnaire).

3.2. Patients’ demographics

A few patients answered anonymously by post to account for missing data. The study participants’ demographic data are shown in Table S1 (see supplementary material associated with this article online): they were young (age: 40.6 ± 1.3 years, median: 41 years), with a mean diabetes duration of 21.3 ± 1.0 years (median: 20.5 years; Fig. S1; see supplementary material associated with this article online). Their mean age at diabetes diagnosis was 21 years. Their mean body mass index (BMI) was 24.8 ± 0.5 kg/m² (median: 24.2 kg/m²), with 24 patients (13.8%) considered overweight (BMI: 25–30 kg/m²) and 13 (7.5%) considered obese (BMI: ≥30 kg/m²). There was a slight predominance of male patients (56.6%), and more than one-fifth of these patients were current smokers (21.8%).

3.3. Diabetes care

3.3.1. Physicians

More than two-thirds of the 174 patients reported at least one GP (n = 118, 67.8%) or one diabetologist (n = 127, 73.0%) visit (missing data: n = 13 and n = 5, respectively, or 7.5% and 2.9%, respectively) over the 2-year study period. The number of patients who reported no GP visit (n = 43, 24.7%) was almost the same as the number who reported no specialized follow-up (n = 42, 24.1%). The time interval between two diabetologist visits was greater or equal to 3 months for most patients, whereas the majority visited their GP almost every month (Fig. S2; see supplementary material associated with this article online). On considering the CPAM data (n = 227), 2.6% and 68.3% of the patients saw neither a GP nor diabetologist, respectively, over the 2-year study period.

Optimized results, which included both the CPAM reported visits and in-hospital visits (as assessed by questionnaire) showed that a maximum of 27 patients (18.1%) did not see a diabetologist during the 2-year survey period, and a maximum of six other patients (4.0%) visited a specialist only once over the 2-year period, thereby suggesting that 77.9% of patients with
T1D did see a diabetologist at least once a year. On considering the questionnaire results, it appears that, of the 169 patients who responded, 24.1% stated that they did not see a diabetologist in the previous 2 years and 4.6% reported only one visit during the same time period. This means that 71.3% of patients reported at least one annual visit to a diabetologist.

Fig. S2 (see supplementary material associated with this article online) shows the percentage of GP, diabetologist and assumed in-hospital diabetologist visits, and the optimized results for diabetologist visits over the 2-year survey period. Table 1 summarizes the percentages of patients who fulfilled the French National Health Authority (HAS; Haute Autorité de santé) recommendations [8] in terms of frequency of specialized care visits and laboratory tests.

Compared with the patients who reported no diabetologist visits, the patients who reported such a follow-up were younger (37.5 ± 17.2 vs 50.0 ± 14.4 years; $P = 0.0002$), had a shorter diabetes duration (19.2 ± 13.3 vs 28.9 ± 11.6 years; $P = 0.001$), were more often female (47.6% vs 28.6%; $P = 0.03$), had more HbA1c tests over the 2-year period (2.1 ± 1.5 vs 1.2 ± 1.2; $P = 0.003$) and were more often receiving optimal treatment (see the insulin regimen section below). However, there was no difference between the two populations for self-reported HbA1c values (8.0 ± 1.5% with vs 7.9 ± 1.2% without diabetologist visits). BMI, smoking habits, frequency of kidney function tests and/or eye exams and the prevalence of complications were comparable, although there was a trend towards a higher frequency of albuminuria in patients followed by a diabetologist (32.3% vs 16.7% in those not followed; $P = 0.07$).

### 3.3.2. Hospitalizations (endocrinology and other departments)

Hospitalization was reported once over the 2-year period by 40 patients (23.0%), twice by 13 patients (7.5%) and more than twice by 16 patients (9.2%). Most patients reported no hospitalizations ($n = 99, 56.9%$; missing data: $n = 6, 3.4%$).

### 3.3.3. Insulin regimen

The most common insulin regimens were all-analogue basal–bolus therapy (BBT; $n = 130, 74.7%$), using either insulin glargine ($n = 77, 44.3%$) or insulin detemir ($n = 14, 8.0%$), and continuous subcutaneous insulin infusion (CSII; $n = 39, 22.4%$). Among all patients, 31 (17.8%) used human neutral protamine Hagedorn (NPH) as basal insulin, eight (4.6%) were treated with a premixed insulin analogue and five (2.9%) with premixed human insulin.

