Patterns of prescription of hypoglycaemic drugs in Gran Canaria (Canary Islands, Spain) and estimation of the prevalence of diabetes mellitus

PL de Pablos-Velasco¹, FJ Martínez-Martín¹, R Molero²; F Rodríguez-Perez³, I García-Puente¹, A Caballero⁴

SUMMARY

Objective: To study the patterns of hypoglycaemic treatment in our community and to estimate the prevalence of known and drug-treated diabetes mellitus.

Methods: From all the diabetic patients who attended the Healthcare Centers of the National Health Service in Gran Canaria in 1999, a random sample of 2924 diabetic patients > 20 years old was selected. Data on age, gender, clinical onset of diabetes, and hypoglycaemic treatment were obtained. Data on drug consumption were supplied by the National Health Service.

Results: Of the DM-2 patients 4.4% (3.65-5.14) 84.2% (82.77-85.42), 9.4% (8.34-10.45) and 2.1% (1.58-2.61) received diet only, oral drugs, insulin or combination. The duration of DM-2 was associated with more oral drugs and more insulin treatment, but the duration of DM-1 was not associated with intensive insulin therapy: < 50% of the type 1 patients had 3 daily injections. The prescriptions of biguanides were scarce; over 1/3 of them were of buformin. DM-1 and DM-2 patients were treated with similar doses of insulin, but DM-1 patients had more insulin injections (2.56 vs 2.07, P < 0.001), and more fast-acting insulins (65.2% vs 38.0%, P < 0.001). The estimated prevalences of known and drug-treated diabetes in the Gran Canaria island were 5.95% (95% CI: 5.09-6.80%) and 5.73% (4.88-6.57%).

Conclusions: Our prevalences of known and drug-treated diabetes is among the highest reported in European populations. The prescriptions of metformin and of combined therapy in DM-2, and of intensive insulin therapy in DM-1 are less frequent than expected, but nonetheless insulin therapy in DM-1 is more intensive and uses more fast-acting insulin than in DM-2.

Key-words: Epidemiology · Prevalence · Diabetes · Treatment · Oral hypoglycaemic drugs.

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RÉSUMÉ

Modalités de prescription des médicaments hypoglycémiant et estimation de la prévalence du diabète à Gran Canaria (Iles Canaries, Espagne)

Objectifs : Étudier les modalités du traitement hypoglycémiant à Gran Canaria et estimer la prévalence du diabète connu et traité par médicaments.

Méthodes : À partir de tous les patients diabétiques qui sont venus dans les Centres médicaux du Service national de Santé de Gran Canaria en 1999, un échantillon randomisé de 2 924 patients diabétiques âgés de 20 ans et plus a été constitué. Les données concernant l’âge, le sexe, les circonstances de découverte du diabète, et le traitement hypoglycémiant ont été recueillies. Les données sur la consommation de médicaments ont été fournies par le Service national de Santé.

Résultats : Parmi les patients diabétiques de type 2, 4.4 % (IC 95 % : 3.7-5.1 %), 84.1 % (82.8-85.4 %), 9.4 % (8.3-10.5 %) et 2.1 % (1.6-2.6 %) recevaient respectivement un traitement hygiéno-diététique seul, des antidiabétiques oraux (ADO), de l’insuline, et une combinaison ADO et insuline. La durée du diabète de type 2 était associée à davantage d’ADO et davantage d’insuline, alors que la durée du diabète de type 1 n’était pas associée à une intensification du traitement insulinique. Un peu moins de 50 % des patients diabétiques de type 1 avaient 3 injections par jour. La prescription de biguanides était rare et dans 1/3 des cas il s’agissait de buformine. Les patients diabétiques de type 1 et les patients diabétiques de type 2 étaient traités avec des doses d’insuline similaires, mais les patients diabétiques de type 1 avaient davantage d’injections d’insuline (2.56 vs 2.07, P < 0.001), et davantage d’insuline d’action rapide (65.2 % vs 38.0 %, P < 0.001). Les prévalences estimées de diabète connu et traité par médicaments à Gran Canaria étaient de 5.95 % (5.09-6.80 %) et 5.73 % (4.88-6.57 %).

