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## BRIEFS ORIGINALS

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### Patients in Nursing Homes: type 2 diabetes mellitus prevalence and its pharmacologic therapy

#### Prevalencia de diabetes mellitus tipo 2 y su tratamiento farmacológico en personas institucionalizadas en centros residenciales

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## Abstract

**Objective:** To determine type 2 diabetes mellitus prevalence, clinical features, specific pharmacologic treatment and problems faced in nursing home patients.

**Method:** Observational, cross-sectional study conducted in March 2019 in six nursing homes, examining persons diagnosed with type 2 diabetes mellitus. Demographic, clinical and biochemical variables, specific pharmacologic therapy and hypoglycemia events as well as falls during the previous year were collected.

**Results:** Prevalence of type 2 diabetes mellitus was 21.7%. 70.90% of the patients had glycated hemoglobin  $\leq$  7% last year, with 92% of the patients having a moderate-severe frailty. 0.4 hypoglycemia/resident-year were found, being more frequent in patients receiving insulinization and in those with impaired renal function. However, no further falls were found in insulinized patients ( $p > 0.05$ ). Diabetes therapy was adequate according to treatment recommendations for the elderly.

**Conclusions:** Prevalence of type 2 diabetes is slightly lower than that found in the literature, finding a strict control of the disease and an appropriate pharmacotherapeutic adequacy according to the recommendations by the European Diabetes Working Party for Older People. Insulinized patients and those with impaired renal function have a higher risk of hypoglycemia.

## Resumen

**Objetivo:** Determinar la prevalencia de diabetes mellitus tipo 2 y sus características clínicas, tratamiento farmacológico específico y problemas derivados en personas institucionalizadas en centros residenciales.

**Método:** Estudio observacional, transversal llevado a cabo en marzo de 2019 en seis centros residenciales en personas con diagnóstico de diabetes mellitus tipo 2. Se recogieron variables demográficas, clínicas y bioquímicas, tratamiento farmacológico específico y eventos de hipoglucemia y caídas el año anterior.

**Resultados:** La prevalencia de diabetes mellitus tipo 2 fue del 21,7%. El 70,90% de los pacientes tuvieron una glucohemoglobina  $\leq$  7% el último año, mostrando el 92% de los pacientes una fragilidad moderada-severa. Se encontraron 0,4 hipoglucemias/residente-año, siendo más frecuentes en pacientes insulinizados y en aquellos con función renal deteriorada. Sin embargo, no se encontraron más caídas en pacientes insulinizados ( $p > 0,05$ ). El tratamiento de la diabetes fue adecuado de acuerdo a las recomendaciones de tratamiento en personas mayores.

**Conclusiones:** Se observa una prevalencia de diabetes tipo 2 ligeramente inferior a lo encontrado en la literatura especializada, con un control estricto de la enfermedad y una apropiada adecuación farmacoterapéutica según las recomendaciones de la European Diabetes Working Party for Older People. Los pacientes insulinizados y aquellos con función renal deteriorada tienen mayor riesgo de hipoglucemia.

## KEYWORDS

Type 2 diabetes mellitus; Frail elderly drug therapy; Diabetes complications; Nursing Homes.

## PALABRAS CLAVE

Diabetes mellitus tipo 2; Persona mayor frágil; Tratamiento farmacológico; Complicaciones de la diabetes; Centros gerontológicos.



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## Introduction

Type 2 diabetes mellitus (T2D) is a common pathology among the elderly; its prevalence increases with age<sup>1</sup>. For the elderly, an asymptomatic process is usually followed and, on the other hand, clinical expression is often insidious and atypical<sup>1</sup>. It is also common to associate with geriatric syndromes—such as falls, frailty, malnutrition, cognitive impairment, depression, pressure ulcers or infectious processes<sup>2</sup>—, as well as coexistence with multiple comorbidities that leads to chronic medication use and risk of interactions<sup>3</sup>.