Of the 127 patients who reported a follow-up visit with a diabetologist, 105 (82.7%) were receiving optimal treatment (either BBT or CSII), whereas only 22 of the 42 patients (52.4%) who did not see a diabetologist had optimal treatment ($P < 0.0001$; missing data: $n = 5$). There was no difference in the characteristics of patients with or without optimal treatment in terms of age, gender, diabetes duration, BMI, smoking habits and declared HbA1c levels (all $P > 0.1$; data not shown).

### 3.3.4. HbA1c tests

Of the 174 patients, 136 (78.2%) reported at least one HbA1c determination over the 2-year survey period on the questionnaire, with most reporting one to three values ($n = 103, 59.2%$). Only 19 patients (10.9%) reported six or more values (three or more tests annually). The HbA1c was reported as low, medium and high by 56 (32.2%), 59 (33.9%) and 21 (12.1%) patients, respectively, by questionnaire.

Table S2 (see supplementary material associated with this article online) summarizes the laboratory classifications by questionnaire as well as according to laboratory values. HbA1c results for the latter were found for 110 patients (63.2%); 71 patients (40.8%) had one to three values; seven patients (4.0%) had six or more values. The number of low, medium and high HbA1c values was 33 (19.0%), 49 (28.2%) and 28 (16.1%), respectively, according to laboratory reports.

Regarding optimized results, when in-hospital stays were accounted for, it appeared that a maximum of seven patients (4.7%) had no HbA1c measurements, and a maximum of 47 patients (31.5%) had fewer than six HbA1c readings over the 2-year period.

### 3.4. Diabetes complications

#### 3.4.1. Retinopathy

According to the patients’ questionnaires, only one patient (0.6%) had not seen an ophthalmologist over the 2-year survey period.
period (missing data: \( n = 25, \ 14.4\% \)), whereas most patients \( (n = 114; \ 65.5\% \)) had two visits, some had only one visit \( (n = 19, \ 10.9\% \)) and 15 \( (8.6\% \)) had four or more visits over that period of time. Analysis of the patients’ questionnaires showed diabetic retinopathy in 39 \( (22.4\% \) ) cases, and 25 \( (14.4\% \) ) reported a history of laser therapy. Seven patients \( (4.0\% \) ) could not remember the results of their eye exams.

When in-hospital stays were accounted for, optimized results suggested that a maximum of 19 patients \( (12.8\% \) ) had no eye exam, and a maximum of 26 patients \( (17.4\% \) ) had only one ophthalmologist visit over the 2-year study period.

### 3.4.2. Nephropathy

By questionnaire, more than half of the patients reported no measurements of either creatinine \( (n = 98, \ 56.3\% \) ) or albuminuria \( (n = 124, \ 71.3\% \) ) over the 2-year survey period. Of the 76 patients who said they had their creatinine levels tested and of the 50 patients who reported albuminuria measurements, most reported being tested either once \( (n = 44, \ 25.3\% \) for creatinine; \( n = 36, \ 20.7\% \) for UAE) or twice \( (n = 21, \ 12.1\% \) and \( n = 11, \ 6.3\% \), respectively). Very few patients had three values or more \( (n = 11, \ 6.3\% \) and \( n = 3, \ 1.7\% \), respectively), while four patients \( (2.3\% \) ) were on dialysis.

As for eGFR values, these could be calculated for 69 patients \( (39.7\% \) ), and were normal, medium, low or very low in 33 \( (19.0\% \) ), 31 \( (17.8\% \) ), five \( (2.9\% \) ) and no patients, respectively. Normo-, micro- and macroalbuminuria were also reported by 41 \( (23.6\% \) ), eight \( (4.6\% \) ) and one \( (0.6\% \) ) patient(s), respectively.

According to laboratory reports, creatinine and UAE results were available for 82 \( (47.1\% \) ) and 53 \( (30.5\% \) ) patients, respectively. These tests were done once for most of our patients \( (n = 44, \ 25.3\% \) and \( n = 38, \ 21.8\% \) for creatinine and UAE, respectively). It was also confirmed that very few patients had three values or more \( (n = 14, \ 8.0\% \) and \( n = 1, \ 0.6\% \), respectively). Also, these test results were similar to those reported in the questionnaires (Table S2; see supplementary material associated with this article online).

As for eGFR values, these could be calculated for 82 patients \( (47.1\% \) ), and were normal, medium, low or very low in 35 \( (20.1\% \) ), 37 \( (21.3\% \) ), six \( (3.4\% \) ) and four \( (2.3\% \) ) patients, respectively. UAE results were found for 52 patients, with normo-, micro- and macroalbuminuria being present in 41 \( (23.6\% \) ), nine \( (5.2\% \) ) and two \( (1.2\% \) ) patients, respectively.