Conclusion : Les prévalences du diabète connu et traité par médicaments dans l’île de Gran Canaria sont parmi les plus élevées des populations européennes. Les prescriptions de metformine et de traitement combinant ADO et insuline dans le diabète de type 2, et de traitement insulinique intensif dans le diabète de type 1 sont moins fréquentes qu’attendu. Cependant, dans le diabète de type 1, le traitement insulinique est plus intensif et fait davantage appel aux insulines d’action rapide que dans le diabète de type 2.

Mots-clés : Épidémiologie · Prévalence · Diabète · Traitement · Antidiabétiques oraux.

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Introduction

The burden of diabetes mellitus and its complications is increasing worldwide, and more markedly in the recently developed regions, or those that underwent sudden and profound changes in their lifestyle [1-3]. A population study in the community of Guía in Gran Canaria has shown that the prevalence of diabetes mellitus (DM) is 18.7% (12.4% adjusted), among the highest ever reported in Europe [4]. Also, the prevalence of end-stage diabetic nephropathy is the highest in Spain [5].

The results of the DCCT [6] and the UKPDS [7] trials proved that intensive glycaemic control can delay or prevent the microvascular complications of DM in type 1 and type 2 diabetic patients, respectively, and therefore the present guidelines for the treatment of DM have emphasized the importance on intensive treatment. On the other hand, the knowledge of the actual patterns of treatment is necessary to assess the degree of compliance with the guidelines for the management of DM in the actual medical practice, and to find out how to improve it.

The pattern of hypoglycaemic treatment (especially on type 2 DM) tends to change markedly along with the time course of the disease. Several studies have reported the patterns of hypoglycaemic treatment in the diabetic population [8-14] but the available information on the change of these patterns with the evolution of the disease is very scarce.

As a part of a comprehensive study on the prevalence of DM and the status of diabetic patients in our community, we undertook a pharmacoepidemiologic study in order to define the patterns of treatment in type 1 and type 2 DM as a function of the time course of the disease, and also in order to establish the prevalence of drug-treated DM in the whole Gran Canaria island. As the drugs prescribed for diabetic patients are specific for the disease, the prevalence of known diabetes can be estimated from drug consumption data [15].

Methods

Gran Canaria is an Atlantic island with 713,768 inhabitants, 516,238 of which were over 20 years old in 1996. The National Health Service (NHS) provides health insurance for 100% of the resident population; furthermore, the NHS finances between 70% and 100% (for the retired or incapacitated) of the cost of hypoglycaemic drugs. The General Practitioners (GP) are responsible for most of the prescriptions of these types of drugs. They are distributed through 40 Basic Healthcare Areas, each based in a Primary Healthcare Centre.

Patients: A sample of 2,924 patients with DM aged 20 years or older was recruited by 40 GPs or nurses during 1999. Patients were chosen randomly from those who attended the Primary Healthcare Centres of the National Health Service (NHS) in Gran Canaria during 1999.

The number of subjects to be studied for a stratified sampling was calculated assuming a prevalence of diabetes (obtained from the population study of Guía) of 2.7, 18.7 and 41.2% (in women) and 7.8, 19.8 and 23.6% (in men), for the age intervals of 20-44 years, 45-64 years and 65 years or older [4]; as there were no previous data for the prescribed daily doses (PDD) of insulin and oral hypoglycaemics, we used the published data from Laure Papoz and the EURO-DIAB Subarea C Study Group [15] for dose calculation. The total number of subjects (2,924) was calculated in order to obtain a 95% confidence interval for the PDD of each drug not exceeding 2% of the mean PDD for each drug.

The patients with diabetes were interviewed in the 40 Basic Healthcare Areas; the number of patients to be interviewed in each Area was calculated depending on the total population cared for in each Primary Healthcare Center, for each interval of age and sex, in order to maintain representativity of the estimated population of diabetic patients. The data were retrieved from both the clinical records and the interview with the patient. The patients were recruited in the primary care offices during the whole year in order to avoid seasonal biases (possible variations in the use of hypoglycaemics during the year, due to seasonal changes in the patterns of diet and exercise); that is, the number of interviews for each month was prearranged for each Healthcare Center.

The Pharmaceutical Department of the National Health Service (NHS) provided us with the consumption data of all oral hypoglycaemic drugs and insulins in Gran Canaria during 1999; these data included only the patients receiving treatment through the NHS (100% of the residential population), thus excluding the consumption by tourists and floating population.