Metabolic control objectives in the elderly diagnosed with T2D must be individualized. There is no agreement between the different guidelines regarding the objective of glycated hemoglobin (HbA1c) in elderly patients<sup>4</sup>. The European Diabetes Working Party for Older People recommends an HbA1c target for uncomplicated 7.0-7.5% and 7.6-8.5% frail patients. The consensus of the American Diabetes Association (ADA)/European Association for the Study of Diabetes (EASD) recommends more cautious objectives for patients with short life expectancy, who are polymedicated and who have a high risk of hypoglycemia, indicating an objective of 7.5-8.0% as acceptable<sup>4</sup>.

Preventing hypoglycemia is an essential aspect, since elderly T2D patients are especially vulnerable to it and its consequences, with significant morbidity and mortality<sup>1,5</sup>. Therefore, in terms of treatment, people with sufficient secretion of endogenous insulin, are preferably to be treated with oral antidiabetic drugs (OAD) alone instead of with insulin because of a lower risk of hypoglycemia<sup>6</sup>. Similarly, long-acting sulfonylureas (glibenclamide, chlorpropamide, glimepiride) are not appropriate due to the risk of prolonged hypoglycemia<sup>7</sup>. If insulin is required, consistent pharmacodynamic profile insulin and lower risk of hypoglycemia, such as glargine, are generally preferable<sup>6</sup>.

With the goal of learning the T2D management status in nursing homes (NH) and, where appropriate, establishing improvement measures, the objectives of this study were: to determine the prevalence of T2D and its clinical characteristics, to study the adequacy of the specific pharmacologic therapy and its adaptation to the degree of frailty, and to recognize the derived adverse events.

## Methods

Observational, cross-sectional study (March 2019) in institutionalized elderly people in six NHs for the dependent elderly.

The present work was carried out in a Foundation that serves 105 patients admitted to a medium and long-stay hospital and around 850 institutionalized persons, mostly in gerontology centers. This Foundation's Pharmacy Service carries out the acquisition, storage, validation of medical orders and structured reviews of pharmacological treatments, dispensing and distribution of medications for the aforementioned centers, among other tasks.

The six NHs included in the study have their own doctor with homogeneous health care, although there is structural variability in size (capacity from 59 to 145 residents).

All patients diagnosed with T2D were included in the six NHs that had been institutionalized for at least one year. There were no exclusion criteria.

The following variables were analyzed: age and sex, T2D prevalence, clinical data (weight, body mass index) and biochemical data (HbA1c, serum creatinine and creatinine clearance), functionality data (Barthel index), cognitive function data (MEC-35 and GDS-FAST), frailty index (IF-VIG)<sup>8,9</sup>, T2D management and its specific pharmacologic therapy, events of hypoglycemia and falls during the previous year of admission.

All data were collected by a pharmacist from the own socio-sanitary management system (SIGECA by its Spanish acronym), as well as from Osakidetza's electronic medical record (Osabide Integra).

The diagnostic criterion of T2D is established by the ADA<sup>10</sup>. Hypoglycemia has been defined as the state in which a blood glucose concentration is below 60 mg/dL, in a routine or non-routine measurement.

A descriptive analysis of central tendency measures (mean, median) and dispersion (standard deviation, interquartile ranges) for quantitative variables, and frequencies and percentages for qualitative variables was

performed. Statistical analyzes were used for comparisons in quantitative variables (student's *t*, Mann-Whitney's *U*) and qualitative (test  $\chi^2$ ) variables. Data was analyzed with the v20.0 SPSS statistical software.

Ethical considerations: the collection of clinical history data for research purposes was carried out by the researchers who were also responsible for the data anonymization.

## Results

The population studied covered 585 institutionalized patients (70% female) in six NHs for the dependent elderly, where 127 with T2D were found, thus T2D prevalence being 21.7% (24.1% in men; 20.7% in women).

The most relevant results are presented in tables 1 and 2.

86% of patients with long-acting or intermediate-acting insulins were being treated with glargine.

Among the OADs applied, 83.3% of patients with OAD used metformin, followed by 35.0% with dipeptidyl peptidase-4 (dPP4) inhibitors, only 5.0% sulfonylureas and 3.3% with meglitinides. 12 patients (9.5%) had two concomitantly prescribed OADs, of which 9 (75%) were metformin+dipeptidyl peptidase-4 inhibitors. There was only one person being treated with three OAD, which was also insulinized.