Regarding optimized results, when in-hospital stays were accounted for, it appeared that a maximum of 16 and 17 patients \( (10.7\% \) and \( 11.4\% \), respectively, had no creatinine or UAE measurements over the 2-year survey period. The same number of patients \( (16 \) and \( 17 \) ) had only one value for either parameter over the 2-year study period.

### 3.4.3. Amputation

Two patients \( (1.1\% \) ) reported below-the-knee amputation, which was bilateral in one case.

### 3.4.4. According to HbA1c

There was no difference in the frequency of HbA1c testing in patients with complications vs those without retinopathy, nephropathy or amputation \( (all \ P > 0.1; \ data \ not \ shown) \). Furthermore, there was no difference in the prevalence of complications according to levels of HbA1c \( (whether \ low, \ medium \ or \ high, \ all \ P > 0.5; \ data \ not \ shown) \).

### 4. Discussion

The Diabetes Control and Complications Trial (DCCT)/Epidemiology of Diabetes Interventions and Complications (EDIC) study showed the importance of tight glucose control in patients with T1D for preventing both microvascular [13] and macrovascular [14] complications. However, tight glycaemic control is often difficult to achieve in patients with T1D because of the fear of hypoglycaemia [15]. Furthermore, diabetes management often requires technical skills from healthcare providers such as carbohydrate counting [16], and CSII [17] is more and more frequently being used. Also, newer technologies, including continuous glucose monitoring (CGM), are occasionally implemented, as their efficacy has been proven in some situations [18], although financial coverage remains an obstacle; studies are now needed to help convince health authorities to cover the best available care using these new technologies [19]. Thus, data for diabetes care in patients with T1D are important for improving the management of such patients and to offer them their best chances of avoiding complications while providing the best quality of life possible.

Yet, data related to the follow-up of patients with T1D in France are rare, and this is the first study into the topic that could become a preliminary step towards a national survey to optimize the management and care of patients with T1D.

The most recent relevant data were the results of the ENTRED study [20], which was performed first in 2001 and more recently in 2007, using basically the same methodology as our present survey, although it was designed to be nationwide, and included both patients with T2D and T1D \( (n = 3894 \) and \( n = 275 \), respectively, in the 2007 survey). Compared with the ENTRED population of T1D patients, our present population was slightly younger \( (40.6 \ vs \ 42 \ years \ of \ age) \), but had a longer duration of diabetes \( (21 \ vs \ 17 \ years) \). However, the mean BMI was similar between the ENTRED survey and our present one \( (25.0 \ vs \ 24.8 \ kg/m^2) \). Yet, the percentage of overweight and obese patients in the ENTRED study was almost double ours \( (30\% \ and \ 14\% \ vs \ 13.8\% \ and \ 7.5\% \), respectively), suggesting a wider distribution of BMIs in the present study, albeit with the high rate of missing values.

One interesting point is that 71.3\% of patients in an essentially rural area had seen a diabetologist at least once a year. This was considerably more than the 31\% reported in the ENTRED study [21], although it should be noted that those results accounted for specialized care during hospitalizations that was comparable to our optimized results. Furthermore, CPAM data suggested that only 31.7\% of patients received specialized care, thereby revealing the limitations of results based solely on the CPAM database. Specialized care also appears to be more prevalent in France than in other countries such as Germany, where a survey of an adolescent population showed that, directly following the transition from paediatric care, 20.5\% had
no specialized follow-up, a rate that increased to 33.3% 5 years later [22].

Thus far, there has been no published study comparing the demographics and quality of care of T1D patients according to their management by GPs or specialists. In our present survey population, patients who were followed by an endocrinologist were more often younger and female, with shorter diabetes duration and optimal treatment. When care was provided in a specialized setting, the HbA1c test frequency was twice that with GP follow-up (2.1 vs 1.2 tests over a 2-year period), although both frequencies were far from the French guideline recommendations of four yearly assessments in patients with T1D [8]. However, when in-hospital stays were accounted for, 68.5% of patients had three assessments or more per year. The rate of complications was the same whatever the rate of follow-up, with a trend towards a higher frequency of albuminuria in patients receiving specialized care despite shorter duration of diabetes. This suggests that the patients being managed by specialists might have had more ‘brittle’ diabetes and/or poorer disease control over the past few years.

Nevertheless, it should be noted that almost 57% of patients reported no hospitalizations over the 2-year period, and that diabetes may not have been the cause of hospital admission in many cases, as causes were mostly unknown. This confirms the current extent of outpatient care for those with T1D at the time of diagnosis [23] and of CSII implementation [24].