Once the actual PDD values for each hypoglycaemic drug in our community were obtained, the prevalence of diabetes mellitus was calculated from these values and the total drugs consumption data, as proposed by Papoz [15], (see Appendix)

The physicians and the nurses performing the procedures were especially trained for this study. The following information was requested from each subject: name, age, gender, date of the clinical onset of diabetes and current therapy for diabetes.

The study design was reviewed and approved by the Ethics Committee for Clinical research of our Hospital. All subjects gave their informed consent for the study.

The subjects were considered as having DM if they had been previously diagnosed by their physician as diabetics and were taking hypoglycemic drugs or were on dietary therapy for diabetes.

Type 1 diabetes was defined by clinical criteria: onset before 30 years of age and needing insulin to avoid ketosis.
Type 2 diabetes was defined by onset after 30 years of age, not needing insulin to avoid ketosis.

Numerical variables are summarized as mean ± standard deviation. All statistical analyses were performed with the SPSS 10.0 software package (SPSS Inc., Chicago, Illinois, USA, 1999). Standard chi-square tests were used to establish the homogeneity of discrete variables. The significance level was P < 0.05.

Results

Global patterns of treatment

The characteristics of the 2,924 diabetic patients studied are shown in Table I. Their mean ages were 34.3 ± 10.7 (type 1 DM) and 60.5 ± 12.8 (type 2 DM) years. Their mean known durations of DM were 8.6 ± 7.1 (type 1 DM) and 11.8 ± 8.0 (type 2 DM) years. There were 59.9% (1751), 9.5% (276), 17.3% (504) and 25.3% (739) of the patients who were treated with secretagogues, biguanides, alpha-glucosidase inhibitors and insulin respectively. There were 60.9% (1782), 11.0% (322) and 1.2% (35) treated with one, two or three oral agents, respectively. 7.1% (208) were treated with secretagogues plus alpha-glucosidase inhibitors, 3.7% (109) were treated with secretagogues plus biguanides, 5 (0.2%) were treated with biguanides plus alpha-glucosidase inhibitors; 1.2% (35) were treated with secretagogues plus biguanides plus alpha-glucosidase inhibitors.

In this study, 15.6% of the patients had type 1 diabetes and 84.4% had type 2 diabetes.

Patterns of treatment in type 1 diabetes mellitus

The characteristics of the 457 type 1 diabetic patients studied are shown in Table I. The mean daily dose of insulin was 43.3 ± 15.4 I.U. The number of insulin injections per day was one in 2.0%, two in 48.6%, three in 40.9%, four in 8.3% and five in 0.2%; no patients used insulin pumps. The mean number of insulin injections per day was 2.56. There was no association between the mean time since diagnosis and the number of insulin injections per day. 65.2% (298) of the type 1 diabetic patients were treated with regular insulin or fast-acting insulin analogues plus NPH or NPL (Neutral Protamine Lys-Pro), and 34.8% (159) were treated with NPH or NPL only.

Patterns of treatment in type 2 diabetes mellitus

The characteristics of the 2,467 type 2 diabetic patients studied are shown in Table I. Of those 71.7% (1770), 13.1% (322) and 1.4% (35) of the patients were treated with one, two or three hypoglycaemic drugs respectively. The number of oral hypoglycaemic drugs was positively and significantly associated with the mean time elapsed since the diagnosis of diabetes (Table II), (P < 0.001, trend analysis).

The mean daily dose of insulin was 42.0 ± 14.3 I.U. The number of insulin injections per day was one in 6%, two in 78.8%, three in 13.8% and four in 0.4% in the insulin-treated type 2 diabetic patients. Of those, 2.1% (51) were also on treatment with oral hypoglycaemic drugs. The mean number of insulin injections per day was 2.07. There was no association between the mean time since diagnosis and the number of daily insulin injections. 38% (107) were treated with regular insulin (or fast-acting insulin analogues) plus NPH or NPL and 62% (175) were treated with NPH or NPL alone.

Of the type 2 diabetic patients who had less than 5, between 5 and 10, and over 10 years elapsed since diagnosis, there were 2.1%, 7.8% and 34.1% on insulin treatment, respectively; there was a positive and highly significant association between time since diagnosis and insulin treatment (P < 0.001).