57 hypoglycaemia were found in the previous year, six of which were only symptomatic (10.5%).

Within the group of people who were under pharmacologic therapy, insulinized residents showed a higher risk of hypoglycemia, compared to those who only took OADs (OR 6.3 CI 1.3-29.6;  $p < 0.05$ , test  $\chi^2$ ). Among patients with insulin, 14 hypoglycemia occurred compared to only two non-insulinized patients. This association did not appear with the falls (OR 1.28 CI 0.62-2.65;  $p > 0.05$ , test  $\chi^2$ ).

Additionally, those who had hypoglycemia events had a higher serum creatinine value (median [IR] 0.84 [0.46] mg/dL vs. 0.99 [0.60] mg/dL) and a lower CrCl (median [IR] 54.72 [25.75] mL/min vs. 42.07 [17.42] mL/min) compared to those who did not have this type of event ( $p < 0.05$ , *U* Mann-Whitney).

## Discussion

The prevalence of T2D in Spain according to a study in population older than 85 years living in the community is 25.9%<sup>11</sup> and another study in people over 75 years living in the community indicates a 30.7% prevalence in males and 33.4% in females<sup>12</sup>. In our study, the prevalence is slightly below, 21.7%, being higher in men.

The pharmacological treatment is adapted to what is recommended by the T2D treatment guidelines for the elderly<sup>13</sup>, with preferential use of metformin among OADs, very low use of sulfonylureas, importance of using a single OAD, and preferential use of insulin glargine for those who are insulinized.

It is important to remember that insulin is a high-risk medication in chronic patients, as indicated by the High-Alert Medications for Chronic Patients criteria<sup>14</sup>. In this sense, it has been found that insulinized patients had a higher risk of hypoglycemia compared to patients treated with OADs. Our results indicate in turn the importance of taking into account the renal function of insulinized patients, in whom the risk of hypoglycemia may be higher. Although it is documented that patients treated with insulin the risk of falls increases<sup>2,6</sup>, in our study, we have not found more falls in insulinized patients, which is understood as a consequence of its multifactorial nature. It is important to highlight the important frequency of asymptomatic hypoglycemia in our study.

In T2D patients with multiple comorbidities and functional limitation, the risks of intensive antidiabetic therapy outweigh the possible benefits. In this sense, different guidelines, although without a global consensus<sup>4</sup> recommend de-intensifying the therapy in older patients, individualizing each therapy according to the person's situation. However, our study has found a strict control of the disease, and also two works have been found: one dealing with outpatients who attend an acute unit<sup>9</sup>, and another in NH<sup>15</sup>. Accordingly, it should be taken into account that in NH, compliance with therapy will probably be greater than in the community, and the same occurs with adherence to a prescribed diet.

**Table 1.** T2D patient features, therapy and follow-up

Features	
Number of patients	127
Gender, n	42 men (33%) 85 women (67%)
Mean age, years (SD)	84.1 (8.3) Men 81.8 (8.3) Women 85.3 (8.2)
Frail-VIG index, median (IR: C1-C3) (n = 75)	0.5 (0.1: 0.4-0.5)
Barthel, median (IR: C1-C3) Barthel ≤ 35, n (%)	40.0 (57.8: 14.5-72.3) 59 (46.4%)
MEC-35, mean (SD) (n = 107) MEC-35 < 17 or NV, n	19.5 (8.3); 25 NV 47 (50.4%)
GDS-FAST, median (IR: C1-C3) (n = 109)	5.0 (2.0: 4.0-6.0)
BMI, mean (SD) (n = 117)	26.8 (6.0)
HbA <sub>1c</sub> (%), median (IR: C1-C3) (n = 110) HbA <sub>1c</sub> < 8,5 HbA <sub>1c</sub> ≤ 7	6.5 (1.2: 6.0-7.2) 99 (90.0%) 78 (70.9%)
Serum creatinine (mg/dL), median (IR: C1-C3)	0.9 (0.5: 0.6-1.1)
Clcr (mL/min) CG, median (IR) (n = 121)	52 (25.8: 41.0-66.8)
Blood glucose monitoring	
• Daily	3 (2.4%)
• Weekly	44 (34.6%)
• Monthly	39 (30.7%)
• No regular monitoring	37 (29.1%)
No drug treatment	37 (29.1%)
Pharmacotherapy	90 (70.9%)
• OAD only	37 (29.1%)
– Only 1 OAD	31 (24.4%)
– Only 2 OAD	6 (4.7%)
– Only 3 OAD	0
• Insulin + OAD	25 (19.7%)
– Insulin + 1 OAD	18 (14.2%)
– Insulin + 2 OAD	6 (4.7%)
– Insulin + 3 OAD	1 (0.8)
• Insulin only	28 (22.0%)
Hypoglycemia, mean (SD)	0.4 (1.9)
• Incidence (episodes/resident/year)	0.4
Falls, mean (SD)	2.3 (4.8)
• Incidence (episodes/resident/year)	2.3