Optimal treatment of T1D has been all-analogue BBT with multiple daily injections (MDI) or CSII [25], with separate indications for each technique [26]. BBT was, in fact, used by 74.7% of patients, with a repartition of 30% using CSII and 70% MDI. The global rate of patients treated with an insulin pump in our present study population (22.4%) was between what has been reported in France in paediatric (18%) and non-paediatric (32%) diabetes centres [27]. However, it should be noted that 25.3% of patients were still using NPH-based regimens in 2007, although BBT had been shown to be superior to NPH-based regimens especially when compared with the high 25-year cumulative incidence of 11.4% for stage 3 chronic kidney disease (CKD) reported in the DCCT/EDIC study [33] in which, interestingly, 24% of the patients with CKD did not have an elevated UAE. This emphasizes the importance of testing both the eGFR and UAE in patients with T1D on a yearly basis. In addition, the percentages of results values in the different categories were similar whether from the questionnaires or laboratory values, indicating that patients were mostly aware of their health status.

The relatively high percentages of patients for whom no creatinine and UAE measurements were found (52.9% and 69.5%, respectively) could be reduced to 10.7% and 11.4%, respectively, by using optimized results, although these rates were doubled (21.4% and 22.8%, respectively) when patients with only one test over the 2-year period were considered. Furthermore, more than half (47 out of 82) of the patients for whom test results could be found had lower-than-normal estimated kidney function (10 had a low or very low eGFR), while an elevated UAE rate was found in 11 of the 52 patients with available results. This is consistent with the 19-year cumulative incidence of 11.4% for stage 3 chronic kidney disease (CKD) reported in the DCCT/EDIC study [33] in which, interestingly, 24% of the patients with CKD did not have an elevated UAE. This emphasizes the importance of testing both the eGFR and UAE in patients with T1D on a yearly basis. In addition, the percentages of results values in the different categories were similar whether from the questionnaires or laboratory values, indicating that patients were mostly aware of their health status.

The amputation rate was very low (1.1%) in our survey, especially when compared with the high 25-year cumulative incidence of 10.1% reported in the patients with T1D included in the WESDR [34].

Also, in our present population, there was no difference in the prevalence of complications according to HbA1c levels. However, ours was not a longitudinal study, but a cross-sectional study aiming to describe diabetes care in patients with T1D. It has been clearly shown, beyond doubt, that tight glucose control is crucial for preventing complications. Furthermore, recent data have shown that tight control is necessary at an early stage of T1D and that it needs to be sustained over time, as the beneficial effects of intensive treatment will wane if HbA1c levels rise [35]. However, there were no available data on past glucose control for our present survey population to explain the prevalence of complications. Moreover, missing data precluded any conclusions as to the true rate of complications.

As with any retrospective survey, our present study had limitations. The main one was the selection of patients based on CPAM data and filled-prescription reports. As a result, only 20% of insulin-treated patients were considered to have T1D. However, some patients may have stored insulin at home and refilled their prescriptions less than once every trimester. Thus,
it is possible that some T1D patients were wrongly excluded from our survey and that—albeit much less likely—some non-T1D patients were included, despite our use of the most accurate method of patient selection that we could define. In addition, some data were missing for the patients’ weight and BMI. Finally, regarding optimized results, it is possible that the patients’ questionnaires included visits or tests that were done prior to the study period. However, looking at the optimized results for specialist visits, their use did not increase questionnaire values in any meaningful way (+15% and +7% for “more than an annual visit” to the endocrinologist and ophthalmologist, respectively).

5. Conclusion

The present study was the first in France to provide data on diabetes care in patients with T1D in a specific region. Although it had the same limitations as any other survey, it showed that most T1D patients (73%) did have specialized follow-up, mostly as outpatients. Such specialized follow-up was mainly associated with an optimal insulin regimen and a greater frequency of HbA1c testing. Eye examinations and kidney tests were also performed at least once over the 2-year period in over 87% of patients, although around 30%, 21% and 23% of patients had an eye examination, creatinine test and UAE measurement, respectively, only once over this same time period. Thus, although the follow-up of patients with T1D in our study was better than previously reported, there is still room for improvement. Ideally, a larger study should be designed to see if our present results are applicable to other regions in France.

Disclosure of interest

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S.P. is a medical writer/consultant for Eli Lilly, Medtronic, Novo Nordisk and Sanofi-Aventis.

Appendix A. Supplementary data

Supplementary material (Figs. S1 and S2, and Tables S1 and S2) associated with this article can be found at http://www.sciencedirect.com at http://dx.doi.org/10.1016/j.diabet.2012.04.006.

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