Table I

Characteristics of the 2,924 diabetic patients studied.

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Type 1 DM</th>
<th>Type 2 DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>2924</td>
<td>457</td>
<td>2467</td>
</tr>
<tr>
<td>Gender (% male)</td>
<td>49.4%</td>
<td>67.6%</td>
<td>46.0%</td>
</tr>
<tr>
<td>age (years)</td>
<td>56.4 ± 15.8</td>
<td>34.2 ± 10.7</td>
<td>60.5 ± 12.8</td>
</tr>
<tr>
<td>Duration (years)</td>
<td>8.6 ± 7.1</td>
<td>11.8 ± 8.0</td>
<td>7.5 ± 6.0</td>
</tr>
<tr>
<td>&lt; 5</td>
<td>43.0%</td>
<td>24.5</td>
<td>46.4%</td>
</tr>
<tr>
<td>6-10</td>
<td>25.3%</td>
<td>28.0%</td>
<td>24.8%</td>
</tr>
<tr>
<td>&gt;10</td>
<td>31.8%</td>
<td>47.5%</td>
<td>28.9%</td>
</tr>
<tr>
<td>DIET ALONE</td>
<td>3.7%</td>
<td>0%</td>
<td>4.4%</td>
</tr>
<tr>
<td>OAD ALONE</td>
<td>71.0%</td>
<td>0%</td>
<td>84.1</td>
</tr>
<tr>
<td>INSULIN ALONE</td>
<td>23.1%</td>
<td>87.4%</td>
<td>9.4%</td>
</tr>
<tr>
<td>OAD+INSULIN</td>
<td>2.2%</td>
<td>12.6%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>
There were no differences in the daily insulin dosage between type 1 and type 2 diabetic patients, but both the number of daily insulin injections and the use of regular insulin (or fast-acting analogues) were significantly higher in type 1 diabetic patients (P < 0.001).

Estimation of the prevalence of diabetes mellitus, and patients treated with each drug

The mean value of the different prescribed daily doses, the number of patients used for calculation of the PDD and the data on consumption in mg/year (I.U./year for insulin) are shown in Table III. According with these data and using the method proposed by Papoz [15] the prevalence of drug-treated diabetes mellitus was 5.73% (95% CI: 4.88-6.57%), with an estimated total of 40,899 drug-treated diabetic patients, the estimated number and percentage of diabetic patients treated with each drug is also given in Table III. The estimated number of drug-treated type 1 diabetic patients was 6,380 (0.89% of the population) and of drug-treated type 2 diabetic patients was 34,519 (4.84% of the population). As 100% of the known type 1 diabetic patients are drug-treated, the number of known and drug-treated patients is the same. On the other hand, only 95.6% of the type 2 diabetic patients were drug-treated, thus the estimated number of known type 2 diabetic patients was 34,519/0.956, i.e. 36,108 (5.06% of the population, with a total estimated prevalence of known diabetes mellitus in the whole Gran Canaria population of 5.95% (5.09-6.80%).

Discussion

This is the first study of the prevalence of diabetes mellitus in the Canary Islands and in Spain based on hypoglycaemic treatment consumption which used a calculation of

### Table II

Relationship between number of oral hypoglycaemic drugs (OAD) and time since diagnosis of type 2 diabetes mellitus, excluding patients on diet only or with insulin treatment.

<table>
<thead>
<tr>
<th>Number of OAD</th>
<th>&lt;5</th>
<th>6-10</th>
<th>&gt;10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>96.9% (979)</td>
<td>80.5% (450)</td>
<td>57.8% (293)</td>
<td>1722</td>
</tr>
<tr>
<td>2</td>
<td>2.7% (27)</td>
<td>17.5% (98)</td>
<td>38.5% (195)</td>
<td>320</td>
</tr>
<tr>
<td>3</td>
<td>0.4% (4)</td>
<td>2.0% (11)</td>
<td>3.7% (19)</td>
<td>34</td>
</tr>
<tr>
<td>Total</td>
<td>100% (1010)</td>
<td>100% (559)</td>
<td>100% (507)</td>
<td>2076</td>
</tr>
</tbody>
</table>

There are highly significant differences in the number of oral hypoglycaemic drugs in relationship with the time since diagnosis of DM-2 (P < 0.001, trend analysis).