C1: first quartile; C3: third quartile; CG: Cockcroft-Gault formula; Clcr: creatinine clearance; Hb1Ac: glycated hemoglobin; NV: not valuable; OAD: oral antidiabetic drug; IR: interquartile range; SD: standard deviation.

Frail-VIG index assessment is not on the date of the study standardized within the obligatory Comprehensive Geriatric Assessment manual in the NHs studied, which implies lost data. However, given its connection with survival<sup>8</sup>, it helps in decision-making and, in fact, in our study a negative trend has been found between this index and the intensity of treatment (Table 2). These same results were found by Molist *et al.*<sup>9</sup>, although the population studied is not institutionalized and HbA1c was found to be comparatively higher.

The study's findings make clear the need to implement strategies in our institution that allow us to establish an individualized optimal treatment.

This study has limitations. On the one hand, the study has been carried out in an institution that works with a Pharmacotherapeutic Guide for geriatric patients, so the results regarding to the management and selection of medications cannot be generalized to the entire population. On the other hand, we have focused on the treatment for diabetes without taking into account other types of concomitant treatments. Additionally, not having all the data from the frailty index assessment prevents evaluating the global sample in this regard.

In conclusion, a prevalence of T2D is slightly lower than that found in the literature, with strict control of the disease and appropriate pharmacotherapeutic adequacy, according to the recommendations of the European Diabetes Working Party for Older People. Insulinized patients and those with impaired renal function have a higher risk of hypoglycemia.

### Funding

No funding declared.

### Conflict of interests

No conflicts of interest declared.

### Contribution to the scientific literature

This work has been carried out in an institutionalized population where the pharmacist's role is growing over the recent years and where bibliography continues to be scarce. Type 2 diabetes mellitus is a prevalent disease in these centers, where there are patients who frequently have comorbidities and polypharmacy, as well as functional and cognitive impairment. In these patients, often fragile, pharmacotherapeutic follow-up is key in order to adapting it to each situation.

Work relevance: The person who resides in a Nursing Home—usually fragile and in many occasions in the final phase of life—requires attention focused on the person, and not segregated by pathologies, opting in the case of type 2 diabetes mellitus for a less strict pharmacologic strategy, and prevailing in greater aspects of safety. Detailed knowledge of the approach is the first step in improving your pharmacotherapy.

**Table 2.** Degree of frailty (IF-VIG) in diabetic patients and degree of control using HbA<sub>1c</sub> according to the degree of frailty (n = 75)

	Non-frail IF-VIG: < 0.20	Mild frailty IF-VIG: 0.21-0.35	Moderate fragility IF-VIG: 0.36-0.50	VIG severe fragility IF-VIG: > 0.50
N (%)	2 (2.66%)	2 (2.66%)	41 (54.66%)	30 (40.00%)
Mean HbA <sub>1c</sub> ± SD	5.70% ± 0.14	6.35% ± 0.21	6.46% ± 0.94	6.90% ± 1.56

HbA<sub>1c</sub>: glycated hemoglobin; SD: standard deviation.

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