### Table III

Hypoglycaemic drugs: calculated prescribed daily dose (mean ± SD), total consumption and estimated number (and percentage) of drug-treated patients for each drug.

<table>
<thead>
<tr>
<th>Drug (number of questionnaires)</th>
<th>PDD (mg/day; U.I/day for insulin)</th>
<th>Total consumption (mg; U.I for insulin)</th>
<th>Estimated number of treated patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorpropamide (33)</td>
<td>564.39 ± 177.11</td>
<td>52,282,500</td>
<td>254 (0.6%)</td>
</tr>
<tr>
<td>Tolbutamide (7)</td>
<td>285.71 ± 94.49</td>
<td>7,990,000</td>
<td>77 (0.2%)</td>
</tr>
<tr>
<td>Glibenclamide (998)</td>
<td>11.57 ± 4.08</td>
<td>52,798,650</td>
<td>12,502 (30.6%)</td>
</tr>
<tr>
<td>Gliclazide (256)</td>
<td>143.75 ± 63.36</td>
<td>136,576,000</td>
<td>2,603 (6.4%)</td>
</tr>
<tr>
<td>Glipizide (109)</td>
<td>10.83 ± 4.54</td>
<td>3,957,500</td>
<td>1001 (2.4%)</td>
</tr>
<tr>
<td>Gliptinamide (13)</td>
<td>12.31 ± 3.88</td>
<td>252,900</td>
<td>56 (0.1%)</td>
</tr>
<tr>
<td>Gliquidone (32)</td>
<td>65.62 ± 24.02</td>
<td>7,866,000</td>
<td>328 (0.8%)</td>
</tr>
<tr>
<td>Glimepiride (213)</td>
<td>2.40 ± 1.84</td>
<td>4,357,600</td>
<td>4974 (12.2%)</td>
</tr>
<tr>
<td>Repaglinide (80)</td>
<td>4.04 ± 1.57</td>
<td>35,500</td>
<td>24 (0.1%)</td>
</tr>
<tr>
<td>Buformin (46)</td>
<td>209.78 ± 84.73</td>
<td>180,913,000</td>
<td>2,363 (5.8%)</td>
</tr>
<tr>
<td>Metformin (230)</td>
<td>1443.15 ± 400.14</td>
<td>2,556,617,000</td>
<td>4,854 (11.9%)</td>
</tr>
<tr>
<td>Acarbose (463)</td>
<td>238.93 ± 88.05</td>
<td>319,204,500</td>
<td>3,660 (8.9%)</td>
</tr>
<tr>
<td>Miglitol (41)</td>
<td>243.29 ± 84.04</td>
<td>18,645,000</td>
<td>210 (0.5%)</td>
</tr>
<tr>
<td>Insulin (739)</td>
<td>42.81 ± 15.15</td>
<td>182,241,474</td>
<td>10,347 (25.3%)</td>
</tr>
</tbody>
</table>
the prescribed daily dose (PDD) and a sampling technique with stratification by age and gender, in order to maintain the representativity of the studied diabetic population. Most of the studies carried out in our country are also based on drug consumption, but the calculation of prevalence is almost always based on the defined daily dose (DDD); only in one of them [9] were the PDD’s calculated, but the population was not stratified. Also, this is one of the first prevalence studies in which the patterns of treatment are detailed for both type 1 and type 2 diabetic patients, and their differences according to the known duration of the disease have been studied.

The stratification did not include diabetic patients younger than 20 years of age but in this age group the proportion of type 2 patients and the consumption of oral hypoglycaemic drugs were negligible. Previous data show that in our community the prevalence of type 2 diabetes is very high (12.7% after age adjustment, WHO 1985 criteria), while the prevalence of type 1 diabetes is quite low [4]. The daily doses of insulin during the paediatric age tend to be lower than in adolescents and adults, thus our calculated prevalence of type 1 diabetes may be slightly underestimated.

According to our study the prevalence of drug-treated diabetes mellitus in our community is much higher than those previously estimated [8] in 1988 (1.73%). This is probably due to several reasons: there were methodological differences (the aforementioned prevalences were based on DDD), the prevalence of diabetes mellitus is increasing dramatically worldwide [1-3], and also, the healthcare services have improved greatly in the last few years in our community, resulting in earlier detection and treatment of diabetic patients.

Comparing the present data with the study recently carried out in the council of Santa María de Guía [4] the prevalence is lower, but again the methods are quite different. In the Guía Study, the prevalence of diabetes mellitus was assessed by OGTT on a population basis, which allowed both the prevalence of known and unknown diabetes to be established, while the present data are based on hypoglycaemic drug consumption and only allow us to establish the prevalence of known diabetes. We have calculated a prevalence of drug-treated diabetes of 5.73%, and in the questionnaire the prevalence of diabetes treated only with diet and exercise was 3.69%. Considering that in the majority of the epidemiological studies the prevalence of undiagnosed diabetes is close to 50% of the total prevalence, the present data are closely concordant with those of the Guía Study.

Comparing our study to different studies carried out with similar methods in other communities of Spain [9-10] and Europe [1,15], we find that our prevalence is among the highest ever reported in Spain (3.35% and 4.41%) and Europe (3%) but somewhat lower than the one reported in the U. S. (6.9%) [3]. Our high prevalence seems to be related to the strikingly high prevalences of obesity and central obesity in our community: 36.5%/66.5% in women, and 23.6%/32.0% in men [16], and to the recent and rapid change from a primary (agriculture and fishing) to a tertiary (tourism and services) economy, while the possible genetic influence has not been studied so far [4].

One of the most striking aspects of the present data is the difference among habits of treatment. In the studies carried out in Avila, Spain [9] in 1993 and in Stockholm, Sweden [13] in 1995, the percentages of known diabetic patients treated only with diet and exercise were 52% and 20%, much higher than in our community, which possibly indicates a trend for an earlier drug treatment when non pharmacological therapy fails, as recommended by most of the current guidelines [17-18]. On the other hand, the sampling in all these studies was based in patients attending clinics, and as the frequency of attendance may be expected to be lower in non-drug treated patients, the prevalence of non drug-treated diabetes mellitus may be underestimated.

Concerning the type of oral hypoglycaemic drugs, the most remarkable finding is the lower use of metformin when compared to other studies [11], despite the high prev-
alence of obesity in our community [16] and the fact that after the UKPDS study, metformin became the first-choice oral hypoglycaemic drug for obese patients [19]. We were also concerned by the relatively high use of buformin, a biguanide with better gastrointestinal tolerance than metformin, but with a substantially higher risk of causing severe lactic acidosis; its use has not been recommended by the European Association for the Study of Diabetes since 1988, and has been banned in the U.S. by the FDA.

The DCCT study [6] proved conclusively that in type 1 diabetic patients, intensive insulin treatment, with at least 3 daily injections, significantly reduces the risk of diabetic complications. Nevertheless, in our study only 49.4% of the patients with type 1 diabetes were receiving 3 or more daily insulin injections, a figure much lower than in other European studies [13]. In our community almost all type 1 diabetic patients have access to specialised care by endocrinologists, able and motivated to prescribe intensive insulin treatment, and with no financial restrictions to do so (except for the case of insulin pumps), but the main obstacle for generalised use of intensive insulin therapy are the limitations (intellectual, emotional, physical or motivational) of the patients themselves. This is not surprising, because intensive insulin treatment is quite challenging for diabetic patients, as the experience from the recruitment phase of the DCCT trial demonstrated: most of the candidates had to be rejected [20].

In conclusion, the estimated prevalence of known diabetes in the Gran Canaria island is 5.95%, among the highest in European populations and concordant with the high prevalence previously shown in the northern Gran Canarian council of Guia. Almost all known type 2 diabetic patients are drug-treated, and their treatment tends to become more complex over time, with a much larger proportion of them on insulin treatment when their duration of known diabetes is over 10 years; however, the use of combinations of insulin and oral hypoglycaemic drugs is very scarce; biguanides are underused, in spite of the high prevalence of obesity, and surprisingly about 1/3 of the prescriptions of biguanides are of buformin, which is deemed unsafe and not recommended. Type 1 diabetic patients have more daily injections of insulin and use a larger proportion of fast-acting insulins than their type 2 counterparts, but the proportion of these patients in intensive treatment is disappointingly low (less than 50% on three or more daily injections), in spite of the fact that they have free access to specialized care.

References